Enhancing Energy Consumption by Intermediate Audit

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Abstract— The Energy consumption is increasing day by day which is causing an adverse effect on the environment. To reduce this, cause the energy management is important. The energy auditing is the way to successful running of an organization with saving energy & contributing toward preserving national recourses of energy. Managing energy is not a just technical challenge but one of how to best implement those technical challenges within economic limits, and with a minimum of disruptions. In this paper importance of energy auditing and process of energy audit is discussed.

Key words: Energy Audit, Energy Audit Report, Energy Saving

I. INTRODUCTION

The main focus of an energy audit for the organisation is to find out opportunities that would reduce their early operating costs. Savings such as energy cost and power factor incentives may be identified during the audit process. In large organisations the energy charges are very large over a year. After the energy audit recommendations often say that auditors overestimate the savings potential available to the customer. This possibility of overestimation concerns utilities who do not want to pay incentives for demand-side management programs if the facilities will not realize the expected results in energy or demand savings. Overestimates also make clients unhappy when their energy bills do not decrease as much as promised.

The problem multiplies when a shared savings program is undertaken by the facility and an Energy Service Company. One of these approaches is to collect data on the energy using equipment in an industrial or manufacturing facility and then to perform both an energy and a demand balance to help insure that we have reasonable estimates of energy uses and therefore, energy savings of this equipment. In addition, we have developed few methods and approaches to deal with these potential problems, and we have found a few ways to initiate our energy audit analyses that lead us to improved results.

II. METHODS OF ENERGY AUDITING

Energy audits can be carried outs in different ways. Depending on time span invested auditing can be classified in as:

1) Primary Audit
2) Intermediate Audit
3) Detailed / Comprehensive Audit

A. Primary Audit

This is simple kind of survey which focus on energy consumption. During rapid walk survey main focus is on the energy input, spots of energy wastages. Data is collected in such a way that, data should be utilized for next detailed audits. As the time span required is short cost involve in auditing is also less.

B. Intermediate Audit

This kind of audit is conducted for detailed survey and measurement of systems compare with walk through audit. Major focus is made on energy loses measure and quantification to analyse energy efficiency of system. This type of audit is carried out for one week to one week; time span required is more so the cost associated with audit is also more compare with preliminary audit.

C. Detailed / Comprehensive Audit

This is exhaustive audit than the previous types of audit. Detailed survey of systems as well as subsystems of an industry is done. Energy consumption of all subsystems and systems is compared with targeted energy consumption. This kind of audit also identifies the consumption of secondary energy like electricity. Modernization and changes in major retrofitting as suggested if required.

III. BASIC COMPONENTS OF EVERY AUDITING

The Energy Audit Process starts by collecting information about facilities Operation and its past record of utility bills. This data is then analysed to get picture of how the facility uses and possibly wastes energy, as well as to help the auditor learn that areas to examine to reduce energy cost. Specific changes called Energy Conversion Opportunities (ECO) are identified and evaluated to determine their benefits and their cost effectiveness. These ECOs are accessed in terms of their costs & benefits and economic comparison is made to rank various ECOs. Finally, an action plan is created whether certain ECOs are selected for implementation and the actual process of energy saving & saving money begins.

A. Auditor's Tool Box

To obtain the best information from a successful energy cost control program the auditor must make some measurement during audit visit.

B. Preparation for Audit Visit

Some preliminary work must be done before the auditor makes actual energy audit. To a facility some parameters that should be needed are: energy use data, energy rate schedule, physical & operational data for facility that will consist of geographical location, whether data, facility layout, operation house, equipment list. One more important part of energy audit is safety of energy auditor & audit team. The audit person & audit team must be thoroughly briefed on safety equipment's & processes.

C. Conducting the Audit

Once the information on energy bills, faculty equipment's and facility operations has been obtained, the audit equipment can be gathered up and actual visit is to be started.

D. Introductory Meeting

audit team should meet facility manager & maintenance manager to brief about purpose of audit

E. Audit Interview

getting correct information on facility equipment and operation is important, if the audit is going to most successful in identifying ways to save money on energy bills. Auditor must interview with floor supervisor and equipment operator to understand building and process problems.

F. Walk Through Audit

a walk through tour of facility or plant should be arranged by facility/ plant manager and should be arranged to the auditor or audit team can see major operational and equipment features of facility. During walk through audit data regarding ECOs should be gathered by looking at: lighting, electrical motors, water heaters, peak equipment loads and other energy consuming equipment's.

G. Post Audit Analysis

after visit data collected should be examined, organized and reviewed for completeness ant thing missing data items should be obtained from facility of re-visit

H. The Energy Audit Report

Next step in energy auditing process is to prepare a report which details the final result and recommendation. An industrial audit report is more likely to have a detailed explanation of ECOs and benefit cost analysis. The report should begin with an executive summary that provide owners/ manager of facility with brief synopsis of total saving available and the highlights of each ECOs

IV. FEATURES OF THE PRELIMINARY AND DETAILED PROCESS AUDIT

	Preliminary audit	Detailed audit	Comments
Purpose	Awake for Audit process	Save energy	Best result performs
Collect Data	Salient Features	Detailed observations is required	Design summary, drawings, utility bills, plant flow and performance information.
Explain electric bill and schedules	May be review	must	Explain the importance of demand and energy and how changes are made.
Conduct field Investigation	Conduct field investigation	Highly essential	Limited investigation for preliminary audit; comprehensive investigation for detailed process audit

V. RELATED WORK

We have calculated actual electrical load with no of pcs and no of equipment's. We have measure the earth resistance value, voltage at different plug points, approximate estimate of material required for correction work

Sr.	Location	LCD PC	Ceiling Fan	Tube light	Load in kW
1	Project lab	39	8	9	4.068
2	Software lab	72	17	18	7.526
3	Comp. workshop lab	30	4	4	2.99
4	DBMS lab	33	8	7	3.15
5	AL lab	21	9	8	2.42
6	Comp. Electronic lab	61	5		5.124

Total Load in Kilo Watt= 25.28 From the above table it is clear that estimated load for computer labs with 256 no's of PC, Light and Fan in working condition is approximately 26 kW

VI. BASIC REVIEW OF LIGHTING LOADS

By using the assumed sample value, the energy consumption of tube lights, CFLs and LEDs are evaluated and compared.

A. Florescent Tubes

The usage of 40 W tube light consumes the specified energy: Total number of tube lights being 46, total energy consumed by the tube lights is 46*40*1 = 1.84kWhour. Assuming 4 working hours a day and 24 working days per month, total energy consumption by the tube lights are 1840*4*24=176.64kWh. The cost wise comparison is also done assuming Rs.6.00 per unit. The total amount is 176.64*6.00 = Rs. 1059.84 per month.

B. CFLs

Replacing the 40W tube lights with 12 watts CFLs [5], total energy consumed by 46 CFLs is, 46*12*1 = 0.552kWhour. Assuming 4 working hours a day and 24 working days per month, total energy consumed by the CFLs are 552*4*24=52.99kWh. The cost wise comparison is also done assuming Rs.6.00 per unit. The total amount is
52.99*6.00 = Rs. 317.94 per month.

C. LEDs

Replacing the 40W tube lights with 7 watts LEDs, total energy consumed by 46 LEDs are, 46*7*1= 0.322kW hour. Assuming 4 working hours a day and 24 working days per month, total energy consumed by the LEDs is 322*4*24=30.912KWh. The cost wise comparison is also done assuming Rs.6.00 per unit. The total amount is 30.91*6 = Rs. 185.4

VII. PAYBACK PERIOD

Replacement of T/L with CFL Light:
Cost of energy consume by T/L per month =Rs.1059.8
Cost of energy consume by CFL per month
=Rs.317.94
Saving:- 1059.84-317.94=Rs.741.9
Cost of 12W CFL is approximately Rs.120
Total cost: 120*46=Rs.5520

Payback period:
5520/317.94=8 Month
Replacement of T/L with LED Light:
Cost of energy consume by T/L per month =Rs.1059.8
Cost of energy consume by LED per month
=Rs.185.4
Saving: - 1059.8-185.4=Rs.874.4
Cost of 7W LED bulb is approximately Rs.250
Total cost=Rs.11500
Payback period:
11500/874.4=13.15 Month

VIII. COST COMPARISON BETWEEN TUBE LIGHT, CFL AND LED

	Tube light	CFL	LED
Number of bulbs	46	46	46
Watt per bulb	40W	12W	7W
Cost per bulb	Rs.40	Rs.120	Rs.250
Cost of 46 bulbs (initial investment)	Rs.1840	Rs.5520	Rs.11500
kWh energy consumed by bulbs	1.84kWh	0.52 kWh	0.32 kWh
Cost of energy consumed at Rs.6 /kWh	Rs.11.04	Rs.3.13	Rs.1.92
kWh energy consumed per month (assuming working 4 hours and 24 working days)	1059.8 kWh	317.9 kWh	185.4kWh
Payback period		8 Month	13.15 Month
Average Life		8000hours	50000hours

IX. RECOMMENDATION

- Use sunlight at the maximum extent possible.
- Turn off electrical gadgets when not in use.
- Clean the ventilators and the windows for proper illumination.
- Replace electromagnetic chokes with electronic ballast chokes.
- Marking should be done on the equipments and the switches so that as per requirement the equipments can be use.

X. CONCLUSION

In present scenario the energy conservation plays an important role. The energy conservation helps in reducing the energy consumption and provide the savings. By adopting proper measures as suggested in recommendation. As per the results obtained from the calculation the conservation of energy is possible by making changes i.e. replacement of lights, CFL is cost effective whereas LED is more efficient. The average life of LED is more than the CFL and the life of CFL is more than Tube Light. If energy audit for the entire institute is conducted, which includes laboratories, workshop, Staff room, office etc the quantitative energy conservation will be more.

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