

**ENERGY AUDIT OF ACADEMIC INSTITUTION
(RIMT POLYTECHNIC)**

Dissertation Submitted in partial fulfillment of the requirement for the award of the degree

Of

MASTER OF ENGINEERING

IN

POWER SYSTEM & ELECTRIC DRIVES

Submitted By:

Dharminder kumar

Regd. No. 821141003

Under the supervision of:

Mrs. Suman Bhullar

Assistant Professor, EIED



ELECTRICAL AND INSTRUMENTATION ENGINEERING DEPARTMENT,

THAPAR UNIVERSITY

PATIALA (PUNJAB) -147004

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CERTIFICATE

I hereby certify that the work which is being presented in the dissertation entitled '**Energy Audit of Academic Institution (RIMT Polytechnic)**' in partial fulfillment of requirement for the award of the master degree in Power Systems submitted in the Electrical and Instrumentation Engineering Department, Thapar University, Patiala is an authentic record of my own work carried under the guidance of **Mrs. Suman Bhullar**, (Assistant Professor EIED, Thapar University, Patiala).

The matter presented in this dissertation has not been submitted for the award of any other degree of this or any other university.



(Dharminder kumar)

821141003

This is to certify that the above statement made by the candidate is correct and true of the best of my knowledge & belief.


(Mrs. Suman Bhullar)

Assistant Professor
Electrical & Instrumentation Engg. Department
Thapar University, Patiala

Countersigned by: 

(Dr. RAVINDER AGGARWAL)

Professor & Head

Electrical & Instrumentation Engg. Department

Thapar University, Patiala


(Dr. S.K. MOHAPATRA)

Sr. Professor & Dean (Academic Affairs)

Thapar University, Patiala

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DHARMINDER KUMAR

Roll No. 821141003

ABSTRACT

An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the propagation of these technologies and options.

Energy Auditing of academic building presented in this dissertation work takes into account the load data and electricity bills. Energy Audit in dissertation is focused on reduction in energy wastage and improvement power saving. Energy audit of RIMT polytechnic is done and various weak areas are identified on account of energy wastage. In this dissertation, multiple measures are suggested to college administration to reduce energy wastage.

TABLE OF CONTENTS

Description	Page no.
Certificate	i
Acknowledgement	ii
Abstract	iii
Table of contents	iv
List of Tables	vi
List of Pie Charts	x
Chapter 1. Introduction	
1.1 Overview	1
1.2 Literature Review	1
1.3 Objective of the work	4
1.4 Organization of the Dissertation	4
Chapter 2. Energy Audit	
2.1 Definitions of Energy Audit	5
2.2 Types of Energy Audit	5
2.2.1 Benchmarking	5
2.2.2 Simple Audit	5
2.2.3 Detailed Energy Audit	6
2.3 Specific Electrical Energy Consumption	6
2.4 Different Stages of Energy Programmers	6
2.5 Energy management	7
2.6 Auditor Input	7
2.7 Basic logic to reduce Electricity bill	7
2.8 Air condition efficiency	8
2.9 Comparison with historical data	8
2.10 Important points to control energy utilization	8
2.11 Basic program of energy Audit	9
2.12 Commercial primary energy	9

2.13 Target points for energy audit	10
Chapter 3. RIMT Building & Room Description	
3.1 RIMT Polytechnic Introduction	11
3.2 Aim of energy audit	12
3.3 Room Analysis	13
3.4 Area of Building	13
3.5 Connected Load	14
Chapter 4. RIMT Polytechnic Load Data	
4.1 Room Load Analysis	17
4.1.1 Block 1	17
4.1.2 Block 2	35
4.1.3 Block 3	49
4.1.4 Block 4	59
4.1.5 Workshop	62
Chapte5. Results, Conclusion and Future Scope	
5.1 Energy saving potential	68
5.1.1 Reduce wastage	68
5.1.2 Use Energy saving appliances	68
5.1.3 Reduce wastage of Light	69
5.1.4 Air conditioning calculations	69
5.1.5 Repair and maintenance	71
5.2 Conclusion	71
5.3 Future Scope	71
References	71

LIST OF TABLES

Table No.	Description	Page No.
3.1	AREA OF BUILDING	13
3.2	CONNECTED LOAD	14
4.1	CHEMISTRY LAB	17
4.2	PHYSICS LAB	17
4.3	FIRST AID CUM SICK ROOM	18
4.4	GIRLS COMMON ROOM	18
4.5	PANTRY	19
4.6	OFFICE	19
4.7	DIRECTOR ROOM	20
4.8	PRINCIPAL ROOM	21
4.9	TOILET	21
4.10	CORRIDOOR (GROUND FLOOR) + STORE	22
4.11	COMPUTER LAB - 1	22
4.12	COMPUTER LAB - 2	23
4.13	SERVER ROOM	23
4.14	COMPUTER LAB - 3	24
4.15	COMPUTER LAB - 4	25
4.16	COMPUTER LAB - 5	25
4.17	COMPUTER LAB - 6	26
4.18	FIRST FLOOR CORRIDOOR + STAFF TOILET	26
4.19	HARDWARE LAB 1 & 2	27
4.20	COMPUTER LAB - 14	27
4.21	COMPUTER LAB - 15	28
4.22	COMPUTER LAB - 12	28
4.23	COMPUTER LAB 10 & 11	29
4.24	COMPUTER LAB - 13	29
4.25	LECTURER HALL - 12	30

4.26	LECTURER HALL - 13	30
4.27	TOILET BOYS	31
4.28	2 ND FLOOR CORRIDOOR	31
4.29	LECTURER HALL - 14	32
4.30	LECTURER HALL - 15	32
4.31	CAD LAB	33
4.32	INTERNET LAB-1	33
4.33	INSTRUMENTATION AND PLC	34
4.34	INTERNET LAB – 2	34
4.35	FACULTY ROOM	35
4.36	MATERIAL SCIENCE LAB	35
4.37	COMMUNICATION SKILLS LAB	36
4.38	AUTOMOBILE ENGG. LAB	36
4.39	HYDRAULIC & PNEUMATIC LAB	37
4.40	APPLIED MECHANICS LAB	37
4.41	EM LAB - 1	38
4.42	EM LAB - 2	38
4.43	ELECTRICAL LAB - 2	39
4.44	LECTURE HALL - 4	39
4.45	LECTURE HALL - 3	40
4.46	LECTURE HALL - 1	40
4.47	ENGINEERING DRAWING HALL - 1	41
4.48	ELECTRICAL WORKSHOP	41
4.49	LECTURE HALL - 7	42
4.50	LECTURE HALL - 6	42
4.51	LECTURE HALL - 5	43
4.52	ECE LAB - 1	43
4.53	CONSUMER ELECTRONIC LAB	44
4.54	MICROPROCESSOR LAB	44
4.55	PROJECT LAB	45
4.56	LECTURE HALL - 8	45

4.57	LECTURE HALL - 9	46
4.58	LECTURE HALL - 10	46
4.59	LECTURE HALL - 11	47
4.60	ENGINEERING DRAWING HALL – 2	47
4.61	TPO ROOM + EDC LAB	48
4.62	CORRIDOOR + TOILET	48
4.63	FITTING WORKSHOP - 2	49
4.64	FITTING WORKSHOP - 1	49
4.65	ELECTRICAL & ELECTRONICS WORKSHOP	50
4.66	CHEMISTYR LAB - 2	50
4.67	GROUND FLOOR TOILET + CORRIDOOR	51
4.68	SHEET METAL WORKSHOP	51
4.69	LECTURE HALL - 16	52
4.70	LECTURE HALL - 17	52
4.71	LECTURE HALL - 18	53
4.72	LECTURE HALL 19 + PUMP	53
4.73	LECTURE HALL - 20	54
4.74	SEMINAR HALL	54
4.75	FACULTY ROOM - 1	55
4.76	FACULTY ROOM – 2	55
4.77	LECTURE HALL - 21	56
4.78	LECTURE HALL - 24	56
4.79	LECTURE HALL - 23	57
4.80	LECTURE HALL - 25	57
4.81	ENGINEERING DRAWING HALL - 3	58
4.82	LIBRARY	58
4.83	CANTEEN	59
4.84	SURVEY LAB	59
4.85	TUTORIAL ROOMS 128 +130 +131 +132+133	60
4.86	TUTORIAL ROOMS 230+232+233+234+235	60
4.87	TUTORIAL ROOMS 323+ 325+ 326+ 327+ 328	61

4.88	TUTORIAL ROOMS 402+404+ 405+ 406+ 407	62
4.89	SMITHY WORKSHOP	62
4.90	CARPENTRY WORKSHOP	63
4.91	MACHINE WORKSHOP	64
4.92	WELDING WORKSHOP	64
4.93	TOILET	65
4.94	CORRIDOOR	65
4.95	TOTAL NO. OF APPLIANCES CONNECTED	66

LIST OF CHARTS

Chart. No.	Topic Description	Page Number
3.1	Total seats	11
3.2	Monthly Electricity Bill	12
3.3	Area of building	14
3.4	Connected Load	16

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

The whole world is going towards the path of energy saving. The idea saving electric energy starts from Generation, through transmission and goes on up to the distribution system. It is not only for country's economic development but also necessary for good environment.

The life style of whole world has been updated because of the advances in technology, Industrialization in all sectors like industry, transport; domestic and commercial happens with any means of electrical energy. The electrical energy is the primary requirement for any Industrial building activity and this increase in per capital.

The gap between demand and supply of electric energy in the world is increasing every year. The world gap between demand and supply is 4.32% in 2001 and this gap increases to 11.35% in 2010, more than double in a period of 9 years. This gap is increasing the challenges towards world power scenario. One of the solutions to tackle this problem is to introduce Energy Audit to check the wastage of electric energy.

The world energy audit is frequently used to analyze a broad area of energy. This study starts from quick walk through to search large effected area for wastage of energy. The target of energy management is to save energy, resulting in least cost and least effect on the environment.

1.2 LITERATURE REVIEW

Wong *et. al.* (1993) described the energy audit. He suggested that energy audit was one of the comprehensive method in checking the energy usage and wastage in building with historical data.

Ljumba *et. al.* (1996) discussed that the consumers having low income are increasing in large quantity (about 20% annually). Most of the newly connected consumers have no previous experience in utilization of electrical energy properly. It was one of the reasons that

the load profile of such consumers was usually peak in nature. So, their consumption pattern was bound to affect the regional system load.

Hongbu Wang *et.al.* (2007) advised the government about the goal to promote the energy efficiency of existed buildings and also had to accelerate the execution of building energy efficiency strategy.

P.R. Harbin (2007) presented a method that the drafting economic incentive policy put forward and economic incentive policy configuration according to different types of buildings.

Predenzi A *et.al.* (2007) presented a software program tool i.e. energy analysis system (EAST). This software was implemented on personal digital assistant (PDA) in order to provide a portable tool that was useful in the field of surveying activities.

Qingmiao Han *et.al.* (2008) proposed that the level of efforts made by existing buildings owners had played a key role to the process of energy efficiency retrofit. The owner had the ability of implementing and maintaining the efforts level in order to obtain huge benefits.

B.O. Jiang *et.al.* (2008) established the system about the information collection, storage, management, issuance and utilization in building energy efficiency (BEE).

Dr. H.P. Inamdar *et.al.* (2008) suggested that the demand of electricity was increased by 6-8 % every year but production was not increased to same ratio. There were two methods to counter this problem. One was to increase generation and second was to conserve the electricity from utility side.

Munoz *et.al.* (2009) presented a case study which demonstrated the impacts of generalized electronic devices on the power quality of the building and implementation on energy use.

Lin chajhan *et.al.* (2009) presented the design and realized system form, system architecture, system source and other environments for safety and also for monitoring technology in power management system.

Qi. Zhang *et.al.* (2009) suggested a case study to the government and also shown an asymmetric game between the building owners and the energy service companies (ESCOs) domain of energy efficiency in buildings and gave final results. Basically, it depends on the initial conditions. So, the government should consider these points while making policies.

Wang Xin *et.al.* (2009) presented a case study about the energy consumption of air conditioning system. The energy consumption of the lighting system was just less than 10 %.

For audit of commercial building, outer climate and office occupancy rate are two leading factors for the change of the total energy consumption.

Jian Vao (2010) suggested an idea of energy efficient building using simulation software. It provided a great help in the study of building energy efficiency.

Jian Yao (2010) presented seven major factors that include government's supervision, design standards, design quality, energy efficient materials, the quality of construction operation and occupant's behavior (building energy) efficiency. This study was based on decision making trail and evaluation laboratory (DEMATEL).

Huijun wv et.al. (2011) presented results about the glass sun shading coefficient. The building cooling energy could be significantly reduced by decreasing the infrared transmitted rate of the glass. The sun shading coefficient of the glass could be significantly reduced from 0.856 to 0.363 as the infrared transmitted rate was decreased for 1.0 to 0.0. The visual light transmitted rate remained constant at 0.6 which could provide sufficient natural light to the building and not increasing the lighting energy consumption.

Zhang Dianguang et.al. (2011) presented a case study on the principal and application conditions of the cooling tower. It could be a useful reference for the application of the cooling tower free cooling system in energy saving reform of the buildings.

Yuan xu et.al. (2011) presented the case study in which the new construction companies were advised to use energy saving and environmental friendly building materials. The material should be selected according to the local climate characteristics. The construction planning, design and material, all could be optimized and combined with other energy saving technologies.

Yue wang et.al. (2011) presented a case study which was concerned about the enhancement of the energy saving awareness. The government should provide free energy saving materials and give faculties to facilitate the development of new energy saving technology.

Corucci Francesco et.al. (2011) suggested that green building was able to provide significant energy savings by the eliminating stand by consumptions and adopting the behavior of appliances to the real environment conditions.

Rensbuy JF Van et.al. (2011) designed a permanent sub-metering system. The data was gathered from the sub material system and ranked the building according to their contribution to the maximum demand.

1.3 OBJECTIVE OF THE WORK

The objective of the work is to collect and analyze the energy data of RIMT polytechnic, Mandi Gobindgarh in order to reduce electrical bill.

1.4 ORGANISATION OF DISSERTATION

The work carried out in the dissertation has been divided into five chapters.

Chapter 1 briefs the overview, literature review and objective of the work. It also contains the organization of dissertation.

Chapter 2 deliberates on definitions of energy audit, types of energy audit and its associated problems.

Chapter 3 deliberates on introduction of RIMT polytechnic, room analysis and connected load.

Chapter 4 load data of RIMT polytechnic.

Chapter 5 contains results, conclusion and future scope.

CHAPTER 2

ENERGY AUDIT

2.1 DEFINITION OF ENERGY AUDIT

It is feasible study which not only serves to identify energy used in various sections but also provides opportunities for energy conservation. It is the primary step for energy management program.

The energy management is step by step going strategy for changing building's electrical energy usage pattern. It is the method to reduce wastage of electrical energy and money with climate or with design of building, location of building, function of the building i.e. occupancy schedules of the rooms etc. It maintains difference between a building annual energy requirement and its actual energy consumption requirement.

2.2 TYPES OF ENERGY AUDIT

1. Benchmarking.
2. Simple audits.
3. Detailed Energy Audit.

2.2.1 Benchmarking:

It is the processes of comparing the best possible result with the given result and the resultant error is used to improve the standard of the quality of the system. It allows management to develop plans on implementation of above discussed method. Bench marking is the very useful tools for better understanding for electrical energy consumption patterns in the building functions. It the process which give the idea of possible and impossible change in the system and also give the path for good, average and bad energy utility.

2.2.2 Simple Audits:

Simple audits (Also called preliminary, screening and walk though audit) is simple and quick type of energy audit. It requires small time, with only view of building personally and bench marking view of bills and other data analysis. It also familiarizes with the building functions, area of energy waste or inefficiency. This audit analysis helps the better understanding of the billing pattern of the building. It gives the general picture of the building energy audit i.e. its use, operation and where an energy loss is taking place.

Simply audit is a quick exercise to:

1. Total energy consumption in the building.
2. Estimate for the scope of saving.
3. Search the most likely attention area of the building.
5. Simple energy audit is to obtain easily existing data.

2.2.3 Detailed Energy Audit: Priority survey:-

When walking through survey, a point to keep in mind is that the building way which is used during survey. The major data of information is obtained from the following points.

- * No. of air condition and its specification.
- * Electrical lighting and its specification and quantity.
- * Total yearly bills and operating hours of all electrical appliances during the whole year.

When surveying also study the building features i.e. paint color of building, sun reflected devices, window screens and so on noted other possible method applied to control or adjust the atmospheric temperature/ sun light etc.

Total building is divided into different zones, which analyze the air condition system and its types of windows i.e. its condition for air sealed. Number of lights required in the room for study purpose, workshops, computer labs, dark rooms, ground, library etc. This type of data information is compared against the recommended data information.

2.3 SPECIFIC ELECTRICAL ENERGY CONSUMPTION (SEEC)

The specific electrical energy consumption is defined as per unit of product output. This energy consumption considers all the members of building who are using energy is calculated which forms the secondary and taken as reference for comparison purpose.

2.4 DIFFERENT STAGES OF ENERGY PROGRAMMERS

This is the method to walk through the one point of the building, which is under energy, study to last point up to which electrical energy is utilized.

The simple monitoring of electric energy used in the building. It is also directly related with energy management programmers and cost. Firstly it searches the area of the building where energy is wasted and this type of reduction will not disturb the functions of the other buildings. It goes with detailed step by step analysis of the whole building's energy use factor and its cost such as building schedules, building cooling efficiency, no. of lights and illumination level, bill records and also unit consumption. The complete study of this system

is read by management and will decide that which type of measure should be adopted to reduce electricity bill without suffering the consumers.

The second stage is to increase the efficiency of equipment and reduce wastage with proper operation and maintenance. This system is applicable when operating machines working hours are reduced without affecting productivity and growth. The following points keep in mind when energy audits:

- ~ Equipment operating hours.
- ~ Ventilation fans analysis and air conditioning.
- ~ Different types of lighting system and its quantity required.
- ~ Service of instruments.

The second stage is requirement of changes to implement this function. Implementation of this type of change required some starting investment. Replace those instruments which are faulty or as completed useful life. Implementation of this method requires large investment to achieve the goal.

2.5 ENERGY MANAGEMENT

The following profession and field are use for energy management.

1. Environmental engineering
2. Management
3. Public Relation
4. Economics
5. Financial analysis & Operational research (System analysis)

2.6 AUDITOR INPUT

We meeting with building maintenance staff and discussed future schedules plans and see the effect in changing electricity bills i.e. function and sports event etc. This type of suddenly change in occupancy in the college building or change in the bills is noted in the yearly system. This type of system is not a permanent.

2.7 BASIC LOGIC TO REDUCE ELECTRICITY BILL

- ~ Switch off the equipment when not in use.
- ~ Replace or Repair the low efficient equipment.
- ~ Awareness to reduce energy waste of all the users.

- ~ Measures to improve the lighting system and also air conducting system in a building.
- ~ To improve the power factor.
- ~ To replace the CFL (Compressed fluorescent light.) with blast fluorescent tube.
- ~ Adjust the lighting system with our different job works.
- ~ Optimum setting of air conditioning temperature.
- ~ Adjust the building design for proper ventilation with or without exact fan.
- ~ Increasing the no. of persons sitting at one place.
- ~ Storage place in a building must be at top floor and sitting arrangement should be on ground floor etc.
- ~ Maximum working in an industry or a large building is day time to reduce lighting requirement.

2.8 AIR CONDITION EFFICIENCY

It is found that air conditioning bill is approximately 60% of the total consumption. If we can focus on the air conditioning maintenance, we can reduce the overall energy consumption of the whole system. We can also reduce some environmental problems i.e. green house effect and Ozone depletion etc.

2.9 COMPARISON WITH HISTORICAL DATA

Collect the 3 to 5 year old data of energy consumption and compare with the latest electricity bill. From this comparison we can understand the past method of energy usage and their trend. This is the base idea of future comparison energy audit and their implementation. It is also compared with other building with similar function and its energy uses in past few years.

2.10 IMPORTANT POINTS TO CONTROL ENERGY UTILIZATION

1. Total working hours of air conditioning and its length of pre-cool period.
2. Building internal condition i.e. humidity, temperature, lighting level etc.
3. Find location for unnecessary lighting and air conditioning/fan etc.
4. Water cooling temperature setting.
5. Unnecessarily sun light inside the building cover with wall curtains to control air conditioning working.

6. Find areas where use high energy consumption and possibility to reduce this consumption.
7. Select the responsible person on duty to control energy consumption of selected area with individual sub energy meter.

2.11 BASIC PROGRAMME OF ENERGY AUDIT

1. **Record analysis:** Compare the electrical energy consumed with the other buildings performing the similar function building.
2. **Environmental conditions:** Check the lighting provision and air condition with environmental conditions.
3. **Electricity:** Check the method to reduce maximum demand of electricity.
4. **Maintenance:** Check the time table of maintenance schedule and improve the efficiency of all type of machines.
5. **Personal:** Motivate employees personally to save electricity.
6. **Energy Manger:** Appoint a full time energy manager to look after the energy audit time to time.
7. **Success evaluate:** evaluate the success of electricity energy saving and show its importance.
8. **Problem solver:** If specific problem is faced, search its solution.
9. **Latest technology:** to use this instrument which save more electricity i.e. Star rated instrument is give more efficiency.

2.12 COMMERCIAL PRIMARY ENERGY

The commercial primary energy i.e. oil, coal, gas, hydro and nuclear in 1989-1990 is estimated about 67% and target is to increase 79.6% up to the year of 2004-05 according to planning commission report (1987). Generating unit added 16,384 MW capacities up to 1989 to 1993. Then total generation of 221 billion units. The maximum contribution comes from thermal power generation i.e. 157 billion units. Hydro power generation is contributing to 57 billion units and other 7 billion units contribute to nuclear and other projects.

The demand is increase approximately 295 trillion watt hours (T.WH) in 1989-90, 400 trillion watt hours (T.WH) in 1994-95 and 818 trillion watt hours (T.WH) in 2004-05 according to the planning commission report (1987).

It is good performance in power sector i.e. 20-25% in national plan outplay. But this is not a sufficient to meet the load demand. This data is taken from ONGC publication.

With this background, we are concluding that energy management practice is must.

2.13 TARGET POINTS FOR ENERGY AUDIT

1. Utility rate
2. Break even analysis
3. Space Conditioning
4. Product energy rate
5. Demand control
6. Process modification
7. Electric rate structure.
8. Power Bill
9. Energy Balance
10. Metering
11. Energy conservation program
12. Marginal cost analysis
13. Energy Monitoring
14. Loss evaluation
14. Load type
16. Energy saving.
17. Load Management
18. Heating
19. Ventilation
20. Lighting
21. Air Conditioning

CHAPTER 3

RIMT BUILDING & ROOM DESCRIPTION

3.1 RIMT POLYTECHNIC INTRODUCTION

RIMT Polytechnic, Mandi Gobindgarh was established in the year 2005 initially with four AICTE approved Diploma, Engineering courses. At present the college is running five diploma courses. The detail students of different branches as shown below:

COURSE	NO. OF SEATS
1. Computer Science and Engineering.	120
2. Electronics & Communication Engineering.	120
3. Electrical Engineering.	120
4. Mechanical Engineering.	180
5. Civil Engineering.	120
TOTAL	<u>780</u>

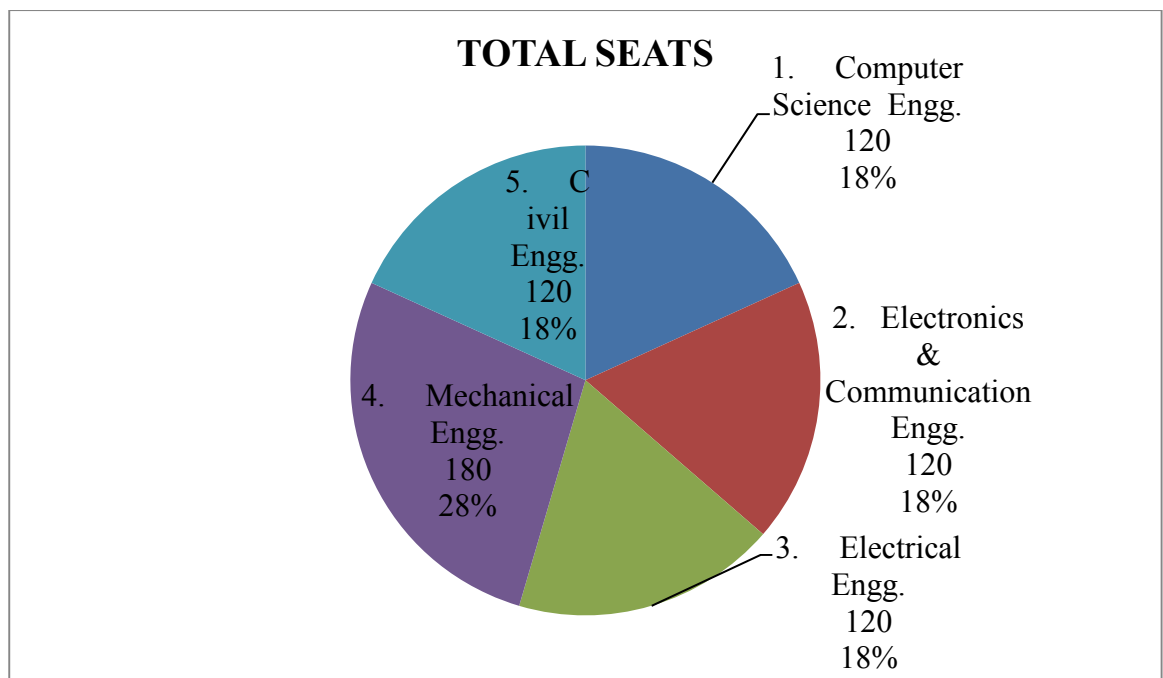


Figure 3.1 Total seats

Also RIMT extends support by:-

RIMT Engineering College

RIMT Aggarsen Engineering College

RIMT Hotel Management College

RIMT Education College

RIMT Management College

RIMT Academic College

RIMT College of Architecture

Om Parkash Bansal Modern School , Mandi Gobindgarh.

3.2 AIM OF ENERGY AUDIT: Objective of this thesis work is to minimize electrical bills of RIMT – POLYTECHNIC MANDI GOBIND GARH, by applying methodology of energy auditing. The RIMT Polytechnic Electricity bill has crossed Rs. 1135480.00 during the year 2013. It was aimed to save energy at different activity of use energy consumption. The target is to save electricity up to 20%. The target is also to simple practical problem and increase efficiency i.e. decrease electricity yearly bill up to 20%.

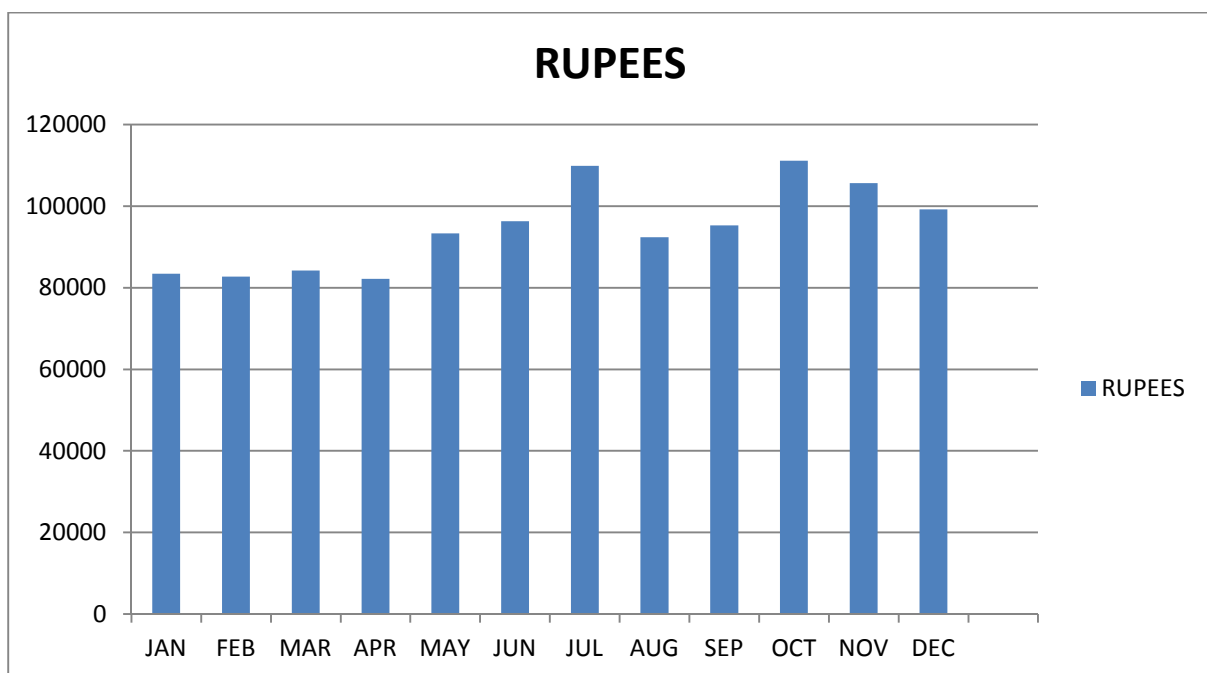


Fig. 3.2 Monthly Electricity Bill

3.3 ROOM ANALYSIS

RIMT Polytechnic building structural foundation was planned for 4 buildings. Two buildings are design up to 4th floor and two buildings are design up to 5th floor. The individual class rooms are given a unique number as indicated in the drawing layout of each floor.

Number of Theory Class Rooms	= 31
Number of Practical Class Rooms	= 30
Number of Faculty Rooms	= 16
Number of Administrative Rooms	= 06
Number of Toilets	= 16
Number of Rooms for Library	= 04
Number of Room for Pantry	= 01
Total number of Rooms	= 104

3.4 AREA OF BUILDING

Table No.3.1

Block No.	Area Sq Mtrs.
Block No. 1	1000
Block No. 2	941
Block No. 3	614
Block No. 4	580
Workshop	700

Total covered area = 3835 Sq M.

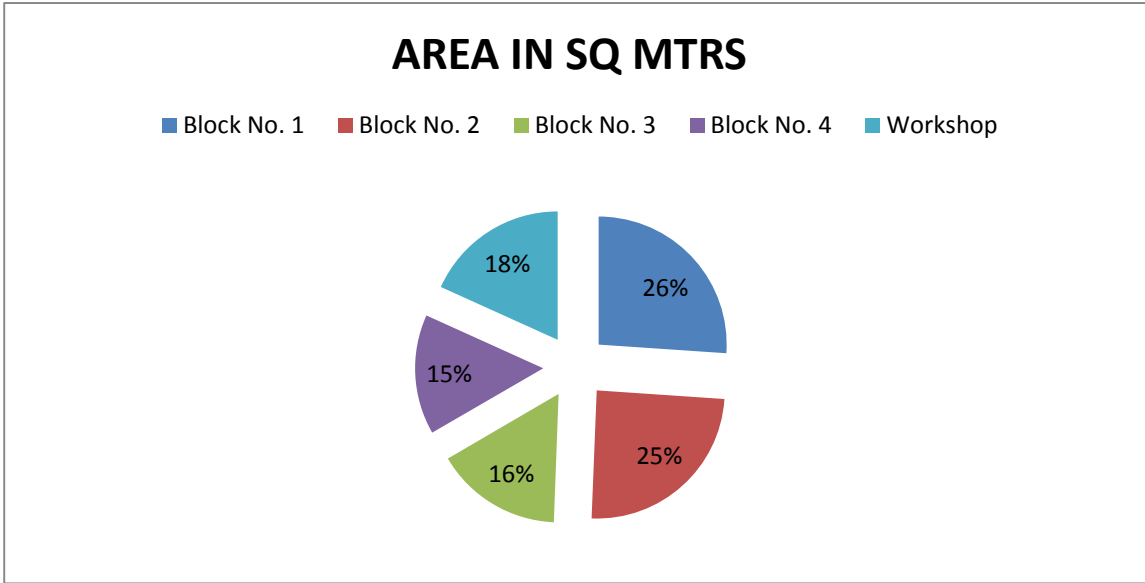


Fig 3.3 Area of Building

3.5 CONNECTED LOAD

Table No.3.2

NAME OF APPLIANCE	NO. OF APPLIANCE	WATTAGE	TOTAL WATTAGE
TUBE LIGHT	772	40	30880
CEILING FAN	897	80	71760
COMPUTER	549	250	137250
EXHAUST FAN	9	40	360
	9	80	720
PRINTER	24	200	4800
XEROX MACHINE	1	1000	1000
	1	750	750
SCANNER	4	200	800
AC 1.5T	39	1500	58500
WATER COOLER	4	750	3000

LAB/WORKSHOP 1HP MOTORS	13(1 HP)	735.5	9561.5
LAB/WORKSHOP 2HP MOTORS	22(2 HP)	1471	32362
LAB/WORKSHOP 3HP MOTORS	3(3 HP)	2206.5	6619.5
LAB/WORKSHOP 0.5HP MOTORS	1(0.5 HP)	367.75	367.75
LAB/WORKSHOP 1.5HP MOTORS	2(1.5 HP)	1103.25	2206.5
FURNACE	5	1000	5000
C F L	17	40	680
REFRIGERATOR	4	750	3000
WALL FAN	4	60	240
WELDING MACHINE	6	1000	6000

Total connect load (w) =375857.25w

Total connect load (k w) =375.85725 kW

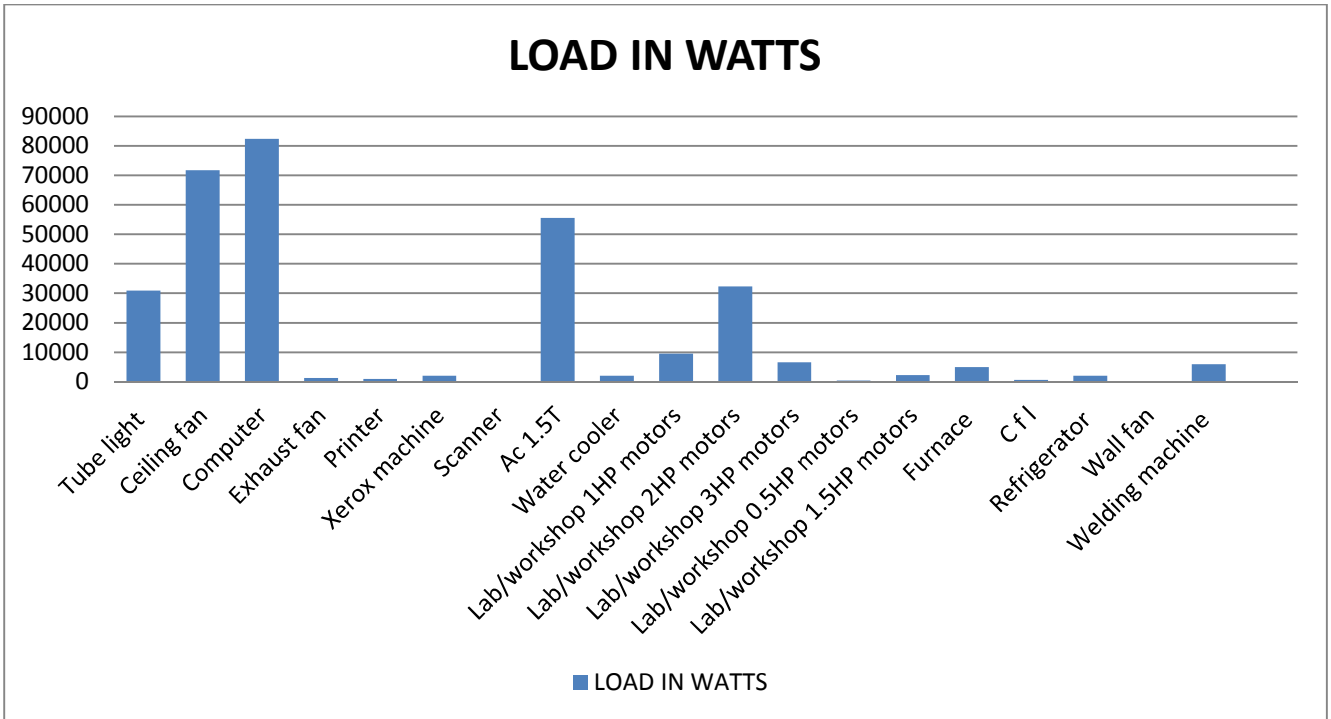


Figure 3.4 Connected Loads

It concludes from the above that the maximum load in the college is due to the following appliances:

1. Computers.
2. Air-conditions.
3. Ceiling fans.
4. Lab/ workshops motors.
5. Tube lights.

These are the main working appliances which consumed maximum electrical energy in the college. So, our main attention to reduce their wastage and their good performances.

CHAPTER 4
RIMT POLYTECHNIC LOAD DATA

4.1 ROOM LOAD ANALYSIS

4.1.1 BLOCK 1

CHEMISTRY LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.1

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	10	400	88	35.2
2	CEILING FAN	80	15	1200	88	105.6
3	EXHAUST FAN	40	2	80	88	7.04

Total energy consumption per month = 147.84kWh

PHYSICS LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.2

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
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1	TUBE LIGHT	40	10	400	88	35.2
2	CEILING FAN	80	15	1200	88	105.6
3	COMPUTER	250	1	250	44	11
4	PRINTER	200	1	200	22	4.4

Total energy consumption per month = 156.2kWh

FIRST AID CUM SICK ROOM

Monthly usage of this room is 154 hours.

Table No. 4.3

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	2	160	154	24.64
3	XEROX MACHINE	1000	1	1000	44	44

Total energy consumption per month = 87.12kWh

GIRLS COMMON ROOM

Monthly usage of this room is 154 hours.

Table No. 4.4

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	4	160	154	24.64

2	CEILING FAN	80	3	240	154	36.96
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Total energy consumption per month = 61.6 kWh

PANTRY

Monthly usage of this room is 154 hours.

Table No. 4.5

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	1	40	154	6.16
2	CEILING FAN	80	1	80	154	12.32
3	FREEZER	750	1	750	720	540

Total energy consumption per month = 558.48 kWh

OFFICE

Monthly usage of this room is 154 hours.

Table No. 4.6

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	9	360	154	55.44
2	CEILING FAN	80	9	720	154	110.88
3	COMPUTER	250	4	1000	154	154
4	PRINTER	200	5	1000	44	44

5	WINDOW A.C.	1500	2	3000	154	462
6	SCANNER + PC	450	1	450	154	69.3

Total energy consumption per month = 895.62 kWh

DIRECTOR ROOM

As per experience it is found that total working hours usage of this room per month is 154 hours.

Table No. 4.7

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	5	200	154	30.8
2	CEILING FAN	80	3	240	154	36.96
3	COMPUTER	250	2	500	22	11
4	PRINTER	200	1	200	11	2.2
5	WINDOW A.C.	1500	1	1500	154	231
6	XEROX MANCINE	750	1	750	4	3
7	FAX MACHINE	200	1	200	4	0.8

Total energy consumption per month =315.76 kWh

PRINCIPAL ROOM

As per experience it is found that total working hours usage of this room per month is 154 hours.

Table No. 4.8

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32
2	CEILING FAN	80	2	160	154	24.64
3	COMPUTER	250	1	250	154	38.5
4	PRINTER	200	1	200	22	4.4
5	WINDOW A.C.	1500	1	1500	154	231

Total energy consumption per month = 310.86 kWh

TOILET

Monthly usage of this room is 154 hours.

Table No. 4.9

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	1	40	154	6.16
2	EXHAUST FAN	40	1	40	154	6.16

Total energy consumption per month = 12.32 kWh

CORRIDOOR (GROUND FLOOR) + STORE

Monthly usage of this room is 154 hours.

Table No. 4.10

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	8	320	154	49.28
2	CEILING FAN	80	5	400	77	30.8
3	WATER COOLER	750	1	750	154	115.5

Total energy consumption per month = 195.58 kWh

COMPUTER LAB - 1

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.11

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	16	400	88	35.2
2	CEILING FAN	80	6	480	88	42.2
3	COMPUTER	250	30	7500	88	660
4	PRINTER	200	1	200	11	2.2
5	WINDOW A.C.	1500	1	1500	88	132

Total energy consumption per month = 871.6 kWh

COMPUTER LAB –2

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.12

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	24	960	88	84.5
2	CEILING FAN	80	9	720	88	63.3
3	COMPUTER	250	30	7500	88	660
4	PRINTER	200	1	200	11	2.2
5	WINDOW A.C.	1500	2	3000	88	264

Total energy consumption per month = 1074 kWh

SERVER ROOM

Monthly usage of this room is 154 hours

Table No. 4.13

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	10	400	154	61.6
2	CEILING FAN	80	4	320	154	49.28
3	COMPUTER	250	4	1000	154	154

4	PRINTER	200	1	200	66	13.2
5	WINDOW A.C.	1500	2	3000	154	462
6	SCANNER +P.C.	450	1	450	66	29.7

Total energy consumption per month = 769.78 kWh

COMPUTER LAB - 3

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.14

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	24	600	88	52.8
2	CEILING FAN	80	9	720	88	63.3
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	2	3000	88	264

Total energy consumption per month = 1040.1 kWh

COMPUTER LAB - 4

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.15

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	18	450	88	39.6
2	CEILING FAN	80	7	560	88	49.2
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	2	3000	88	264
5	PRINTER	200	1	200	88	176

Total energy consumption per month = 1188.8 kWh

COMPUTER LAB - 5

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.16

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	18	450	88	39.6
2	CEILING FAN	80	6	480	88	42.2
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	1	1500	88	132

Total energy consumption per month = 873.8 kWh

COMPUTER LAB - 6

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.17

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	34	850	88	74.8
2	CEILING FAN	80	15	1200	88	105.6
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	2	3000	88	264
5	PRINTER	200	1	200	11	2.2

Total energy consumption per month = 1106.6 kWh

FIRST FLOOR CORRIDOOR + STAFF TOILET

Monthly usage of this room is 154 hours.

Table No.4.18

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	40	23	920	154	141.68
2	WATER COOLER	750	1	750	154	115.5

Total energy consumption per month = 257.18 kWh

HARDWARE LAB 1 & 2

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.19

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	40	1000	88	88
2	CEILING FAN	80	14	1120	88	98.5
3	COMPUTER	250	2	500	88	44

Total energy consumption per month = 230.5 kWh

COMPUTER LAB - 14

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.20

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	24	600	88	52.8
2	CEILING FAN	80	8	640	88	56.3
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	2	3000	88	264

Total energy consumption per month =1033.1 kWh

COMPUTER LAB - 15

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.21

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	8	320	88	28.2
2	CEILING FAN	80	6	480	88	42.2
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	2	3000	88	264

Total energy consumption per month = 994.4 kWh

COMPUTER LAB – 12

The College is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.22

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	28	700	88	61.6
2	CEILING FAN	80	12	960	88	84.4
3	COMPUTER	250	30	7500	88	660

4	WINDOW A.C.	1500	1	1500	88	132
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Total energy consumption per month = 938 kWh

COMPUTER LAB 10 & 11

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.23

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	36	900	88	79.2
2	CEILING FAN	80	15	1200	88	105.6
3	COMPUTER	250	60	15000	88	1320
4	WINDOW A.C.	1500	3	4500	88	396
5	PRINTER	200	1	200	88	17.6

Total energy consumption per month = 1918.4 kWh

COMPUTER LAB - 13

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.24

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	16	400	88	35.2

2	CEILING FAN	80	6	480	88	42.2
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	1	1500	88	132

Total energy consumption per month = 869.4 kWh

LECTURER HALL - 12

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So total hour's usage of this room is 154 hours per month.

Table No.4.25

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	5	200	154	30.8
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 117.04 kWh

LECTURER HALL - 13

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room is 154 hours per month.

Table No.4.26

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	5	200	154	30.8
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 117.04 kWh

TOILET BOYS

Monthly usage of this room is 154 hours.

Table No.4.27

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32
2	EXHAUST FAN	40	1	40	154	6.16

Total energy consumption per month = 18.48 kWh

2ND FLOOR CORRIDOOR

Table No.4.28

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	WATER COLLER	750	1	750	154	115.5

Total energy consumption per month = 133.98 kWh

LECTURER HALL - 14

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.29

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

LECTURER HALL - 15

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So total hour's usage of this room per month is 154 hours.

Table No.4.30

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

CAD LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.31

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	24	600	88	52.8
2	CEILING FAN	80	9	720	88	63.3
3	COMPUTER	250	60	15000	88	1320
4	WINDOW A.C.	1500	2	3000	88	264

Total energy consumption per month = 1700.1 kWh

INTERNET LAB-1

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.32

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	24	600	88	52.8
2	CEILING FAN	80	9	720	88	63.3
3	COMPUTER	250	60	15000	88	1320
4	WINDOW A.C.	1500	2	3000	88	264
5	PRINTER	200	1	200	88	17.6

Total energy consumption per month = 1717.7 kWh

INSTRUMENTATION AND PLC

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.33

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	88	7
2	CEILING FAN	80	6	480	88	42.2

Total energy consumption per month = 49.2 kWh

INTERNET LAB – 2

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.34

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	25	16	400	88	35.2
2	CEILING FAN	80	6	480	88	42.2
3	COMPUTER	250	30	7500	88	660
4	WINDOW A.C.	1500	2	3000	88	264
5	PRINTER	200	1	200	88	17.6

Total energy consumption per month = 1019 kWh

FACULTY ROOM : Monthly usage of this room is 154 hours.

Table No.4.35

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT (CFL)	40	1	40	154	6.16
2	CEILING FAN	80	3	240	154	36.96

Total energy consumption per month = 43.12 kWh

4.1.2 BLOCK 2

MATERIAL SCIENCE LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.36

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	7	280	88	24.6
2	CEILING FAN	80	12	960	88	84.4
3	LAB SET UP	2000	2	4000	88	352

Total energy consumption per month = 461 kWh

COMMUNICATION SKILLS LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.37

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	13	520	88	45.7
2	CEILING FAN	80	10	800	88	70.4
3	COMPUTER	250	1	250	88	22
4	WINDOW A.C.	1500	1	1500	88	132
5	CASSETTEL RECORDER	200	1	200	88	17.6

Total energy consumption per month = 287.7 kWh

AUTOMOBILE ENGG. LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.38

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	5	200	88	17.6
2	CEILING FAN	80	9	720	88	63.3

Total energy consumption per month = 80.9 kWh

HYDRAULIC & PNEUMATIC LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.39

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	8	320	88	28.2
2	CEILING FAN	80	12	960	88	84.4
3	COMPUTER	250	1	250	88	22
4	PRINTER	200	1	200	11	2.2

Total energy consumption per month = 136.8 kWh

APPLIED MECHANICS LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.40

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	5	200	88	17.6
2	CEILING FAN	80	8	640	88	56.3
3	COMPUTER	250	1	250	88	22
4	PRINTER	200	1	200	11	2.2

Total energy consumption per month = 98.1 kWh

EM LAB - 1

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.41

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	8	320	88	28.2
2	CEILING FAN	80	12	960	88	84.4
3	LAB SETUP	735.5×2	5	7355	88	647.2

Total energy consumption per month = 759.8 kWh

EM LAB - 2

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.42

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	4	160	88	14
2	CEILING FAN	80	6	480	88	42.2
3	LAB SETUP	734.5×2	10	14710	88	1294.4

Total energy consumption per month = 1350.6 kWh

ELECTRICAL LAB - 2

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.43

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	88	21.1
2	CEILING FAN	80	9	720	88	63.3

Total energy consumption per month = 84.4 kWh

LECTURE HALL - 4

The college 7 hours per day is allotted for this theory classroom & 22 days in a month. So, Total hours usage of this room per month is 154 hours.

Table No.4.44

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	154	36.96
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 123.2 kWh

LECTURE HALL - 3

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hour's usage of this room per month is 154 hours.

Table No.4.45

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	5	200	154	30.8
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 117.04 kWh

LECTURE HALL - 1

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hour's usage of this room per month is 154 hours.

Table No.4.46

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	8	320	154	49.2
2	CEILING FAN	80	10	800	154	123.2

Total energy consumption per month = 172.4 kWh

ENGINEERING DRAWING HALL - 1

The college is allotting 6 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 132 hours.

Table No.4.47

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	12	480	132	63.3
2	CEILING FAN	80	18	1440	132	190

Total energy consumption per month = 253.3 kWh

ELECTRICAL WORKSHOP

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.48

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	7	280	88	24.6
2	CEILING FAN	80	12	960	88	84.4
3	COMPUTER	250	1	250	88	22
4	PRINTER	200	1	200	11	2.2
5	EXHAUST FAN	40	1	40	154	6.16

Total energy consumption per month = 139.36 kWh

LECTURE HALL - 7

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.49

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	154	36.96
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 123.2 kWh

LECTURE HALL - 6

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.50

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	154	36.96
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 123.2 kWh

LECTURE HALL - 5

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total usage of this room per month is 154 hours.

Table No.4.51

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	154	36.96
2	CEILING FAN	80	9	720	154	110.88

Total energy consumption per month = 147.84 kWh

ECE LAB - 1

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.52

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	7	280	88	24.6
2	CEILING FAN	80	12	960	88	84.4
3	COMPUTER	250	5	1250	88	110
4	PRINTER	200	1	200	11	2.2

Total energy consumption per month = 221.2 kWh

CONSUMER ELECTRONIC LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.53

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	88	21.1
2	CEILING FAN	80	9	720	88	63.3
3	COMPUTER	250	1	250	88	22
4	PRINTER	200	1	200	11	2.2

Total energy consumption per month = 108.6 kWh

MICROPROCESSOR LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.54

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	8	320	88	28.2
2	CEILING FAN	80	12	960	88	84.4

Total energy consumption per month = 112.6 kWh

PROJECT LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.55

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	88	21.1
2	CEILING FAN	80	9	720	88	63.3

Total energy consumption per month = 84.4 kWh

LECTURE HALL - 8

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.56

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32
2	CEILING FAN	80	9	720	154	110.88

Total energy consumption per month = 123.2 kWh

LECTURE HALL - 9

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.57

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 98.56 kWh

LECTURE HALL - 10

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.58

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month =98.56 kWh

LECTURE HALL - 11

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.59

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	12	960	154	147.84

Total energy consumption per month = 166.32 kWh

ENGINEERING DRAWING HALL - 2

The college is allotting 6 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 132 hours.

Table No.4.60

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	132	31.6
2	CEILING FAN	80	18	1440	132	190

Total energy consumption per month = 221.6 kWh

TPO ROOM + EDC LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.61

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	7	280	154	43.12
2	CEILING FAN	80	15	1200	154	184.8
3	EXHAUST FAN	80	1	80	154	12.32

Total energy consumption per month = 240.24 kWh

CORRIDOOR + TOILET

Monthly usage of this room is 154 hours.

Table No.4.62

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	13	520	154	80
2	CEILING FAN	40	3	120	154	18.48

Total energy consumption per month = 98.48 kWh

4.1.3 BLOCK 3

FITTING WORKSHOP - 2

The college is allotting 6 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 132 hours.

Table No.4.63

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	132	15.8
2	CEILING FAN	80	9	720	132	95
3	LAB SETUP	735.5×2	1	1471	132	194.1

Total energy consumption per month = 304.9 kWh

FITTING WORKSHOP - 1

The college is allotting 6 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 132 hours.

Table No.4.64

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	132	15.8
2	CEILING FAN	80	9	720	132	95

Total energy consumption per month = 110.8 kWh

ELECTRICAL & ELECTRONICS WORKSHOP

The college is allotting 6 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 132 hours.

Table No.4.65

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	132	15.8
2	CEILING FAN	80	9	720	132	95

Total energy consumption per month = 110.8 kWh

CHEMISTRY LAB - 2

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.66

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	88	10.5
2	CEILING FAN	80	9	720	88	63.3
3	FURNACE	1000	2	2000	44	88

Total energy consumption per month = 161.8 kWh

GROUND FLOOR TOILET + CORRIDOR

Monthly usage of this room is 154 hours.

Table No.4.67

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	EXHAUST FAN	80	2	160	154	24.64
2	TUBE LIGHT	40	1	40	154	6.16

Total energy consumption per month = 30.8 kWh

SHEET METAL WORKSHOP

The college is allotting 6 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 132 hours.

Table No.4.68

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	132	15.8
2	CEILING FAN	80	9	720	132	95

Total energy consumption per month = 110.8 kWh

LECTURE HALL - 16

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.69

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 89.6 kWh

LECTURE HALL - 17

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.70

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

LECTURE HALL - 18

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.71

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

LECTURE HALL 19 + PUMP

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.72

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32
2	CEILING FAN	80	7	560	154	86.24
3	PUMP MOTOR	0.5× 735.5	1	367.75	22	8

Total energy consumption per month = 106.56 kWh

LECTURE HALL - 20

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No.4.73

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

SEMINAR HALL

Monthly usage of this room is 44 hours.

Table No.4.74

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	44	5.2
2	CEILING FAN	80	15	1200	44	52.8

Total energy consumption per month = 58 kWh

FACULTY ROOM - 1

Monthly usage of this room is 154 hours.

Table No.4.75

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	12	960	154	147.84

Total energy consumption per month =166.32 kW

FACULTY ROOM – 2

Table No.4.76

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	1	40	154	6.16
2	CEILING FAN	80	12	960	154	147.84
3	CFL	25	2	50	154	7.7

Total energy consumption per month =161.7 kWh

LECTURE HALL - 21

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.77

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	9	720	154	110.8

Total energy consumption per month = 129.28 kWh

LECTURE HALL - 24

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.78

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

LECTURE HALL - 23

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.79

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

LECTURE HALL - 25

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.80

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	154	18.48
2	CEILING FAN	80	7	560	154	86.24

Total energy consumption per month = 104.72 kWh

ENGINEERING DRAWING HALL - 3

The college is allotting 6 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 132 hours

Table No. 4.81

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	132	31.6
2	CEILING FAN	80	21	1680	132	221.7

Total energy consumption per month =253.3 kW

LIBRARY

Monthly usage of the library room is 154 hours.

Table No. 4.82

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	CFL	25	17	425	154	65.45
2	CEILING FAN	80	48	3840	154	591.36
3	COMPUTER	250	11	2750	154	423.5
4	PRINTER	200	2	400	22	8.8
5	WINDOW A.C.	1500	5	7500	154	1155
6	SCANNER + PC	450	1	450	88	39.6

Total energy consumption per month = 2283.71 kWh

4.1.4 BLOCK 4

CANTEEN

Monthly usage of this room is 154 hours.

Table No. 4.83

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	9	360	154	55.44
2	CEILING FAN	80	18	1440	154	221.76
3	REFRIGERTOR	750	4	3000	720	216

Total energy consumption per month = 493.2 kWh

SURVEY LAB

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No.4.84

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	4	160	88	14
2	CEILING FAN	80	9	720	88	63.36
3	SCANNER+ PC	450	1	450	88	39.6

Total energy consumption per month =116.96 kWh

TUTORIAL ROOMS 128 +130 +131 +132+133

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.85

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	13	520	154	80.08
2	CEILING FAN	80	37	2960	154	455.84
3	EXHAUST FAN	40	1	40	154	6.16

Total energy consumption per month = 542.08 kWh

TUTORIAL ROOMS 230+232+233+234+235

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.86

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	13	520	154	80.08
2	CEILING FAN	80	33	2640	154	406.56
3	LAB SETUP	735.5×1H.P.	1	735.5	44	32.3
4	EXHAUST FAN	40	1	40	154	6.16

5	FURNERCE	1000	3	3000	44	132
6	UNICONFINER TEST	1000	3	3000	44	132

Total energy consumption per month = 789.1 kWh

TUTORIAL ROOMS 323+ 325+ 326+ 327+ 328

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.87

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	13	520	154	80.08
2	CEILING FAN	80	30	2400	154	369.6
3	COMPUTER	250	1	250	88	22
4	PRINTER	200	1	200	22	4.4
5	SCANNER+ PC	450	1	450	88	39.6
6	EXHAUST FAN	40	1	40	154	6.16

Total energy consumption per month = 521.84 kWh

TUTORIAL ROOMS 402+404+ 405+ 406+ 407

The college 7 hours per day is allotted for this theory classroom & 22 days a month. So, total hours usage of this room per month is 154 hours.

Table No. 4.88

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	13	520	154	80.08
2	CEILING FAN	80	29	2320	154	357.28
3	EXHAUST FAN	40	1	40	154	6.16

Total energy consumption per month = 443.52 kWh

4.1.5 WORKSHOP

SMITHY WORKSHOP

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.89

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	132	15.8
2	CEILING FAN	80	5	400	132	52.8
3	LAB SET UP	735.5 ×H.P.	2	1471	88	129.4
4	EXHAUST FAN	80	2	160	154	24.64

5	WALL FAN	60	2	120	154	18.48
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Total energy consumption per month = 241.12 kWh

CARPENTRY WORKSHOP

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No .4.90

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	132	14.8
2	CEILING FAN	80	4	320	132	42.2
3	LAB SET UP	1.5HP ×734.5 1HP×734.5	2 2	3677.5	132	484.4
4	EXHAUST FAN	80	1	80	154	12.32
5	WALL FAN	60	2	120	154	18.48

Total energy consumption per month = 574.2 kWh

MACHINE WORKSHOP

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.91

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	6	240	132	31.6
2	CEILING FAN	80	9	720	132	95
3	LAB SET UP	2HP× 735.5 0.5 HP × 735.5	19 1	28316.75	132	3737.8
4	EXHAUST FAN	80	1	80	154	12.32
5	WALL FAN	60	1	60	154	9.24

Total energy consumption per month = 3885.96 kWh

WELDING WORKSHOP

The college is allotting 4 hours for the practical class. The total hour's usage of this room is 22 days in a month i.e. 88 hours.

Table No. 4.92

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	3	120	132	15.8
2	CEILING FAN	80	5	400	132	52.8

3	LAB SET UP	2HP ×735.5 1HP ×735.5	3 1	2206.5	132	291.2
4	EXHAUST FAN	80	2	160	154	24.64
5	WELDING MACHINE	1000 W	6	6000	132	792

Total energy consumption per month = 1176.44 kWh

TOILET

Monthly usage of this room is 154 hours.

Table No. 4.93

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32

Total energy consumption per month = 12.32 kWh

CORRIDOOR

Monthly usage of this corridor is 154 hours.

Table No. 4.94

Sr. No.	Name of equipment	Rating of Equipment (W)	Number of Equipments	Connected Load	Total running hour per month	Energy consumption per month(kWh)
1	TUBE LIGHT	40	2	80	154	12.32

2	CEILING FAN	80	2	160	88	14
3	PUMP MOTOR	3 HP × 735.5	3	6619.5	88	582.5
	WATER COOLER	750 W	1	750	154	115.5

Total energy consumption per month = 724.32 kWh

Total electrical energy consumption in a month is 41292.49 kWh.

TOTAL NO. OF APPLIANCES CONNECTED

Table No. 4.95

NAME OF APPLIANCE	NO. OF APPLIANCE	WATTAGE	TOTAL WATTAGE
TUBE LIGHT	772	40	30880
CEILING FAN	897	80	71760
COMPUTER	549	250	137250
EXHAUST FAN	9	40	360
	9	80	720
PRINTER	24	200	4800
XEROX MACHINE	1	1000	1000
	1	750	750
SCANNER	4	200	800
AC 1.5T	39	1500	58500
WATER COOLER	4	750	3000

LAB/WORKSHOP 1HP MOTORS	13(1 HP)	735.5	9561.5
LAB/WORKSHOP 2HP MOTORS	22(2 HP)	1471	32362
LAB/WORKSHOP 3HP MOTORS	3(3 HP)	2206.5	6619.5
LAB/WORKSHOP 0.5HP MOTORS	1(0.5 HP)	367.75	367.75
LAB/WORKSHOP 1.5HP MOTORS	2(1.5 HP)	1103.25	2206.5
FURNACE	5	1000	5000
C F L	17	40	680
REFRIGERATOR	4	750	3000
WALL FAN	4	60	240
WELDING MACHINE	6	1000	6000

Total connect load (w) =375857.25w

Total connect load (k w) =375.85725 kW

CHAPTER 5
RESULTS, CONCLUSION AND
FUTURE SCOPE

5.1 ENERGY SAVING POTENTIAL

5.1.1 Reduce Wastage: During auditing for last 12 months it is observed that almost half lecture hall i.e. theory class rooms are normally used up to 3:20 p.m. But room cleaning work by sweepers is finished at approximately 5:00 p.m. During this 1 hours 40 minutes are very less time but all the appliances in the classroom i.e. fans and lights are run when classrooms is unoccupied. This 1 hour 40 minutes wastage can be reduced if every room is providing individual MCB (Miniature circuit breaker). The working appliance in the room can be put off by any students, faculty or attendant when leaving the room.

There are total 26 class rooms (3 engineering drawing hall + 23 lecture halls) in the college buildings and connected load is 23000 Watt. So the monthly electrical saving in 1 hours 40 minutes i.e. 1.67 hours is $23000 \times 1.67 \times 22$ Watt Hours per months is 843.333kWh.

Yearly energy saving is $843.333 \times 12 = 10120$ kWh.

The cost of energy = $10120 \times \text{Rs. } 6 = \text{Rs. } 60720/-$

Cost of 26 MCB is $\text{Rs. } 120 \times 26 = \text{Rs. } 3120 /-$

Net saving per year $\text{Rs. } 60720/- - \text{Rs. } 3120/- = \text{Rs. } 57600/-$

5.1.2 Use Energy Saving Appliances: Replacing 40Watt Fluorescent tube with 26 Watt CFL (Compressed fluorescent Light).

40 Watt Fluorescent tube gives 1880 lumens [34]

26 watt CFL gives 1800 lumens [35]

Which give the approximately same lumens light.

Total 40 watt tube in the college = 772

Total wattage is consumed = $772 \times 40 \text{ w} = 30880 \text{ W}$

Total 26 watt CFL required for same lumens output = 807

Total wattage is consumed = $807 \times 26 \text{ w} = 20982 \text{ W}$

Total load difference = 9898 W

College working per month = 154 hours

So, total wattage per month = $9898 \times 154 = 1524292$ W

Yearly total wattage = 12×1524292 W

$$= 18291504 \text{ watt} = 18291.504 \text{ kW}$$

Total cost @ 6 per kilowatt = $6 \times 18291.504 \text{ kW} = \text{Rs } 109749.024$ /-

Total yearly saving = Rs 109749.024 /-

Cost of 1 CFL (26W) = Rs 220 /-

Cost of 807 CFL (26W) = $807 \times 220 = \text{Rs } 177540$ /-

i.e. 807 CFL (26W) recovers the electricity bill nearly one and half years.

5.1.3 Reduce Wastage Of Light: It is observed that during thesis the corridor lights, canteen lights and computer lab lights are ON for 4 hours a day. It is not required for 4 hours working in normal day. The proper light in India is about 10 months in a year. So, 25% of total load consumed is saved without any type of effect for their performance.

Total monthly connected light load working 4 hours per day is = 4942.06kWh.

So yearly total light load working 4 hours per day is = $4942.06 \times 12 = 59304.72$ kWh

Yearly total cost of this electrical energy is

$$= 59304.72 \times @6 \text{ per kWh is } = \text{Rs. } 355828.32$$

Yearly 25% saving wastage of light load is = $\text{Rs. } 355828.32 / 4 = \text{Rs. } 88957.08$ /-

5.1.4 Air Conditioning Calculations

Calculating the cooling capacity needed for your room is a complicated process as there are many factors to consider.

Step 1 Find the volume of the room in cubic feet. This is done by measuring the length, width and height of the room in feet and multiplies all the three dimensions together.

Volume = Width \times Length \times Height (cubic feet)

$$\text{Volume} = 20 \times 25 \times 10 = 5000 \text{ (cubic feet)}$$

Step 2 to convert this volume to BTU/hr, multiply it by 6 as mentioned in [34].

$$C1 = 5000 \times 6 = 30000$$

Step 3 Estimate the number of persons (N) that will usually occupy this room. Each person produces about 500 BTU/hr of heat for normal office-related activity. Multiply these two figures together to get the required BTU/hr for the room.

$$C2 = N \times 500 \text{ BTU/hr}$$

$$N=30$$

$$C2 = 30 \times 500 \text{ BTU/hr}$$

$$= 15000 \text{ BTU/hr}$$

Step 4 Adding C1 and C2 will give a very simplified cooling capacity needed for the room.

$$\text{Estimated Cooling Capacity needed} = C1 + C2 \text{ (BTU/hr)}$$

$$= 3000 + 15000 \text{ (BTU/hr)}$$

$$= 45000 \text{ (BTU/hr)}$$

1.5 Ton of AC compensates the 18000 BTU/hr

In one lab 2 AC of 1.5Ton are installed

$$\text{i.e. } 18000 \times 2 = 36000 \text{ BTU/hr}$$

$$\text{Required AC's (1.5 T) for one lab} = 45000/18000 = 2.5$$

i.e. 1.5Ton of 2 AC's are overloaded

15 labs in the college is same size and AC capacity

$$\text{i.e. } 15 \times 1 = 15$$

Required AC of 1.5 Tons in the college is 15 for proper cooling.

One time investment of one AC 1.5 Tons cost= Rs.22000 /-

$$\text{Cost of 15 AC 1.5 Tons} = 15 \times 22000 = \text{Rs. } 330000 \text{ /-}$$

As we know that, the air conditioning requirement in northern India is only needed during the summer season. As our academic institution comes under the same region, so the air conditioning requirement is at its peak during the summers and air conditioning has most of the share in the energy requirement of the institution. In the entire laboratories 1.5 ton window AC's are installed. Most of these units have been operating for the last 9 years, during which no proper maintenance has been given. This results in the functioning of the air

conditioners below its rated capacity. From the calculations given above, it is found that the air conditioning system of all the laboratories is overloaded. Due to this, there is no tripping of the compressor unit of the AC. Resulting more consumption of the energy due the continuous operation of the compressor unit. Moreover, the air conditioning units which are already operating are old and can be replaced with the new ones with energy saving capacity. With the use of inverter type models are 30 to 40 % energy can be saved and these AC's are also known for their quiet operation which would be ideal for an academic environment.

The energy audit also revealed that the AC's are often improperly used. They are even operating when the Laboratories are not in use. For this, occupancy sensors could be installed in the laboratories to cut-off AC's when the sensors detect no movement in the room for at least five minutes. It is also important to ensure the regular maintenance of the air conditioning units to maintain their efficiency and to extend their lifetime.

5.1.5 Repair and Maintenance: The workshops and lab fans have very low efficiency. So, the wastage of electrical energy is more. I suggest the management to repair or maintenance these fans for increase the efficiency i.e. reduce the energy consumption.

*** Due to the above recommendation a net yearly saving is Rs 2, 56,306.104 /-**

Total yearly bill paid in year 2013 is Rs. 1135480/-

%age yearly saving is = 22.57 %

5.2 CONCLUSION

Energy consumption data of the RIMT POLYTECHNIC is collected and analyzed. From the data collected, various methods were suggested to cut the energy wastage in the institution. As a result of which energy consumption of the institution is reduced and a significant reduction of 22.57 % of yearly saving in electricity bill is calculated. Moreover, some suggestions were also given to improve the efficiency of air conditioning system of the institution.

5.3 FUTURE SCOPE

The presented work can be further progressed by conducting energy audit with the help of various software tools available.

Energy audit of the institution can also be conducted for calculating the solar potential of the institution.

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MANDI GOBINDGARH