

“CASE STUDY ON ENERGY AUDIT OF ELECTRICAL DEPARTMENT

SVIT COLLEGE OF ENGG, NASHIK”

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ABSTRACT

The objectives of this project : To present information on the calculation of loads for the electrical system of a building so that one can prepare an electrical load balancing and energy audit for the Electrical Department As part of the construction plans, one is able to understand and take the electrical load for Department permit applications. With a full understanding of the electrical load the students can better estimate the cost of a construction project.

Energy audit is a process of checking the way energy is used and identify areas where wastage can be minimize if not totally eradicate. Energy audit consists of several tasks which can be carried out depending on the type of audit and the function of audited facility. It started with review the historical data of energy consumption which can be compiled from the electricity bills. The energy utilization such as running hours of efficiencies of equipment's and machine and the areas of high energy consumption and the possibility to reduce consumption should be record for further analysis.

The energy audit will only focused in the sir visvesvaraya institute of technology , nashik It is carried out in aim of analysing and identifying possible energy saving measures and load balancing which can later be implemented for saving energy conservation program in our collage.

The energy audit discussed in this paper also focused in the Electrical department. It is carried out in aim of analysing and identifying possible energy saving measures in the such department, which can later be implemented for energy efficiency program in college.

Keywords- : Energy Audit, Conservation, Energy Saving, Types of Auditing. Data Collections, Recommendations, Calculations, Graphical Representation.

1. INTRODUCTION

The SVIT College was established in 1998 as the First Engineering College in the Nashik. The College It was given the status of University of post-independent India. Dr. Vitthalrao Vikhe presented the Charter in November 1994 elevating the erstwhile college to the Engineering University of pune On September 21, 2001, an Ordinance issued by the Government of India declared it as the nation's seventh Indian Institute of Technology. The purpose of the energy audit is to identify, quantify, describe and prioritize cost saving measures relating to energy use in the Departments and Institute Central Facilities. As per the energy conservation act, 2001, passed by the government of India, energy audit is defined as “the verification,

monitoring and analysis of use of energy including submission of technical reports containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption.”

The scope of Energy Audit Study includes:

- Recommending low cost measures to enhance the effectiveness of energy use.
- Identification of energy saving potential based on the energy wastage in different locations.

2. LITERATURE SURVEY

A case study has been done [1] which says that audit was conducted and suitable strategies of adjusting and optimizing energy were suggested so as to reduce energy requirements and hence, the total cost spent towards energy consumption.[2] a case study of energy audit Electrical Department was presented which discusses the common aspects of electrical energy management in Electrical Labs. It contains the findings and the analysis of the results obtained from the electrical energy audit program employed in an Electrical Department, Sir Visvesvaraya Institutes of Technology, Tal. Sinnar, Dist. Nashik. The electrical energy audit was carried out under three major heads: (i) lighting audit, (ii) power load audit (motors, meters, etc.), and (iii) Computer. [3] standard design practice to assist engineers in evaluating electrical options from an energy standpoint has been presented. It establishes engineering techniques and procedures to allow efficiency optimization in the design and operation of an electrical system considering all aspects.

3.OBJECTIVE OF ENERGY AUDIT EXERCISE

The objective of Energy Audit is to promote the idea of Energy Conservation in the Electrical Department of SVIT College. The purpose of the energy audit is to identify, quantify, describe and prioritize cost saving measures relating to energy use in the Departments and Institute Central Facilities.

❖ The work eligible for Energy Audit Study should be directed towards:

- Identification of areas of energy wastage and estimation of energy saving potential in Departments and Institute Central Facilities.
- Suggesting cost-effective measures to improve the efficiency of energy use.
- Estimation of implementation costs and payback periods for each recommended action.
- Documenting results & vital information generated through these activities.
- Identification of possible usages of co-generation, renewable sources of energy (say Solar Energy) and recommendations for implementation, wherever possible, with cost benefit analysis.

4.ENERGY AUDIT METHODOLOGY

The methodology adopted for this audit was a three step process comprising of:

1. **Data Collection** – In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, interviewing key persons, and measurements.
2. **Data Analysis** - Detailed analysis of data collected was done by manually. The database generated by manually was used for producing graphical representations.

5. TYPES OF ENERGY AUDITING

- a) Preliminary energy audit
- b) Detailed energy audit.

1. Walk through energy audit

The preliminary audit alternatively called a simple audit, screening audit or walk-through audit, is the simplest and quickest type of audit. It involves minimal interviews with site operating personnel, a brief review of facility utility bills and other operating data, and a walk-through of the facility to become familiar with the building operation and identify areas of energy waste or in efficiency. Typically, only major problem areas will be uncovered during this type of audit.

2. Detailed energy audit

Detailed energy is also called comprehensive audit or investment grader audit. It expands on the general energy audit. It covers estimation of energy input for different processes, collection of past data on production levels and specific energy consumption. It is a comprehensive energy audit action plan to be followed effectively by the industry. In detail audit we define energy use and losses through a more detailed review and analysis of equipment, systems, operational characteristics, and on-site measurements and testing.

6.BLOCK DIAGRAM :- STAGES OF ENERGY AUDIT.



7.CASE STUDY: ELECTRICAL DEPARTMENT

	Connected Load(Watt)	Daily KWH	Monthly energy Consumed (kwh)	Monthly Electricity Bill(RS.)
IDC Lab	18306	4.23	101.74	1017.52
Basic Electrical	12590	4.15	98.82	988.2
Microprocessor lab	1820	5.22	122.28	1252.8
Anolog &Digital lab	620	1.62	38.88	388.8
Control system Lab	6320	18.72	449.28	4492.8
CP Lab	6320	18.73	449.52	4495.2
Machine Lab	112957	29.09	700.76	7007.72
Class room1	360	1.2	28.8	288
Class room2	460	1.2	28.8	288
Class room 3	300	0.72	17.28	172.8
Tutorial Lab	820	2.28	54.87	548.79
HOD Cabin	1480	4.1	98.4	984
High Voltage Lab	14598	5.45	130.6	1306.88
Corridors	160	0	0	0
Total	75277	96.71	2321.04	23211.4

8. CALCULATIONS

1) Daily KWh:- Nos. of Appliances*Wattage of Appliances*Active Hours

1000

2) Monthly KWh:- Daily KWh*Nos. of Days in Month(24 days)

3) Electricity Bill in Rs.:- Monthly KWh*Cost of Unit(10 Rs.)

i) Electricity Bill for IDC Lab:-

[Formula:-{Daily KWh*Nos. of Days in Month(24 days)* Cost of Unit(10 Rs.)}]

$$= 4.23*24*10= 1017.52Rs.$$

ii)Electricity Bill for Basic Electrical Lab:-

$$=4.15*24*10=988.2Rs.$$

iii)Electricity Bill for Microprocessor Lab:-

$$=5.22*24*10=1252.8 Rs.$$

iv)Analog & Digital Lab:-

$$=1.62*24*10=388.8 Rs.$$

v)Control System Lab:-

$$=18.72*24*10=4492.8 Rs.$$

vi)Computer Programing Lab:-

$$=18.73*24*10=4495.2 Rs.$$

vii) Machine Lab:-

$$=29.09*24*10=7007.72 Rs.$$

viii) Class Room 1,2 :-

$$=1.2*24*10=288 Rs.$$

ix) Class Room 3 :-

$$=0.72*24*10=172.8 Rs.$$

x)Tutorial Lab:-

$$=2.28*24*10=548.79 Rs.$$

xi)HOD Cabin:-

$$=4.1*24*10=984 Rs.$$

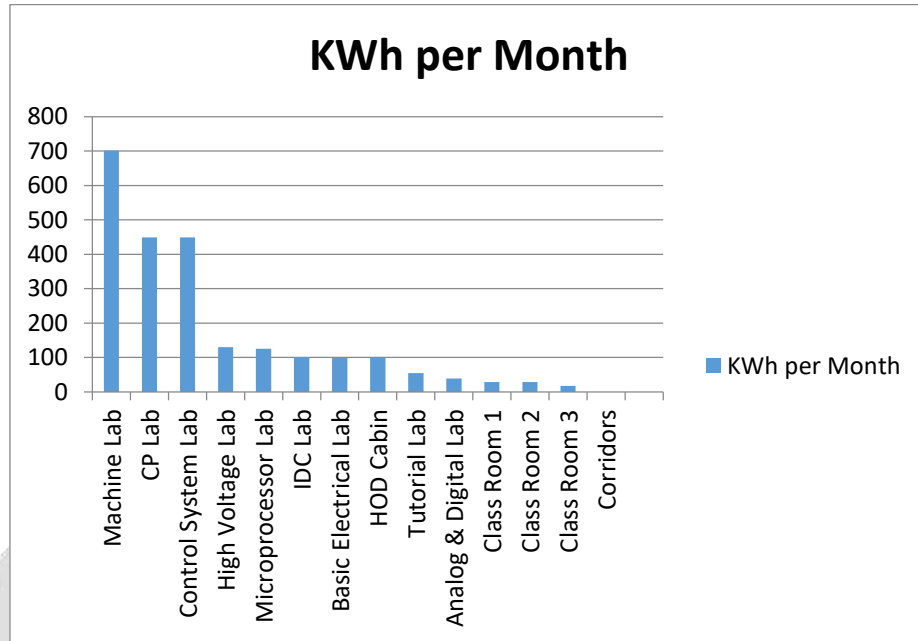
xii)High Voltage Lab:-

$$=5.45*24*10=1306.88 Rs.$$

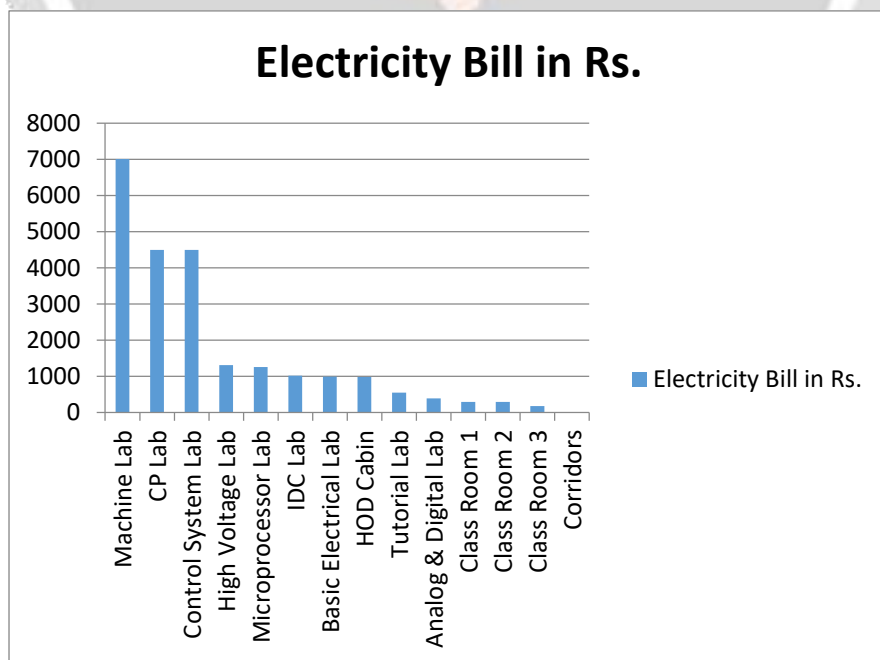
❖ Total:-

$$= 96.71*24*10=23211.4 Rs.$$

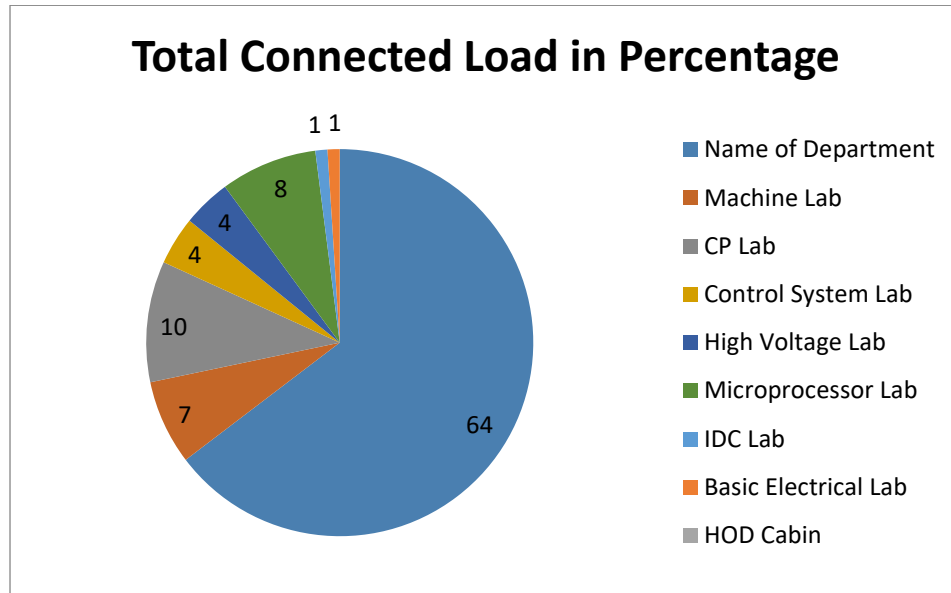
9. GRAPH FOR ENERGY KWH PER MONTH OF EACH LAB



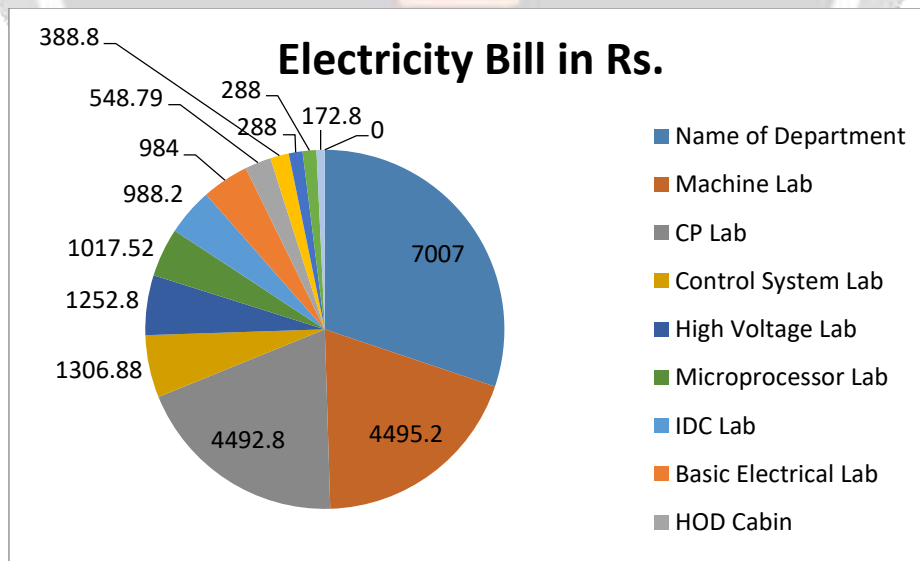
10. GRAPH FOR MONTHLY ELECTRICITY BILL OF EACH LAB



11. PIE CHART FOR TOTAL CONNECTED LOAD IN PERCENTAGE



12. PIE CHART FOR ELECTRICITY BILL PER MONTH



13. RECOMMENDATION FOR APPLIANCES

Appliances	Nos.	Monthly Saving in KWh	Monthly Saving in (Rs.)	Annual Saving Rs.	Recommended
Ceiling Fans	36	92.16	921.6	11059.2	Used 80 watt Bajaj fan
Tubes	32	50.12	501.2	6014.4	Used for natural day light more saving
Computers	53	572.4	5724	68688	Use Lenovo c20 pc more saving
Motors	40	700.52	7005.2	84062.4	High Efficient Motors are used.

Formulie:-

I) Monthly Saving in KWh*Cost of Unit(10Rs.)= Monthly Saving (Rs.)

II) Monthly Saving in (Rs.)*No of Months(12)= Annual Saving (Rs.)

14. CALCULATIONS

I) Ceiling Fan:-

- i) Monthly Saving in Rs. is $80.64 * 10 = 806.4$ Rs.
- ii) Annual Saving in Rs. Is $806.4 * 12 = 9682.8$ Rs.

II) Tubelights:-

- i) Monthly Saving in Rs. is $50.12 * 10 = 501.2$ Rs.
- ii) Annual Saving in Rs. Is $501.2 * 12 = 6014.4$ Rs.

III) Computers:-

- i) Monthly Saving in Rs. is $572.4 * 10 = 5724$ Rs.
- ii) Annual Saving in Rs. Is $5724 * 12 = 68688$ Rs.

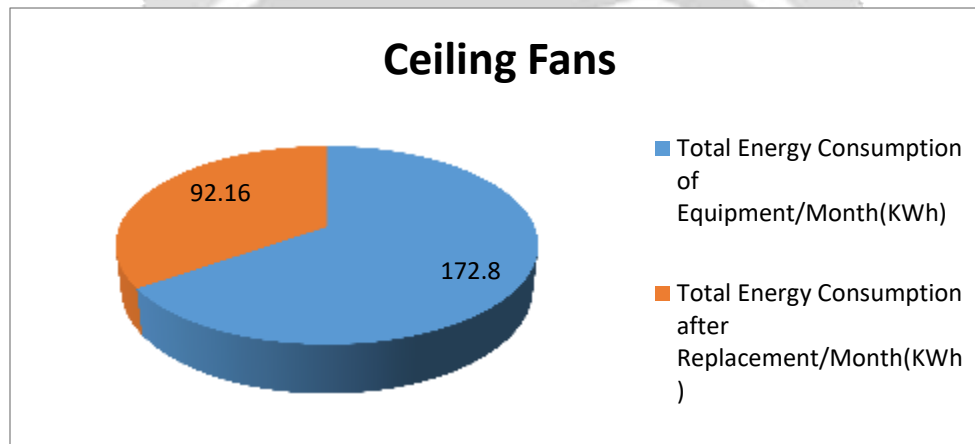
IV)Motors:-

- i)Monthly Saving in Rs. is $700.52 * 10 = 7005.2Rs.$
- ii)Annual Saving in Rs. Is $7005.2 * 12 = 84062.4Rs.$

15. GRAPHICAL REPRESENTATION OF ENERGY AUDIT

Audit Observation: The additional cost incurred towards the replacement will be paid back in 4 to 5 years time period. Life of fans is approx 10 to 15 years. Hence, the audit party suggested for replacement. The Comparison of existing energy consumption with recommended consumption in case of fan is shown in Figure.

**Comparison Of Existing And Recommended Energy Consumption In
Case Of Fan**



Audit Observation: The additional cost incurred towards the replacement will be paid back in 2 to 3 months time period. Life of Tubelight is approx 4 to 5 years. Hence, it was suggested for replacement. The Comparison of existing energy consumption with recommended consumption in case of night lamp is shown in Figure.

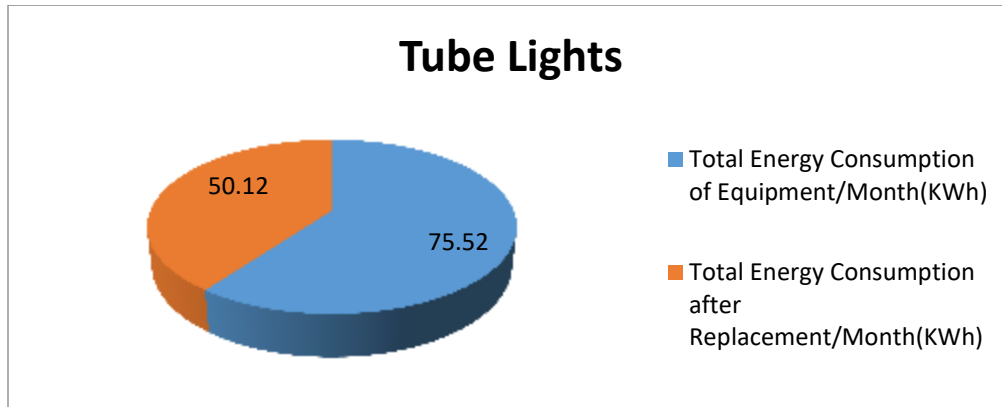
The energy production (supply) and consumption (demand) pattern at local and global level not only determines whether a country is developed or developing, it also bears some major issues like cost, pollution / carbon emissions, desertification etc. The major reasons for raise of demand in energy from the consumer point of view (demand side) are rapid raise in population, luxurious style of living, improper use of electrical equipment, inadequate knowledge etc.

Hence, demand of energy is growing in a rapid phase but the supply or production is maintaining its own phase, resulting in a wide gap between demand and supply.

The following measures were identified and are to be implemented in various phases.

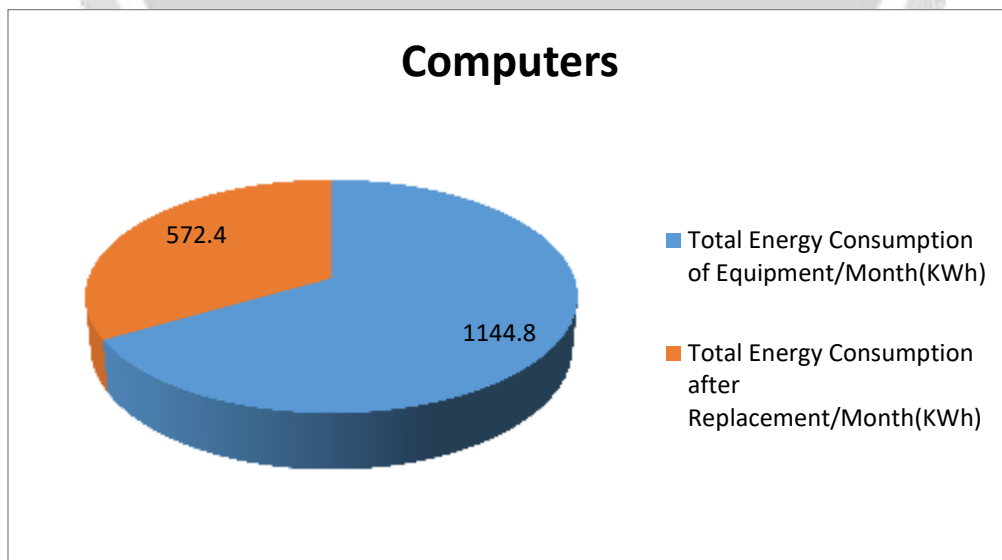
1. Maximum utilization of natural light.
2. Combination of natural and artificial light.
3. Sensors to detect natural lighting and switch on artificial light.

**Comparison Of Existing And Recommended Energy Consumption In
Case Of Tube Light**



Audit Observation: The additional cost incurred towards the replacement will be paid back in 4 to 5 years time period. Life of Computers is approx 20 to 25 years. Hence, the audit party suggested for replacement. The Comparison of existing energy consumption with recommended consumption in case of Computers is shown in Figure.

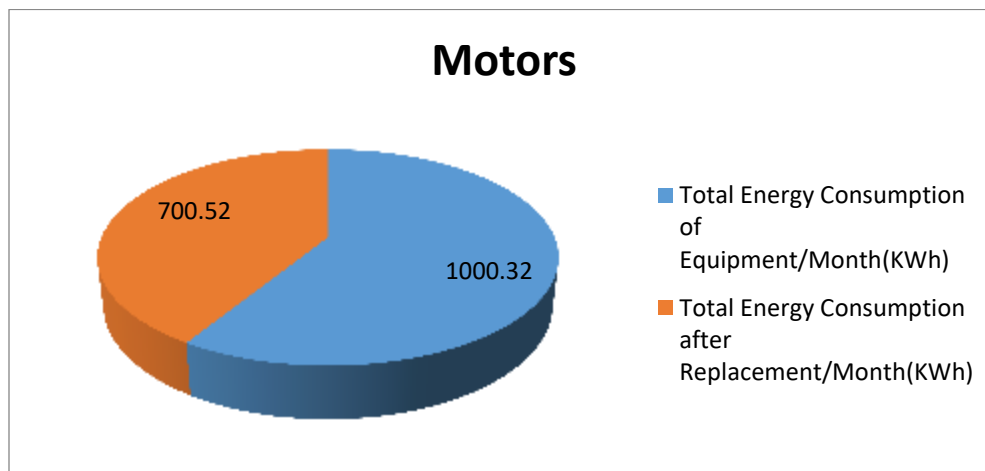
**Comparison Of Existing And Recommended Energy Consumption In
Case Of Computers**



Audit Observation: The additional cost incurred towards the replacement will be paid back in 4 to 5 years time period. Life of Motors is approx 20 to 25 years. Hence, the audit party suggested for replacement. The Comparison of existing energy consumption with recommended consumption in case of Motors is shown in Figure.

Comparison Of Existing And Recommended Energy Consumption In

Case Of Motors



RECOMMENDATION FOR ENERGY SAVING OF TUBE

- Used natural day light more energy saving is below
- Monthly electricity bill saved tube up to 921.6 RS.
- Annual saving of tube is 11052 RS.
- Monthly energy saving in tube is 92.16kwh
- 20 watt tube more energy saving than 40 watt tube
- Philips 20watt tube should connected in remaining room to more power saving and electricity bill.

RECOMMENDATION FOR ENERGY SAVING OF FAN

- Monthly kwh energy saving of fan up to 80.64 kwh
- Monthly electricity bill saving up to 1935.3 RS
- Annual electricity bill saving up to 9682.8 RS
- Capital investment up to 3200 RS
- Bajaj 80 watt fan more energy saving than 120 watt fan and more saving electricity bill.

RECOMMENDATION FOR ENERGY SAVING OF PC

- Monthly energy saving of pc up to 572.4kwh
- Monthly electricity bill saving up to 5724RS
- Annual electricity bill saving up to 68688RS
- Daily energy saving up to 23.85 kwh
- **Lenovo c20** pc is used to more energy saving from pc.

16. ADVANTAGES

- To easy find out of load of building such as lighting, fan and power circuit.
- To find out of cost for load of building.
- Improve building energy efficiency.
- Reduce energy consumption of electrical building up to 10 to 15%

17. FUTURE SCOPE OF DEVELOPMENT:

- With the use of harmonic analyzer, harmonic study can be carried out. Study different losses, harmonic distortion factor etc can be carried out.
- Using photo sensors if the atomization in the lighting system is implemented, then considerable energy saving can be achieved. With the use of Master Switch in computer lab to more energy saving.

18. MAINTENANCE:

- It is observed that the solar panels installed at the roof of new Building are not being cleaned regularly. The surface panel needs to be cleaned in regular intervals so that efficiency can be increased to the maximum extent.
- It is observed several joints / nodes in wiring. It is recommended that such conductors are to be replaced.
- Replacing conventional electrical regulators in Electrical Department to electronic type regulators for controlling the speed of ceiling fans.

19. ACKNOWLEDGEMENT

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20. CONCLUSION

- In this project we have studied that, it provide information for cost estimates and permitting needs.
- Energy auditing improve energy conservation and efficiency of building devices.
- Energy auditing provide better recommendation of motor computer fan and tube. More energy saving
- Total electricity of bill of electrical department 23,211 RS.

21. REFERENCES

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