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Theoretical Analysis of Energy Utilization through Energy Audit and Energy Management

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Abstract

This paper presents the study of "Theoretical analysis of Energy Utilization through Energy Audit and Energy Management". The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. Energy Audit is the key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with its use, and serves to identify all the energy streams in a facility. It quantifies energy usage according to its discrete functions. Industrial energy audit is an effective tool in defining and pursuing comprehensive energy management program.

Keywords: Energy audit; energy management; BEE.

1. Introduction

The phrase energy management means different things to different people. To us, energy management is: The judicious and effective use of energy to maximize profits(minimize costs) and enhance competitive positions. This Saving Money on energy bills is attractive to business, industries and individuals alike, customers whose energy bill use up a large part of their income and especially those customers whose energy bills represent substantial fraction of their companies operating cost, have strong motivation to initiate and continue on an ongoing to energy cost control program. No cost or very low cost operational changes can often save a customer or an industry 10-20% on utility bills Capital Cost Programs with pay back times of two

years or less can often save an additional 20-30%[1]. The energy auditing is one of the first task to be Promoted in the accomplishment of an effective energy cost control Program .An energy audit consist of a detailed examination of a how facility uses energy,what the facility pays for that energy ,and finally, a recommended program for changes in operating practices or energy consuming equipment that will cost effectively saves bucks on energy bills. With new technology and alternative energy resources now available, this country could possibly reduce its energy consumption by 50%. If there were no barriers to implementation [2] but off course there are barriers mostly economical. Energy auditing is an official method of finding out the ECO's. It is the official survey / study of the energy consumption / processing / supply aspects related with of industry or organization. Purpose of energy auditing is to recommend steps to be taken by Management for improving the energy efficiency, reduce energy cost and saving the money on the energy bills.

2. Energy Management: Step By Step

Energy management can be described by five distinctive steps – each containing a number of smaller steps. The five steps are reiterated during the lifetime of the system.

2.1 Energy Policy

The energy policy defines the overall guidelines for the efforts to achieve greater energy efficiency. It is established and maintained by the top management of the company.

2.2 Planning

The company reviews all energy aspects to form an overview of the significant energy consumption i.e. the machinery, equipment and activities which account for the highest energy consumption or which offer the most considerable potential for energy savings. Thereview forms the basis for determining the order of priority of the energy saving efforts. Concrete energy targets are set complying with the overall energy policy. To achieve the targets the company elaborates action plans.

2.3 Implementation and Operation

The company involves the employees in the implementation of the objectives and makes sure better use of energy becomes a part of their daily routines. This includes introducing procedures for energy conscious purchasing, operation and maintenance of equipment with significant energy consumption, energy efficient design activities etc.

2.4 Checking and Corrective Actions

The company monitors and measures the significant energy consumption and all activities with a significant impact on energy aspects. Corrective and preventive actions are taken incase of non-conformance e.g. when the energy targets have not been achieved within the specified time limit.

2.5 Management Review

The top management periodically evaluates how the implementation of plan, objectives and operational control is proceeding to ensure its continuing suitability. The management review must address the possible need for changes of the elements of the energy management system, in the light of the commitment to continual improvement.

3. Objectives of Energy Management and Auditing

3.1 Improving energy efficiency and reducing energy use, thereby reducing costs.

3.2 Developing and maintaining effective monitoring, reporting, and management strategies for wise energy usage

3.3 Finding new and better ways to increase returns from energy investments through research and development.

3.4 Developing interest in and dedication to the energy management program from all employees.

3.5 To clearly identify the types and costs of energy use.

3.6 To understand how that energy is being used and possibly wasted.

3.7 To identify and analyze alternatives such as improved operational techniques and new equipment that could substantially reduce energy costs.

3.8 To perform an economic analysis on those alternatives and determine which ones are cost-effective for the business or industry involved.

4. Energy Utilization Index

A very basic measure of a facility's energy performance is called the Energy Utilization Index (EUI). This is a statement of the number of Btu's of energy used annually per square foot of conditioned space. To compute the EUI, all of the energy used in the facility must be identified, the total Btu content tabulated, and the total number of square feet of conditioned space determined.

5. Methods of Energy Auditing

5.1 Walk through Audit

This is simple kind of energy audit, it carries rapid survey of plant. During rapid walk survey main focus is on the energy input, spots of energy wastages and ECO's. Data about plant is collected in such a way that, data should be utilized for next detailed audits. Usually audit is carried out at two periods viz. During off period & during working shifts, generally this kind of audit is carried out for three days to one week. As the time span required is short cost involve in auditing is also less.

5.2 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 analyze energy efficiency of system. Generally low tech recommendations are preferred with first preference is given for -Switching off lights and fans when not required. -Placing of automatic thermostat to control temperature of water heaters etc -Spotting out golden ECO's which involves higher energy wastage cost.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 walk through audit.

5.3 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, steam, gases etc. Modernization and changes in major retrofitting as suggested if required.

6. Basics Components of Energy Auditing

The Energy Audit Process starts by collecting information about facilities Operation and its past record of utility bills. This data is then analyzed 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 [4].

6.1 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.

6.2 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 equipments & processes.

6.3 Conducting the audit:
Once the information on energy bills, faculty equipments and facility operations has been obtained, the audit equipment can be gathered up and actual visit is to be started. Following are some important steps in audit.

6.4 Introductory meeting:
Audit team should meet facility manager & maintenance manager to brief about purpose of audit.

6.5 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.

6.6 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, HVAC system, electrical motors, water heaters, waste heat sources, peak equipment loads and other energy consuming equipments.

6.7 Post Audit Analysis:
After visit data collected should be examined, organized and reviewed for completeness ant thing missing data items should be obtained form facility of re-visit.

6.8 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.

6.9 Energy Action Plan:
The last step in audit process is to recommend an action plan for facility. The energy action plan list the ECOs which should implement first and suggest an over all implementation schedule , often one or more of the recommended ECOs should provide an immediate or very short period pay back, so saving from that Eco or those ECOs can be used to generate capital to pay for implementing other ECO.

7. Role of BEE(Bureau of Energy Efficiency)

The Government of India set up Bureau of Energy Efficiency (BEE) [5] on 1st march 2002 under the provisions of energy conservation act, 2001. The missions of the Bureau of Energy Efficiency is to assist in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act.2001 with the primary objective of reducing energy intensity of the Indian economy. This will be achieved with active participation of all stakeholders, resulting in accelerated and sustained adoption of energy efficiency in all sectors.

BEE co-ordinates with designated consumers, designated agencies and other organizations and recognize, identify and utilize the existing resources and infrastructure, in performing the function assigned to it under the energy conservation act. The Energy Conservation Act provides for regulatory and promotional function.

8. Conclusion

Energy audit is an effective tool in identifying and perusing a comprehensive energy management program. A careful audit of any type will give the industry a plan with which it can effectively manage the industrial energy system at minimum energy cost. This approach could be useful for an industry in combating essential energy cost and also raps several other benefits like improved production, better quality, higher profit and most important satisfaction of heading towards contributing in world energy saving.

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