

# Energy Audit for Different Institutes-A Review

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**Abstract – This paper is review of energy auditing and process of energy auditing are presented in detail. A sincere attempt can made to conduct the Energy Audit at DES's College of Engineering & Technology Dhamangaon Rly., to estimate the Energy consumed in a day, week and month. Identification of areas of energy wastage and estimation of energy saving potential in the Canteen, hostel, all Departments and Institute Central Facilities can made by walk-through energy Audit. Also, detail analysis of data collected can done by suggesting cost-effective measures to improve the efficiency of energy use. Estimation of implementation costs and payback periods for each recommended action can made. The results & vital information generated through these activities can documented. The Energy Auditing for a day is the index of the consumption which normalizes the situation of Energy crisis by providing the conservation schemes.**

**Index Terms – Energy audit, Energy Consumption, Energy management, Estimation, Energy Conservation.**

## 1. INTRODUCTION

Energy audit is a part of an overall energy management program. The energy management is a continuous process and aims at the long term optimization of energy input and utilization so as to reduce the energy costs. Electrical energy conservation is very important as energy supplies are limited , it's very important to find ways to utilize available energy in proper and efficient manner. Energy audit provides the thinking ability to find out ways to conserve energy.

Electrical energy is the only source of energy for electrical appliances. No one can imagine life without electric energy. Computer cooling and the lighting all are powered by electric energy. An electric bill depends on which appliances are being used. In order to reduce electric bill, substitute high watt appliances for low watt.

Before planning this project the various papers related to the Energy Audit available in the IEEE archives were studied. Most of the papers [1] related to such studies made in different industries like, mechanical and heavy engineering. To the best of our knowledge no paper could be located on the energy auditing of educational institutions. However, the following

paper was identified. Methodology adopted for energy audit is mentioned in [1].

The main types of energy audit has been discussed in paper [3] which gives the idea about how energy auditing carried out in an institutes, similarly the methods which are useful for energy auditing is mentioned in [4]. The definition of an energy audit is properly mentioned in the [1] which gives exact meaning of energy audit.

## 2. ENERGY AUDIT& ITS TYPES

Energy Audit shows where the power consumption is more in the given system. An Energy Audit is a survey, inspection and analysis of energy flow for energy conservation in a building, Process or system to reduce the amount of energy input into the system without negatively affecting the output.

Although energy audit have various degrees of complexity and can vary widely from one organization to another. It provides thinking for improving energy efficiency and conservation to achieve environmental sustainability. They are the simplest way to reduce greenhouse gas emission and other forms of air pollution such as acid rain and smog. Good energy management starts with an energy audit.

The energy audit orientation would provide positive results in reduction energy billing for which suitable preventive and cost effective maintenance and quality control programmes are essential leading to enhanced production and economic utility activities. The type of energy audit to be performed depends upon the function or type of industry. There can be three types of energy audit. Preliminary energy audit, General energy audit, detailed energy audit.

### 1. Preliminary Energy Audit:

The preliminary energy audit alternatively called a simple audit screening audit or walk through audit, is the simplest and quickest type of audit. It is carried out in a limited span of times and it focuses on major energy supplies and demands. It involves activities related to collection, classification, presentation and analysis of available data in arising at the

most appropriate steps to be taken in establishing energy conservation. It involves collection of necessary data, minimal interviews with site operating personnel, a brief review of facility utility bills and other operating data and identifies glaring areas of energy waste or inefficiency. Typically, only major problems area will be uncovered during this type of audit, corrective measures are briefly described and quick estimates of implementation cost, potential operating cost savings and simple payback periods are provided. This level of detail, while not sufficient for searching a final decision on implementing proposed measures, is adequate to prioritize energy efficiency projects and determine the need for more detailed audit.

## 2. General Energy Audit:

The general energy audit is also called a mini audit or site energy audit or complete site energy audit. It expands on the preliminary audit by collecting more detailed information about facility operation and performing a more detailed evaluation of energy conservation measures identified. Utility bills are collected for a 12 to 36 months period to allow the auditor to evaluate the facility energy/demand rate structure and energy usage profiles. Additional metering of specific energy consuming systems is often performed to supplement utility data. In depth interviews with facility operating personnel are conducted to provide a better understanding of major energy consuming systems as well as insight into variations in daily and annual energy consumption and demand. This type of audit will be able to identify all energy conservation measures appropriate for the facility given its operating parameters. A detailed financial analysis is performed for each measures based on detailed implementation cost estimates, site specific operating cost savings and the customer's investment criteria. Sufficient detail is provided to justify project implementation.

## 3. Detailed Energy Audit:

Detailed energy audit 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.

Thus, the scope of this audit is to formulate a detailed plan on the basis of quantitative and control evaluation, to evolve detailed engineering for options to reduce total energy costs, consumption for the product manufactured. It should be at 8 to 10 percent savings, detailed audit study shall be completed in a period of three weeks from the date of commencement. After which, preparation of energy audit reports shall be completed in a period of three weeks. The major system that are encountered in industries with regard to which energy audit is to be carried out are: Boilers, furnaces, air conditioning systems, refrigeration or cold room etc., power generation and

distribution systems, compressed air generation systems, pumping systems and electric motor driven system.

## 3. DEFINITION OF AN ENERGY AUDIT

An energy audit is an inspection, survey and analysis of energy flows for energy conservation in a building, Process or system to reduce the amount of energy input into the system without negatively affecting the output. It shows where the power consumption is more in the given system. It can also be called as controlling of the power to avoid losses for maximize efficiency.

We have chosen the terms “macro-audit” and “micro-audit” to refer to the level of detail of an audit. Level of detail is the first significant characteristic of an audit.

The second significant characteristic is the audit's physical extent or scope. By this we mean the size of the system being audited in terms of the number of its subsystems and component.

- 1) The macro-audit starts at a relatively high level in the structure of energy consuming systems perhaps the entire site or facility and addresses a particular level of information, or ‘macro-detail’ that allow EMO's to be identified. A macro-audit involves a broad physical scope and less detail.
- 2) The micro-audit has a narrower scope, often begins where the macro-audit ends and works through analysis to measure levels of greater detail. A micro-audit might be for a production unit, energy-consuming system or individual piece of equipment.

Generally, as an audit's level of detail increases, its physical scope decreases.

## 4. METHODOLOGY ADOPTED

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 made using different methods such as observation, interviewing key persons, and measurements. Following steps were taken for data collection:

- Visited each department, centre, laboratories, library, canteen, auditorium and other entities of the institution.
- Information about the general electrical appliances was collected by observation and interviewing.
- Obtained Site drawing of available building lay-out and Electricity distribution.
- Collection of Electricity bill from the in-charge personnel.

- The power consumption of appliances was measured using power analyser in some cases (such as fans) while in other cases, rated power was used (CFL for example).
- Information collected on redundant / non-operational energy systems.
- The details of usage of the appliances were collected by interviewing key persons e.g. Electrician, caretaker (in case of departments) etc.
- Approximations and generalizations were done at places with lack of information.

## 2. Data Analysis –

Detailed analysis of data collected was done. Energy consumption per month in kWh is calculated based on each department and block-wise. The analysis of data is done in following way:

- Power Flow diagram
- Evaluation of collected data department wise analysis, block wise analysis and location wise analysis.
- Reasons for the Variance between connected load and actual consumption was evaluated.
- The database prepared was further studied and the results have been graphically represented.

This helped to identify the areas with maximum energy saving potential.

## 3. Recommendation –

On the basis of results of data analysis and observations, some steps for reducing power consumption were taken. The recommended measures will not affect the present working conditions and at the same time substantial energy savings will arise. Following were the steps involved in this process:

- The capital cost involved in replacing an appliance and/or process was estimated. The energy saving by the move was calculated in terms of price of energy per year.
- These two costs were compared to calculate the capital cost recovery time which is defined as the total time by which the saving in energy bill balances the capital cost involved.

If capital cost recovery time is less than the product life, the move can be supported. Some other recommendations were also made which are based on lighting intensity, computer usage, fans and motion sensors.

## 5. REASON FOR UNDERTAKING AN ENERGY AUDIT

There are several levels of reasons for undertaking an energy audit. In the short term, it saves money at a time where the costs of fossil fuels, gas and electricity are rising inexorably.

These days, there are many ways of saving energy. Conservation strategies and technologies are becoming increasingly sophisticated. So much so that, that in most cases, the time and money outlaid on an energy audit often can be saved within a year, and will pay dividends thereafter.

In the medium term, the use of more and more electrical and electronic devices, in homes and industry, has begun to stretch our generating capacity. Within the next few years, Victoria faces the real prospect of blackouts.

It may seem strange, but the critical time is summer. As our summers become longer and warmer due to global warming, there will be insufficient generating capacity to meet an increasing reliance on air-conditioning. Last year's supply/demand projections published by the National Electricity Market Management Company showed that Victoria and South Australia would need extra generating capacity on line to be certain of meeting the demand in the summer of 2006/7.

Greater efficiency of energy use is the quickest and cheapest way to help the community meet this problem. And any energy efficiency measures which lower dependence on electricity supplied from the grid—such as installing solar cells—will decrease disruption to daily lives. In the long term, the world faces a crisis due to global warming.

## 6. CONCLUSION

This paper represents the innovative idea of reducing energy losses in different institutions by replacing high power consuming devices to low power consuming devices such as tubelight can be replaced by CFL. In this way the energy consumption can be reduced.

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