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Maximum Conservation of Energy through Energy Audit (Case Study of GHTP Lehra Mohabatt)

Manvir Kaur

Dept. of Electrical Engineering, Guru Kashi University, Talwandi Sabo, India

ABSTRACT

Efficiency of all resources is crucial both in an environmental and economic sense. Using energy inadequately creates waste in all the world's economies. It has environmental impacts with regional, local and global implications. The key object is to adopt energy management in every field in order to reduce the wastage of energy sources and cost effectiveness without affecting productivity and growth. Energy audits help to recognize the pattern of energy, form of energy consumption and amount of energy consumption so that to identify the possible area of energy conservation. The load distribution or consumption patterns in the power plant and the operation of energy intensive equipments or systems were planned to be studied during the energy audit in order to identify potential areas where energy saving was practically possible. Energy conservation means, the need is to use energy efficiently and effectively. Energy Audit is a technical survey of a plant in which the machine/section wise/ department wise pattern of energy consumption studied and attempts to balance the total energy input correlating with production. As a result of the study the areas where the energy is wastefully used and the improvements are felt, are identified and corrective measures have been recommended so that the overall plant efficiency could be improved. Fundamental understanding of the process is essential if we are to improve the overall efficiency of the system.

Keywords: energy audit, economic analysis

INTRODUCTION

In India, about 70% of energy generation capacity is from fossil fuels. Coal consumption is 40% of India's total energy consumption which followed by crude oil and natural gas at 24% and 6% respectively. India is dependent on fossil fuel imported to fulfill its energy demands. The energy import is expected to exceed 53% of India's total energy consumption. In 2013-2014, 159.26 million tons of crude oil was imported which amount to 80% of its domestic crude oil consumption. The percentage of oil imports are 31% of countries total imports. The demand of electricity has been hindered by domestic coal shortages. Because of this, India's coal import is increased by 18% for electricity generation in 2012.

Energy audit

Energy audit is the first step forward systematic efforts for conservation of energy like financial audit. It involves and collection of energy related data on regular basis. It tells how and where the energy is being consumed and it also tells how efficiently and effectively the energy is being used. It is not only study to identify various week areas but also tells the tool to take corrective actions and monitor the performance. Energy audit provides with the tool to bench mark your consumption against your best figure. Energy audit is an analytical method of detection of energy wastage and misuse. It is same to the monthly accounts statements in financial accounts system. It is a part of the action step a detailed analyses of energy aspects of a cost or eradication problem, together with proposed solution and objectives for use in monitoring. The energy audit is thus the process of collection and analysis of data on present energy use, choice of energy management and the process used to monitor progress toward those objectives. Energy audit indicates where the consumer stands from the energy utilization point of view, and where he wants to proceed to. The objective of the energy audit is to reduce energy consumption for the same level of production.

Types of energy audit

1) Preliminary Audit

Preliminary energy audit is a relatively quick exercise to:

- Estimate the scope for saving
- Establish energy consumption in the organization
- Set a reference point
- Identify the most likely and the easiest area for the attention
- Identify immediate improvements and saving

2) Detailed Audit

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

Energy Audit a Tool

The first thing energy auditor needs to be aware of end user expectations and then audit start with an analysis of historical and current utility data. This sets the stage for an onsite inspection. The most important outcome of an energy audit is a list of recommended energy efficiency measures (EEMs). Energy audit serves the purpose of identifying energy usage within a facility, process or equipment, and then identifies the opportunities for conservation, called energy conservation measures (ECMs). Audit provides the most accurate picture of energy savings opportunities. Energy audits can be targeted to specific systems i.e. boiler, turbine, generator and motor etc.

ENERGY SAVING ON LIGHTING SYSTEMS

To find out the various energy saving opportunities in the thermal power plant in areas of Lighting system indoor and outdoor

- HPS (High Pressure Sodium Light) are replaced with LED
- Incandescent lamps are replaced with compact Fluorescent lamps

DETAILS OF EXISTING LIGHTS WITH PROPOSED LIGHTS

Sr. No.	No. of Lights	Classification Depending Upon no. of Working Hours		Wattages of Existing Lights(HPS) (lumen)	Wattages of Proposed Lights (LED)	Saving Potential In Terms of Wattages
		24hrs	12hrs			
1	9179	2295	6884	70 W(4500)	36W(4599)	34 W
2	1348	335	1013	150 W(11680)	60 W(12540)	90 W
3	894	220	674	250 W(21170)	90 W(22150)	160 W
4	918	228	690	400 W(36500)	120 W(36700)	280 W
5	1109	280	829	125 W	55 W	70 W
6	510	130	380	36 W	15W	21 W
7	502	130	372	100W(incandescent)	15W (CFL)	85 W

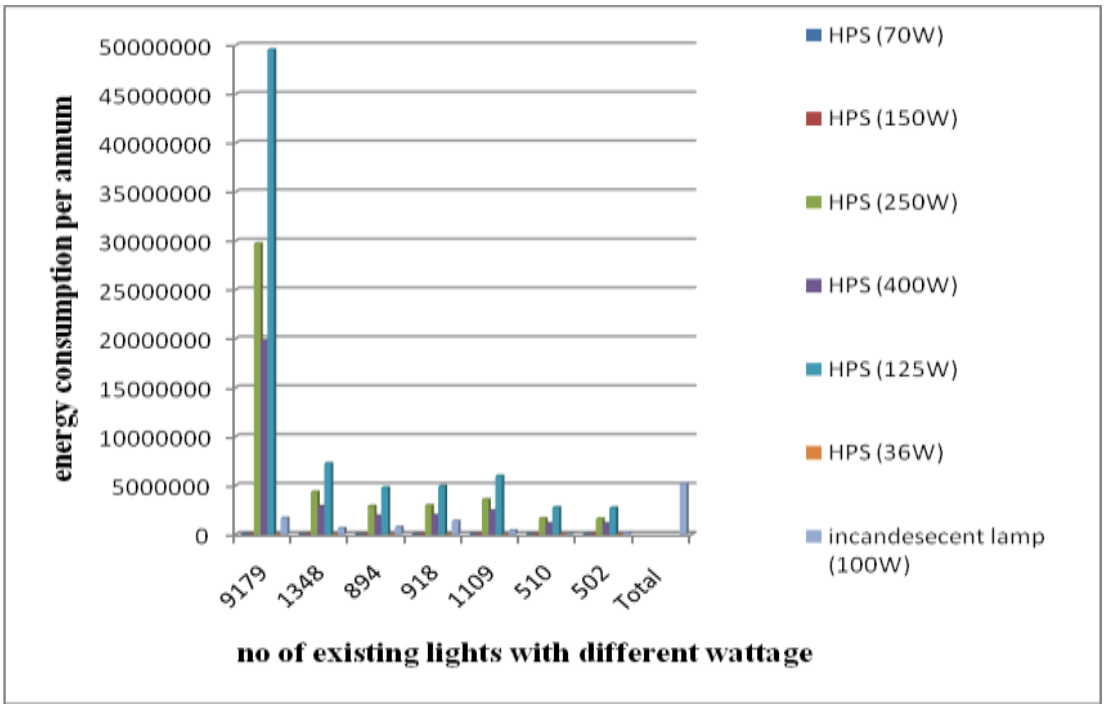
Calculation of Energy saving potential:

It is to be noted that some lights work for 12 hours per day where as some works for 24 hours every day for a year.
Total running hours of light on 12 hr operation per year= (12X3X12) = 4320 **(A)**
(12 no. of working hrs, 30 days, 12 months)
Total running hours of lights on 24 hr operation per year= (24X30X12) = 8640 **(B)**
(24 no. of working hrs, 30 days, 12 months)

Yearly energy saving for indoor lights

Total Lights	**Quantity as per Usage hrs**		**Usage hrs per Year**		**Total Usage hrs of lights per Year (x+y)**	**Energy Saving per light in Watt (**	**Yearly Total Energy Saving In KWH**
	12hrs	**24hrs**	**(A)=x**	**(B)=y**			
9179	6884	2295	29738880	19828800	49567680	34 W	1685301
1348	1013	335	4376160	2894400	7270560	90 W	654350
894	674	220	2911680	1900800	4812480	160 W	769997
918	690	228	2980800	1969920	4950720	280 W	1386202
1109	829	280	3581280	2419200	6000480	70 W	420034
510	380	130	1641600	1123200	2764800	21W	58060
502	372	130	1607040	1123200	2730240	85W	232070

Total Energy Units (KWH) Saved per Year = **5206014 per annum**
Cost of Power **5.64 Rs/KWH**
(As per Tariff order of 2012-13)
Total Saving (in Rs) per annum = **Rs. 29361918.96**



In the above table, yearly saving in KWH is calculated i.e. total energy units saved per year is 5206014 KWH. As per tariff order of 2012-13 cost of power is 5.64 Rs/KWH. Thus the total saving per annum is Rs. 29361918.96.

For Street lights:

Total running hours of light on 12 hr operation per year= (12X3X12)= 4320 **(A)**
(12 no. of working hrs, 30 days, 12 months)

Street lights with proposed lights

Yearly energy saving for street lights

Sr. No.	No. of Lights working 12hrs	Usage hrs per year	Energy Saving per light in Watt	Yearly Total Energy Saving In KWH
1	50	216000	45W	9720
2	27	116640	100 W	11664
3	27	116640	180 W	20995
4	24	103680	256 W	26542
Total				68921

Total Energy Units (KWH) Saved per Year = **68921 per annum**
Cost of Power **5.64 Rs/KWH**
(As per Tariff order of 2012-13)
Total Saving (in Rs) per annum = **388714.44 INR**

PAY BACK PERIOD

A) Extra Cost Paid For Total LED's = 84767050
Saving Energy in Rs For LED's = 28053044.16 INR

Pay Back Period: - Extra cost paid/ Saving Energy in Rs

= 3.02/6
= .503 Year

B) Extra Cost Paid For Total CFL 's = 170680
Saving Energy in Rs For CFL's = 1308874.8 INR

Pay Back Period :- Extra cost paid/ Saving Energy in Rs

= 7.66/ 7
= 1.09 Year

C) Extra Cost Paid For street lights = 5029080
Saving Energy in Rs = 388714.44 INR

Pay Back Period: - Extra cost paid/ Saving Energy in Rs

= 12.93/ 6
= 2.15 Year

Total payback period of lights (A+B+C) = 3.75 years

Sr. No.	No. of Lights	Working Hrs	Wattages of Existing Lights	Wattages of Proposed Lights	Saving Potential In Terms of Wattages
1	50	12	70 W	25W	45W
2	27	12	150 W	50 W	100 W
3	27	12	250 W	70 W	180 W
4	24	12	400 W	144 W	256 W

RESULTS

Area	Existing Consumption (KWH)	Consumption With proposed (KWH)	Saving (KWH)	Pay back Period
Indoor Lights	8866347	3660333	5206014	1.6 years
Street Lights	103248	34327	68921	2.15 years

Replacement of existing lights (HPSV) with improved lights (LED) brings benefits in energy conservation with affective payback period. Ruining cost is overriding factor than the initial cost of improved lights. From the calculation done above, it is concluded that improved lights and less energy if properly designed, operated and maintained. In the present time energy price goes high day by day as compared to the equipment price lights etc. Since, the payback periods are attractive it makes a strong case for carrying out the replacements to promote energy efficiency right at the place where energy is being produced.

FUTURE SCOPE

We have concentrated on only one Thermal Power Plant. The scope of study can be done to all types of power plants for other equipments also

REFERENCES

[1]. Bhansali V.K.,"Energy conservation in India - challenges and achievement", IEEE Department of Electrical Engineering Jai Narain Vyas University, Jodhpur. INDlA, 1995 pp 365-372.
[2]. Babu N. Sundar, Chelvan R. Kalai,Nadarajan R., "Restructuring the Indian Power Sector with Energy Conservation as the motive for Economic and Environmental Benefits" ,IEEE Transactions on Energy Conversion, Vol. 14 No. 4 December 1999, pp 1589-1596
[3]. Bera S. C., Bhowmick M. S., "Study the Performances of Induced Fans and Design of New Induced Fan for the Efficiency Improvement of a Thermal Power Plant", IEEE Region 10 Colloquium and the Third ICIIS, Kharagpur, INDIA December 8-10, 2008, pp 479-483.
[4]. Bentarzi H.,Chentri R.A., Quadi A., "A new approach applied to steam turbine controller in Thermal power Plant", IEEE, 2nd international on Control instrumentation and automation (ICCIA) 2011, pp 236- 240
[5]. PSPCL, "Operation Manual for 2x210 MW G.H.T.P. Stage-1 Lehra Mohabbat", Bathinda, Library G.H.T.P., lehra Mohabbat. pp 1-277
[6]. Changliang Liu, Jie Su, Weiping Liang, Wanyun Sun, "Model identification of Thermal process in Power Plant", IEEE North China Electric Power university, Boarding 071003, china, 2004, PP 303-306.
[7]. Cao Lihua, Chen Xuliang, Jiang Tieliu, Li Yong, "Diagnosis on Thermal Economical Performance and Analysis on Energy Saving Potential for a Fossil-thermal Power Plant", IEEE Supported by the Science and Technology Development Plans of Jilin Province of China (20080523), 2010, pp 1-4.
[8]. Chai Yuman, Zhao Hongbin, "Exergy analysis of a power cycle system with 300 MW capacity", IEEE International Conference on Advances in Energy Engineering, 2010, pp 247-250.
[9]. Guo Tieqiao, Zheng Haiming, "Relative Accuracy Test Audit Evaluation for Flue Gas Continuous Emission Monitoring Systems in power plant", IEEE Pacific-Asia Workshop on Computational Intelligence and Industrial Application, 2008, pp 239-243.

[10]. Jiang Tie-Liu, Li Yong, Wang Jian-Jun, Zhang Bing-Wen, "Energy Audit and Its Application in Coal-fired Power Plant", School of Energy Resources and Mechanical Engineering Northeast Dianli University Jilin City, China, 2009, pp 1-4.
[11]. Kim Hoyol, Park Dooyong, Shin Youngjin, "Control Strategy for the Ultra-Super Critical Coal-firing Thermal Power Plant", IEEE International Joint Conference 2006 in Bexco, Busan, Korea, Oct. 18-21, 2006, pp 1719- 1721.
[12]. Lee Wei-Jen, Kenarangui Rasool, "Energy Management for Motors, Systems, and Electrical Equipment", IEEE Transactions on industry applications, vol. 38, no. 2, march/April 2002, pp 602-607.
[13]. Evonik Industries, "Guidelines for Energy Auditing of Pulverized Coal/ Lignite fired thermal Power Plant", Indo-German Energy Programme, Dec, 2009.
[14]. PSPCL, "Operation Manual for 2x210 MW G.H.T.P. Stage-1 Lehra Mohabbat", Bathinda, Library G.H.T.P., lehra Mohabbat. pp 1-277.