Energy Audit Report

(2021 – 22)

For

Dhamangaon Education Society's

Adarsha Science, J. B. Arts and Birla Commerce Mahavidyalaya,

Dhamangaon Railway, Dist: Amravati

Prepared by

Mr. G. S. Mendhe

Mr. S. K. Shelake

Dr. S. A. Ghogare

Dr. S. G. Vidhale

Dr. R. R. Kuralkar (Advisor)

Preface

Data collection for energy audit of the Adarsha Science, J. B. Arts and Birla Commerce Mahavidyalaya, Dhamangaon Rly was conceded by the team for the period of April 2021 to March 2022.

This audit was over sighted to inquire about convenience to progress the energy competence of the campus. All data collected from each classroom, laboratory etc. The work is completed by considering how many tubes, fans, A. Cc., electronic instruments, etc. in each room and their participation in total electricity consumption.

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy saving exists and prepare proposals for energy saving along with investment with payback periods.

Acknowledgement

We are very much thankful to principal, Dr. Y. B. Gandole and IQAC coordinator, Dr. A. G. Naranje for motivating us and giving us the opportunity for energy audit. We would like to express our sincere thanks to all the faculties and staff members from each department for providing us necessary information and data for this audit survey.

Introduction

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output.

The energy demand in every institution is growing day by day for to meet the international level comfort. This is challenge for every institution to ensure that energy growth in institute does not become unmanageable. As natural resources are limited and energy uses are increasing very sharply so it is very necessary to save natural resources by reducing energy consumption which can be achieved by using energy efficient equipment's and also by awareness of peoples about energy conservation.

In this energy audit survey, we collected data from every department and then find out the energy consumption in each department. The power consumption is calculated by considering the consumption of various devices such as tube lights, CFL bulbs, LED bulbs, fans, A. Cs. practical laboratory equipment's etc. from each department. The scope for energy conservation is found out by replacing the equipment's with equivalent energy efficient equipment's. The data generated in energy audit are useful for to understand the energy distribution and utilization of the college.

Department wise Energy Requirement:

1) Department of Physics

Sr. No.	Name of the applicance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	4	4	640
2	LED Tubelight	20	4	4	320
3	CFL bulb	24	2	4	192
4	Ceiling Fans	60	9	3	1620
5	Cooler	300	1	0.5	150
6	PC (LED monitor)	60	3	1	180
7	Printer	500	2	0.2	200
8	Scanner	12	1	0.5	6
9	LCD Projector	300	1	0.5	150
10	Refrigerator (185 L)	1.5 KWHr/day	1	24	1500
11	Lab equipments for practicals	300	10	2	6000
	Total				10958
	Power Requirements in one day				10.96 unit
	Average Power requirement in one year				4000.4 units
	Average power requirement in one month				333.37 units
	Remarks :				
1)	Replacement of Old electric filltings.				
2)	3 -phase connection for furnace and water distillation plant is taken from microbiology lab. Separate 3-phase connection should be provided to avoid power load				

2) Department of Computer Science

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	11	5	2200
2	Exhaust Fan	60	3	2	360
3	Ceiling Fans	60	8	4	1920
4	PC (LED monitor)	60	12	3	2160
5	Laptop	50	1	2	100
6	Printer	500	3	0.5	750
7	LCD Projector	300	2	2	1200
	Total				8690
	Power Requirements in one day				8.69 unit
	Average Power requirement in one year				3171.85 units
	Average power requirement in one month				264.32 units
	Remarks:				
1)	Replacement of conventional light by LED tubelights.				
2)	Replacement of monitors				

3) Department of Chemistry

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	11	4	1760
2	CFL light	22	1	4	88
3	Exhaust Fan	60	2	0.5	60
4	Ceiling Fans	60	6	4	1440
5	Wall Fan	40	2	4	320
6	PC (LED monitor)	60	4	2	480
7	Scanner	12	1	1	12
8	Printer	500	1	0.5	250
9	LCD Projector	300	1	0.5	150
10	Refrigerator	2 KWHr/Day	1	24	2000
11	Electric Ovens	1000	2	0.25	500
12	Practical Instruments	100	12	0.5	600
	Total				7660
	Power Requirements in one day				7.66 unit
	Average Power requirement in one year				2795.9 unit
	Average power requirement in one month				233 unit
	Remarks:				
1	Replacement of electric wiring.				

4) Department of Electronics

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	3	1	120
2	LED Tubelight	20	2	2	80
3	CFL bulb	24	1	1	24
4	Ceiling Fans	60	2	1	120
5	Tabel Fan	40	1	1	40
6	PC (LED monitor)	60	3	2	360
7	Laptop	50	2	1	100
8	Printer	500	1	0.25	125
9	LCD Projector	300	1	0.5	150
10	Cooler	250	1	0.5	125
11	Practical equipments				150
	Total				1394
	Power Requirements in one day				1.394 unit
	Average Power requirement in one year				508.81 units
	Average power requirement in one month				42.4 units
	Remarks:				
1.	Replacement of Old electric fitting.				

5) Department of Microbiology

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	11	4	1760
2	Ceiling Fans	60	6	4	1440
3	Wall Fan	40	2	4	320
4	Exhaust Fan	60	2	5	600
5	Cooler	300	1	0.5	150
6	PC (LED monitor)	60	3	1	180
7	Scanner	12	1	1	12
8	Printer	500	1	0.2	100
9	LCD Projector	300	2	1	600
10	Refrigerator	2 KWHr/Day	3	24	6000
11	Electric Ovens	1750	2	1	3500
12	Incubator	0.25 KW/Hr	4	24	12000
13	BOD Incubator	0.25 KW/Hr	1	24	3000
14	Autoclave	2500	3	1	7500
15	Laminar Air flow	1000	1	0.02	20
	Total				37182
	Power Requirements in one day				37.18 unit
	Average Power requirement in one year				13570.7 unit
	Average power requirement in one month				1130.89 unit
	Remarks:				
1.	Two fans and two tube lights are not working.				

6) Department of Zoology

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	8	3	960
2	LED tubelight	20	2	3	120
3	Ceiling Fans	60	7	3	1260
4	PC (LED monitor)	60	1	1	60
5	Printer	500	1	0.1	50
6	LCD Projector	300	1	0.2	60
7	Refrigerator	2 KWHr/Day	1	24	2000
8	Electric Ovens	1000	2	0.1	200
9	Autoclave	3000	1	0.05	150
10	Laminar flow hood	500	1	0.05	25
11	Centrifuge	150	1	0.05	7.5
12	Bact. Incubator	150	1	0.05	7.5
	Total				4900
	Power Requirements in one day				4.9 unit
	Average Power requirement in one year				1788.5 unit
	Average power requirement in one month				149.04 unit

7) Department of Mathematics

Sr. No.	Name of the Appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	1	4	160
2	CFL bulb	24	1	2	48
3	Ceiling Fans	60	1	4	240
4	OHP	300	1	0.5	150
5	PC (LED monitor)	60	1	2	120
6	Laptop	50	1	2	100
7	Printer	500	1	0.5	250
8	LCD Projector	300	1	1	300
9	Cooler	300	1	0.5	150
	Total				1518
	Power Requirements in one day				1.518 unit
	Average Power requirement in one year				554.07 units
	Average power requirement in one month				46.17 units

8) Department of Botany

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light (F)	40	8	5	1600
2	Ceiling Fans	60	5	4	1200
3	PC (LCD monitor)	60	1	0.5	30
4	PC (CRT monitor)	100	1	1	100
5	Laptop	50	1	3	150
6	Printer	500	1	0.5	250
7	LCD Projector	300	1	1	300
8	Refrigerator	1.5 KWHr/Day	1	24	1500
9	Electric Ovens	1000	1	0.1	100
10	Autoclave	1000	1	0.1	100
11	Electric Heater	1000	1	0	0
12	Spectrophotometer	500	1	0.1	50
13	Inverter	1000	1	0.5	500
	Total				5880
	Power Requirements in one day				5.88 unit
	Average Power requirement in one year				2146.2 unit
	Average power requirement in one month				178.85 unit
	Remarks:				
1	Electric feeting repairing is urgent requirement				
2	Proper earthing is not present				
3	Two more ceiling fans are required				
4	Three more electric boards are required				
5	One desktop PC is required to replace CRT				

9) Department of Commerce

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	CFL light	24	2	3	144
2	LED light	20	6	1	120
3	Ceiling Fans	60	5	4	1200
4	PC (LED monitor)	60	19	3	3420
5	Laptop	50	4	4	800
6	Printer	500	2	0.5	500
7	LCD Projector	300	1	1	300
	Total				6484
	Power Requirements in one day				6.48 unit
	Average Power requirement in one year				2365.2 unit
	Average power requirement in one month				197.1 unit

10) Department of English

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight	40	4	1	160
2	Ceiling Fans	60	4	1	240
3	PC (LED monitor)	60	10	1	600
4	Printer	500	1	0.25	125
	Total				1250
	Power Requirements in one day				1.25 unit
	Average Power requirement in one year				456.25unit
	Average power requirement in one month				38.02 unit
	Remarks:				
1.	Two tube lights are not in working condition.				

11) Department of social sciences and Humanities

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	CFL bulb	24	1	5	120
2	Ceiling Fans	60	1	5	300
	Total				420
	Power Requirements in one day				0.42 unit
	Average Power requirement in one year				153.3 unit
	Average power requirement in one month				12.78 unit
	Remarks:				
1	Required two more lights and fans.				

12) Library

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight	40	20	3	2400
2	CFL light	24	4	2	192
3	LED light	20	10	3	600
4	Ceiling Fans	60	19	2	2280
5	Exhaust Fan	60	1	5	300
6	PC (LED monitor)	60	8	4	1920
7	Printer	500	2	0.5	500
8	Xerox machine	1200	1	4	4800
9	Coolers	300	2	1	600
10	Water cooler	575	1	0	0
	Total				13592
	Power Requirements in one day				13.59 unit
	Average Power requirement in one year				4960.35 unit
	Average power requirement in one month				413.36 unit

13) Department of Physical Education, Indoor stadium, NSS office

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	CFL light	24	4	5	480
2	Ceiling Fans	60	4	3	720
3	PC (LED monitor)	60	1	1	60
4	Printer	500	1	0.5	250
	Total				1510
	Power Requirements in one day				1.51 unit
	Average Power requirement in one year				551.15 unit
	Average power requirement in one month				45.93 unit

14) Health Center, NCC office

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	9	5	1800
2	Ceiling Fans	60	2	5	600
	Total				2400
	Power Requirements in one day				2.4 unit
	Average Power requirement in one year				876 unit
	Average power requirement in one month				73 unit

15) Administration office, Cabin

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight	40	6	6	1440
2	LED light	20	3	6	360
3	CFL	24	3	6	432
4	Ceiling Fans	60	7	5	2100
5	Wall Fan	40	1	5	200
6	PC (LED monitor)	60	8	3	1440
7	Printer	500	4	0.5	1000
8	A.C.	1000	1	5	5000
9	Coolers	300	1	1	300
	Total				12272
	Power Requirements in one day				12.27unit
	Average Power requirement in one year				4478.55 unit
	Average power requirement in one month				373.21 unit

16) IQAC

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight	40	1	3	120
2	CFL	24	4	2	192
3	Ceiling Fans	60	6	1	360
4	PC (LED monitor)	60	1	1	60
5	Printer	500	1	0.25	125
6	Cooler	300	1	0.5	150
	Total				1007
	Power Requirements in one day				1 unit
	Average Power requirement in one year				365 unit
	Average power requirement in one month				30.42 unit

17) Seminar Hall

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight	40	10	1	400
2	Ceiling Fans	60	7	1	420
3	Laptop	50	1	0.5	25
4	LCD Projector	300	1	0.5	150
5	Sound system	200	1	0.5	100
	Total				1095
	Power Requirements in one day				1.1 unit
	Average Power requirement in one year				401.5 unit
	Average power requirement in one month				33.46 unit

18) Staff room

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	2	6	480
2	Ceiling Fans	60	2	6	720
3	Cooler	300	1	1	300
4	RO system	100	1	5	500
5	Water cooler	2.5 KW.Hr/day	1	24	2500
	Total				4500
	Power Requirements in one day				4.5unit
	Average Power requirement in one year				1642.5 unit
	Average power requirement in one month				136.88 unit

19) Auditorium

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	6	1	240
2	Ceiling Fans	60	7	1	420
3	Sound system	1000	1	0.2	200
	Total				860
	Power Requirements in one day				0.86 unit
	Average Power requirement in one year				313.9 unit
	Average power requirement in one month				26.16 unit

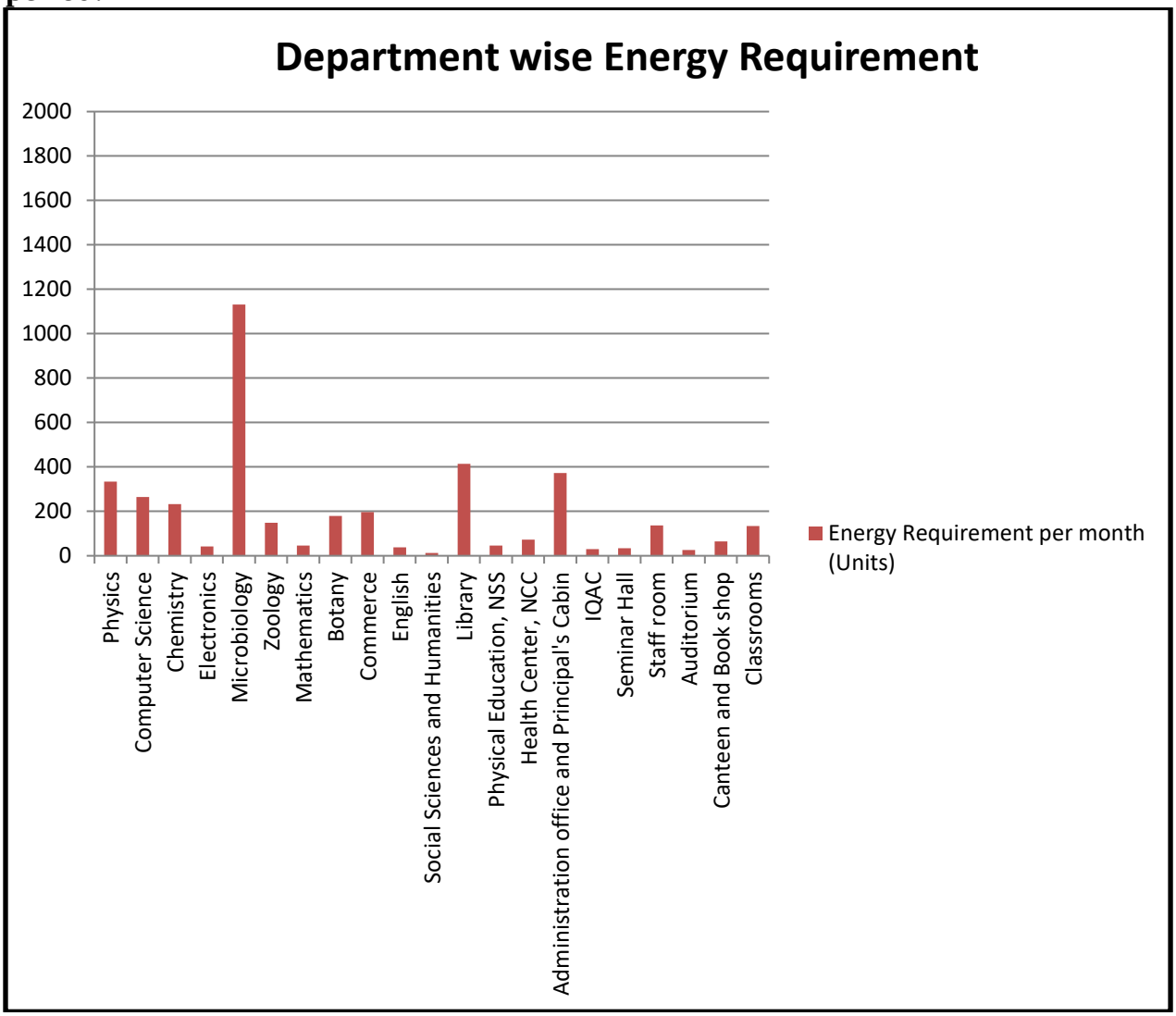
20) Canteen and Bookshop

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	3	3	360
2	Ceiling Fans	60	2	3	360
3	Xerox Machine	1200	1	1	1200
4	Wall Fan	40	1	2	80
5	PC	60	1	2	120
	Total				2120
	Power Requirements in one day				2.12unit
	Average Power requirement in one year				773.8 unit
	Average power requirement in one month				64.48 unit

21) Classrooms

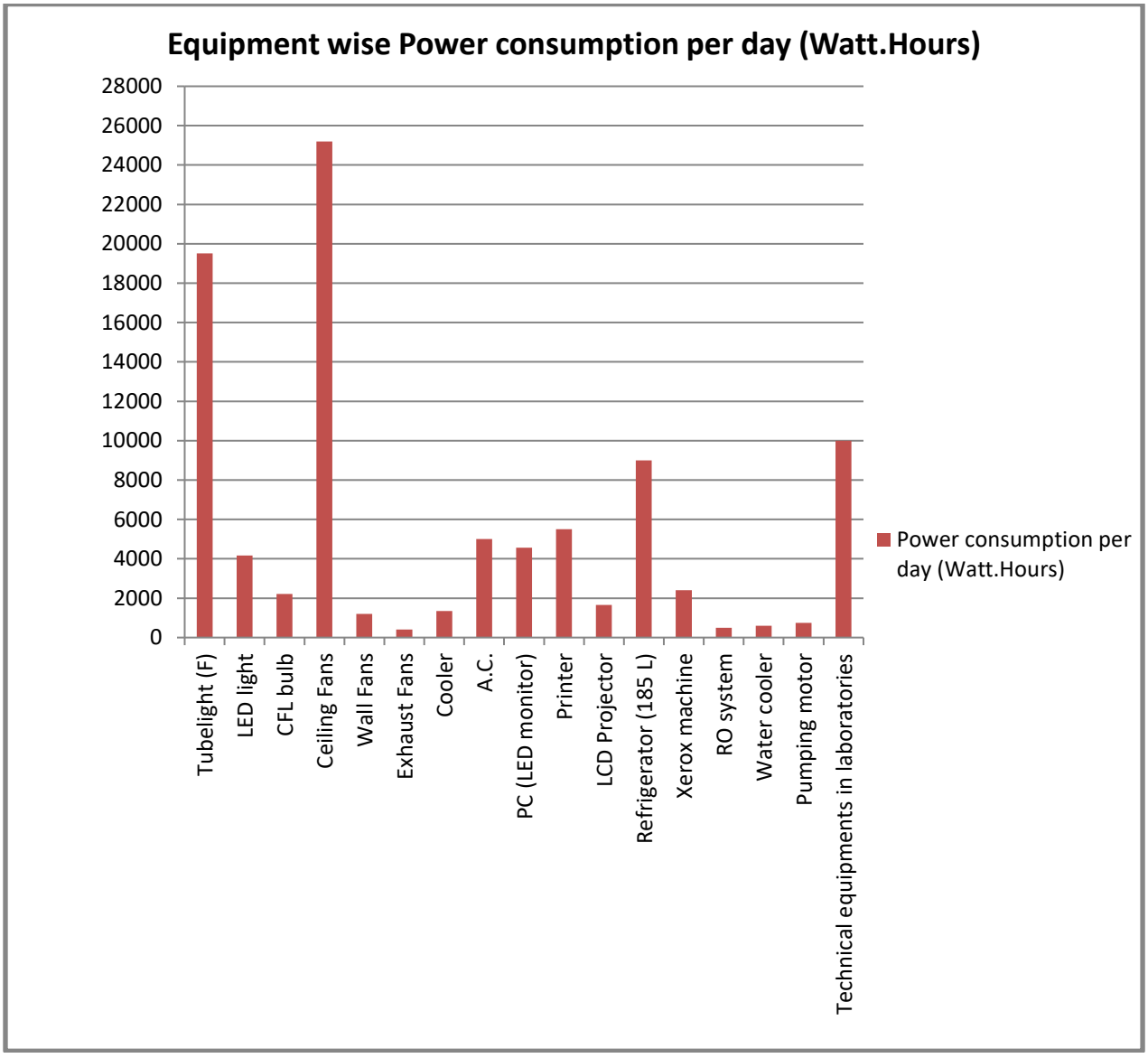
Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	4	1	160
2	LED	20	25	1	500
3	Ceiling Fans	60	30	2	3600
4	Wall fan	40	2	2	160
	Total				4420
	Power Requirements in one day				4.42 unit
	Average Power requirement in one year				1613.3 unit
	Average power requirement in one month				134.44 unit

Note: This is total load consumption considered approximately. Actual load consumption might be different according to actual use of power for particular time period.



Equipment wise Energy Consumption:

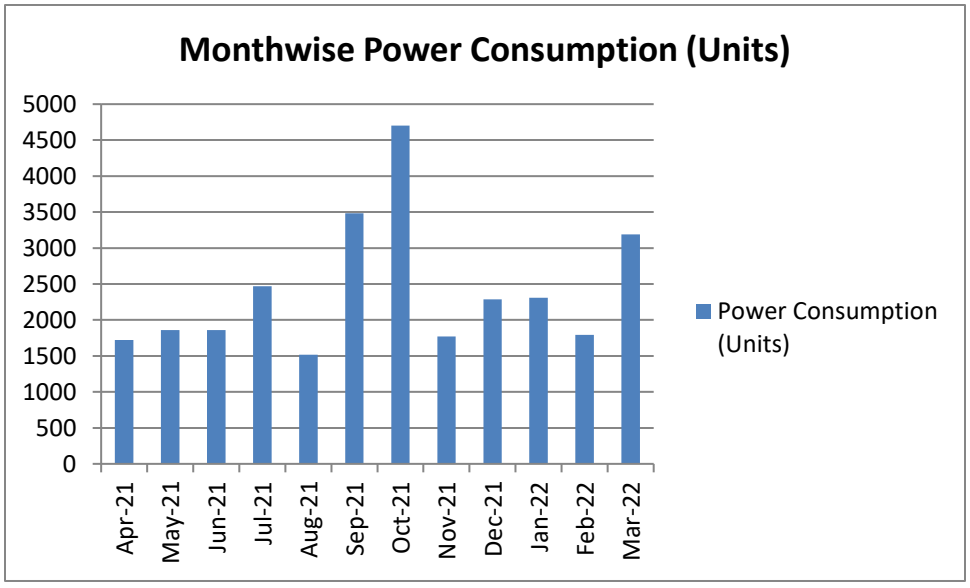
Sr. No.	Name of the applicance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	122	4	19520
2	LED light	20	52	4	4160
3	CFL bulb	24	23	4	2208
4	Ceiling Fans	60	140	3	25200
5	Wall Fans	50	8	3	1200
6	Exhaust Fans	50	8	1	400
7	Cooler	300	9	0.5	1350
8	A.C.	1000	1	5	5000
9	PC (LED monitor)	60	76	1	4560
10	Printer	500	22	0.5	5500
11	LCD Projector	300	11	0.5	1650
12	Refrigerator (185 L)	1 KWHr/day	9	24	9000
13	Xerox machine	1200	1	2	2400
14	RO system	100	1	5	500
15	Water cooler	2.5 KW.Hr/day	1	6	600
16	Pumping motor	746	1	1	746
17	Technical equipments in laboratories				10000
	Total				93994
	Energy consumed in one day = 94 unit				
	Average Energy consumption in one year = 34310 units				
	Average Energy consumption in one month = 2859 units				


Equipment wise Power consumption per day (Watt.Hours)
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Tubelight (F)
LED light
CFL bulb
Ceiling Fans
Wall Fans
Exhaust Fans
Cooler
A.C.
PC (LED monitor)
Printer
LCD Projector
Refrigerator (185 L)
Xerox machine
RO system
Water cooler
Pumping motor
Technical equipments in laboratories
Power consumption per day (Watt.Hours)

Month wise Energy Consumption:

Month	Power Consumption (Units)
Mar-22	3189
Feb-22	1794
Jan-22	2311
Dec-21	2287
Nov-21	1773
Oct-21	4702
Sep-21	3483
Aug-21	1518
Jul-21	2467
Jun-21	1858
May-21	1861
Apr-21	1720
	28963

Average Energy Consumption in one month = 2414 units



Recommendations

1) Replace all conventional tube lights with LED tube lights, to save more power.
2) In Physics laboratory, 3 -phase connection for furnace and water distillation plant is taken from microbiology lab. Separate 3-phase connection should be provided to avoid power load
3) In old building, there is need to replace the electric boards and electric fitting.
4) Install solar plant to reduce electric bill.
5) Switch off Light, fans, P.Cs. and other electrical appliances whenever they are not in use.

Energy saving calculation:

1) If the conventional tube lights are replaced with LED tube light, a large amount of energy can be save.

   Total number of conventional tube lights in college campus = 122
   The average power of conventional tube light = 40 W
   The average power of LED tube light = 20 W
   Difference in power saved per tube light = (40 – 20) = 20 W
   Total power saving = 122 × 20 = 2440 W
   Let average use of each tube light per day = 4 Hours
   Energy saved per day = 2440 × 4 = 9760 Watt.Hours = 9.76 KW.Hours = 9.76 units
   Energy saved in one year = 9.76 × 365 = 3562.4 units
   The reduction in electric bill in one year = 3562.4 × 5.47 = 19486/- Rs
   Average cost of single LED tube light = 400 Rs
   Total cost of replacing all conventional tube lights = 48800 Rs
   Pay back period required = 48800/19486 = 2. 5 Years

Estimate for installation of solar plant in college campus:

Department wise required power load:

S.N.	Department	Power Load (Watt)
1	Physics	2320
2	Computer Science	1870
3	Chemistry	2262
4	Electronics	1024
5	Microbiology	5592
6	Zoology	1840
7	Mathematics	534
8	Botany	1830
9	Commerce	1808
10	English	1000
11	Social Sciences and Humanities	84
12	Library	5576
13	Physical Education, NSS	396
14	Health Center, NCC	480
15	Administration office and Principal's Cabin	3612
16	IQAC	856
17	Seminar Hall	1070
18	Staff room	2600
19	Auditorium	660
20	Canteen and Book shop	1540
21	Classrooms	2540
	Total	39494

Total required power load = 40 kW

Note: While calculating power load, the technical instruments with high power rating (Furnace, incubator, oven etc) in Physics, Chemistry, Botany, Zoology and Microbiology departments are not taken into consideration.

Approximate expenditure required to install solar plant of 1 kW = Rs. 60,000/-
Approximate space required to install solar plant of 1 kW = 1 m^2
The approximate units produced by solar plant of 1 kW per day= 4 units
The approximate units produced by solar plant of 1 kW in one year= 1460 units
Approximate Saving in electric bill in one year = Rs. 10,000/-
Payback period = 6 years

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(2020 – 21)

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Acknowledgement

We are very much thankful to principal, Dr. Y. B. Gandole and IQAC coordinator, Dr. A. G. Naranje for motivating us and giving us the opportunity for energy audit. We would like to express our sincere thanks to all the faculties and staff members from each department for providing us necessary information and data for this audit survey.

Introduction

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output.

The energy demand in every institution is growing day by day for to meet the international level comfort. This is challenge for every institution to ensure that energy growth in institute does not become unmanageable. As natural resources are limited and energy uses are increasing very sharply so it is very necessary to save natural resources by reducing energy consumption which can be achieved by using energy efficient equipment's and also by awareness of peoples about energy conservation.

In this energy audit survey, we collected data from every department and then find out the energy consumption in each department. The power consumption is calculated by considering the consumption of various devices such as tube lights, CFL bulbs, LED bulbs, fans, A. Cs. practical laboratory equipment's etc. from each department. The scope for energy conservation is found out by replacing the equipment's with equivalent energy efficient equipment's. The data generated in energy audit are useful for to understand the energy distribution and utilization of the college.

Department wise Energy Requirement:

1) Department of Physics

Sr. No.	Name of the Appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light (F)	40	9	4	1440
2	CFL bulb	24	2	5	240
3	Ceiling Fans	80	6	6	2880
4	Cooler	300	1	0.5	150
5	PC (LED monitor)	60	3	3	540
6	Printer	500	2	0.2	200
7	Scanner	12	1	0.5	6
8	LCD Projector	300	1	0.5	150
9	Refrigerator (185 L)	1.5KWHr/day	1	1	1500
10	Lab equipment's for practical	300	10	2	6000
11	Microwave Oven	1400	1	0.1	140
12	Muffle Furnace	5000	2	0.1	1000
13	Water Distillation Plant	5000	1	0.1	500
	Total				14746
	Power Requirements in one day				14.746 unit
	Average Power requirement in one year				5382.29 units
	Average power requirement in one month				448.52 units
	Remarks:				
1.	Replacement of Old electric fittings.				
2.	3 -phase connection for furnace and water distillation plant is taken from microbiology lab. Separate 3-phase connection should be provided to avoid power load				

2) Department of Computer Science

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light (F)	40	11	6	2640
2	Exhaust Fan	60	3	2	360
3	Ceiling Fans	80	8	6	3840
4	PC (LED monitor)	60	12	3	2160
5	Laptop	50	1	2	100
6	Printer	500	3	0.5	750
7	LCD Projector	300	2	2	1200
	Total				11050
	Power Requirements in one day				11.05 unit
	Average Power requirement in one year				4033.25 unit
	Average power requirement in one month				336.1 unit

3) Department of Chemistry

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	**B**	**C**	**D**	**E**	**F = C × D × E**
1	Tube light (F)	40	11	6	2640
2	CFL light	22	1	6	132
3	Exhaust Fan	60	2	0.5	60
4	Ceiling Fans	80	6	4	1920
5	Wall Fan	40	2	4	320
6	PC (LED monitor)	60	4	2	480
7	Scanner	12	1	1	12
8	Printer	500	1	0.5	250
9	LCD Projector	300	1	0.5	150
10	Refrigerator	2 KWHr/Day	1	1	2000
11	Electric Ovens	1000	2	0.25	500
12	Practical Instruments	100	12	0.5	600
	Total				9064
	Power Requirements in one day				9.06 unit
	Average Power requirement in one year				3306.9 unit
	Average power requirement in one month				275.58 unit
	Remarks:				
1	Replacement of electric wiring.				

4) Department of Electronics

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	**B**	**C**	**D**	**E**	**F = C × D × E**
1	Tube light (F)	40	4	1	160
2	CFL bulb	24	1	1	24
3	Ceiling Fans	80	2	1	160
4	Tabel Fan	40	1	1	40
5	PC (LED monitor)	60	3	2	360
6	Laptop	50	2	1	100
7	Printer	500	1	0.25	125
8	LCD Projector	300	1	0.5	150
	Total				1119
	Power Requirements in one day				1.119 unit
	Average Power requirement in one year				408.44 unit
	Average power requirement in one month				34.04 unit
	Remarks:				
1.	Replacement of Old electric filltings.				

5) Department of Microbiology

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light (F)	40	11	5	2200
2	Ceiling Fans	80	6	5	2400
3	Wall Fan	40	2	4	320
4	Exhaust Fan	60	2	5	600
5	Cooler	300	1	0.5	150
6	PC (LED monitor)	60	3	1	180
7	Scanner	12	1	1	12
8	Printer	500	1	0.5	250
9	LCD Projector	300	2	2	1200
10	Refrigerator	2 KWHr/Day	4	24	8000
11	Electric Ovens	1750	2	1	3500
12	Incubator	0.25 KW/Hr	4	24	24000
13	BOD Incubator	0.25 KW/Hr	1	24	6000
14	Autoclave	2500	3	2	15000
15	Laminar Air flow	1000	1	0.02	20
	Total				63832
	Power Requirements in one day				63.83 unit
	Average Power requirement in one year				23297.95 unit
	Average power requirement in one month				1941.5 unit

6) Department of Zoology

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light (F)	40	10	3	1200
2	Ceiling Fans	80	7	3	1680
3	PC (LED monitor)	60	1	1	60
4	Printer	500	1	0.1	50
5	LCD Projector	300	1	0.2	60
6	Refrigerator	2 KWHr/Day	1	24	2000
7	Electric Ovens	1000	2	0.1	200
8	Autoclave	3000	1	0.05	150
9	Laminar flow hood	500	1	0.05	25
10	Centrifuge	150	1	0.05	7.5
	Total				5432.5
	Power Requirements in one day				5.43 unit
	Average Power requirement in one year				1981.95unit
	Average power requirement in one month				165.16unit

7) Department of Mathematics

Sr. No.	Name of the Appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light (F)	40	1	4	160
2	CFL bulb	24	1	2	48
3	Ceiling Fans	80	1	4	320
4	OHP	300	1	0.5	150
5	PC (LED monitor)	60	1	2	120
6	Laptop	50	1	2	100
7	Printer	500	1	0.5	250
8	LCD Projector	300	1	1	300
	Total				1448
	Power Requirements in one day				1.448 unit
	Average Power requirement in one year				528.52 unit
	Average power requirement in one month				44.04 unit

8) Department of Botany

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light (F)	40	8	6	1920
2	Ceiling Fans	80	5	5	2000
3	PC (LCD monitor)	60	1	0.5	30
4	PC (CRT monitor)	100	1	1	100
5	Laptop	50	1	3	150
6	Printer	500	1	0.5	250
7	LCD Projector	300	1	1	300
8	Refrigerator	1.5KWHr/Day	1	24	1500
9	Electric Ovens	1000	1	0.1	100
10	Autoclave	1000	1	0.1	100
11	Electric Heater	1000	1	0	0
12	Spectrophotometer	500	1	0.1	50
13	Inverter	1000	1	0.5	500
	Total				7000
	Power Requirements in one day				7 unit
	Average Power requirement in one year				2555 unit
	Average power requirement in one month				212.92 unit
	Remarks:				
1	Electric feeting repairing is urgent requirement				
2	Proper earthing is not present				
3	Two more ceiling fans are required				
4	Three more electric boards are required				
5	One desktop PC is required to replace CRT				

9) Department of Commerce

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	CFL light	24	4	3	288
2	LED light	20	1	1	20
3	Ceiling Fans	80	5	4	1600
4	PC (LED monitor)	60	19	3	3420
5	Laptop	50	1	4	200
6	Printer	500	2	0.5	500
7	LCD Projector	300	2	1	600
	Total				6628
	Power Requirements in one day				6.63 unit
	Average Power requirement in one year				2419.95unit
	Average power requirement in one month				201.66 unit

10) Department of English

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	4	1	160
2	Ceiling Fans	80	4	1	320
3	PC (LED monitor)	60	10	2	1200
4	Printer	500	2	0.25	250
	Total				1930
	Power Requirements in one day				1.93 unit
	Average Power requirement in one year				704.45 unit
	Average power requirement in one month				58.7 unit

11) Department of social sciences and Humanities

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	CFL bulb	24	1	5	120
2	Ceiling Fans	80	1	5	400
	Total				520
	Power Requirements in one day				0.52 unit
	Average Power requirement in one year				189.8 unit
	Average power requirement in one month				15.82 unit
	Remarks:				
1	Required two more lights and fans.				

12) Library

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	26	3	3120
2	CFL light	24	4	2	192
3	LED light	20	4	3	240
4	Ceiling Fans	80	19	2	3040
5	Exhaust Fan	60	1	5	300
6	PC (LED monitor)	60	8	4	1920
7	Printer	500	2	0.5	500
8	Xerox machine	1200	1	4	4800
9	Coolers	300	2	1	600
10	Water cooler	575	1	0	0
	Total				14712
	Power Requirements in one day				14.71 unit
	Average Power requirement in one year				5369.15 unit
	Average power requirement in one month				447.43 unit

13) Department of Physical Education, Indoor stadium, NSS office

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	CFL light	24	4	5	480
2	Ceiling Fans	80	4	3	960
3	PC (LED monitor)	60	1	1	60
4	Printer	500	1	0.5	250
	Total				1750
	Power Requirements in one day				1.75 unit
	Average Power requirement in one year				638.75 unit
	Average power requirement in one month				53.23 unit

14) Health Center, NCC office

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	9	5	1800
2	Ceiling Fans	80	6	5	2400
	Total				4200
	Power Requirements in one day				4.2 unit
	Average Power requirement in one year				1533 unit
	Average power requirement in one month				127.75 unit

15) Administration office, Cabin

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	7	6	1680
2	LED light	20	4	6	480
3	Ceiling Fans	80	7	5	2800
4	Wall Fan	40	1	5	200
5	PC (LED monitor)	60	8	3	1440
6	Printer	500	4	0.5	1000
7	A.C.	1000	1	5	5000
8	Coolers	300	1	1	300
	Total				12900
	Power Requirements in one day				12.9 unit
	Average Power requirement in one year				4708.5 unit
	Average power requirement in one month				392.38 unit

16) IQAC

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	3	3	360
2	Ceiling Fans	80	3	3	720
3	PC (LED monitor)	60	1	1	60
4	Printer	500	1	0.25	125
5	Cooler	300	1	0.5	150
	Total				1415
	Power Requirements in one day				1.42 unit
	Average Power requirement in one year				518.3 unit
	Average power requirement in one month				43.19 unit

17) Seminar Hall

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	10	1	400
2	Ceiling Fans	80	7	1	560
3	Laptop	50	1	0.5	25
4	LCD Projector	300	1	0.5	150
5	Sound system	200	1	0.5	100
	Total				1235
	Power Requirements in one day				1.24 unit
	Average Power requirement in one year				452.6 unit
	Average power requirement in one month				37.72 unit

18) Staff room

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	2	6	480
2	Ceiling Fans	80	2	6	960
3	Cooler	300	1	1	300
4	RO system	100	1	5	500
5	Water cooler	2.5 KW.Hr/day	1	24	2500
	Total				4740
	Power Requirements in one day				4.74 unit
	Average Power requirement in one year				1730.1 unit
	Average power requirement in one month				144.18 unit

19) Auditorium

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	4	1	160
2	Ceiling Fans	80	4	1	320
3	Sound system	1000	1	0.2	200
	Total				680
	Power Requirements in one day				0.68 unit
	Average Power requirement in one year				248.2 unit
	Average power requirement in one month				20.68 unit

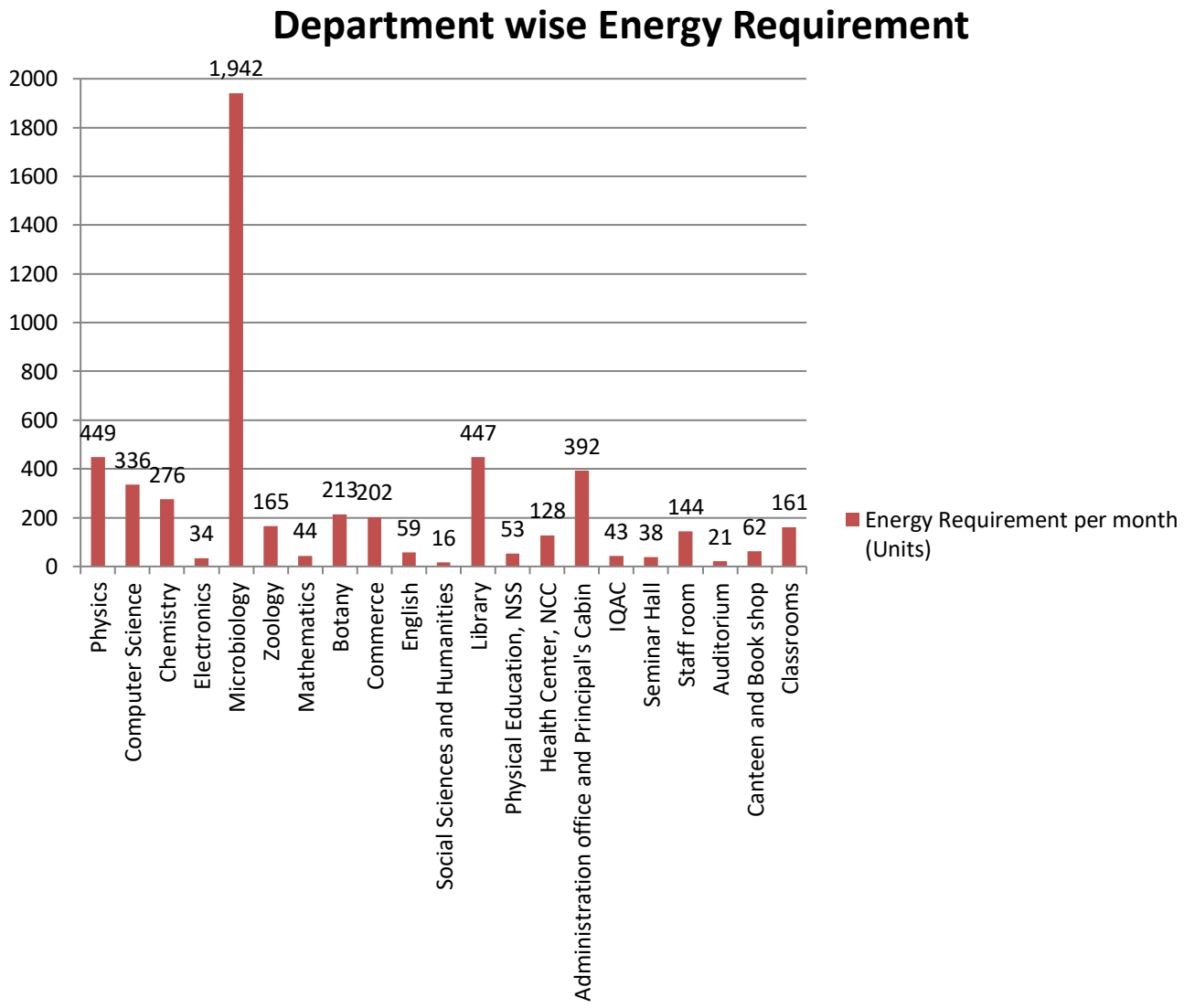
20) Canteen and Bookshop

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	3	3	360
2	Ceiling Fans	80	2	3	480
3	Xerox Machine	1200	1	1	1200
	Total				2040
	Power Requirements in one day				2.04 unit
	Average Power requirement in one year				744.6 unit
	Average power requirement in one month				62.05 unit

21) Classrooms

Sr. No.	Name of the appliance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tube light	40	10	2	800
2	Ceiling Fans	80	14	4	4480
	Total				5280
	Power Requirements in one day				5.28 unit
	Average Power requirement in one year				1927.2 unit
	Average power requirement in one month				160.6 unit

Note: This is total load consumption considered approximately. Actual load consumption might be different according to actual use of power for particular time period.

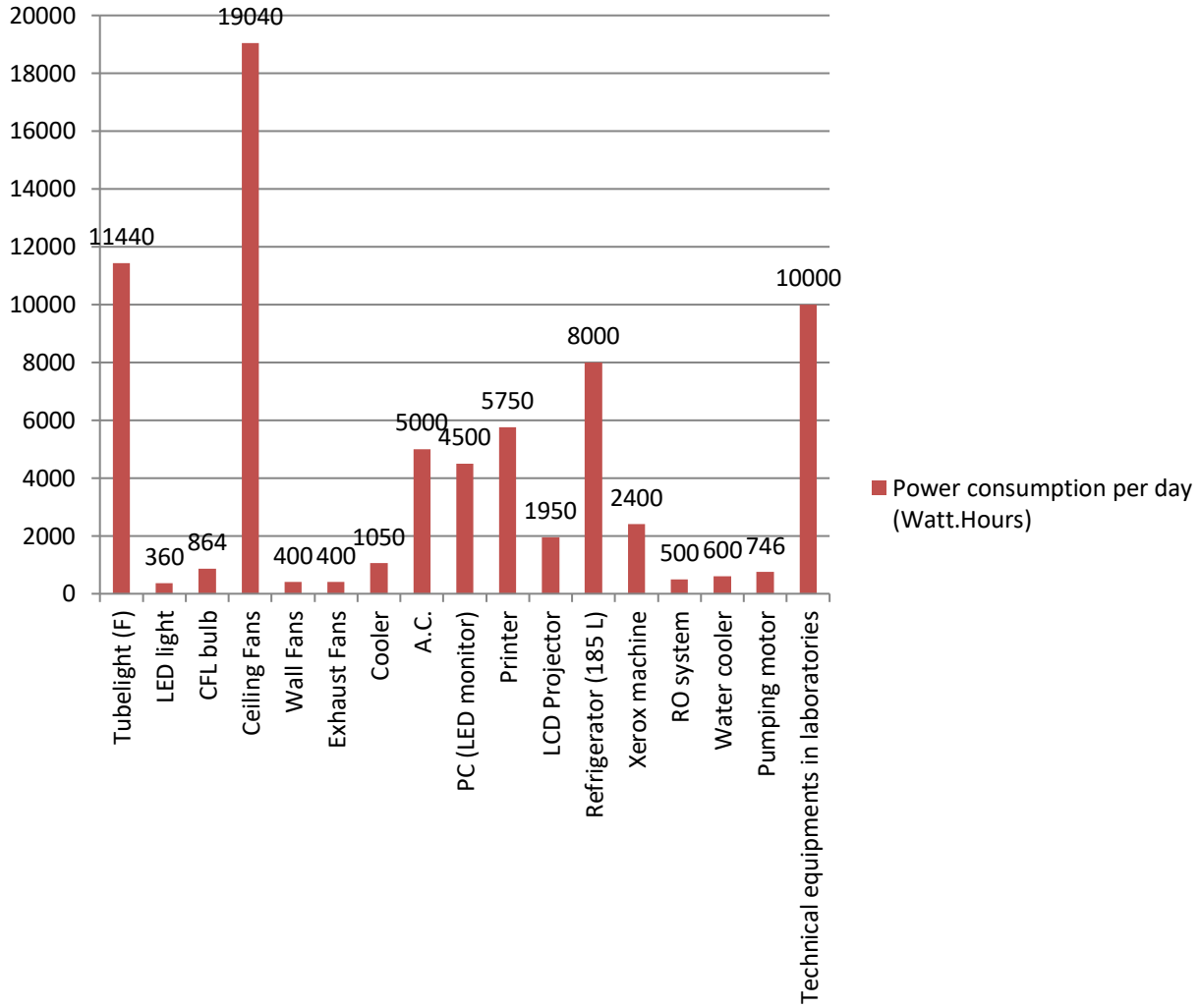


Equipment wise Energy Consumption:

Sr. No.	Name of the applicance	Power Rating (Watt)	Quantity	Average daily usage in hours	Power consumption per day (Watt.Hours)
A	B	C	D	E	F = C × D × E
1	Tubelight (F)	40	143	2	11440
2	LED light	20	9	2	360
3	CFL bulb	24	18	2	864
4	Ceiling Fans	80	119	2	19040
5	Wall Fans	50	4	2	400
6	Exhaust Fans	50	8	1	400
7	Cooler	300	7	0.5	1050
8	A.C.	1000	1	5	5000
9	PC (LED monitor)	60	75	1	4500
10	Printer	500	23	0.5	5750
11	LCD Projector	300	13	0.5	1950
12	Refrigerator (185 L)	1 KWHr/day	8	24	8000
13	Xerox machine	1200	1	2	2400
14	RO system	100	1	5	500
15	Water cooler	2.5 KW.Hr/day	1	6	600
16	Pumping motor	746	1	1	746
17	Technical equipments in laboratories				10000
	Total				73000
	Energy consumed in one day = 73 unit				
	Average Energy consumption in one year = 26645 units				
	Average Energy consumption in one month = 2220 units				

Note: Since during the academic session 2020 – 21 the college is remain closed for students due to covid – 19 pandemic, the actual power consumed is less as that of required power.

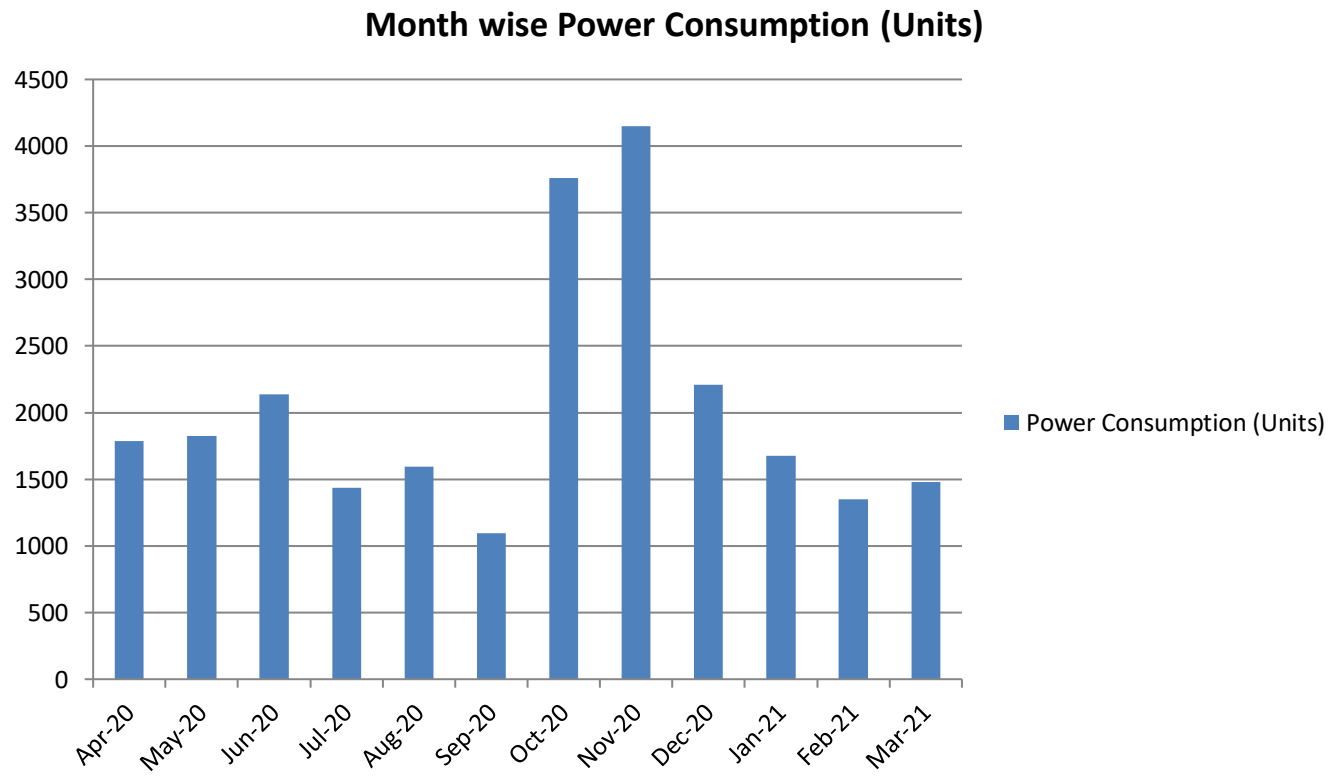
Equipment wise Power consumption per day (Watt.Hours)



Month wise Energy Consumption:

Month	Power Consumption (Units)
Mar-21	1478
Feb-21	1348
Jan-21	1675
Dec-20	2207
Nov-20	4150
Oct-20	3758
Sep-20	1094
Aug-20	1594
Jul-20	1437
Jun-20	2135
May-20	1823
Apr-20	1787
Total	24486

Average Energy Consumption in one month = 2040 units



Recommendations

1) Replace all conventional tube lights with LED tube lights, to save more power.
2) In Physics laboratory, 3 -phase connection for furnace and water distillation plant is taken from microbiology lab. Separate 3-phase connection should be provided to avoid power load
3) In old building, there is need to replace the electric boards and electric fitting.
4) In some classrooms there is requirement of fans and tube lights.
5) Install solar plant to reduce electric bill.
6) Switch off Light, fans, P.Cs. and other electrical appliances whenever they are not in use.

Energy saving calculation:

1) If the conventional tube lights are replaced with LED tube light, a large amount of energy can be save.
   Total number of conventional tube lights in college campus = 143
   The average power of conventional tube light = 40 W
   The average power of LED tube light = 20 W
   Difference in power saved per tube light = (40 – 20) = 20 W
   Total power saving = 143 × 20 = 2860 W
   Let average use of each tube light per day = 5 Hours
   Energy saved per day = 2860 × 5 = 14300 Watt.Hours = 14.3 KW.Hours = 14. 3 units
   Energy saved in one year = 14.3 × 365 = 5219.5 units
   The reduction in electric bill in one year = 5219.5 × 4.86 = 25366 Rs
   Average cost of single LED tube light = 400 Rs
   Total cost of replacing all conventional tube lights = 57200 Rs
   Pay back period required = 57200/25366 = 2.25 Years

2) If the old ceiling fans are replaced with 5 star energy saving fans:
   Total number of ceiling fans in college campus = 119
   The average power of existing ceiling fan = 80 W
   The average power of 5 star energy saving ceiling fan = 50 W
   Difference in power saved per ceiling fan = (80 – 50) = 30 W
   Total power saving = 119 × 30 = 3570 W
   Let average use of each ceiling fan per day = 5 Hours
   Energy saved per day =3570 × 5 =17850 Watt.Hours = 17.85 KW.Hours =17.85 units
   Energy saved in one year = 17.85 × 365 = 6515.25 units
   The reduction in electric bill in one year = 6515.25 × 4.86 = 31664 Rs
   Average cost of single 5 star energy saving fan = 1600 Rs
   Total cost of replacing all ceiling fans= 1,90,400 Rs
   Pay back period required = 1,90,400/31664 = 6 Years

Estimate for installation of solar plant in college campus:

Department wise required power load:

S.N.	Department	Power Load (Watt)
1	Physics	2880
2	Computer Science	3130
3	Chemistry	2094
4	Electronics	1464
5	Microbiology	3512
6	Zoology	2020
7	Mathematics	1354
8	Botany	1930
9	Commerce	3306
10	English	2080
11	Social Sciences and Humanities	104
12	Library	6076
13	Physical Education, NSS	976
14	Health Center, NCC	840
15	Administration office and Principal's Cabin	4740
16	IQAC	1220
17	Seminar Hall	1510
18	Staff room	890
19	Auditorium	480
20	Canteen and Book shop	1480
21	Classrooms	1520
	Total	43606

Total required power load = 44 kW

Note: While calculating power load, the technical instruments with high power rating (Furnace, incubator, oven etc) in Physics, Chemistry, Botany, Zoology and Microbiology departments are not taken into consideration.

Approximate expenditure required to install solar plant of 1 kW = Rs. 60,000/-
Approximate space required to install solar plant of 1 kW = 1 m^2
The approximate units produced by solar plant of 1 kW per day= 4 units
The approximate units produced by solar plant of 1 kW in one year= 1460 units
Approximate Saving in electric bill in one year = Rs. 10,000/-
Payback period = 6 years

----- THE END -----

7.1.2 ENVIRONMENT PROTECTION AND ENERGY CONSERVATION