

## CASE STUDY: ENERGY AUDIT

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**Abstract:** *Energy is the requirement of the time. There are huge losses in the energy systems. In this paper author focused on the energy audits for conservation. It is the study of usage of energy and the methods for saving of energy. A mix of new technologies and the existing ones can provide future references for saving energy. The process of energy management initiates with an energy audit. with the help of these audits society will be able to save lots of losses.*

**Key words:** Energy, Energy Audits

### 1 INTRODUCTION:

Energy audit is one of the most important tools for energy conservation and for achieving energy efficiency. The domains of leakage, wastage of renewable energy can be identified by using energy audits. Energy audits also provide a means to reduce energy losses in the systems of current use. Therefore energy audits provide as a means of providing-

- Energy saving
- Cost saving

As well as increased comfort, lower maintenance costs, and extended equipment life etc.

Energy audits act as a key to providing systematic approach for decision-making in energy management. A basic energy audit comprises of-

- Efficient measurement of energy
- Identifying losses
- Calculating the actual energy consumption capabilities of our system

Finally, providing appropriate solutions

The main result of such an exercise is to improvise current systems to make them more and more efficient by renovating and modernising them. Hence on a

broader perspective the method evolved is designed to save energy which is the need of the hour.

### 2 ENERGY CONSERVATION ACT

According to the energy conservation act, 2001, energy audit is defined as "The verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption".

### 3 NEED FOR ENERGY AUDIT

One of the major reasons for energy audits is to provide cost reduction in current systems, audit programs will also help in keeping a check on energy cost bifurcations in an elaborative manner, provide the reliability on supply of energy and help in defining energy conservation methods with view to retro fitting them.

The main objective of using energy audits is to provide a way to reduce energy consumption per unit for the defined system. These audits also provide us with a "benchmark" for managing energy for the whole organisation and planning an effective use of the same.

### 4 TYPE OF ENERGY AUDIT

Choice of the energy audit depends upon the understated factors-

- Type and function of the industry
- The depth required for audits
- Cost reduction desired

Thus energy audits can be bifurcated as-

1. Preliminary audits
2. Detailed audits

#### 4.1 Preliminary Energy Audit Methodology

Preliminary energy audits can be useful to-

- Obtain the cumulative energy consumption for the organisation
- Determine the scope of savings
- Mark the easiest ways of energy saving
- Mark the immediate ways of energy saving
- Obtain a “benchmark”
- Identify the domains requiring advanced studies

This audit uses the existing or currently available data.

#### 4.2 Detailed Energy Audit Methodology

Detailed energy audit provides a complete outlook on energy consumption for the organisation evaluating all major energy consuming processes in the industry. It is very accurate in approach and provides very efficient readings. One of the key elements of this audit is to provide with an accurate energy balance. There is an estimated use of current operating conditions which is further compared to utility bill charges.

The detailed energy audit is carried out in three steps-

Step1- pre audit

Step2-audit

Step3-post audit

##### Preliminary Audit

Preliminary audit alternatively referred to as simple audit, screening audit or walkthrough audit is considerably the simplest of all audits. Performing minimal interviews of the site operational personnel, understanding the building operations, identifying the areas of energy wastage and glaring the utility bills a few times completes the audit. The audit is followed by a quick review of corrective instructions for the organisation and a complete estimate of the total cost saving for the organisation.

##### General Audit

The audit is also referred to as mini edit or complete site energy audit is performed in such a manner to expand the preliminary audit stated above in a more detailed and elaborative manner. Utility bills for a period of 12 to 36 months are scanned in the above proceedings.

Additional metering may also be carried out for the energy consuming systems as an extra measure to increase the accuracy of the results obtained. In-depth interview of the site in charge may also be carried out to obtain the complete insight of the energy consumed by the organisation. Finally a detailed financial structure is presented in front of the company to sum up the total energy savings for the organisation.

##### Investment-Grade Audit

The investment grade audit explained here after alternatively termed as max audit, detailed audit or general audit is useful to provide a dynamic model for the energy use characteristics. Extensive and detailed processes are carried out to provide the final audit results with focus on all smaller details consuming energy in the organisation. The study also inculcates load fluctuations occurring throughout the year making the study more and more precise. The data is further supplemented with sub metering of the various energy consuming parameters of the complete organisation.

#### 5 ENERGY AUDIT METHODOLOGY/STEPS

##### Step 1 – Initial meeting

A meeting is scheduled initially between the auditors focussing primarily on audit objectives, scope of work, rules to be followed, role of each team member and a briefed description of the whole process.

##### Step 2 – Touring the facility

Preceding the initial meetings a visit is arranged to the organisation to view the current operation and methods beforehand. The main focus of the visit is to analyse the various architectural, lighting, mechanical, and process energy systems.

##### Step 3 - Documentation

A set standard of documents comprising of construction documentation, operating documentation the major energy consuming processes in the facility is presented. Also appropriate field measures are carried out in addition to the above documents.

##### Step 4 - Facility Inspection

Furthermore after the thorough investigation of documents provided, an investigation of the most energy consuming processes of the industry is carried out. The

process also involves appropriate field dimensioning of the facility.

### Step 5 - Staff Interviews

After the facility inspection is completed the auditors once again call for a meeting with the facility staff to review the findings and considerations of the audit. The members of the facility may include in them the operators and maintenance teams of the most energy consuming processes of the facility.

### Step 6 - Utility Analysis

One of the most important steps of the audit is the utility analysis involving the study of the utility bills of the facility. The bills include various purchased consumable resources of energy like electricity, liquefied petroleum gas and natural gas. The data is further normalised to facilitate the changing demands due to changing weather. Analysing such variety of resources for the facility introduces to the auditors the most energy efficient systems. When found suitable in some cases it may be advised to produce some of the resources on-site.

### Step 7 - Identify/Evaluate Feasible ECMs

ECM'S or energy conservation measures may be defined and designed for the facility and with the agreement of facility managers provisions may be made to set-up such ECM'S for the facility. Often it is found that ECM'S offer a high payback to the facility luring the managers to take their services for them.

### Step 8 - Economic Analysis

Models and simulations with software's are built by the auditors to produce the base line against which energy saving ECM's is identified. Auditors then calculate the implementation cost and energy saving savings for each ECM.

### Step 9 - Prepare a Report Summarizing Audit Findings

The results thus obtained are finalised in a report including a description of the facilities and their operation, a discussion of all major energy consuming systems, a description of all recommended ECMs with their specific energy impact, implementation costs, benefits and payback. The report also incorporates the summary of the whole procedure and certain recommendations to optimize energy.

### Step 10 - Review Recommendations with Facility Management

Formal presentation comprising all recommendations is presented to the facility management. The presentation includes in it data on decision making for implementing the suggested ECM'S.

## 6 INTRODUCTION TO LIGHTING SYSTEMS

Lighting is one of the most essential part of energy consuming domains of an industry with there consumption varying between 2 to 10 % of the total energy consumption of the organisation. Lightning as a domain has a whole lot of potential to save energy for the industry by the use of efficient lamps apart from good operational practices.

A typical commercial building has many lighting requirements and each normally has its own set of options for improving lighting efficiency. Centuries ago people were able to read by the light of a candle but today in typical office buildings a person often reads under thousand times the energy.

In a normal office a person requires glare free surfaces for reading and ambient lights around typically very less than the current available lighting. Often lighting designers end up in producing a beautiful building but consuming a lot more energy. The designers should consider a host of other factors, including the effect of quality of light on the visual comfort and health of the occupants. Small improvement in lighting quality can improve productivity of the user substantially. Correct type of lightning can be provided by using appropriate audits and the use of day light.

### Day light

Sun light is a free light available to humans in which even humans are much more comfortable in comparison to conventional lightings. Hence the usage of sun light in offices can be very economical idea for the industry. By simple addition of a few windows to the buildings at the appropriate places can end up in lighting of much larger areas in desired manners.

- Day lighting is a mixture of art and science involving an essential key to allow only required light in the building.
- Poorly designed day lighting may do more harm than benefits.
- Day lighting can be applicable even cloudy climates.
- Usage of daylight sensitive lighting systems can be very advantageous for the organisation.
- Sun light produces less heat per lighting area hence it can be very much useful for reducing cooling loads.
- Spectrally selective tints or coatings may be used by the organisations to improve the quality of illumination.

Lighting is one of the fastest developing industries with modernisation occurring very swiftly and efficiently. Energy efficient T5 and T8 linear fluorescent lighting systems, LED powered DC lighting systems are in much use nowadays. Selection of energy efficient lamps should be the starting point of deciding how to illuminate a particular space effectively and efficiently. It has been understood long ago itself that the conventional incandescent lamp is much less efficient than the fluorescent counterparts. Further improvement in the lighting industry can be of great value for the organisations and for the nature around us.

## 7 CONCLUSION:

In this paper authors focus on the energy audits . these audits are very important for the society. The buildings, offices, rooms etc. are designed without taking into consideration of the use of energy efficient lighting system. These buildings consume more energy as the energy required by energy efficient structure design for

the same. So energy audits should be done for conservation of energy.

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