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Electrical Energy Audit of A Medium Scale Industrial Unit

Salini M Venugopal[1], Ahamed Shahas S[2], Amal George[2], Arjun P D[2], Mohammed Yaseen P K[2], Nelson J[2]

Assistant Professor, Dept. of EEE, College of Engineering Kidangoor, Kottayam, Kerala, India[1]

UG Student, Dept. of EEE, College of Engineering Kidangoor, Kottayam, Kerala, India[2]

ABSTRACT: In any industry, the three top operating expenses are often found to be on energy, labor and materials. if one were to find out the potential cost savings in each of the components, energy would invariably emerge at the top, and thus energy management function constitutes a strategic area for cost reduction, the total cost of energy plays a vital role in determining the product cost of a commodity, therefore the identification of potential energy savings and the implementation of the solutions for a given industrial facility is important to ensure its competitive advantage over other industries. This paper discusses the common aspects of energy management in medium-sized industry. The energy audit program was carried out under two major heads: (1) light audit and (2) power load audit

KEYWORDS: Energy Audit, Power Load Audit, Light Audit,

I.INTRODUCTION

Energy is one of the major inputs for the economic development of any country. The global need for energy is increasing on an average by about 1.5% every year. For sustainable development, we need to adopt energy efficiency measures. So energy conservation plays a vital role for present and future of human survival. Energy conservation is achieved when growth of energy consumption is reduced, measured in physical term.

One of the best method for energy conservation is ENERGY AUDITING. An energy audit is defined as: "The verification, monitoring and analysis of the use of energy and submission of technical report containing recommendations for improving energy efficiency with cost-benefit analysis and an action plan to reduce energy consumption". Energy audit is the translation of conservation ideas in to realities by blending technically feasible solutions with economic and other organizational considerations within a specified time frame. An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings.

II. AUDITING PROCEDURE

The scope of an energy audit, the complexity of calculations, and the level of economic evaluation are all issues that may be handled differently by each individual auditor and should be defined prior to beginning any audit activities. Proper planning is needed before the commencement of auditing. Energy audit consists of several procedures which can be carried out depending upon the type of audit and the size and the function of audited facility. The audit described in this paper has been carried out based on the following activities.

- Walk through survey
- Light audit
- Power load audit.

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III.INDUSTRIAL UNIT

Kavanar Latex Ltd., established in 1991, at VAKAKKAD taluk in Kottayam district. Industry produces rubber of specific quality grades of TSR like ISNR 5, ISNR 10 and ISNR 20. Facility gets the raw rubber material from local farmers and rubber dealers.

There are around 40 induction machines which varies from .5 HP-60 HP. By analyzing these machines using measuring instruments such as power logger, clamp meter etc.

The following points can be observed from this survey:

- There is a transformer of the rating 11kv/415kv, 315KVA.
- The major load in the plant is that of motor which constitutes approximately 80% of the total load.
- The total connected load of the plant is 495 KW.

PLANT ENERGY CONSUMPTION

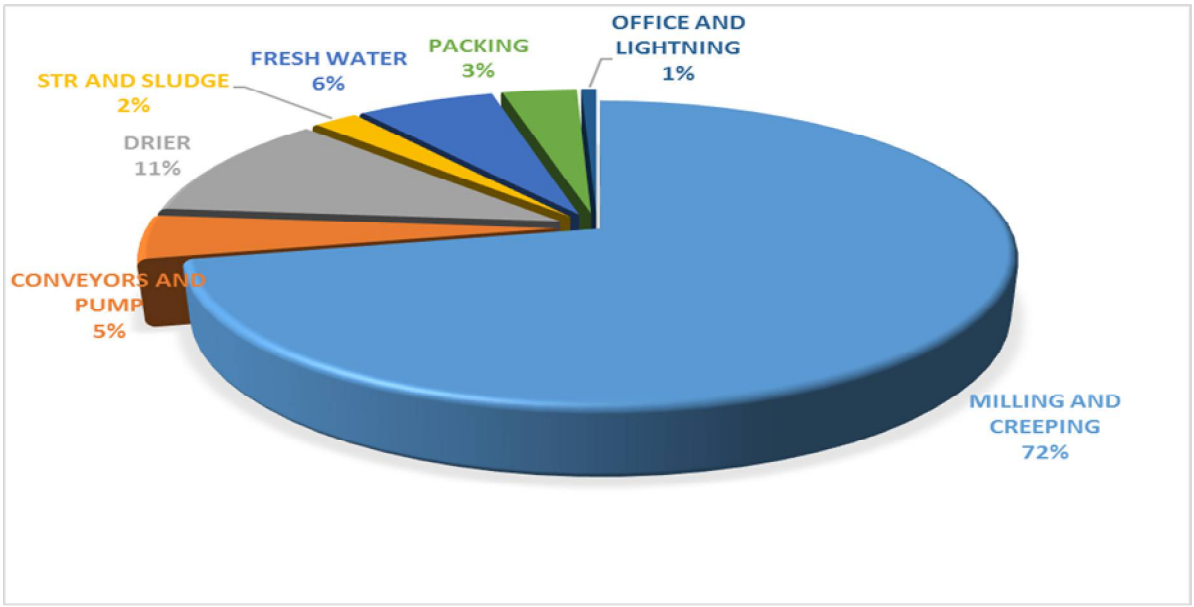

Fig: 1 Power Consumption

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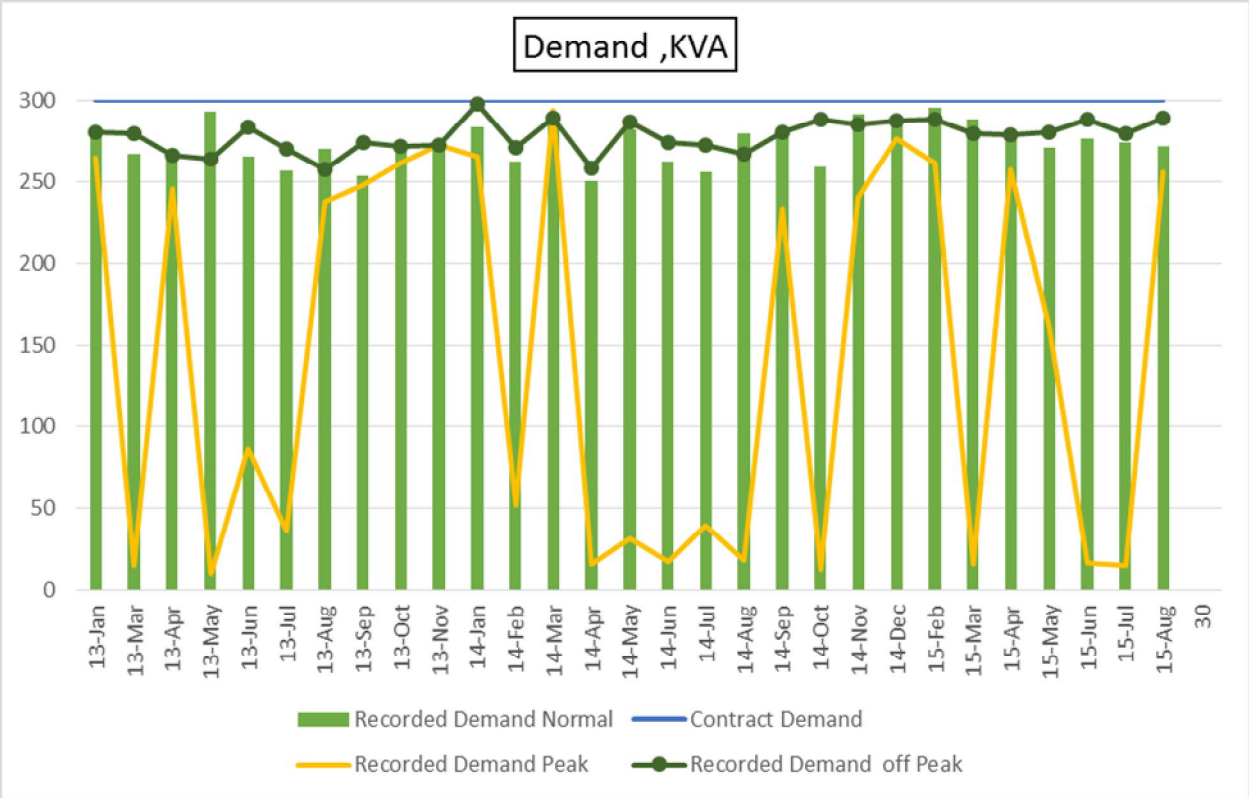

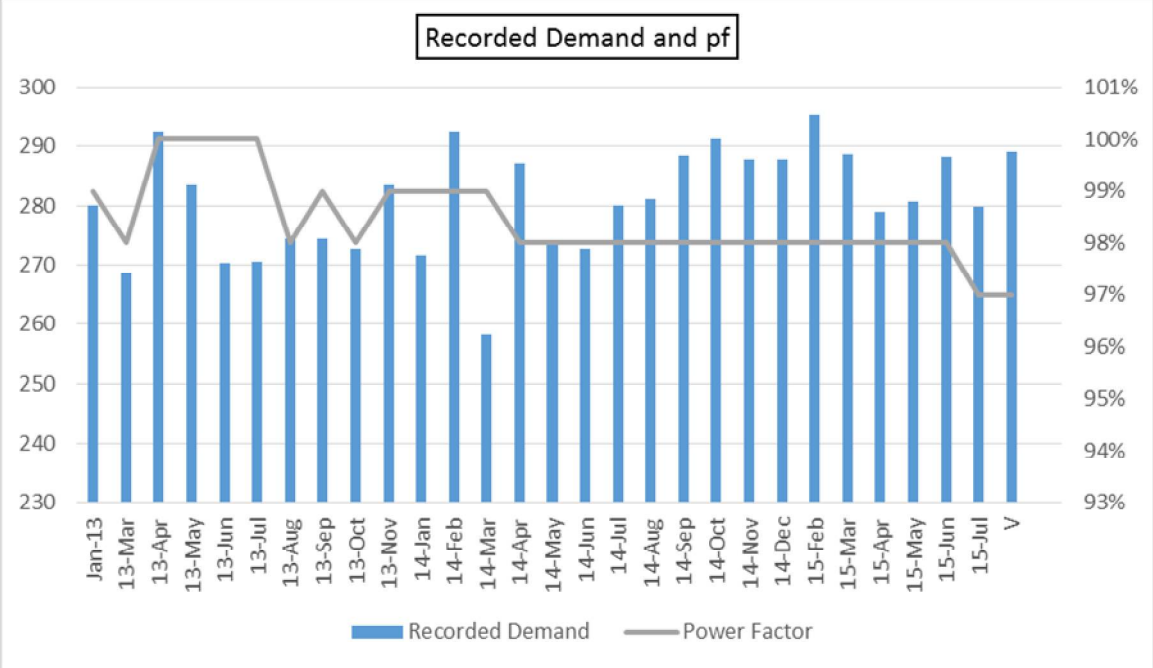

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IV.MOTOR SURVEY

A motor survey was conducted using energy audit instruments like fluke 1735 power logger and clamp on meter. By this Survey we had analyzed loading of the motor.

Table 1. Motor Load Analysis

Description	Rated power	% loading
Hammer Mill 1	60 hp	58.3
Hammer Mill 2	60 hp	54.3
Conveyor belt 1	1 hp	43
Conveyor belt 2	1 hp	55.5
Conveyor belt 4	1 hp	55.5
Conveyor belt 6	1 hp	38.8
Bucket Elevator 1	1 hp	51
Bucket Elevator 2	1 hp	37.5
Bucket Elevator 3	1 hp	46.1
Blower Motor	5 hp	51

Observation

There are 10 induction motors with loading percentage below 60% .60 hp motors hammer mill-1,hammer mill-2 are loaded with a maximum power of 29.2KW only.

Recommendations:

1. Replacement of 60 hp motors with 40 hp motors:

It is found that 60 hp motors like hammer mill 1 and hammer mill 2 are loaded only up to a load in below 60%.The loading percentage of these motors hammer mill 1 and hammer mill 2 are 58.3% and 54.2% respectively. So they are under loaded motors. So we suggests the replacement of 60 hp motors with 40 hp motor.

Cost benefit analysis

Table 2. Cost Benefit Analysis of 60 hp replacement

DESCRIPTION	UNIT	PARAMETER
Wattage of present motor	KW	44.76
Duration of Operation	Hours	5360
Energy Consumption (present)	KWh	266570
Wattage of Proposed Motor	KW	29.84
Energy Consumption (proposed)	KWh	177713
Difference in consumption	KWh	88857
Cost/Unit	Rs	5
Annual Savings	Rs	444285
Cost Of Installation	Rs	100000
Pay Back Period	Month	2.7
Salvage Value	Rs	50000

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2. Coupling of Conveyor Belt with Creeper

From the motor load analysis, it is evident that conveyor belt 1,2,4,6 are under loaded motor whose loading is less than 60%. So it is suggested to replace the 1 hp motor used in conveyor belt. As a part of energy conservation measures a new method can be used "coupling of conveyor belt with creeper". The replaced 1 hp motors goes to inventory. So there is no salvage value.

Cost benefit analysis

Table 3. Cost benefit analysis of coupling

Description	Unit	Parameters
No: of Underloaded motors	No.	4
Wattage of present Motor	KW	0.746
Duration of Operation	Hours	5360
Energy Consumption (Present)	KWh	5000
Cost/Unit	Rs	5
Annual Cost	Rs	25000
Annual Cost (4 Motors)	Rs	100000
Cost of Installation (Including Maintanance/operating)	Rs	15000
Payback Period	Months	1.8
Salvage Value	Rs	0

V.LIGHT SURVEY

A walk through audit was conducted during our visit to access the illumination requirement of plant and scope to improve illumination level. It was conducted with the objective of reducing electric power consumption and electricity bills. Facility has eight 85W CFL lamps, six 35W CFL lamps, four 25W lamps, four 18W lamps. In plant area, illumination is mainly done by 85W CFL lamps and 35W CFL lamps. For proper illumination and better power consumption, replacement of CFL with LED is suggested.

Recommendations

1. Replacement of 35W CFL with 18W LED and 85W CFL with 40W LED.

Table 4. Cost benefit analysis

Description	Unit	35W with 18W LED	85W with 40W LED
No. of CFL	No.	6	8
Avarage Operating hours	Hours	16	16
Annual Energy Consumption	KWh	1117	3645
Energy Consumption with Replacement	KWh	574	1715
Difference in Consumption	KWh	543	1930
Annual Saving	Rs	2715	9650
Cost of Installation	Rs	5200	12000
Pay Back Period	Years	1.9	1.25

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VII.SPECIFIC ENERGY CONSUMPTION

SEC of present system:
Electricity: 0.21 kWh/kg
SEC of proposed system:
Average production per month = 217696 kg
Average electric energy consumption per month = 45025 KWh
Reduction in electric energy consumption per month:
1. Replacement of 60hp motor with 40hp motor = 7404.75 KWh
2. Coupling of conveyor belt with creeper = 416 KWh
3. Replacement of CFL with LED = 61.37 KWh
SEC of electric energy=37142.88/217696=0.17 kWh/kg

VII.CONCLUSION

Energy minimization in an industry plays crucial role in energy conservation. So, proper and timely energy audits in these industries are necessary to achieve this goal. After completion of our work we were be able to specify various general recommendations and suggestions which would help the industry to reduce their electricity bills. The work helped us to increase our knowledge about various machines in an industrial context.

The specific energy consumption of the plant will decrease significantly with our proposed improvements. Following are the details,

SEC Of Present System:
Electricity: 0.21 KWh/kg
SEC After Proposed Improvements
Electricity: 0.17 KWh/kg
So, this work can be considered as a benchmark for all the medium scale rubber factories.

REFERENCES

1. "E.A. Abdelaziz a, R. Saidur , S. Mekhilef,Elsevier*Renewable and Sustainable Energy Reviews*,20118.
2. Putri Zalila Yaacoh and Dr. Abdullah Asuhainu MOM. tin ,IEEE ,*"Electical Energy Management In Small And Medium Size Industries"*,1993.
3. Harapajan Singh,Manjeevan Seera,Mohamad Adha Mohamad Idin,IEEE,*"Electrical Energy Audit in a Malaysian University- A Case Study"*,2012
4. Sunil M. Jaralikar and Mangalpady Aruna,IEEE,*"Energy Audit of a 400/220 kV Substation - a Case Study"*,2012..
5. Sunita R. Bhawarkar,S.Y. Kamdi,IEEE,*"Electrical Energy Audit of A Electroplating Unit A Case Study"*,2011