International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 2 Issue: 10 3134 – 3137

On Energy Auditing: An Experience With A Jute Mill

Dr. R. S. Chanda
Associate Professor in Electrical Engg.
Department of Jute & Fibre Technology, IJT
University of Calcutta
35, Ballygunge Circular Road.
Kolkata-700019, W.B, India
E-mail:rabi82@rediffmail.com

Abstract:-The Indian government has already been selected the energy sector in industry as a priority sector & stressed the need of efficient use of energy in industry. Most of the state governments in India have made energy audits mandatory for large scale energy consuming industries. So in industrial sectors the energy saving practices is gaining importance of the realization that 'energy saved is energy produced & that too at economical cost'. This paper shares the experiences of the author regarding some of the energy saving measures of jute mill situated in West Bengal. The effect of such measures were realized through reduction of cost in respect of energy.

Keywords: *Energy Audit, Jute Industry, Distribution System, Power Factor*

*****

I. INTRODUCTION

Now-a-days energy is one of the major areas which needs greatest attention throughout the world. Jute industries are found to be energy-intensive compared to other industries but no extensive research has been done on such industries in the past to reduce the energy cost and the total input cost. However a very little work has been done on textile industry.

Although being an important industry sector with significant energy consumption, there are not many scientific papers published to address the energy issues in the Jute or textile industry, especially when compared to the energy-intensive industries. C. Palanichamy et al. [1] reports the energy conservation experience with a textile industry. They selected this industry because of (i) the higher magnitude of electrical energy used in such industries, and (ii) the large number of textile industries in our country. Since there is a constraint on the investment budget for energy conservation measures imposed by the management of the textile industry they considered projects conserving only electrical energy since the electrical cost in the total energy cost of the textile industry is found to be around 65%. They mentioned all other energy conservation measures are reserved for next stage of implementation at a higher budget level. A. Hasanbeigi et al. [2] in their paper contribute to the understanding of energy use in the textile industry by presenting the energy use of textile plants in five sectors in Iran i.e spinning, weaving, wet processing, worsted fabric manufacturing and carpet manufacturing. They mentioned that there are not many published papers that cover the energy intensity of all the above sub-sectors. The data they used for their study is based on Iran's textile industry in 2005. R. Hartungi et al. [3] in their paper presented a case study of an office building of UK & show how the technology in energy efficiency in building will contribute to the energy conservation by full filling a particular building regulation of their country. Actually they presented how an office building can be designed to utilize energy efficiently. Author has not found any work for energy conservation on jute mill.

This paper highlights some energy saving approaches for a jute mill based on actual data collected from a reputed jute mill situated in West Bengal & presented in the form of Findings, Recommendations & Benefits with a clear indication about the economic benefits that a jute mill can achieve.

II. ENERGY AUDITING

The author in its own interest decided to go for energy saving measures of the mill under consideration due to the following reasons:

- The mill is a very old one.
- The increase in input energy cost due to the repeated increase in tariff by supply authority.
- Renewable energy sources can be used in some areas in a jute mill for economic reasons.
- Government is encouraging such industries to adopt energy saving measures to save energy.

A. Energy Audit Outcome

The author identified some areas but not all through which energy can be saved very simply:

i) Cables & distribution systems.
ii) Motors & drives.
iii) Distribution losses.
iv) Lighting system etc. etc.

For each study, (i) the annual energy saving, (ii) annual cost saving, (iii) capital investment, (iv) payback period & return on investment are calculated.

III. ELECTRICAL ENERGY SAVING MEASURES (FINDINGS, RECOMMENDATONS AND BENEFITS)

A. Saving estimation for running parallel cables:-

Findings:-

As per the mill engineer's information one aluminum armored 3 core, 1.1KV, 335A, 400 sq. mm, 0.0915 Ω resistance /core/km, PVC under ground cable of 200m length is running from the sub-station to weaving section bus bars.

Recommendations:-

As one of the energy conservation measures, it is recommended to run a similar cable in parallel with the existing one. As per mill engineer's version the existing cable was in sound working condition & it was recommended to retain the cable as it was. It was also advised to mark the changes in the electrical layout for future reference.

Benefits:-

Total length of cable was=200 m

Total resistance of the cable R=(3 x 0.0915 x 200)/1000 = 0.0549 Ω

For a Load current of 300 A & considering 8000 hrs. of operation in a yr.

Total energy loss in the cable in a year = 300^2 x 0.0549x8000Wh
= 39528 Kwh.

For parallel cables, assuming equal load sharing,

the current in each cable = 300/2 = 150 A.

Power loss in each cable = 150^2 x 0.0549 = 1.235 Kw

Total power loss for both cables = 2 x 1.235 = 2.47 Kw

Now, considering 8000 hrs of operation,

Total energy loss = 2.47 x 8000 = 19760 Kwh.

Saving in energy loss/yr. = 39528 – 19760 = 19768 Kwh

Considering energy charges of Rs. 7.27 / Kwh (as per mill electric bill supplied by mill engineer)

The annual saving in energy cost due to parallel cables

= 19768 x 7.27 = Rs. 143713.36/-

Investment required for running additional 200m cable

= Rs. 2,00,000/- (@ Rs. 1000/m including labour)

Pay back period = (200000/ 143713.36) x 12 = 16.7 month ≈ 17 month

Return on investment = 1/ 17 =5.88 % per month.

B. Saving estimation by using energy efficient motors:-

Findings:-

Mill engineer said that they are using energy efficient motors in various sections but about 15 motors of 15KW are still there which ware not energy efficient motor.

Recommendations:-

It is recommended to replace these motors by energy efficient motors because replacement of standard efficiency motors with premium of high efficiency motors is a valuable energy conservation program .This motors have 4 to 5% higher efficiency than standard one & 30% more cost than standard one. Economics, however depends on operating hr. & tariff. However, motors operating for less than 2000hr./yr. are not suitable for replacement.

Benefits:-

No. of Motor=15

Existing 15 KW m/c with 85% efficiency is replaced by 15 KW m/c with 90% efficiency motor.

Considering load factor of 80% & annual working hrs of 8000,

The annual saving in energy = [15 x 8000 x 0.80 x

(1/.85 – 1/.90)] x 15 = 94117.647 kwh

The annual saving in energy cost = 94117.647 x 7.27 = Rs. 6,84,235.29/-

Investment required for 15 no. of 15 KW energy efficient motor = 15 x 60,000=Rs.9,00,000/-

Resale value of old motors

=15 x10000=Rs.1,50,000/-

Net investment required= (900000 – 150000) = Rs.7,50,000/-

Pay back period = (750000 / 684235.29) x 12

= 13.15 month = 13 month

Return on investment = 1/13 = 7.7% per month.

C. Saving estimation by the use of power factor improvement technique.

Findings:-

The average power factor of the jute mill under consideration is 0.9586 based on the last three month bill supplied by the Mill Engineer. They failed to supply the last one year electric bill. The maximum demand has reached during this period is 1331.2 KVA.

Recommendations:-

It is recommended to improve the power factor to an average value of 0.98. For this capacitor with automatic control arrangement has to be installed at the sub-station to compensate the base load. For increasing 98% of power factor mill has to add capacitor of 119.94 KVAR =120 KVAR.

Benefits:-

For a load of 1331.2 x 0.9586 = 1276.088 KW the KVA demand at .98 power factor is 1276.088/.98=1302.13 KVA

Saving in KVA =1331.2 - 1302.13 = 29.07 KVA

Annual saving in cost due to KVA reduction=317 x 29.07 x 12=Rs. 1,10,582/-

(Considering maximum demand tariff as Rs. 317/KVA/month)

Cost of capacitor with automatic control arrangement =Rs.2,00,000 /- (approx. including all)

Payback period = (200000/110582) x 12

= 21.7 months = 22 months

Return on investment= (1/22) x 100 = 4.5% per month.

D. Saving estimation through peak shaving.

Findings:-

Mill engineer supplied us only last three months bill, they failed to supply last one year bill as per our requirement. From the last three months bill it is seen that agreemental load is 1200KVA but in one month it exceeds to 1331.2KVA i.e it crosses about 131.2KVA.

Recommendation & Benefit :-

It is not possible to recommend based on the three months data. However it is possible to save some amount by running D.G set during peak hours. Whether it is economical or not that can only be decided based on one year data.
However the mill under study has to pay about 2% of its bill amount in a particular month.
Charge for per KVA= Rs.317.00
Total extra pay=317 *131.2= Rs. 41590.4 (2%extra on bill) = Rs. 42422.20

E. Energy saving studies through Lighting:-

Findings:-

Mill engineer said that they are using electronic choke tube light in various sections in the mill. However there are about 60 tube light existing in some section which are using conventional chokes.

Recommendations:-

Substantial amount of electricity saving can be achieved by replacing conventional chokes by electronic chokes in the mill & using true light. A saving of more than 10 Watt per tube is possible.

It is recommended to replace these 60 tube light by 40 electronic choke true light tube light as their wattage is less & lumen output is more.

The Power & Lumen output of standard tube light & true light

	Lamp Watt	Ballast Watt	System Watt	Lumen Output
Standard Tube light (40W tube +ballast+ starter)	40	12.5	52.5	2450
Modern electronic (36W truelite+ ballast)	32	5	37	3250

Benefits:-

Say no. of tube light in a mill = 60
Now considering 8000 hrs of operation/ year and considering energy charges =Rs.7.27/Kwh
Present energy cost=(60 x 52.5 x 8000 x 7.27)/1000
= Rs.183204/-
Total energy cost as per recommendation
= (40 x 37 x 8000 x 7.27)/1000 = Rs.86077/-
Cost of annual energy saving= 183204 – 86077
= Rs. 97127/-
Approximate investment required=Rs.550 per tube including labour charge
Total investment = 40 x 550= Rs. 22000/-
Resale value of old chokes= 60 x 10 =Rs. 600/- (@ Rs. 10 per choke)
Net investment= Rs. 21400/-
Payback period = (21400 x 12 / 97127) = 2.64 month ≈ 3 month
Return of investment = 33.3 % per month

F. Saving estimation for the replacement of street light by solar lighting.

Findings:-

It is found that about 60 street light each of wattage 60 watt existing in the mill under study.

Recommendations:-

It is recommended to replace these street lights by solar lighting system each of wattage 40Watt. Although its initial cost is large but average life is very long such as 25 yrs. & running and maintenance cost is approximately nil.

Benefits:-

Number of street light in the mill under consideration = 60

Wattage of each bulb = 60 watt

Present yearly energy cost of mill on street light considering 12 hr. operation per day =

[(60 * 60)/1000]*12* 7.27*365 = Rs.1,14,633.36/-

Considering 20% running & maintenance cost,

The Total cost= Rs.137560/-

For solar lighting system:-

Total watt = 60*40 =2400 watt = 2.4 kw

Considering 12 hr light operation = 2.4 * 12

=28.8 kwh per day

For 365 day i.e in a year = 28.8*365=10,512 kwh per year

Cost of 1 kwh =7.27 rupees

Total energy expenses of the mill on street light in year for solar lighting =NIL per year

Saving in energy cost = (137560 – 0) = Rs.137560/-

Considering estimated life of solar system for at least 10 yr. (Although experts consider its life as 25 yr.) the total saving in energy cost = Rs.1375600/-

Price of solar street light of 40 wattage is

= Rs.16,000 /-

But price of scrape (old street light system) is

=Rs. 3,000 /-

Net price of solar street light will be = (16,000-3000)

= Rs.13,000/-

Total number of street light require=60

Total price of street light =60 * 13,000

=Rs. 7,80,000

We have to also include some extra arrangement because rainy day or other causes.

Cost for this extra arrangement (@Rs.2000/-)

= 60 * 2000 =Rs.120000/-

Total expenses on solar system for first year =7,80,000+120000

=Rs.9,00,000/-

Payback period = (900000 x 12 / 1375600)

= 7.85 month = 8 month

Return of investment = 12.5 % per month

[This payback period is considering life of solar system only for 10 yrs not for 25 yrs. For 25 yrs life the payback period will be 3 months only & return of investment will be 32% per month]

IV. CONCLUSION

In this paper author concentrate electrical energy saving measures of a Jute mill & experiences in this regard were presented. After identification of the major sectors of a mill where energy audit can be carried out some energy saving approaches are presented in this paper based on actual field data. Finally this paper presented the energy saving measures in the form of findings, recommendations & benefits in some specific field of the mill considered & their benefits are stated clearly.

REFERENCE

[1] C. Palanichamy, C. Nadarajan, P. Naveen, N.S. Babu & Dhanalakshmi, " Budget Constrained Energy Conservation- An Experience With a Textile Industry". *IEEE Trans. On Energy conversion*, Vol-16, No.- 4, pp-340-345, Dec'2001.

[2] A. Hasanbeigi, A. Hasanabadi & M.Abdorrazaghi, " Energy Efficiency Technologies and Comparing the Energy Intensity in the Textile Industry". *ACEEE Summer Study on Energy Efficiency in Industry*,Vol-1, pp-34-46, 2011.

[3] R. Hartungi & L. Jiang, " Energy Efficiency and Conservation in an office building: A case Study". *International Journal of Energy Sector Management*, Vol-6, No.-2, pp- 175-188, 2012.

[4] P.Balasubramanian, "Energy Auditing Made Simple", Bala Consultancy Services, Mylapore, India, August, 2004.

[5] Amit Kumar Tyagi, "Handbook on Energy Audits and Management" , TERI , India, 2000

[6] M.K.Lahiri, "Saving of Electricity by system Management" , M.K.Lahiri & Associates, Kolkata-64, India.