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## 9. Energy Audit and Its Importance in Current Scenario

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### **Abstract:**

*The development of any organisation, establishment, facility or building requires the consumption of energy. The demand for energy is increasing day by day. Fossil fuels account for about 82 percent global energy supply. The burning of fossil fuels generates the energy required for most of our daily needs. Heat-trapping gases like carbon dioxide are also released into the atmosphere causing global warming and affecting the climate. Generation of energy is very expensive and, therefore, conservation and judicious use of energy is the need of the hour. An energy audit is an important tool that facilitates the efficient use of energy. It helps in understanding and identifying the areas where wastage of energy can occur by measuring or noting the energy consumption data. The main aim of an energy audit is to reduce consumption, energy cost and carbon footprint without affecting human health, safety and convenience. An energy audit can be done as walk through energy audit, target energy audit, and detailed energy audit.*

*BEE (Bureau of Energy Efficiency) an agency of the Government of India carries out energy audits for various establishments. They analyse energy systems and give reports on electricity and thermal consumption. An energy audit is done by qualified auditors with work experience in the operation and maintenance of energy units. Instruments that are used for investigating include infrared thermometers temperature indicators, steam trap monitors, etc. to check air sealing, insulation, updating heating systems, and repairing ducts for effective and efficient energy use without wastage.*

### **9.1 Introduction:**

Climate change and Pollution are two major threats to life on our planet. Burning of fossil fuels like coal, oil and gas produce heat-trapping gases or the greenhouse gases such as carbon dioxide, methane and ozone causing global warming and thus, the climate change. Earth's temperature has risen by 0.14°F per decade since 1880. The rate of warming in the past 40 years is almost twice that at 0.32°F per decade since 1981. Sea surface temperatures have risen about 0.2°F per decade since the 1980's leading to the rise of sea level to about 3cm (1.2 inches) per decade. All these have resulted in changes in salinity, oxygen levels, severe storm patterns, sea-level rise, melting of glaciers, intense drought and warming of both land and oceans. This has affected food production and human health. We, therefore, need to control climate change by investing in clean and renewable energy resources and

moving away from fossil fuels. The burning of fossil fuels releases a large amount of energy that is converted to electricity and heat. We need to use alternative sources of energy like solar energy, hydropower energy, wind energy, biofuels etc.

Energy audits became popular in 1973 in response to the energy crisis. In recent years they are gaining importance due to human impact on climate change and global warming. Energy needs to be used efficiently and conserved. An energy audit is the first important step in successful energy management. An energy audit is an inspection, survey and analysis of energy flow for conservation in an organisation, building or plant. Sustainable development can be achieved by reducing emissions released into the environment by reducing energy demand. Energy audit helps in keeping a check on energy quality, energy usage and energy efficiency. Its implementation can increase the efficiency, and quality and in reducing the bills by controlling wastage of energy. Energy audit detects operational problems and improves the comfort of the inhabitants in buildings. Energy audit can help to understand better options of energy and to promote proper use of energy by achieving the main goal of reduction of greenhouse gas emissions. It also helps us to understand how energy is used by an organisation, commercial establishment or residential buildings and identify the areas where wastage of energy can occur by measuring or noting the energy consumption data. It is important to reduce electrical tariffs and decrease wastage. Due to increasing environmental concerns, energy audit for both existing and new to construct buildings has started. Energy audit need to have a detailed review of energy consumption and to date consumption data. There are two energy audit standards ISO 50002 and EN 16247. The International standards ISO 50002: 2014 specifies the process required for carrying out an energy audit in relation to energy performance. It mainly deals with principles of carrying out energy audits and requirements for the process. It, however, does not address the requirements for the selection and evaluation of bodies that provide energy audit services. European standards for energy audit BS EN 16247 deal with commercial, industrial, non-commercial and public sector organizations. It does not deal with private residential complexes.

The world's largest energy audit program is the American IEC 18000 energy audit since 1976. ESEA (Electrical safety and Energy Auditor) is an Energy consulting company of India. It offers customized energy-saving solutions. The team consists of Certified Energy Auditors from BEE (Bureau of Energy Efficiency) an agency of the government of India. They carry out energy audits for various establishments, hospitals, hotels, residential buildings and industries. Under BEE regulations 2010 mandatory energy audit is to be conducted within 18 months of the notification date i.e. 2014.5.27 of the Indian Government. A BEE rating certificate is required to demonstrate the level of performance and electricity usage of a product. The star labels on the equipment show how much efficient an appliance is in terms of electricity consumption.

## **9.2 Energy Conservation Measures (ECM):**

Energy can be conserved by following practices:

- Use of LED bulbs and tube lights
- Cleaning or replacing air filters in air conditioners

- Do full loads of dishwashers and washing machines
- Air-dry dishes and clothes
- Smart thermostats for appliances
- The burner of gas tops should be of the right size
- Baking with glass or ceramic pans
- Unplug devices not being used etc.
- Insulate rooms properly
- Seal up any gaps
- Reduce water consumption etc.

Various instruments are used for auditing energy like an infrared thermometer, flue gas analysers, temperature indicators, steam trap monitors etc.

### **9.3 Energy Auditors:**

Energy auditors are well trained and skilled. They have a degree in engineering and management with work experience in the operation and maintenance of energy units. They analyse the energy systems and full report of electricity and thermal consumption. They analyse the heating and cooling systems, and insulation levels of the entire building whether home or business establishment for which audit is being done. After evaluating the inside and outside of an establishment and determining energy usage they perform the airtightness test known as the blower door test. In this test auditor checks any air leakage from the building. They perform air sealing, and thermographic scans by using equipment to measure energy consumption such as infrared cameras, surface thermometers and furnace efficiency meters. Finally, he analyses the past bills and gives recommendations to improve energy efficiency. Implementation of recommendations help in saving money on bills.

At times occupants try to save money of paying for the services of a professional energy auditor and thus, prefer to take a do-it-yourself approach and conduct an energy audit of their own home themselves, although it is not reliable. The person occupant may himself look for air leaks, and check ventilation, insulation levels, lighting and appliances.

#### **9.3.1 The Procedure of Energy Audit:**

The energy audit procedure consists of 4 steps:

- **Step 1: Planning**

In this complete survey of the establishment or the facility is done. Current energy consumption is noted by the help of appropriate instruments.

- **Step 2: Investigating**

In this step exhaustive energy audit is done by a certified energy auditor with proper in-depth analysis.

- **Step 3: Implementing**

A report is made that includes low-cost measures, and evaluation of the current consumption of energy in comparison to the set standards for industries.

- **Step 4: Sustaining**

The results are implemented and converted into efficient energy consumption and savings.

Energy management and audit is the quickest, cheapest and cleanest way to reduce energy consumption.

The objective of an energy audit is the same for all industries but the process and time taken might vary from industry to industry or facility to facility. Generally, the process involves the collection of previous bills, analysis for identification of energy conservation measures and plan of action for implementation of ECM.

### **9.3.2 Types of Energy Audits:**

There can be 3 types of energy audits:

#### **A. Walkthrough Energy Audit:**

This is the first preliminary type of audit and includes a simple survey. It does not require a lot of measurement and data collection. The auditor investigates the energy consumption of an establishment.

An auditor identifies the energy consumption and makes a list of energy-saving measures. However, the details obtained by this type of audit are not sufficient for getting a concrete energy-saving solution.

#### **B. Targeted Energy Audit:**

This audit starts with knowing the detailed findings of a walk thorough energy audit. A detailed analysis of a specific project is done during a targeted energy audit by taking into consideration the type of structure of the established commercial and residential.

Recommendations are given for the actions to be taken. A clear and brief energy report is submitted with the plan of action for improving energy efficiency and reducing consumption. Suggestions are given for both savings and improvements.

#### **C. Comprehensive or Detailed Energy Audit:**

This is also referred to as a diagnostic energy audit. It gives more accurate details of energy performance. It is a detailed energy audit. In this, measurements and data are collected for various energy systems like pumps, heating steam process, etc. It is carried out in 3 phases:

**a. Pre-Audit Phase:**

The auditor organises and plans for an energy audit. A formal interview with various seniors of the establishment like the CFO, plant manager, energy manager, and production manager is conducted. They discuss the aim of the comprehensive energy audit and the data needed for auditing. Analysis of major areas of energy consumption is also done. The outcomes of this phase help to plan and finalize the whole comprehensive energy audit.

**b. Audit Phase:**

This is the second phase of a comprehensive energy audit. It depends on the nature and complexity of the site. This audit can take more time. It is done with proper care so that nothing is overlooked. The information collected during this phase includes the source of energy supply, energy bills, load, and preparation of process of the energy flow diagram and identifying energy conservation measures and giving energy-saving recommendations.

**c. Post Audit Phase:**

This includes implementation and follow-up of energy conservation opportunities in the concerned organization as discussed in the audit phase.

A detailed energy audit report is made at the end with guidelines for energy auditing methods. These reports highlight the details of energy consumption, energy costs, major areas of energy consumption, the performance of equipment and measures suggested for energy saving and consumption. Important information regarding energy usage and energy star rating can be obtained from the audit report. This information can then help identify and correct any energy usage issues to cut electricity costs. Improvements can help save money as well as help us better fight climate change.

**9.3.3 Need for Energy Audit:**

As the demand for energy is increasing we need to use more of renewable energy resources than non-renewable resources, the fossil fuels for energy generation that are harmful for our planet and its biodiversity. An energy audit is, therefore, the need of the hour because it can reduce energy consumption, save money, reduce carbon footprints - and also reduce unnecessary wastage and pollution. Energy audits must be made compulsory for all buildings at particular time intervals.

Energy audit => Energy management.

▪ Thus, An Energy Audit Is Important:

1. For identifying energy-saving opportunities.
2. Helping to understand energy usage and ways to use energy better.
3. For identifying safety concerns with electrical systems, wiring and ventilation making home or business establishment safer.
4. Increasing home resale value.

5. Help in identifying how to reduce carbon monoxide production at home or business.

▪ Some Software Used for Energy Audits:

- Easy Audit
- MATLAB
- TREAT
- eQUEST
- The energy analysis software
- OptiMiser
- Buldee etc.

#### **9.4 References:**

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