

Review Paper on Energy Audit of a Manufacturing Industry

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Abstract - Energy Audit is an important tool in transforming the fortunes of any organization. Conservation and efficient use of energy in industry has been priority of the Government of India for a long time. Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, the energy sector assumes a critical importance in view of the ever-increasing energy needs requiring huge investments to meet them. Energy audit will determine energy wastage and losses, and provide techniques and ways to minimize the losses. As per Energy Conservation Act 2001, energy audit is mandatory for every commercial firm in India. As a result, among industrial consumers, the aspect of energy conservation is gaining importance due to the realization that “energy saved is energy produced and that to at an economical cost”. This paper shares the experiences of energy conservation project carried out in manufacturing industry situated in Maharashtra state. Economic and efficient measures of energy conservation have been followed subject to budget constraints, and the effects of such measures were realized through reduction in energy cost with the added advantage of environmental safety.

Key Words: Energy Audit, environmental Safety, wastage & Losses, Energy Conservation, Economic

1.INTRODUCTION

The advent of high crude oil prices resulted in a global energy crisis leading to huge cost in generating power, running of boilers and internal combustion engines, necessitating a need for energy management by industrial sector for efficient energy use, maximization of profit and enhanced competitive position. Energy in one form or the other is an integral part of our economic activity. Its availability and cost would affect the economic well-being and future of our country. In the present day world scenario of acute energy crunch, the need of the hour is energy conservation. Indian industries consume more energy than other countries hence there is substantial scope for energy conservation.

Industrial energy audit is performed for automotive and inter-connected components manufacturing industry having 109 companies as client. The purpose of an energy audit is to determine how energy is used in an existing facility and to reduce its use. Being manufacturing industry they are using primary energy source electricity continuously. So objective is to reduce the energy consumption of the company to make them

energy efficient. An energy audit is a preliminary activity towards instituting energy efficiency programs in an establishment. It consists of activities that seek to identify conservation opportunities preliminary to the development of an energy savings program.

2.PROBLEM DEFINITION

Case: - Engaged in manufacturing & supplying of various aluminum products. There are mainly FO fired, LPG gas fired & electric furnace for undergoing through various mechanical & heat treatment process. In this industry furnace oil & LPG gas is purchased from market & electricity is procured from MSEDCL through HT connection MSEDCL supplies electricity 2000 KVA for contract demand 900 KVA. It is expected to bring in lasting benefits (saving) in term of saving in energy as well as cost to the management.

Scope of Work: - The task of energy audit has objective to identify energy saving & conservation opportunity in case study of single 10 Ton capacity Aluminum melting furnace & cooling tower associated with it as well as to verify electrical motor loading installed with this equipment.

The scope of energy audit can vary widely, and can include an entire building or plant, or even energy use associated with a specific process. An energy audit provides the baseline of the organization's current energy use. Numerous studies carried out in the past by energy experts indicate that there exists scope for saving 10% to 25% of energy costs by employing cost effective energy conservation measures. Effective energy management in an enterprise can lead to significant energy and cost savings in addition to indirect benefits, such as extended equipment life, reduced maintenance costs, increased comfort, safety, and productivity, all leading to enhanced profits and an improved bottom-line. An effective and successful energy management program begins with an energy audit, which is a systematic approach for assessing energy end-use efficiency of all concerned systems/equipment. An energy audit evaluates equipment/system efficiency, estimates associated energy losses, identifies potential areas for cost reduction, and recommends cost-effective schemes for achieving energy and cost savings. Therefore, it is observed that there is a scope for reduction of power consumption by adopting energy

conservation techniques, without adversely affecting production.

Objective of proposed case study: In any industry, the three top operating expenses are often found to be energy (both electrical and thermal), labor and materials. If one were to relate to the manageability of the cost or potential cost savings in each of the above components, energy would invariably emerge as a top ranker, and thus energy management function constitutes a strategic area for cost reduction. Energy Audit will help to understand more about the ways energy and fuel are used in any industry, and helps in identifying the areas where waste can occur and where scope for improvement exists. The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programs which are main for production and utility activities. Such an audit programme will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc.

- To reduce wastage of electrical energy of that particular building and site.
- To obtain actual energy consumption of building.
- To improve efficiency of electrical supply system of the relevant site.
- To improve performance of supply system of the building.
- To reduce cost of the system

3. METHODOLOGY

Auditing in Industries means the checking of the efficiency of the production according to the consumption of energy, this is following some steps.

- Preparation and planning
- Data collection and review
- Plant surveys and system measurements
- Observation and review of operating Practices
- Data documentation and analysis
- Reporting of the results and recommendations

3.1 Methodology For Detailed Energy Audit

Phase I -Pre Audit Phase Activities A structured methodology to carry out an energy audit is necessary for efficient working. An initial study of the site should always be carried out, as the planning of the procedures necessary for an audit is most important.

Initial Site Visit and Preparation Required for

Detailed Auditing:- An initial site visit may take one

day and gives the Energy Auditor/Engineer an opportunity to meet the personnel concerned, to familiarize him with the site and to assess the procedures necessary to carry out the energy audit.

During the initial site visit the Energy Auditor/Engineer should carry out the following actions: -

- Discuss with the site's senior management the aims of the energy audit.
- Discuss economic guidelines associated with the recommendations of the audit.
- Analyze the major energy consumption data with the relevant personnel.
- Obtain site drawings where available - building layout, steam distribution, compressed air distribution, electricity distribution etc.
- Tour the site accompanied by engineering/production

The main aims of this visit are: -

- To finalize Energy Audit team
- To identify the main energy consuming areas/plant items to be surveyed during the audit.
- To identify any existing instrumentation/ additional metering required.
- To decide whether any meters will have to be installed prior to the audit eg. kWh, steam, oil or gas meters.
- To identify the instrumentation required for carrying out the audit.
- To plan with time frame
- To collect macro data on plant energy resources, major energy consuming centers
- To create awareness through meetings/ programme

Phase II- Detailed Energy Audit Activities

Depending on the nature and complexity of the site, a comprehensive audit can take from several weeks to several months to complete. Detailed studies to establish, and investigate, energy and material balances for specific plant departments or items of process equipment are carried out. Whenever possible, checks of plant operations are carried out over extended periods of time, at nights and at weekends as well as during normal daytime working hours, to ensure that nothing is overlooked. The audit report will include a description of energy inputs and product outputs by major department or by major processing function, and will evaluate the efficiency of each step of the manufacturing process. Means of improving these efficiencies will be listed, and at least a preliminary assessment of the cost of the improvements will be made to indicate the expected payback on any capital investment needed. The audit report should conclude with specific recommendations for detailed engineering studies and feasibility analyses, which must then be performed to

justify the implementation of those conservation measures that require investments.

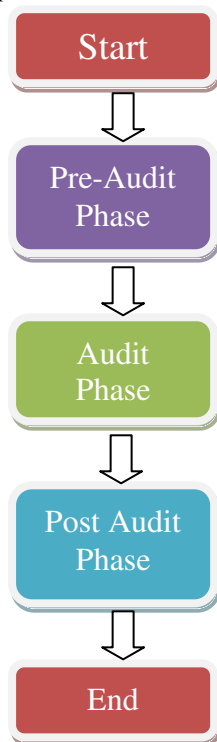


Fig -1: Flowchart for detailed Energy Audit

4. ENERGY SCENARIO OF THE INDUSTRY

Electricity is the prime source of energy in TT. The MSEDCL (MAHARASHTRA STATE Electricity Distribution Company Ltd.) power supply is coming to the plant with the help of 22kV feeders. The connected electrical load of plant is 750 kW and a contract demand is 641 kVA. Energy consumed is in the form of electricity. This electricity is mainly analyzed in kilowatt-hour (kWh). The exiting tariff rate is Rs. 220/kVA for max demand and Rs.8.23/kWh for energy consumption.

The foundation for the energy management program is the energy audit, which is the systematic study of factory or other building to determine where and how well energy is being used. It is the nucleus of any successful energy saving program – it is a tool, not a solution. Energy audit can be defined as, a formal in depth review of an enterprise by the experts in the field of energy to develop and evaluate energy conservation opportunities. Energy audit can also be described as ‘input to output analysis of energy with efficiency as basis. The most important factor to be remembered in this context is that energy audit is aimed at developing and evaluating ideas for improving energy efficiency. It must result in a techno-commercially viable energy management plan.

4.1 ANALYSIS

Analyzing historical energy consumption provides a basis for more in-depth analysis of energy performance. In particular, it provides the data needed for comparing performance.

Analysis is divided in two parts:

1. Comparative Analysis
2. Economic Analysis

4.2 The Role of an Energy Audit

To institute the correct energy efficiency programs, you have to know first which areas in your establishment unnecessarily consume too much energy, e.g. which is the most cost-effective to improve. An energy audit identifies where energy is being consumed and assesses energy saving opportunities - so you get to save money where it counts the most. In the factory, doing an energy audit increases awareness of energy issues among plant personnel, making them more knowledgeable about proper practices that will make them more productive.

An energy audit in effect gauges the energy efficiency of your plant against “best practices”. When used as a “baseline” for tracking yearly progress against targets, an energy audit becomes the best first step towards saving money in the production plant.

5. PRESENT STATUS

The per capita energy consumption is too low for India as compared to developed countries. It is just 4 % of USA and 20% of the world average. The per capita consumption is likely to grow in India with growth in economy thus increasing the energy demand. The high standards of living in the developed countries are attributable to high-energy consumption levels. On the contrary the rapid population growth in the developing countries has kept the per capita energy consumption low compared with that of highly industrialized developed countries.

Coal and other fossil fuels, which have taken three million years to form are likely to deplete soon. In the last two hundred years, we have consumed 60% of all resources. For sustainable development, it is essential to adopt energy efficiency measures. Although, energy efficiency has been in practice ever since the first oil crisis in 1973, it has today assumed even more importance because of being most cost-effective and reliable means of mitigating the global climatic change. With the background of high energy saving potential and its benefits, bridging the gap between demand and supply, reducing environmental emissions through energy saving, and to effectively overcome the barrier, the Government of India has enacted the Energy Conservation Act-2001. The act provides the much-needed legal framework and institutional arrangement

for embarking on an energy efficiency drive. Under the provisions of the Act, Bureau of Energy Efficiency has been established with effect from 1st March 2002, which would be responsible for implementation of policy programmes and coordination of implementation of energy conservation activities.

It is observed that the industrial sector is the biggest consumer of commercial energy and its share in the overall consumption is 49% (Reference year: 1999/2000). Energy costs turned out to be a major operating expense due to an ever-increasing trend in energy prices. Competitiveness and profitability became the core issues for survival in the period of liberalization. Energy conservation techniques to reduce energy costs are seen as an immediate and handy tool to enhance competitiveness. The Indian industries are today strategizing on energy efficiency improvement, more than ever before. In this context, energy audit is manifesting its due importance in various sectors which helps to understand more about the ways energy and fuel are used in any industry and help in identifying the areas where waste can occur and where scope for improvement exists.

6. CONCLUSIONS

A famous quote “Energy saved is energy generated”. A well-managed energy program can be a successful method to reduce energy consumption. Billing analysis is an important and easy way of analyzing the electrical energy consumption behavior of a particular industry. It helps to plan future electrical energy consumption behavior and to schedule production activities. Billing analysis helps us to know the daily KWh consumption, percentage load factor and energy intensity pattern of a plant. Based on the energy audit carried out the following conclusions were arrived at, installation of electric meters in each workshop and administrative units to monitor and curtail power wastages in each unit thereby reducing energy consumption and procurement of test equipment for energy monitoring in the factory. Furthermore, good maintenance and control must be put in place in order to improve the energy efficiency. Significant capital investment should be made in replacement of inefficient energy consuming equipment to reduce the energy consumption for example motivation for energy conservation among workers and provision of Sensors to detect natural lighting and switch on artificial light.

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