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"Electrical Energy Conservation through Electrical Audit"

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Abstract: *Energy audit is a primary study that identifies energy use among various services and provides opportunities for energy conservation. Energy audit can be one of the fastest and cheapest solutions to mitigate the gap between energy demand and supply. Since, it identifies the energy loss and improvement areas Energy auditing along with energy management is an integral part of energy conservation. It is an initial study in establishing an energy management programme. This paper reviews the initial attempts to understand the energy consumption patterns in a Jaggery plant and to reduce the energy consumption. A case study is included to investigate the reduction in energy consumption per unit in order to make the Jaggery plant energy efficient..*
Keywords: *Energy Audit, Energy Conservation, Energy Consumption*

I. Introduction

Electricity and its availability is one of the imperative factors for a country, since it acts as an acute resource for modern life and an infrastructural input for an economic growth. Every day, the demand for electrical energy is soaring up due to the fast progress in industrialization, population growth and urbanization. Hence,efficiency and energy conservation can be one of the affordable and swift solutions to overcome the energy crisis. Efficiency refers to using less energy as input with constant output and conservation refers to mitigating energy usage. Energy audit is a survey, assessment and perusal of energy flows for energy conservation in a building which examines the possible techniques to reduce input of energy into the system without having negative effects on the output. These two ideas can be united together by energy audit. In this paper we are presenting the results of case study done based on energy audit performed at IIT sponsored Jaggery plant Warnanagar district Kolhapur. This energy audit study mainly focus on energy consuming area such as lightning system and motoring system with safety audit as an integral part of it.

II. Overview Of Jaggery Plant

The Jaggery plant is located at Warnanagar in Kolhapur district. This plant is sponsored by IIT Bombay and Rajiv Gandhi Science and Technology commission (RGSTC) Government of Maharashtra. This energy audit would give a positive orientation to the energy cost reduction, preventive maintenance, and quality control programs which are vital for production and utility activities. The Load distribution of Jaggery plant is specified in below pie chart:

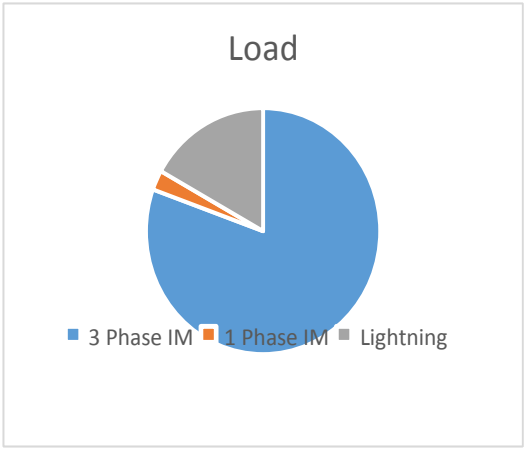

Figure 1: Total load distribution at Jaggery Plant

Various motors are used in the Jaggery plant. The rating of the motors are specified in the table given below. The strategy adopted for this audit will be as, visual inspection and data collection, observations on the general condition of the facility and equipment and quantification, identification / verification of energy consumption and other parameters by measurements, detailed calculations, analyses and assumptions, potential energy saving opportunities and implementation.

Sr. No.	MOTOR	HP RATING	KW RATING	AMP	VOLT	P.F.	η %
1	Crusher 1	10	7.5	14.5	415	0.24	86.5
2	Crusher 2	10	11	21	415	0.83	88.4
3	Chain Drive Motor	2	1.50	3.30	415	0.82	80
4	Drier Motor	5	3.3	6.7	415	0.79	82
5	Bagasse Feeder1	0.5	0.37	1.05	415	0.74	66
6	Bagasse Feeder 2	0.5	0.37	1.05	415	0.37	66
7	Bagasse Feeder 3	0.5	0.37	1.05	415	0.82	66
8	FD Fan	1	0.75	1.6	415	0.82	77
9	Oil circulation Motor1	5	3.7	6.7	415	0.91	84.60
10	ID Fan	3	2.20	4.6	415	0.83	82
11	Oil Pumping Motor	3	2.2	41.1	415	0.89	85.10
12	Juice Transfer Motor	0.5	0.37	1.3	415	0.82	37
13	Condenser Tan Motor	0.5	0.37	0.88	415	0.74	76.5
14	Vacuum Pump	5	3.70	6.8	415	0.82	84
15	Feeding Pump 1	2	1.50	2.95	415	0.89	81
16	Feeding Pump 2	2.5	1.50	2.95	415	0.87	81
17	Oil Circulation Pump 2	1	0.75	1.81	415	0.83	77
18	Compressor Motor	1	0.75	1.5	230	0.82	77
19	Moulding Machine	1	0.75	1.9	415	0.74	76
20	Stirrer Motor	0.25	0.18	0.7	415	0.74	75
21	Cooling Tower-Top Motor	2	1.5	3.9	415	0.83	74
22	Cooling Tower-Bottom Motor	3	2.25	5	415	0.82	82
23	Oil Circulation Pump 3	1.50	1.10	2.55	415	0.74	78
24	Press Filter Pump	1	0.75	1.81	415	0.83	77
25	IM Tank	1	0.37	1.02	415	0.82	70
26	Small Setup	1	0.85	1.81	415	0.74	77

Table 1: List of Motor with ratings

III. Research Methodology

A. Interview with key facility person: For understanding the whole Jaggery plant the initial meeting was conducted with the chief engineer of plant Mr. Vishwambhar Chavan-Patil sir and permission was granted by him to carry out the Electrical Audit study in the plant.

B. Facility Tour: After getting permission from chief engineer we visited plant in various scheduled days. We observed various sections and design the single line diagram of electrical system.

C. Date gathering : During the visit and subsequent meeting with engineers, we collected the rating of each equipment including various motors and lighting load.

D. Survey and Monitoring: We done the motor survey by taking a reading at various condition.

E. Utility Analysis: Energy loss analysis was done by using the data obtained from survey.

F. Economic Analysis: ENCON measures were identified and an efficient system for replacement of the existing lighting system was found. During this process of economic analysis, review of ideas of previous energy audit done at same facility was done.

G. Cost Benefit Analysis: Calculation of implementation cost in energy saving, time saving and payback period calculations were carried out.

IV. Electrical Audit

Electrical audit at Jaggery plant was carried out in three stages. The first stage included lighting system audit, the second stage motoring system audit and the final stage included safety audit.

In plant, CFL lamps were used for lighting system which had rating of 100W. CFL lamps are used for lighting small areas because its lumen output is low. LED lamp is the most efficient choice available in the market for lighting. It has high lumen output as compared to other lamps and also gives saving in energy as compared to other lamps. The main advantage of LED lamp is that it does not produces glare to eyes and also life span of the LED is high.

While carrying out motoring system audit, we analyzed all the induction motor with respect to their ratings and connections. The induction motor were then loaded and its current and voltage rating were recorded .After the analysis we figured out that few motors in plant were overloaded and hence for conservation of energy replacement of such motors was essential. These motors were then efficiently replaced with proper rating of induction of motor.We carried out the audit for motoring system in the following stages:

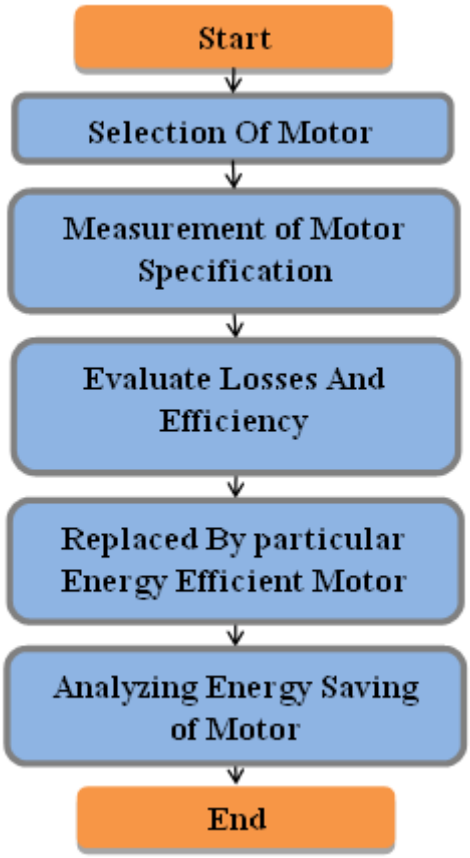

Figure 2: Power Flow for Evaluation of Motor

Safety plays vital role in electrical system. Hence safety audit was an integral part of electrical audit that we carried out at Jaggery plant. Under safety audit we provided proper earthing connections to each equipment and panels in plant, proper insulation was provided to joints and lugs used for connections were tightened.

V. Recommendation

As we all know, LED Lamp is most efficient, high lumen output, it also does not produces glare to eyes therefore we suggested them to replace the CFL lamp (rated 100 watt) with LED (rated at 40 watt). It also consumes less power as compared to CFL lamp.

In old system, the motors were overloaded, this caused huge amount of wastage of energy. We recommended replacement of these motor with energy efficient motor which leads to conservation of electrical energy.

We suggested them to keep the soil moisturized where earthing is done. We also suggested them to avoid the joints of cables to reduce heating losses, use proper insulated tools during maintenance to avoid risk of electric shock.

Switching off the unused electrical appliances in premises is the best energy conservation one can do.

VI. Conclusion

Conducting an energy audit at Jaggery plant had one of the main objectives in identifying the potential areas of the unit for energy conservation. A simple and minor change in the system can conserve energy and bring down the utility of energy to a greater extent and also address several problems which can result in over-optimistic saving projections, and suggest the ways to prevent mistakes.

In the present case study, energy conservation through lighting audit has shown tremendous improved results. During the lighting audit, the main objective of this research is to improve the lighting design of the existing system without affecting the productivity and visual comfort.. Thus it can be concluded that by optimizing lamps type, and number of lamps will reduce the energy consumption and provide substantial savings. Moreover, ,the use of appropriate wiring design, maintenance schedule, replacement of overloaded motors with energy efficient motors and proper location of distribution boards, switches and lamps within the Jiggery plant provides a physiological relief and visual comfort to the workers and saves time.

Referances

[1]. Terry W. Becker, "Electrical safety audit findings do's & don'ts", IEEE paper: ESW2014-40, Jan 2, 2014.
[2]. Vivek Jadhav, Rushikesh Jadhav, Pramod Magar, Sandip Kharat, "Energy Conservation through electrical Audit", IEEE Paper 978-1-5090-4257-9/17.
[3]. Mr. Vaibhav Kolhe, Mr. Kunal Kolhe, Ms.Shrutika Choudhari, Ms.Susmita Khedekar,"A Case Study: Energy Conservation through Energy Audit at Kandalgaon Substation" ,International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS-2017).
[4]. Mr.P.S.Magdum, Mr.S.R.Lokhande, Mr.P.M.Maskar, Mr.I.D.Pharne, "A Case study: Energy Audit at commercial and educational building",IEEE International Conference on Power, Control, Signals and Instrumentation Engineering 978-1-5386-0814-2/17.
[5]. A Hasib Chowdhury, "Electric and Lighting Energy Audit: A Case Study of Selective Commercial Buildings in Dhaka"2015 IEEE Internartional WIE Conferrance on Electrical and Computer Engineering 19-20 December 2015,BUET,Dhaka,Bangladesh.
[6]. Muhammad Usman Khalid, Mariam Gul, Mohammad Mohsin Aman, "Energy conservation through lighting Audit" IEEE Internartional Conferrance on Power and Energy (PECon),2-5 December 2012.