



Energy Audit – An Analytical Approach

Dr. Barun Kumar Roy

Director -Principal,

Gyan Ganga Institute of Technology & Sciences, Jabalpur(M.P)

Abstract: “The strategy of adjusting and optimizing energy, using system and procedure so as to reduce energy requirements per unit of output while holding constant or reducing total cost of producing the output from these systems”. Energy audit is the key to a systematic approach for decision making in the area of energy management. It attempts to balance the total energy input with its use, and serves to identify all the energy streams in a facility. It qualifies energy usage according to its discrete functions. Energy audit is the key to a systematic approach for decision making in the area of energy management. It attempts to balance the total energy input with its use, and serves to identify all the energy streams in a facility. It qualifies energy usage according to its discrete functions.

Key Words: Energy, Energy audit, systematic approach, discrete functions.

INTRODUCTION

The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect the term energy management means many things to many people. One definition of energy management is: “The judicious and effective use of energy to maximize profits (minimize cost) and enhance competitive positions” (Cape et al 1997) “The strategy of adjusting and optimizing energy, using system and procedure so as to reduce energy requirements per unit of output while holding constant or reducing total cost of producing the output from these systems” The objective of energy management is to achieve and maintain optimum energy procurement and utilization, throughout the organization and:

*To minimize energy cost/waste without affecting production & quality

*To minimize environmental effects.

1.1 Energy audit: type and methodology

Energy audit is the key to a systematic approach for decision making in the area of energy management. It attempts to balance the total energy input with its use, and serves to identify all the energy streams in a facility.

It qualifies energy usage according to its discrete functions. Industrial energy audit is an effective tool in defining and pursuing comprehensive energy management programme. As per energy conservation act, 2001, energy audit is defined as “The verification, monitoring and analysis of use of energy including submission of technical report containing recommendation for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption”

1.2 Requirement of energy auditing

In any industry three top operating expenses are often found to be energy (electrical and thermal), labour and materials. If one were tolerate to the manageability of the cost or potential cost saving in each of the above components, energy would invariably emerge as a potential cost savings in each of the above components, energy would invariably emerge as a top ranker, and thus energy management function constitutes a area for cost reduction.

Energy audit will help to understanding more about the ways and fuel are used in any industry, and help in identifying the areas where waste can occur and where scope for improvement exist. Such an energy audit programme will help to keep focus on variation which occur in the energy cost, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc. The primary objective of the energy audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs.

1.3 Types of energy audit

- ✓ function and type of industry
- ✓ depth to which final audit is needed
- ✓ potential and magnitude of cost reduction desired
- ✓ location and place where energy audit required

Mainly energy audit can be classified in two groups- preliminary audit and detailed audit.

Preliminary energy audit methodology

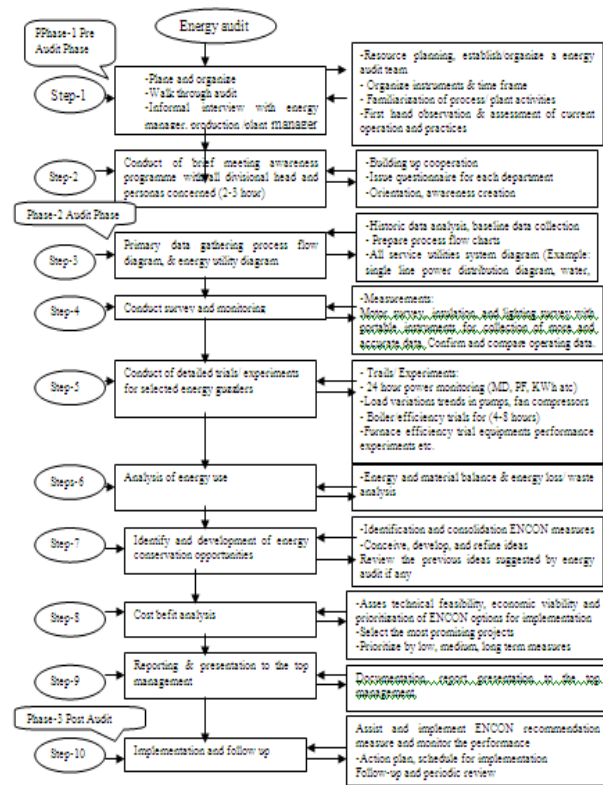


- ❖ Establish energy consumption in the organization
- ❖ Estimate the scope for saving
- ❖ Identify the most likely and easiest area of attention
- ❖ Identify immediate improvements/ savings
- ❖ Set a reference point
- ❖ Identify area for more detailed study/measurement
- ❖ Preliminary energy audit uses existing, or easily obtained data

Detailed energy audit methodology

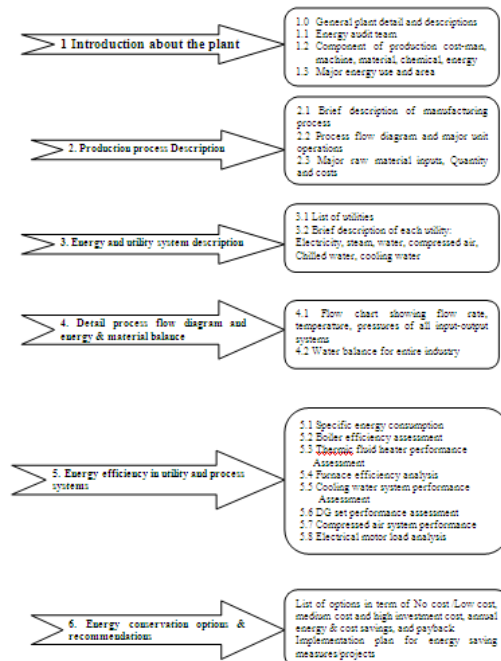
A comprehensive audit provides detailed energy project implementation plane for a facility, since it evaluate all major energy using systems. The type of audit offers the most accurate estimate of energy saving and cost. It considers the interactive effects of all projects accounts for the energy use of all major equipment, and include detailed energy cost saving calculations and project cost. In a comprehensive audit, one of the key elements as the energy balance. This is based on an inventory of energy using systems, assumptions of current operating conditions and calculation of energy use. This estimated use is then compared to utility bill charges.

- Detailed energy audits carry out in three phases
 Phase 1- Pre Audit Phase
 Phase 2- Audit Phase
 Phase 3- Post Audit Phase

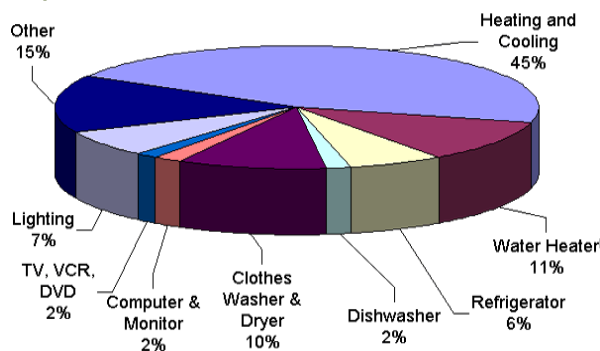
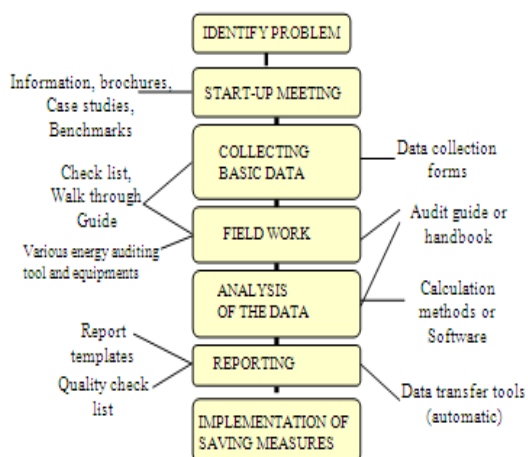


**Energy audit process step by step with purpose
 CONTAINS OF ENERGY AUDIT REPORT**

1. Acknowledgement 2. Executive summary: - At a glance & Recommendations



Energy auditing tool & Equipment requirement at various position



Energy Auditing Tips to reduce the above consumption:

- ❖ Uses CFL tubes in place of simple bulb.
- ❖ Open the refrigerator door a minimum No. of times as possible.
- ❖ There should be open space in the back side of the refrigerator it will reduce the ambient temp. Of refrigerator as a result increases the COP of refrigerator.
- ❖ Use the solar water heater for heating the water.
- ❖ Switch of the monitor of computer when it is not in use.
- ❖ Check the insulation levels in your attic, exterior and basement walls, ceilings, floors, and crawl spaces.
- ❖ Check for holes or cracks around your walls, ceilings, windows, doors, light and plumbing fixtures, switches, and electrical outlets that can leak air into or out of your home.
- ❖ Check for open fireplace dampers.
- ❖ Make sure your appliances and heating and cooling systems are properly maintained. Check your owner's manuals for the recommended maintenance.
- ❖ Study your family's lighting needs and use patterns, paying special attention to high-use areas such as the living room, kitchen, and outside lighting. Look for ways to use lighting controls—like occupancy sensors, dimmers, or timers—to reduce lighting energy use, and replace standard (also called incandescent) light bulbs and fixtures with compact or standard fluorescent lamps.
- ❖ Keep your Air conditioner (AC) temp. Set at a reasonable room temp. Because lower the temperature of room higher will be the heat transfer with the surrounding which increase the AC load and energy consumption.
- ❖ Out door lighting should be controlled by the day light sensor which will be effective to save the consumption of the light.

Various equipment used for energy auditing:



Infrared Thermometer: This is a non contacting type of device which is used for measuring high temperature. It is

Some example of the power, equipment and illumination intensity required at various place for best power utilization:

Place	Power required for lighting (KW)	Electric lighting Equipment	Specific power (W/ m ²)	Illumination intensity (lx)
Gymnas tics hall	3	58 W fluoresce nt lamp	8	250-340
Kitchen & Dining Room	2	58W & 36W Fluoresce nt lamp		
Office	3	58W Fluoresce nt lam	15	450-550 at desk level
Corridor s and Halls	9	36W & 18W fluoresce nt lamp	10	100-200
Study Table		6W-12W CFL		

Energy audit of a home: II-chart shows the mainly energy consumption in a home. The mainly major part of the energy consumed in a hone is in heating and cooling (45%), water heating (11%), clothes washer and dryer (10%), Refrigerator (6%).so during the energy auditing main concentration should be on the above stated areas because they play a major role in energy consumption.



useful for measuring hot spots in furnaces, surface temperatures etc.



Thermal leak detector- a very simple device that allows you to detect temperature differences between different points in your house. You start by shining a light from the device on one location and choosing a reference temperature difference (options of 1, 5 and 10 degrees). Then, move the light to a different point - if the temperature difference between the new location and the reference point is greater than the threshold that you set, the light will change color (blue for cold and red for hot)

Leak detectors: Ultrasonic instruments are available which can be detect leaks of compressed air and other gases which are normally not possible to detect with abilities.



Multimeter: It is device which is used for the measurement of the electrical properties. It can be used for the measurement of the resistance, capacitance, current, voltage etc.

Lux meter: it is a device used for the measurement of illumination level. It consists of a photo cell which senses the light output, converts to electrical impulses which are calibrated as Lux.



Tachometer: It is a device used for the measurement of speed of a rotating shaft or other part

CONCLUSION

When an energy audit is conducted on your home, a professional assess the property to determine how energy-efficient your structure is overall. This kind of audit is a good way to find out where excess energy may be creeping out of your home. It also shows you where



elements of your home that are not energy-efficient may contribute to the problem. This is important because lost energy often results in higher utility bills, which can be a financial strain on you as the homeowner.

Increased Comfort

Because an energy audit reveals virtual cracks in your home's ability to distribute energy -- including heated and cooled air from heating, ventilation and air conditioning (HVAC) systems -- you can address those issues effectively. Solutions include sealing the space around doors and windows and figuring out how to better insulate your home. The result is a cooler-feeling home during the summer months and a warmer home during the winter months. **Cost Savings** Because you are no longer heating or cooling the entire outdoor area of your home, you can save money on your electric bill. When the air is contained in the space in which it was meant to distribute heated or cooled air, your system has to work less. This, in turn, means that with less electrical output from your system, you pay less each month in utilities. In fact, according to the Energy Audits Unlimited website, you can save between 20 and 30 percent on the cost to heat or cool your home.

Environmental Impact: An energy audit can provide satisfaction for those people interested in conserving energy for the sake of the environment. Being more energy efficient means that your home has less of a negative environmental impact on the environment around you. An energy audit also means that you contribute less to global warming because your unit is being more efficient and releasing fewer carcinogens and other harmful emissions into the air.

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