Energy Audit Report

of

Smt. Meenalben Mehta College, Panchgani-412805

Submitted to

Principal,

Smt. Meenalben mehta College, Panchgani, 412805

BY

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Preface

Electrical Energy conservation/Audit is the effort made to reduce the consumption of energy by using less energy consuming devices and services. This can be achieved either by using efficient and Non dissipative electrical and electronics devices more efficiently or by suggesting or imposing restrictions on time duration of amount of service used. The actual consumption of energy computed considering, how much LED TUBEs, fan, A.Cs, electronic instruments, etc in each room. The necessary data required for the audit was collected using the energy consumption Bills of Maharashtra State Electricity Distribution Company(MSDCL), Wattage /consumption from each block/Room, Science laboratory, Use of energy in Different time slots, Voltages and Currents measurement's at different period Zone etc. The main aim of this audit to recognize energy proficient appliances such as LED LED TUBEs, LEDs Bulbs, use of Invertor based fans/ Motars pumps. The Students, faculty of Physics Department and members of the criterion-VII helped for collecting the data and Survey.

Contents

1. ABBREVIATIONS

CFL	: Compact Fluorescent Lamp
FTL	: Fluorescent LED TUBE Lamp
kVA	: kilo Volt Ampere
kVAr	: kilo Volt Ampere reactive
kW	: kilo Watt
kWp	:kilo Watt peak
kWh	: kilo Watt hour (Unit of Electricity)
LED	: Light Emitting Diode
LT	: Low Tension
PF	: Power Factor
MEDA	: Maharashtra Energy Development Agency
MSEDCL	: Maharashtra State Electricity Distribution Company
Solar PV	: Solar Photo Voltaic

2. ACKNOWLEDGEMENT

The Audit team of Department of Physics thanks, Incharge Principal Prof.(Dr.) Kiran Pandurang Shinde for assigning Energy Audit Survey of the institution to us.

The Audit team sincerely acknowledges the co-operation and kind support by staff members of the institution for extending their help throughout the study.

We also thank Maharashtra Energy Development Agency for facilitating this study.

Team: Dr.Milind M.Sutar, Energy Auditor.

And Department of Physics.

3. EXECUTIVE SUMMARY

Bill Analysis from the yearly electricity consumption, the total monthly average electricity consumption was **400** kWH per month amounting to nearly Rs.59,600/- annually. It was previously the average expenditure for electricity consumption nearly Rs.78,000/. This is because of the Institute uses hybrid devices like, totally LEDs lamps and LED TUBEs for lighting purpose.

For improving energy efficiency and reducing energy bill following suggestions and observations are made:

Sr. No.	Recommendations	Savings		Investment
		kWh/year	Rs/year	Rs.
1	Installing LED LED TUBE lights and Bulbs	1323	14,414/-	18,400/-

Apart from the above suggestions, as a renewable energy and sustainability initiative, it is recommended to install 3kW roof top solar PV power plant which can save the 25% of annual electricity consumption of the college.

Also, following suggestions are made for energy saving purpose:

- All computers have to be set for power save mode for switching off screen if not used for 05 minutes and hibernate if not used for more than 60 minute.
- Students may be educated towards saving of electricity by displaying messages in the classroom and common public area for switching off lights, fans and computers when not required.

- As the Panchgani is a hill station about 4242ft above the sea level there is always cool and pleasant climate hence Fans should be used only in the summer climate mostly in the month of April and May every year. hence instead Ceilling Fans wall mount fans having 5 STAR rated energy efficient fans are fitted to reduce energy consumption.

4. INTRODUCTION

Smt. Meenalben Mehta College of was previously have only two faculties viz.Arts andCommerce. From June 2014-15 with reference to special case and demand of 12th Science students in the Hilly region the faculty Programme extended by starting Science wing. The college is affiliated to Shivaji University, Kolhapur. The college offers undergraduate courses namely, B.A., B.Com, and B. Sc. through Marathi /English medium and other certificate courses to B.A., B.Com, and B. Sc. Students.

4.1 Methodology Adopted

The Audit is conducted as per the guidelines given by State Electricity Board:

1. Relevant Data Collection like list of lighting fixtures, pumps, etc.
2. Measurement of main supply Voltage, Current, kW, kVA and kVA are done and the trend is recorded.
3. Analysis of the past data for understanding the consumption patterns.
4. Recommendation of energy efficiency improvement projects and methods to reduce the energy cost.
5. Analysis of Techno-economic feasibility of the projects with Simple payback.

4.2 Instruments Used

Following instruments are used for the study:

a. Single Phase Power meter. b. Three phase Power meter

c. Lux Meter for light level measurements

5. PAST ELECTRICITY BILLs ANALYSIS

Electricity Consumption (2020-21)

a. Monthly Electricity Consumption Analysis

- The College has onesingle Phase connection. Following table gives the detail of bills:
- Load Allowed:5KW
- Meter No. 6107177501

Following table shows the electricity consumption in Units and amounting Rupees.

Table 4-1: Electricity Consumption Analysis (April, 2020 to March,2021)

2020-21			
Month	Unit	KWH	Amt Rs.
Apr-2020	675	675	14840
May-2020	675	675	
Jun-2020	675	675	
Jul-2020	966	966	8580
Aug-2020	286	286	
Sep-2020	498	498	7070
Oct-20v	387	387	
Nov-2020	389	389	7030
Dec-2020	328	328	2980
Jan-2021	409	409	3610
Feb-2021	411	411	3630
Mar-2021	418	418	3710
Tot	6117		51450
Avg	**510**		**4288**
		Average Cost Per Unit	**8**.40

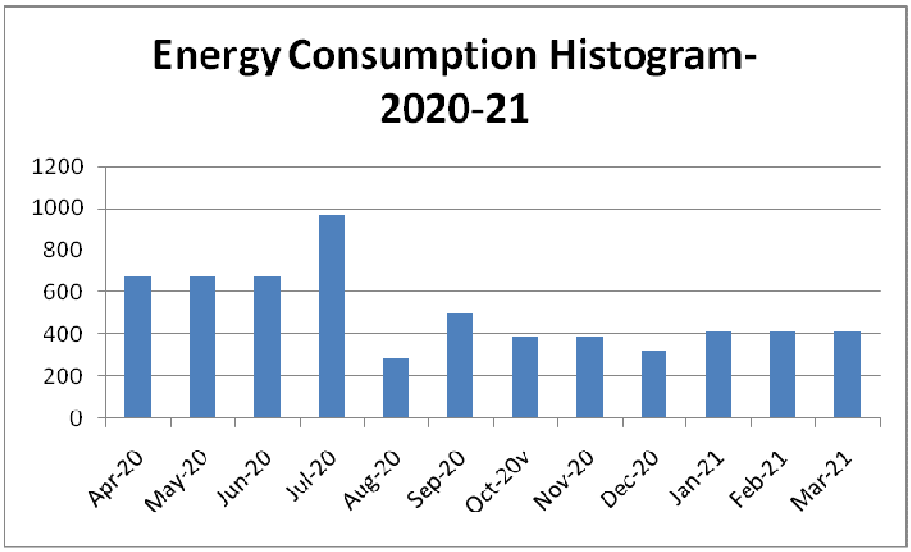

Figure 4-1: Electricity Consumption pattern(2017-18)

- For months April, May and June the average units are 675 KWH, this due to the effect of pandemic period, where the person who was coming to read meter was unable to come. Hence MSEB have decide to to bill for average meter reading.

- The average Electrical Energy Consumption per day in Academic year 2020-21 is **17** Units.
- Highest Electrical Energy consumption was recorded in the month of July 2020.

- The average Electrical Energy Consumption per day **cost works out to be Rs. 142 which was Rs.221/- in year 2017-18.**

- Monthly average consumption is 510kWH amounting to **4288/-.**

- The yearly average electricity Units consumption is 6117kWH amounting to **Rs.51,450/-** per year which is very less as compared to bill for year2017-18.
- The consumption pattern is shown above.

The Institute has a separate electrical Power backup facility in case of mains Power failure and it is supplied through Diesel Electrical Power Generator having 5kVA capacity(Brand Name-Kirloskar Electrical Power Generator)

6. ELECTRICAL VOLTAGE PROFILE

b. Voltage level

- Phase to Neutral voltage levels were observed as below:

Figure 4-2:Phase to Neutral Voltage at the mains meter

V	Average	Minimum	Maximum
Voltage Level	223	205	230

- Average Line voltages are in the range of 220 V to 230V.
- The maximum voltage of 230V was observed in Phase.
- Even though voltage unbalance is on higher side due to single phase loading, voltages are within the limits.

c. Lighting

- The Campus and Corridor lighting is mainly by 40W/36W LED lights and 10W LED bulbs. Also, few 18W LED lights installed in the premises.
- There are total of 35 no. of 18W LEDs TUBE lights, 42 no. of 9W LED lamps and only 02 no. of 18W CFLs.
- Lux levels are measured at various places and the observations are as below:

7. ROOM WISE LOAD DISTRIBUTION

Table 4-2: Lighting and Roomwise Load

Room No. 1	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer	Incubator	Oven		LCD Projector	Total watt
	1	1	2	1	1	1	0					
Watt	36	9	36	80	40	80	0					281
Room No. 2	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer					
	0	1	3	0	1	3	3					
Watt	0	9	54	0	40	240	60					403
Room No. 3	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer					
	0	2	0	0	0	2	1					
Watt	0	18	0	0	0	160	40					218
Room No. 4	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer					
	2	4	2	3	0	3	1					
Watt	36	36	36	240	0	240	20					608
Room No. 5	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer					
	0	0	0	0	0	0	0					
Watt	0	0	0	0	0	0	0					0
Room No. 6	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer					
	0	1	0	0	0	0	0					
Watt	0	9	0	0	0	0	0					9
Room No. 7	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer					
		1	0	0	0	0	0					
Watt		9	0	0	0	0	0					9
Room No. 8 ZOOLogy lab	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Printer					
	0	4	0	0	0	1	0	1	1		1	
Watt	0	36	0	0	0	80	0	400	1750		280	2546
Room No. 9(Botany	CFL	LED Bulb	LED TUBE	Ceiling	Table fan	Computer	Printer					

Lab)				**Fan**								
	0	**3**	**0**	**0**	**0**	**1**	**0**				**1**	
Watt	**0**	**27**	**0**	**0**	**0**	**80**	**0**				**280**	387
Room No. 10(Physics Lab)	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**	**Hg**				
	0	**2**	**1**	**0**	**0**	**1**	**0**				**1**	
Watt	**0**	**18**	**40**	**0**	**0**	**80**	**0**	**36**			**280**	**454**
Room No. 11(Chemistry Lab)	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**	**Water Bath**				
	0	**2**	**1**	**0**	**0**	**1**	**0**	**1**			**1**	
Watt	**0**	**18**	**40**	**0**	**0**	**80**	**0**	**1000**			**280**	**1418**
Room No. 12(Staff Room)	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**0**	**2**	**2**	**0**	**0**	**0**					
Watt	**0**	**0**	**36**	**80**	**0**	**0**	**0**					116
Room No. 13	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**1**	**0**	**0**	**0**	**0**	**0**					
Watt	**0**	**9**	**0**	**0**	**0**	**0**	**0**					9
Room No. 14	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**1**	**0**	**0**	**0**	**0**	**0**					
Watt	**0**	**9**	**0**	**0**	**0**	**0**	**0**					9
Room No. 15(Auditorium (J.P.Maheta Auditorium)	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**0**	**10**	**7**	**0**	**0**	**0**				**1**	
Watt	**0**	**0**	**180**	**50**	**0**	**0**	**0**				**280**	510
Room No. 16	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**2**	**0**	**0**	**0**	**0**	**0**				**1**	

Watt	**0**	**18**	**0**	**0**	**0**	**0**	**0**				**280**	298
Room No. 17	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**1**	**1**	**0**	**0**	**1**	**0**				**1**	
Watt	**0**	**9**	**18**	**0**	**0**	**80**	**0**				**280**	387
Room No. 18	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**1**	**1**	**0**	**0**	**1**	**0**					
Watt	**0**	**9**	**18**	**0**	**0**	**80**	**0**					107
Room No. 19	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	1	**0**	**1**	**0**	**0**	**1**	**0**				**1**	
Watt	**18**	**0**	**18**	**0**	**0**	**40**	**0**				**280**	356
Room No. 20	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	1	**0**	**1**	**0**	**0**	**1**	**0**				**1**	
Watt	**9**	**0**	**18**	**0**	**0**	**80**	**0**				**280**	387
Room No. 21	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**1**	**1**	**0**	**0**	**1**	**0**				**1**	
Watt	**0**	**9**	**18**	**0**	**0**	**40**	**0**				**280**	347
Room No. 22	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	1	**0**	**1**	**0**	**0**	**0**	**0**				**1**	
Watt	**18**	**0**	**18**	**0**	**0**	**0**	**0**				**280**	316
Room No. 23	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**	**TV**	**Gyser**	**Frez**		
	1	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	
Watt	**18**	**0**	**18**	**0**	**0**	**0**	**0**	**80**	**1000**	**200**	**280**	**1596**
Room No. 24	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					

	1	**0**	**1**	**1**	**0**	**1**	**0**					
Watt	**18**	**0**	**18**	**40**	**0**	**80**	**0**					156
Room No. 25	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	0	**1**	**0**	**0**	**0**	**0**	**0**					
Watt	**0**	**9**	**0**	**0**	**0**	**0**	**0**					9
Room No. 26	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	1	**0**	**1**	**0**	**0**	**0**	**0**				**1**	
Watt	**40**	**0**	**18**	**0**	**0**	**80**	**0**				**280**	418
Room No. 27	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	2	**0**	**1**	**1**	**0**	**0**	**0**					
Watt	**36**	**0**	**18**	**40**	**0**	**80**	**0**					174
Room No. 28	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	1	**1**	**1**	**1**	**0**	**0**	**0**					
Watt	**18**	**9**	**18**	**40**	**0**	**80**	**0**					165
Room No. 29	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Printer**					
	1	**1**	**1**	**1**	**0**	**0**	**0**					
Watt	**18**	**9**	**18**	**40**	**0**	**80**	**0**					165
Room No. 30(Comp Lab)	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**						
	1	**0**	**0**	**1**	**0**	**20**					1	
Watt	**18**	**0**	**0**	**40**	**0**	**100**					280	438
Room No. 31(IQAC)	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**						
	0	**0**	**1**	**1**	**0**	**2**					1	
Watt	**0**	**0**	**18**	**40**	**0**	**160**					280	498
Room No. 32	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**						
	0	**0**	**0**	**0**	**0**	**0**						
Watt	**0**	**0**	**0**	**0**	**0**	**0**						0
Room No. 33	**CFL**	**LED Bulb**	**LED TUBE**	**Ceiling Fan**	**Table fan**	**Computer**	**Exhaust Fan**					

	0	0	1	0	0	0	1					
Watt	0	0	18	0	0	0	200					218
Room No. 34	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Exhaust Fan					
	0	0	1	0	0	0	0					
Watt	0	0	18	0	0	0	0					18
Room No. 35	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer						
	0	0	1	0	0	0						
Watt	0	0	18	0	0	0						18
Room No. 36	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer	Exhaust Fan					
	0	0	1	0	0	0	1					
Watt	0	0	18	0	0	0	200					218
Room No. 37	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer						
	0	1	0	0	0	0						
Watt	0	9	0	0	0	0						9
Room No. 38	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer						
	0	1	0	0	0	0						
Watt	0	9	0	0	0	0						9
Varanda	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer						
ground	0	4	0	0	0	0						
Watt	0	36	0	0	0	0						36
1st Floor	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer						
Stair	1	4	0	0	0	0						
Watt	200	36	0	0	0	0						236
Physical	CFL	LED Bulb	LED TUBE	Ceiling Fan	Table fan	Computer						
Ground	4	0	0	0	0	0						
Watt	72	0	0	0	0	0						72
											Total Watt	13628

- In most of the class rooms, the lux levels are in the range of 100 to 40, which is as per norms. Few class rooms are having lux levels below 100, which can be improved.
- At other places, the lux levels are satisfactory.

RECOMMENDATIONS

From the measurements, data analysis, observations and discussions following opportunities are identified for energy saving.

1. **Installing LED TUBE lights of 18 Watt inplace of CFLs and 40W TUBE lights**

There are around 35 no. of LED TUBE lights and 02 no. of CFLs are in working. Due to different requirements, the operating hours will vary significantly anywhere from 4 to 8 hours per day. It is suggested to replace incandescent TUBE lights having an average operating hours of 6 h/day and more. The savings calculated are as below for replacement of all 35 No. of LED TUBEs:

Existing LED TUBE light wattage with electronic ballast	W	40
LED TUBE light consumption	W	18
Net savings	W	22
Daily operating hours	h/day	8
Yearly operating days	days/year	250
Yearly electricity saved per fitting	kWh/year	~1 Unit
Cost of electricity	Rs./kWh	8.66
monetary savings per day	Rs./day	~390Units
Total number of LED TUBE lights to be replaced	No.	35
Total electricity saved	**kWh/year**	**1900**
Total monetary savings	**Rs./year**	**20,000**
Total Cost of replacement	**Rs.**	**9000**
Simple payback period	**Year**	**½**

Note:

- Each LED TUBE light with fittings are available in the range of Rs. 500 to Rs. 700 per piece depending upon the brand and quality. We have considered a cost of Rs. 200- 250/- per LED TUBE for savings calculations. This cost may come down with bulk purchase.
- LED TUBE lights in offices, staff rooms, library, computer labs and class rooms having maximum operating hours may be taken initially for replacement.
- Other Lamps may be replaced with LED lights as and when they fail.

2. Installation of Solar PV power plant

The College is having a very good open terrace area of more than 500$m^2$to accommodate 10 kWp solar PV power plant. This solar PV power plant can generate up to 60% of the existing annual consumption.The estimated savings and payback are as below:

Proposed Solar PV plant capacity	kWp	10
Yearly estimated generation	kWh/kWp.year	1200
Total yearly consumption by the facility	kWh/year	14000
Cost of electricity	Rs./kWh	8
Savings due to avoidance of import from MSEDCL	Rs./year	112000
Cost of Installation of solar PV plant	Rs.	6.5-7 lakh
Simple payback period	Year	7

With government subsidy, the payback may probably will reduce.

8. Annexure-1

List of vendors for reference

S. No.	Name & Address	Product/Service
1	**Modern Hardware Store** Main road ,Panchgani, -412805, India Contact: 02168-240818	Lighting product (LED & Conventional lighting)
2	**Shri Sai Electricals lights Sales and Services** 66A, MalharPeth, Satara, Pin 415001 India. Tel : +02162 - 237945	Lighting product (LED & Conventional lighting)

9. Conclusion

From above Electrical Energy Consumption Analysis it is observed that after following the suggestions of Energy saving options of low energy consuming devices, the comparative analysis study shows that there is great step toward the Electrical energy conservation.

Dr. Milind M. Sutar