International Journal of Research in Engineering, Science and Management
Volume-2, Issue-5, May-2019
www.ijresm.com | ISSN (Online): 2581-5792

Energy Audit in Oil Mill: Considering Motor Load

Shraddha Deshmukh[1], Akash Badukale[2], Gaurav Patne[3], M. R. Chavan[4]
[1,2,3]*Student, Department of Electrical, Electronics and Power Engineering, Shri Sant Gajanan Maharaj College of Engineering, Shegaon, India*
[4]*Professor, Department of Electrical, Electronics and Power Engineering, Shri Sant Gajanan Maharaj College of Engineering, Shegaon, India*

***Abstract*: Day by day energy demand keeps rising as there is a limited amount of resources that can help us to generate electricity. So that it is essential to reduce energy consumption. The main aim of paper is to perform an in-depth study in industry in order to reduce energy consumption. For finding the scope for conservation of energy the best option is energy audit. Energy audit is a process to determine how and where energy is being used and to identify opportunities to reduce energy usage. This paper is based on energy audit performed for an industry Ganesh oil Mill, specialized in producing oil as a main product and by product as cotton seed cake. Main objective is to evaluate used of energy in above industry for energy conservation in motors and determine opportunities for energy saving with efficient techniques to reduce monthly electricity bill. Calculation of payback period for each recommended action has been made. The result of this activities are documented. Execution of audit in oil mill can develop the plant efficiency.**

***Keywords*: Textile Industry, Energy audit, three phase motor, Efficiency.**

1. Introduction

Energy audit is verification, monitoring and analysis of energy use including submission of technical report containing all recommendations with cost benefit analysis and action plan to reduce consumption. The energy audit was conducted at Ganesh Oil Mill of Khamgaon MIDC, Buldhana. The above industry produces cotton seed oil and by product as cotton seed cake whose annual input is 1 lakh 70 thousand quintal in form of cotton seed and annual output is 17 thousand quintal oil and 1 lakh 40 thousand quintal cotton seed cake. It is under the category of HT-1(A) Industry-General having Transformer of 250 KVA, 11Kv/433v, connected load at 433v is 200 Kw and actual load is 197 Kw which comprises of lightning as well as motor load. It has sanctioned maximum demand of 190 Kw. It has many types of equipment and heavy machinery like oil expeller, oil extracting pump, oil neutralizer, dryer etc. As heavy load of industry is motor load therefore paper majorly focused on it.

2. Methodology

Methodology includes the discussions with the plant officials to identify the areas for energy conservations. Energy audit team visits the site, and collects data of operations and distribution of load within the plant. This collected data is then analyzed and measures are identified to get best possible energy conservation opportunity. Detailed energy auditing is carried out in three phases:

1. Phase I: Pre Audit
2. Phase II: Audit Phase
3. Phase III: Post Audit

The information to be collected during detailed audit includes energy consumption in various sections and major equipment, energy cost and tariff.

1) Pre-audit phase

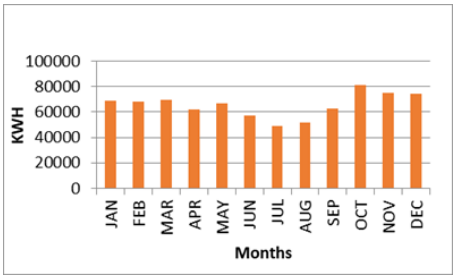

Fig. 1. Monthly Unit Consumption in KWH

Table 1
Sectioned Wise Motor load

Sr. No.	Sections	No. of Motors & Ratings
1	Storage & Dryer	3 HP (2 Nos.) 2 HP (6 Nos.)
2	Cleaning	5 HP (3 Nos.) 3 HP (2 Nos.)
3.	Production	25 HP (8 Nos.) 3 HP (2 Nos.) 5 HP (1 Nos.)
4	Oil Section	3 HP (1 Nos.) 5 HP (2 Nos.)
Total motor load		263 HP (196.19 kW)

In pre-audit phase includes Informal Interview with Plant Manager, Walk through Audit. Schedule of operation of industry is about 12 hrs. Daily for 20 days of month. By conducting the survey total motor load is calculated as 196.19

kW as shown in Table1. From the analysis of annual energy bill, it was observed, during the month October to February energy consumption is more as compared to other month which is represented in the form of graph as shown in figure1.

2) Pre-audit phase

From the collected data it was found that the major power saving regions are replacing old rewound motors with newer energy efficient motor. Energy conservation for motor load is basically perform by major two ways.

1. Replacing existing 25 Hp motor by lower wattage
2. Efficiency Improvement that is replacing existing old motor by newer energy efficient motor with higher efficiency.

As the plant is using 25 Hp motor for expeller while normally expeller for extracting oil work on 30 Hp motor. Considering this statement there is no scope for reducing Hp rating of motor. Hence second option is chosen toward energy conservation in motor. Total motor load of industry is about 196 kW. Major motor load of industry is occupied by Production unit having 3 phase Squirrel Cage Induction Motor of 25 Hp (18.6 kW). In observation it was found that motors are too old and rewound many times hence to know the operating efficiency of motor experimentation is carried out to measure the parameters. In order to find out energy conservation opportunity by replacing the existing motors with energy efficient motor 18.65 kW, 91% efficiency, following procedure is followed.

- Selection of rewound motor.
- Measurement of motor parameter.
- Calculation of motor losses & efficiency.
- Selection of energy efficient motor.
- Analyzing the motor for energy saving.

3. Analysis

1) Calculation of parameters

The parameters of three phase induction motor are measured by using tong tester and Multi-meter as shown in table 2. These Parameters are used to calculate the power losses of motor and motor efficiency is calculated by using formulas as listed below. Variation in efficiency of 8 motors is between 80% to 82%.

Table 2
Measured Parameters

Type of motor	3 phase squirrel cage induction motor
Rating of motor	25 Hp (18.65 kW), 50 Hz
No of pole	4 pole
No load speed	1449 Rpm
Line voltage	430 V
Loading percentage	75 %
No load current	20.4 A
Operating speed	720 Rpm
Current on load	28 A

- I/P Power = 1.73 * Vl * I1 * Pf
- Copper Loss = INL2 * R
- Constant loss = I/P Power – Copper Loss
- Output power = (HP Rating) * 746
- Resistance per phase = 1.2*0.9
- Copper loss = IFL2 * R
- Loading condition = 75%
- Power output= (Output Power) * 0.75
- Input power= output power + (copper loss + constant loss)
- Efficiency % = (output/input) * 100
  Efficiency % = 80.28 %

2) Selection of energy efficient Motor

As per the market survey and cost benefit analysis, profile of newer energy efficient motor is Kirloskar 25 Hp (18.5 kw), 430 V, 4 pole, 50 Hz, 1500 Rpm, 3 phase foot Mounted Squirrel Cage Induction Motor,91% efficiency, power factor 0.83 of cost Rs 55000. Analysis of replacement of total 8 motor has been done as shown in table 3. And payback period is about 20 months.

Table 3
Analysis of Implementation

Difference in efficiency	10%
Energy difference	19 kWh
Total energy consumption of 8 motors	152 kWh
Monthly energy consumption	3043 kWh
Monthly cost saving	Rs 21492.8
Yearly Cost saving	Rs 2,57,913

- Prize of Energy Efficient Motor = Rs 55000
- Total Investment = Prize of Motor * Total No of Motor = 55000*8 = Rs 4,40,000
- Payback Period= (Investment/Yearly Cost Saving)*12
  = (440000/257913) *12
  = 20 Month

4. Conclusion

In this article, case study depicts that there is a large scope of energy savings in oil mill by replacing the old rewound/ faulty motors by energy efficient motors, there is scope for saving of energy, cost with less payback time of 20 months. The implementation of energy saving measures suggested in this paper is solely dependent on the decision of the industry. Technical Result is as shown in table 4. Energy saving proposals for Oil mil gives approximately saving of Rs. 2.57 Lakhs.

Table 4
Technical result

S. No	Energy Saving proposal	Annual Saving in Rs/Lakhs	Investment required in Rs/Lakhs	Simple Payback in Month
1	Replace Re-Winded Motors by Energy Efficient Motor	2.57	4.40	20

The project has completed with two phases of Audit. Third phase of audit is about implementation of energy saving measures recommended to the Management and monitoring as

well as analyze the progress of the energy conservation measures if it is implemented by the authority of industry.

References

[1] S. Kumar Rajput and O. Singh, "Energy audit in textile industry: A study with ring frame motor," *2016 International Conference on Control, Computing, Communication and Materials (ICCCCM)*, Allahbad, 2016, pp. 1-4.

[2] J. S. Hsu, J. D. Kueck, M. Olszewski, D. A. Casada, P. J. Otaduy and L. M. Tolbert, "Comparison of induction motor field efficiency evaluation methods," in *IEEE Transactions on Industry Applications*, vol. 34, no. 1, pp. 117-125, Jan.-Feb. 1998.

[3] Albert Thumann, P. E., C. E. M. William J. Youngers C. E. M, “Hand Book of Energy Audit”.

[4] “Guide Book for National Examination BEE for energy conservation managers and auditor”.

[5] Bureau of Energy Efficiency, “Manual on Energy Conservation Measures in Alwar Oil Mill Cluster”.