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Energy Auditing and Efficiency Improvement on Electrical Machines

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ABSTRCT: Now a day'sIndia is facing a lack ofElectrical 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 – Kohler Power India, Aurangabad.

KEYWORDS: Power Scenario of India, Energy Audit,Energy Conservation.

I. INTRODUCTION

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 necessitatecorresponding 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..Even Indian government introduce an ambitious rural electrification program but around 400 million Indians lose electricity access during blackouts. Before 2017, India needs to add 135 GW of power generation capacity, if the current average Transmission and Distribution losses remains as it is at around 32%.
In the next 10 years, India's power demand is expected to cross 300 GW. To meet this demand India need five to ten times increase in the pace of capacity addition, the profileof planned capacities will also need to be suitably modified to fulfill peak demands.

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A step-up of this magnitude is unlikely to materialize with a traditional approach. A new radically approach of Energy Audit and conservation at all levels of Electrical Energy utilization is required [3]. In the past five years, strategic measures such as the Electricity Act 2003 and the Ultra Mega Power Projects have been introduced, and a number of administrative steps, like tripartite agreements between the central government, central generators and the states and recapitalization of State Electricity Boards have been taken to unleash the potential of the power sector. Though progressive and necessary, these measures have been insufficient.

To fulfil the required power requirement of 315 to 335 GW by 2017, India require a generation capacity of 415 to 440 GW. This implies a tripling of installed capacity from the current level of about 140 GW, which, in turn, translates into an annual addition of 20 to 40 GW. This is fivefold to tenfold the 4 GW per year that was achieved in the last 10 years.

The magnitude of the task at hand will not be enough to achieve this quantum of increase in the pace of capacity addition. To suitably modify the profile of fresh capacities, India needs to adopt new radical approach of Energy Audit and its conservation at all levels of utilization of Electrical Energy.

II. 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 asEnergy 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 notdirectly linked to energy consumption. There are different types of energy audits, which can include simple ordetailed 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.

III. INDUCTION LAMP

To overcome the disadvantages of High PressureSodium Vapour lamp (HPSV), the Induction lamp can be preferred for bay lighting. In place of 400wHPSV lamp, 200w induction lamp is used**.**Induction lighting is based on technology that is fundamentallydifferent from conventional gas sources or incandescent lamps. Instead of electrodes used in gasdischarge lamps or the glowing filament of incandescent, light generation is by means ofinduction the transmission of energy by way of a magnetic field combined with a gas discharge. Theprinciple is the same as that of an electrical transformer (Figure 3. 1). An alternating current (Ip)in the primary coil induces a corresponding alternative magnetic field in the core and thesurrounding space. This magnetic field in turn induces a current of the same frequency (Is)

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in the secondary coil. The higher the frequency of the alternating current, the higher the overall efficiencyof the system, and the more compact the system can be.

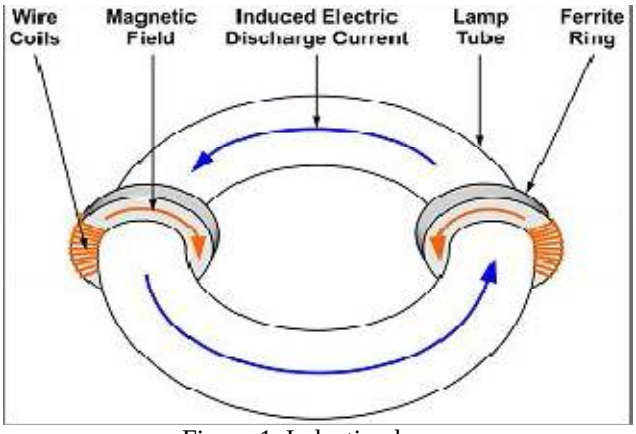

Figure 1. Induction lamp

Fig.1 gives the illustration of Induction Lamp of how it is been working and its auditing process and the calculation is made to get the rate of efficiency.

Calculation for induction lamp

HPSV = 275 × 400w × 12 × 365/1000= 4,81,800 kWh

INDUCTION= 275 × 200W × 12 × 365/1000= 2,40,900 kWh

Annual energy savings by replacing with

200w induction lamp = 4,81,800 – 2,40,900= 2,40,900 kWh

Annual cost of energy saved= 2,40,900 × Rs.7= Rs.16,86,300

Cost of implementation of 275 induction lamp

= 275 × Rs.12,300

=Rs.33,82,500

Payback period = Implementation cost/Annual costof energy saved

= 33,82,500/16,86,300

= 2 years

Table.1 Savings in replacement of lamp

DESCRIPTION	HIGH PRESSURE SODIUM VAPOUR LAMP	INDUCTION LAMP
HOURS OF LAMP OPERATION	24,000	100,000
MONTH OF OPERATION FOR THE LAMP	66.66	277.77
YEAR OF OPERATION FOR THE LAMP	5.47	22.83
NO OF REPLACEMENT LAMPS IN 20 YEARS PER FIXTURE	4	1
TOTAL NO OF REPLACEMENT LAMPS IN 20 YEARS FOR ALL FIXTURES	1100	275
COST FOR LIGHT REPLACEMENTS IN 20 YEARS (Rs)	6050000	3382500
SAVINGS (Rs)		26,67,500

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Table.1 gives the savings in replacement of lamps by Induction Lamp over Sodium Vapour Lamp For every year, in electricity bill Rs.16,86,300 will besaved for implementing induction lamp instead of using High Pressure Sodium Vapour lamp. Rs 33,82,500 will be get back within two years. Induction lamp having the warranty of five years. And lifetimeof induction lamp is 100,000 hours. For twelve hoursworking in cold mill, the lifetime of induction lamp is22 years. For 22 years, Rs.3,71,05,200 is savedwithout the maintainace cost.

IV. SIMULATION RESULT

The simulation results using the visual basic is given below. Fig.3 represents the output voltage,current are electrical input of motor. The parameters like speed, torque are the mechanical outputs of the motor.

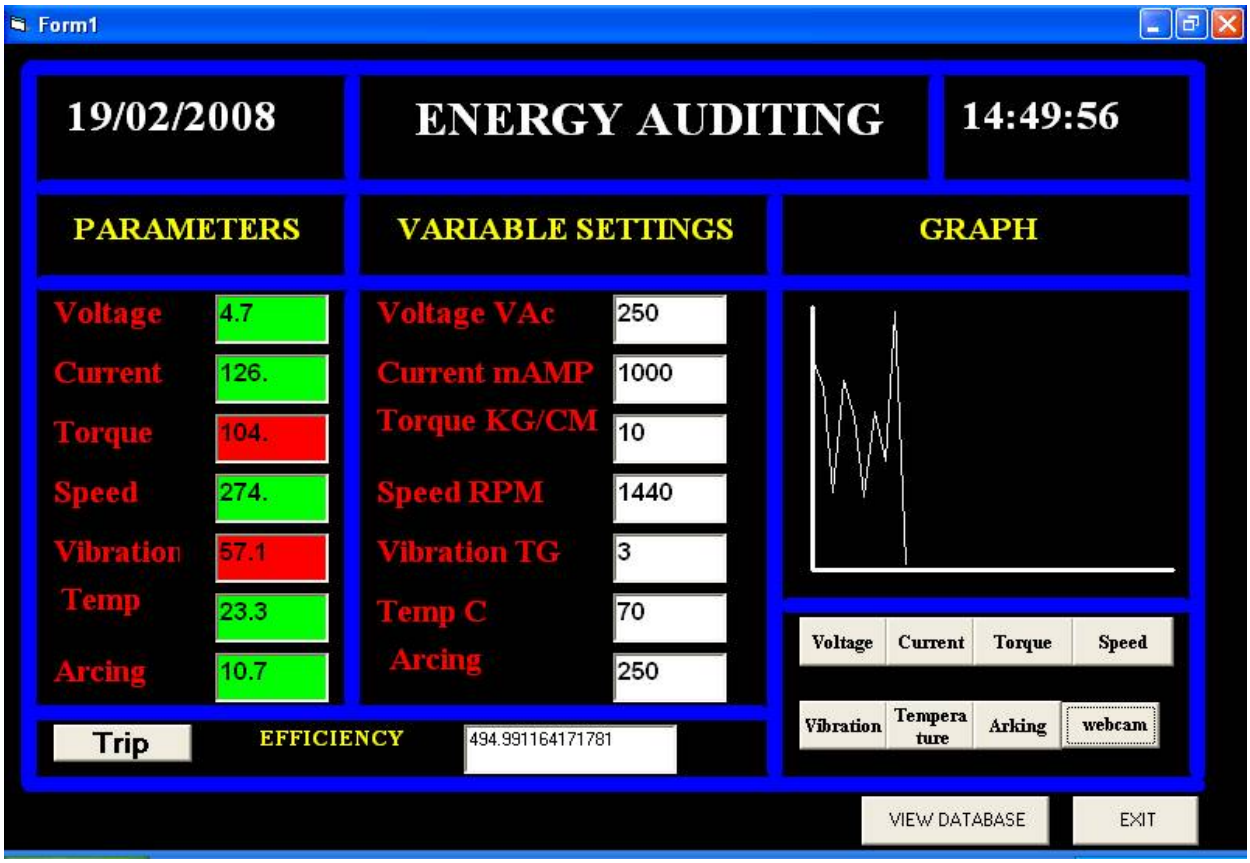

Fig.3 output of energy auditing

V. CONCLUSION

Through this paper, we have tried to shed some light on the way of energy generation through energy conservation by means of Energy Audits at all types of users of Electrical Energy / customers.
It is undeniable that various methodologies are an integral part of power conservation activity and that it plays a crucial role in bridging the gap between power generation & requirement.
In India, currently registered small / medium industries are around 36368nos and its average power consumption is around 38.64Gwh . If we conduct such primary Energy Audit in each industry, then we can expect minimum 20% of reduction in Energy Consumption pan India, which will be around 7.728Gwh.

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Hence, we are stating as Energy Audit and Conservation is a Tool for Energy Efficiency and Energy Audit can be used as a continuous improvement tool with periodic re-assessments to track and trend of progress and its effectiveness.

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