

# Improving Building Efficiency by Energy Audit

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## ABSTRACT

*Today energy is very important and necessary process for all bulk consumers. It just not provides information about cost and consumption but also provide various energy saving strategies. The energy audit is used to identify the weak points of the building energy usage system and to build up energy saving responsibility. The main aim of energy audit is to calculate total energy consumption of the equipment's, mainly on air conditioning system, electronically equipment's and lighting etc. The main objective of energy audit is to find out the different type of losses and to provide cost effective alternate solution for power consumption in commercial buildings. With the help of energy audit process we have collect some important data in which first of all we have to find out more energy consumption area like motor, lighting and air conditioning. We reduce the losses in motor, lighting and air conditioning and increase the overall efficiency of the plant by reducing these losses.*

**Keywords:** Energy Audit, Lighting, Reduce Losses, Efficiency.

## I. INTRODUCTION

An energy audit is an inspection, survey and analysis of energy flows in a building for the conservation of energy or it is a process or system which is used to reduce the amount of energy used for the system without negatively affecting its output. Energy audit is the first step for identifying opportunities to reduce energy expense in commercial and industrial real estate. Nowadays people are more concern about energy efficiency and conservation. Energy audit is considered as one of the comprehensive method in checking the energy usage and wastage in commercial buildings, educational institutes, universities and industries etc.

An energy audit is a detailed examination of facilities energy usage and costs and give suggestions to reduce energy losses which required no financial impact and further generates recommendations to reduce those costs by implementing energy efficient technologies and operational changes. The proper energy accounting is the first step in energy audit process. It is the process of identification, collection, organization and monitoring of energy usage in the commercial buildings, universities, industries etc.

Energy audit is helpful for both residential and commercial owners for making their home or commercial building more energy efficient. It is very important to show owners exactly where improvements can be made to start saving money. It analyse the billing history to ensure accuracy and inspect the insulation, HVAC and lighting systems for leaks and inefficiencies. To measure air leakage and tightness of the building envelope energy audit perform a blower door test. For improving energy efficiency a good energy auditor will help owners make more informed decision. There are many benefits to performing an energy audit; if we use energy more efficiently then it can result in reduction of CO<sub>2</sub> emissions, environmental impact and national energy demand. Energy audit also helps to improve the air quality of homes and commercial buildings so that increase their resale value.

## II. TYPES OF ENERGY AUDIT

Energy Audit can be classified into the following three types.

### Preliminary Energy Audit

The preliminary audit is also known as walk-through audit. It is a visual inspection of each of the energy using systems and it includes an evaluation of energy consumption data to analyse the energy use. It is the least costly audit which provides an estimate of saving potential and through improvement in operational and maintenance practices it can provides a list of low cost saving opportunities.

Steps in Preliminary Energy Audit (PEA)

- Identify the quality and cost of various energy forms used in the plant
- Identify energy consumption at the process level
- Relate energy input to production and highlight energy wastage in major equipment / Process

### General Energy Audit

The general audit is also known as mini audit or site audit. The general audit expands on the preliminary audit by collecting more detailed information about each energy using system and performing a more detailed evaluation of energy conservation measures. To allow the auditor to evaluate the facilities energy demand rate structure and energy usage profiles a 12-36 months period utility bills are collected. For providing a better understanding of major energy consuming systems interviews with facility operating personnel are conducted.

### Detailed Energy Audit

Detailed energy audit analyses the amount of energy consumption in each sub systems of the plant. In this type of audit computer simulation software are used for evaluation of energy use patterns.

Comparison between the required investments for implementing the energy conservation measures and the projected saving through the energy conservation measures are also included in the report of detailed energy audit.

Steps in Detailed Energy Audit

It can be divide into following subparts:

- I. Envelope Audit: Envelope Audit surveys the building envelope for losses and gains due to leaks, building construction, doors, glasses, insulation etc.
- II. Functional Audit: It identifies Energy Conservation Opportunities in Operation & Maintenance (O&M), HVAC (Heating, ventilation& Air conditioning) and other functions.
- III. Process Audit: This audit determines the amount of energy required and ECOs in process machinery.
- IV. Utility Audit: It analyses the daily monthly or annual usage for each utility including electrical motors, induction heating furnaces, ovens, geysers etc.

- V. Transportation Audit: This type of audit covers amount of energy required for forklifts, trucks, belt pulleys and other vehicles for transportation of materials in the plant.
- VI. Modernization Audit: It recommends major changes in process if the existing process is found to be obsolete or new energy efficient technologies are available.

### **III. METHODOLOGY FOR ENERGY AUDIT OF A COMMERCIAL BUILDING**

The methodology for energy audit of a commercial building is explained step by step below:

- I. Collection of Building Data: In this step we collect the room wise details of electrical connected load, previous two years electricity bill and other power consumption information.
- II. Calculation of Total Load: In this step we calculate the total load of the building from the collected data of all kind of devices and equipment.
- III. Generator Data Collection: In this step we collect the information about generator like monthly diesel consumption, monthly running time of generator and monthly amount paid for diesel.
- IV. Identification of Weak Points of Installation: In this step we identify the weak point in the wiring and lighting system of each floor of the building.
- V. Total Unit Consumed per Day/ per Month/ per Year: In this step of methodology we calculate the total unit of electricity consumed in a day, month and year.
- VI. Total Amount Paid to Grid: In this step we calculate the total amount paid to the grid on daily, monthly and yearly basis according to the unit consumption.
- VII. Analysis of DG Data: In this step we analyse the whole data of generator and calculate the total amount paid for diesel and total amount of diesel consumed.
- VIII. CO<sub>2</sub> Emission due to Burning of Diesel: In this step we have estimated the total emission of CO<sub>2</sub> gas due to DG set working.
- IX. Total Cost Losses in Electricity: In this step of methodology we calculate the total amount of losses in the electricity.
- X. Suggestions for Reducing Power Consumption Cost and CO<sub>2</sub> Emission: Solar power plant is proposed to reduce the consumption of diesel in DG set and to reduce the emission of CO<sub>2</sub>.
- XI. Calculation of Payback Period: In this step we calculate the payback period on the basis of cost and saving.
- XII. Implementation of Plant: After complete audit process plant are proposed to implement.

### **IV. CONCLUSION**

Energy audit gives the information to the energy managers which are required to identify energy consumption patterns and components of a facility and document existing conditions, energy conservation opportunities can be identified and prioritized. By taking a methodical approach to the audit process, it is possible to identify and avoid unnecessary expenditures in the building while improving operation and comfort.

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