

# **ENERGY AUDIT FOR ENERGY EFFICIENCY**

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## **Introduction**

Every industry or commercial undertakings need a specific amount of energy to undertake the process and operations. It could be in the form of electrical energy, thermal energy or any other forms of energy use. During good old days, when energy was in surplus, no one cared about designing the system to minimise the energy use. In addition to this, designers used to take huge safety margins on one side and extra precaution on initial capital investment on the other, which also led to extra amount of energy consumption to undertake a specific task. However, the situation has changed now dramatically. Energy is a scarce resource now and the increment in energy cost is too steep.

Global market is facing a period of recession. The Asian market is one of the worst affected. There was a feeling among the industry that the period of recession will pass off in a limited time and adopted a wait and watch approach. Industry was sleeping during this period, without any extra activity other than pulling on normal routine job. However, recession is still continuing unfortunately and survival becomes a question mark in front of most of the industries that were enjoying a very comfortable position earlier.

Under such a scenario, competitive pricing strategy is the only option for survival. To cut price, the cost of production needs to be reduced. The energy cost is 5 to 25% or even more in Indian Industry. With steep increase in energy cost, it has become one of the most important cost components of production in any type of

industry. So, cost reduction in energy or in other words reduction in energy consumption is of prime importance for survival of industry. It is the time for change and closer of many of the traditional industries of India is as a result of reluctance to adapt and change in tune with the current scenario.

## **Energy Efficiency**

Energy efficiency is eliminating wastage while using energy. Optimising the energy pattern in generation, distribution and utilisation is the key to energy efficiency.

## **Energy Audit**

Energy Audit is a tool to identify areas where excess energy consumption or wastage of energy is taking place. An Energy Audit involves measuring the actual energy used in the plant, comparing it with an estimate of the minimum energy required to undertake the process and establishing technically and economically feasible means to achieve the same. It is an established fact that, a properly executed energy audit can bring forth potential for savings of the order of 2 to 20% in an average Indian Industry.

## **Types Of Energy Audit**

Energy Audit can be classified into two types, preliminary and detailed audits.

### **Preliminary Energy Audit**

**Preliminary Energy Audit is conducted to:-**

- Ensure top management commitment

Top management commitment is a basic necessity for a successful energy audit. Without top management commitment, the audit report will become another document for industry without any good use or purpose. During the preliminary audit, projecting the potential areas and benefits ensures the involvement of the top management.

- Formation Of Energy Committee

An Energy Committee will be formulated, preferably the chief executive of the plant as the head of the committee. The committee should comprise personnel from the engineering department, production department, accounts department and shop floor level operators.

- Assigning Responsibilities

Energy Conservation is a teamwork. It is not only the responsibility of the auditor, top management or the engineering department alone in a plant. Each and every department of the plant is a part of the team. The core team of people formed in the Energy Committee is assigned with specific responsibilities to perform during the audit and implementation period.

- Preparation Of Energy File

An energy file will be prepared covering types of energy being used in the plant like electricity, fuel oils, coal, paddy husk etc; cost of energy over a specific period of time, production details of the period, process flow chart, energy flow chart, major components of process and utilities, energy use pattern in different

areas, equipment, if available, etc. The present specific energy consumption pattern over a period of 2-3 years will be prepared.

- Identification Of Potential Areas

During the preliminary audit, the process of the plant is understood and major areas where potential of energy optimisation exists is identified. The requirement of instrumentation needed in-house and for spot measurement is evaluated. If any additional on-line instrumentation is required or alteration needed to facilitate measurement during detailed study is assessed and conveyed to the management.

- Evaluation of Time Frame

Approximate time frame required to conduct the detailed energy audit is evaluated during the preliminary study after examining the different process, utility components etc.

- Specific Problems

Any specific problems being faced by the industry in energy efficiency or related issues is looked into during the preliminary audit so that the same can be addressed in detail during the detailed study with possible solutions.

### **Detailed Energy Audit**

The detailed energy audit of a facility involves the following steps:-

- Assessment of Historical Data

The historical data collected during the preliminary audit is assessed during the

detailed audit to verify the energy use pattern of the plant. Any variation in energy use pattern with respect to product variations, market situations, atmospheric conditions etc. is confirmed. The specific energy consumption of the plant is evaluated with respect to electricity and other fuels, departmentwise and for the total plant.

- Spot Measurement and Evaluation

Spot measurements of various energy use parameters are taken in the next phase. The collected data is then evaluated with respect to actual requirements and standard practices. Analytical models and other relevant features for energy efficiency of the plant are developed.

- Techno-Economic Feasibility Evaluation

No suggestion is complete without a proper techno-economic feasibility calculation. The return on investment to save energy should be within about two years to be attractive to the industry, other than in specific cases. Returns on investment calculations are prepared for each proposal with vendor support.

- Presentation of Report

All proposals are discussed with the management before finalising the report. The report is prepared in a simple, easily understandable language and presented to the management. Necessary calculations, diagrams, charts, vendor information etc. are presented in the report with detailed description of the recommendations. As such, the report will act as an energy efficiency guide to the plant personnel for future use. The report will also contain prioritisation of implementation with respect to benefits, capital investment etc; trends of future targets to be set, possible barriers, methods for monitoring etc.

### *Areas Covered under Detailed Energy Audit*

A detailed energy audit of a facility will cover different operational features of basically the following areas.

- Electricity tariff and billing
- Possibility of elimination of penalties etc.
- Demand side management and power factor correction
- Electrical distribution network, operating voltage
- Performance of capacitors, harmonics in the system
- Performance of installed motive load
- Performance of installed machinery
- Performance of installed utility equipments like air-conditioning/refrigeration, cooling towers, air compressors, evaporative cooling system etc.
- Boiler and steam distribution
- Furnaces
- Fuel substitution
- Process optimisation
- Combined power and fuel options, co-generation
- Use of non-conventional energy sources

In addition to the above, the specific areas, which are lone characteristics of any given industry, should also be attended.

### **ENERGY ACCOUNTING**

Energy accounting is the foremost and relatively easier method by which the energy management program can be monitored effectively. The major

components of energy monitoring are:-

- Understanding Energy Costs
  - Purchased Electricity
  - Generated Electricity
  - Waste Recycling
  
- Energy Used In Production
  - Direct use as a function of process
  - Indirect use like space cooling
  - Non-productive load like lighting etc.
  
- Enhanced Monitoring
  - To ensure energy saving programs making progress and actual savings are achieved
  - Initial ideas of energy use reduction are investigated more specifically
  - Targets are set to achieve for further reduction in energy consumption

## **APPLICATION OF ENERGY AUDIT**

Energy audit is applicable to all types of energy user like:-

- All industries irrespective of size, type, product, nature, capacity etc.
- Commercial Buildings like office complex etc.
- Hospitals

- Hotels
- Entertainment facilities like cinema halls, clubs etc.
- Public utilities like water and sewage etc.

## **BENEFITS**

The benefits of energy audits are:-

- Reduction in energy cost which is a direct profit
- Reduction in energy consumption leads to reduced environmental pollution directly and indirectly.
- Slower depletion of natural resources and narrowing demand supply gap.