Industrial Energy Audit: Everest LTD

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Abstract – Now a day's India is facing a lack of Electrical power availability. Out of total commercial energy available in the country, the industrial sector is the sector which is consuming almost 50% of total energy. Obsolete technology is one of the main reason for major energy consumption in India. Demand of electricity is increasing by 6-8% every year, but production of energy is not increasing in the same ratio and so the gap between demand and supply is increasing. To reduce this gap, there are two alternative ways: one is to conserve the electricity and second is to generate more electricity, which requires huge investment. So even a 5% of saving in electricity will prevent the necessity to install power plants in MW. With this concern the government of India has to make mandatory the "Energy Audits" for all Industrial users. Using energy more efficiently and effectively by reducing wastages of energy is the Energy Conservation. For making energy conservation effective, Energy audit is only a basic tool which we have to use in which auditing is the process to identify the wastages of energy without affecting productivity. Through this paper we are trying to shed some new focus on the way of energy generation through energy conservation by means of Energy Audits at all levels, types of customers. It is undeniable that various methodologies are an integral part of power conservation / generation activity and that it plays a crucial role in bridging the gap between power generation & requirement. The results has been evaluated by actual conducting Energy Audit in sample Industry – Everest LTD Lakhmapur,Dindori,Nashik.

Key Words: *Power Scenario of India, Energy Audit,Energy Conservation*

I. INTRODUCTION

Energy is the ability to do work and work is the transfer of energy from one form to another. Energy comes in different forms - heat (thermal), light (radiant), mechanical, electrical, chemical, and nuclear energy. Coal and other fossil fuels, which have taken three million years to form, are likely to deplete soon. In the last two hundred years, we have consumed 60% of all resources. For sustainable development, we need to adopt energy efficiency measures. Today, 85% of primary energy comes from non-renewable and fossil sources (coal, oil, etc.). These reserves are continually diminishing with increasing consumption and will not exist for future generations In this paper we study energy conservation and energy efficiency by how to reduce energy demand to reasonable minimum Cost, recover and re-use heat where possible and also study use of energy efficient equipment to supply remaining energy demand, and provide a means to manage use of energy and also study energy and environment and study how to carry out energy audit.

1. Energy Scenario and energy sources:

Energy can be classified into various types based on following criteria..

- Primary and Secondary energy
- Commercial and Noncommercial energy
- Renewable and Non-Renewable energy

Primary energy sources are those that are either found or stored in nature. Common primary energy sources are coal, oil, natural gas, and biomass (such as wood). Other primary energy sources available include nuclear energy from radioactive substances, thermal energy stored in earth's interior, and potential energy due to earth's gravity.

Secondary energy sources like steam, electricity are derived from primary energy sources like coal, oil & gases & are suitable for transportation, distribution and control.

Commercial Energy sources that are available in the market for a definite price are known as commercial sources that are available in the market for a definite price are known as commercial energy. Commercial energy forms the basis of industrial, agricultural, transport and commercial development in the modern world.

Non-commercial energy sources that are not available in the commercial market for a price are classified as Non-commercial energy. Example: Firewood, agro waste in rural areas; solar energy, animal power, wind energy.

Renewable energy sources are those that are essentially inexhaustible, like wind power, solar power, geothermal energy, tidal power and hydroelectric power.

Non-renewable energy is the conventional fossil fuels such as coal, oil and gas, which are likely to deplete with time.

II. POWER SCENARIO OF INDIA

Since from independence, with the growth of economy, India's power requirement has grown substantially. Country today faces a peak shortage of power around 11-18% and an energy shortage of about 7-11% [1]. Projected economic growth (@6.4%) of India will necessitate corresponding growth in

power requirement. In India, different sectors electric energy consumption is as follows,

1 Industrial: 26.64%
2 Domestic and commercial: 30.78%
3 Agriculture: 1.66%
4 Transport: 29.35% 5) Others: 11.57%

As of March 2015 the installed capacity of electrical sector in India is around 271.722 GW. In year 2014-15, it was 1010 kwh, the per capita electricity consumption in India with total electricity consumption of 938.823 billion kWh. Among all countries, in 2014-15 the Electric energy consumption in agriculture sector was recorded highest 18.45% in India.. During the fiscal year 2014-15, the electricity generated in utility sector was 1,030.785 billion KWh with a short fall of requirement by 38.138 billion KWh (-3.6%) against the 5.1% deficit anticipated [2]. The peak load met was 141,180 MW with a short fall of requirement by 7,006 MW (-4.7%) against the 2.0% deficit anticipated. A base load energy deficit and peaking shortage to be 2.1% and 2.6% respectively anticipated for the 2015–16 fiscal year in a May 2015 report of India's Central Electricity Authority.

III. ENERGY AUDIT

An energy audit is defined as a systematic procedure that obtains an adequate knowledge of existing energy consumption profile of the site. It is a process inspection, survey and analysis of energy flows for energy conservation in a building, process or system to reduce the amount of energy input into the system without affecting the output. It helps to identify the factors that have an effect on the energy / power consumption. The performance of an energy audit is the essential step to the energy efficiency improvements. It is a procedure that helps to analyze the use of energy in an industries, enterprise, commercial or building. It serves to identify how a facility of factories uses energy and to identify opportunities of energy conservation. Energy audit can assist in evaluating energy efficiency, identifying energy saving opportunities and establishing a plan to implement energy saving projects. It is a process to collect comprehensive data on energy use. Energy Audit is a process which needs experienced personnel know as Energy Auditor and some auditing equipment's. Through the energy audit we can assess the energy cost and its effect to the total production cost. Also, we can identify financially and technically viable options for reducing energy usage. It will help us to identify possible ways to improve productivity through interventions in areas not directly linked to energy consumption. There are different types of energy audits, which can include simple or detailed data analysis & surveys. The time required to conduct any audit depends on the size and type of factory. But priority should be given to the departments or sections of the plant of highest energy / power consumption. Broadly Energy audit is having two types, one Preliminary Audit & another one is detailed audit. Preliminary Audit is type of energy audit uses existing or easily obtained data for energy audit. The amount of energy consumptions in a facility is obtained by conducting a simple survey. Detailed Audit is done in three phases, preparing for the audit visit, performing the facility survey and implementing the audit recommendations. Let's take an example of one medium scale industry to conduct preliminary energy audit & evaluate the possible energy savings which in turn, we can compare with how much we can save the energy if we conduct such audits in each and every industry in India.

A. Energy audit methodology

Effective Energy audit is a process that consists of four steps:

Step 1. Identify all the Opportunities
Step 2. Prioritize the activities rationally
Step 3. Accomplish the activities successfully
Step 4. Maintain the activities throughout the life of the facility.

B. Steps of audit

The key steps in an energy audit are as follows:

1. Conduct a condition survey – Assess the general level of repair, housekeeping and operational practices that have a bearing on energy efficiency and flag situations that warrant further assessment as the audit progresses.
2. Establish the audit mandate – Obtain commitment from management and define the expectations and outcomes of the audit.
3. Establish the audit scope – Define the energy-consuming system to be audited.
4. Analyze energy consumption and costs –
Collect, organize, summarize and analyze historical energy billings and the tariffs that apply to them.
5. Compare energy performance – Determine energy use indices and compare them internally from one period to another, from one facility to a similar one within your organization, from one system to a similar one, or externally to best practices available within your industry.
6. Profile energy use patterns – Determine the time relationships of energy use, such as the electricity demand profile.
7. Inventory energy use –
Prepare a list of all energy consuming loads in the audit area and measure their consumption and demand characteristics.
8. Identify Energy Management Opportunities (EMOs) –
Include operational and technological measures to reduce energy waste
9. Assess the benefits –
Measure potential energy and cost savings, along with any co-benefits.
10. Report for action –

Report the audit findings and communicate them as needed for successful implementation. Each step involves a number of tasks that are described in the following sections. As illustrated several of the steps may result in identifying potential EMOs. Some EMOs will be beyond the scope of a macro-audit, requiring a more detailed study by a consultant.

C. About everest

Everest was established in 1934 and has over 8 decades of experience in building products. It is the pioneer of fibre cement products in India. The company offers a complete range of roofing, ceiling, wall, flooring& cladding products and pre engineered steel buildings for industrial, commercial and residential applications. The Company has introduced modern products & solutions to meet the contemporary requirements of the construction industry. The Company's building products and solutions are available in more than 1,00,000 villages and 600 cities in India and also in many countries globally. The Company has designed and erected more than 2,000 Pre-Engineered steel buildings across 275 cities in India.

D. Simple steps towards energy conservation in lighting

Using task lighting to target work and leisure activities. This helps reduce overall room lighting levels. Using energy efficient compact fluorescent bulbs—especially in fixtures that operate more than two hours a day. They cost more initially but use 75 percent less electricity and last about ten times longer than incandescent bulbs. Long-life bulbs emit less light than standard incandescent bulbs of the same wattage. Use long-life bulbs only in hardto reach places. Selecting bulbs carefully; looking for the highest lumens at the lowest wattage. Wattage is the power needed to make a bulb work. Lumens measure brightness. Keep light fixtures clean to gain the most illumination. Cleaning the lamps & fixtures regularly; Illumination levels fall by 20-30% due to collection of dust. Switching of the lights when they are not in use. Photo sensors to be installed in department to utilize optimum day lighting. There are several types of sensors available in the market at affordable prices with the help of which we can save a plenty amount of energy. Natural lighting can be considered for corridors

E. Everest company – details of electrical load

Total Connected Load -	6060 KW
Sanction Load -	6064 KW
SEB Sanction Max. Demand -	2500 KVA
Available Power Source – Transformer1-	2000 KVA
Transformer2-	2500 KVA
DG-set as Standby to MSEB Power DG 1 -	1000 KVA
DG-set as Standby to MSEB Power DG 2 -	1000KVA
DG-set as Standby to MSEB Power DG 3 -	1010 KVA
Power Factor -	0.99
SEB Per Unit Charges-	7.07
Tarrif –	TOD Tarrif

F. LED lights against conventional lights

LED (Lighting Emitted Diode) is an alternative to traditional light sources and considered to be the latest cutting edge lighting technology. Now a days LED has already exceeded the values of halogen and incandescent lamps. [5]. Illustration of possible savings at Everest Power System – Payback Period For 60W LED Lamp Against 250W Sodium vapor. These lamps were used as flood lights in shop floor in EPS. We do appreciate that the initial costs are quite high for organization. To see all the benefits, organization will receive from using LED lighting. Everyone is different and need different levels and colors of light.

Table - 1: Illustration of Possible savings at Everest Ltd. due to LED Lights

Conventional Lamp	
250W Light Consumption,Considered For 10Hrs Working (Kwh)	2.5
Daily Electricity Charges @ Rate Of Rs.7.07/Kwh	17.67
Monthly Charges (30 days)	530.25
Yearly Charges (12 month)	6363
LED Lamp	
60W LED Lamp Equivalent to 250W SVL Considered For 10Hrs Working(Kwh)	0.600
Daily Electricity Charges @ Rate Of Rs.7.07/Kwh	4.24
Monthly Charges (30 days)	127.26
Yearly Charges (12 month)	1527.12
Net Saving Per Lamp (6363-1527.12)	4835.88
Pay Back Period One Lamp In Years	0.75
Net Power saving Per Year Per lamp(W)	190
Total Power saving on 320nos SV lighting lamp (kw)	60.8
Total Monthly unit Saving(Kwh)	729.6

G. Controlling load factor

Electrical Load factor is a measure of the utilization rate, or efficiency of electrical energy usage. It is the ratio of total energy (KWh) used in the billing period divided by the possible total energy used within the period, if used at the peak demand (KW) during the entire period. Thus, Load Factor = KWh/KW/hours in the period. But, controlling Load Factor will not give direct energy savings but it will provide reduction in power charges Electricity bills. We can work towards to maintain Load Factor in required limit, it will help us to utilize the incentive schemes of Electricity Boards. We can refer the incentives declared by Maharashtra State

Electricity Distribution Co. Ltd. as below:- Consumers having load factor over 75% up to 85 % will be entitled to a rebate of 0.75 % on the energy charges for every percentage point increase in load factor from 75% to 85%. Consumers having a load factor over 85 % will be entitled to rebate of 1% on the energy charges for every percentage point increase in load factor from 85 %. The total rebate under this head will be subject to a ceiling of 15% of the energy charges for that consumer. This incentive is limited to HT-I category only. Further, the load factor rebate will be available only if the consumer has no arrears with the MSEDCL, and payment is made within seven days from the date of the bill or within 5 days of the receipt of the bill, whichever is later. However, the consumer would be subjected to the penal charges for exceeding the contract demand and has to pay.

H.redefining,monitoring and controlling – maximum demand

Maximum demand is the maximum power value, usually the average of 15 minutes, reached during the billing period. Again this is not the option to reduce energy consumption directly but we can work out to reduce Electricity charges. Power charges are depend on the Contract Demand, it's 50% of Con. Demand and Bill Demand of that particular month. If in case, in any month Actual Max Demand crosses the Connected Demand then it will be charged extra. And hence, if we monitor and control the Max Demand and maintain it below the Connected Demand we can save the extra charges to pay.

I. Proposed recommendations for energy conservation

The general recommendations are presented here. The savings due to their implementation could not be easily quantified, but their importance cannot be understated. Implementing all these measures, a total saving of 20-25% can be achieved without compromising much on the existing facilities and comforts.

1. Reduce lighting

There are a couple of ways to do this is to take advantage of natural daylight. Turning lights off or dimming them during the day allows for lower energy costs and a more comfortable environment. Need more light on a work surface use task lights?

2. Use timers and sensors

The installation of occupancy sensors, timers, or photocells will ensure that interior and exterior lights are turned off at the appropriate time. These inexpensive devices can reduce lighting costs by up to 40 percent by turning off lights in unoccupied areas. In closets and restroom install motion sensors or timers so that the lights are off when no one is using the room.

3. Replace incandescent bulbs with compact fluorescent lamps (CFLS)

This type of bulbs can last up to ten times longer and provide the same amount of light as standard incandescent bulbs. Replace incandescent lights in exit signs with LED fixtures, which can reduce costs of these signs by up to 95 percent.

4. Use of motion sensor

Motion Sensor Senses If there are People in that area or not, Accordingly it keep the vital systems Running as desired e.g.(lights, TV's, Air conditioning .etc.). However if motion Sensor Do not detect movement for quite long time according to the area usage class, then it shall start to power down and reduce energy wastage. This is the main concept behind it. Actually there are two types of motion sensors, one is occupancy type and one is normal type. Each one of those types is also work in different topology, wither stand alone type, or part of a system.

5. Motion sensor light switch

Fit a motion sensor light switch to automatically switch off lights when a room is empty. The Motion Sensor Light Switch pictured above is a new product which will only turn lights on in a room when it is occupied. By automatically turning off the lights when no-one is in the room, the manufacturers claim that an average of 128 hours of unnecessary lighting will be avoided reducing electricity consumption for the lighting by 10%.

IV. CONCLUSION

A well-managed energy program can be a successful method to reduce energy consumption. There are many aspects involved in the aspect, equipment modification, instalment of motion switches use of CFL, efficient use of resources. An effective energy program should be able to reduce energy consumption by 2% to 5% per year depending upon the resources available and the current level of energy efficiency. Over time, these energy savings will add up to improve the environment by reducing greenhouse gases and also the cost reduction in electricity bill of department bottom line.

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