Case Study:

Energy conservation measures in coir industry – A Case Study

Chitra L.[1]*, Senthilkumar A.[1] and Rameshkumar M.[2]
1. Department of Electrical and Electronics Engineering, Dr. Mahalingam College of Engineering and Technology, Pollachi-3, INDIA
2. Sri Energy Solutions, Udumalpet, INDIA
*chitral@drmcet.ac.in

Abstract
Energy conservation is a key element for setting up of the profit cost of the product. But the energy auditing practice is not carried out in the coir industry due to lack of awareness. This study deals with the energy consumption of coir industries and its potential areas for energy consumption. The Fluke 435 III power quality analyzer and FLIR thermal imager are used for the measurement of various quantities. From the analysis, the areas of energy consumption are identified and their corresponding measures for improvement are suggested for energy conservation.

Keywords: MSME (Micro, Small and Medium Enterprises), Slippage loss, Energy.

Introduction

As per the sixth census of MSME cluster, 58.5 million establishments are functioning in India. Out of that 34.8 establishments were found to be in rural areas and 23.7 million were found to be in urban areas. In Tamilnadu, 11.10 lakh registered MSME's are in operation with a investment of 91.480 crores and provides job opportunities to 70.85 lakh persons.

Tamilnadu occupies second position in the cultivation of coconut and first place in the production of brown fibre. The value added products developed are coir fibre, coir pith and Mats. The 95% of the coir fibre produced are exported to the countries like china, Australia, U.S.A, European Countries and New Zealand and the remaining 5 % balance is marketed locally.5339 Coir industries are currently functioning in tamilnadu.

In that 264 units are functioning in the Coimbatore cluster. 145 units are involved in Fibre Extraction, 13 units are involved in Yarn Spinning, 40 units are involved in Curled Coir Rope Making, 1 unit engaged in Rubberized Coir Manufacturing and 65 units are involved in manufacturing of Pith Blocks. The industry mainly deals with extraction of fibre, spinning of yarn, manufacturing of curled coir and rubberised coir products. The process flow coir from the husk is depicted in figure 1.

The fibre extraction from the brown husk is depicted in figure 2. The process flow of coir yarn spinning and coir pith block making are depicted in figure 3 and figure 4.

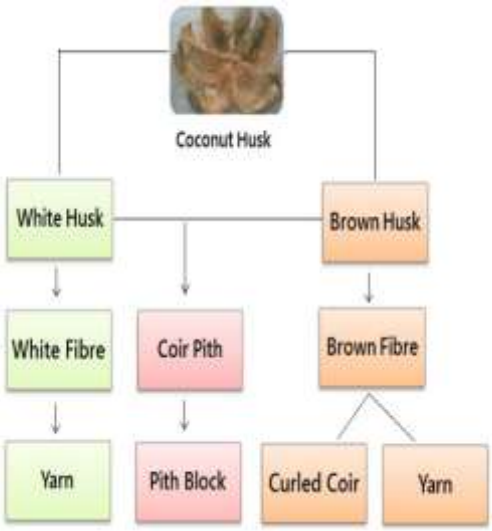

Fig. 1: Process flow of coir from Husk

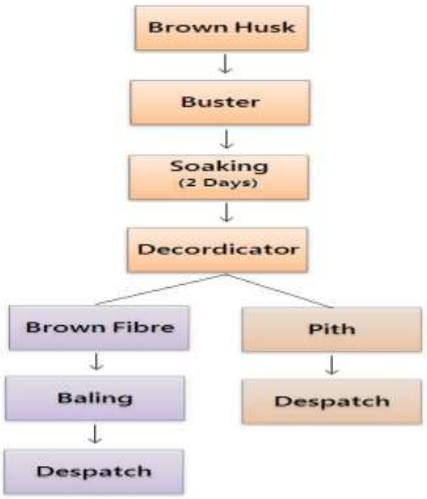

Fig. 2: Process flow of fibre extraction from brown husk

The state government introduced a PEACE (Promotion of Energy Audit and Conservation of Energy) to improve energy efficiency in MSME units. Under this scheme, 50% of subsidy is given to MSME units for conducting the energy audit and 25% subsidy is given for the replacement of machines or any new technology addition.

This study aims in analysing the energy consumption of the coir units and thereby reducing the energy wastage of the units which indirectly achieve the unit consumption of the corresponding area. The proposed study was analysed in the

two different coir units and their corresponding analysis with recommendations for improvement also proposed.

Fig. 3: Process flow of coir yarn spinning

Fig. 4: Process flow of cir pith block manufacturing

Coir Industry -Case study 1

Analysis of Case study 1: The study was carried out in the Coir Industry located at Negamam. The maximum demand of the unit is 110kW for Fibre unit, 50kW for curling unit and 44kW for pith unit. The recorded demands are low the power and power factor trend of the main incoming is shown in figure 5 and figure 6.

The per hour energy consumption of various motors in the unit are listed in the table 1.

The associated slippage losses of the machines are calculated and its corresponding values are listed in table 2.

The figure 7 shows pulley worn out due to that temperature raises to very high which leads to the slippage losses of the machine.

Coir Industry -Case study 2

Analysis of Case study 2: The study was carried out in the Coir Industry located at Negamam. The power and factor trend of the main incoming are shown in figure 8 and 9.

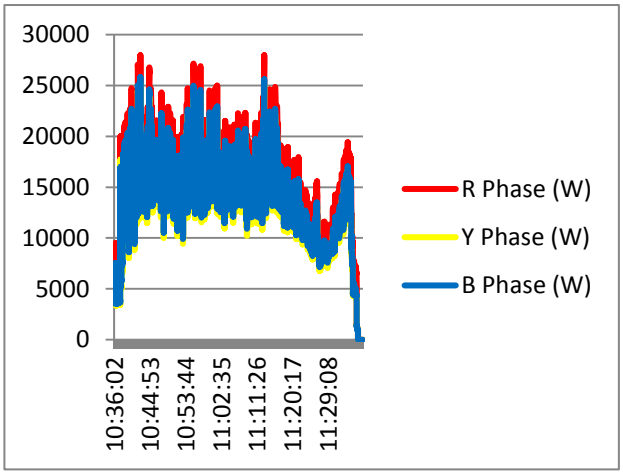

Fig. 5: Power trend of main Incoming

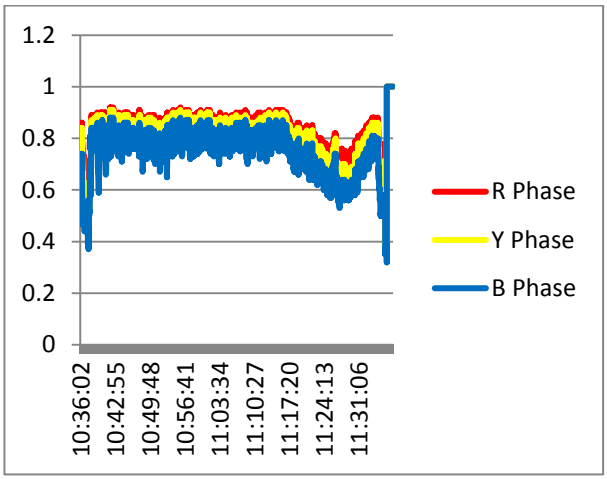

Fig. 6: Power factor trend of main incoming

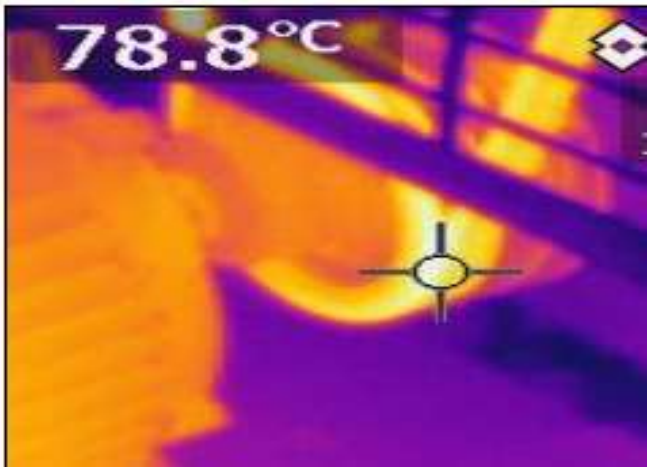

Fig. 7: Image of the Beater motor belt and pulley

Table 1
Per hour Energy consumption of various motors

Machine name	Per hour Energy consumption (kWh)
Beater Motor	14.23
Polisher No.1	21.78
Polisher No.2	16.7
Fiber feeding Conveyor – Drum Motor	1.2
Inlet Belt Conveyor Motor	0.8
Drum Inlet Belt Conveyor Motor	0.62
Polisher 1 outlet conveyor	0.56
Screener to Polisher Conveyor Motor	0.37
Final Fibre Conveyor	0.42
Screener Motor	1.12
Polisher to Last conveyor Motor	0.47
Fibre Screener – Pith Outlet Conveyor motor	0.54
Polisher Pith Outlet Conveyor motor	1.07
Combined Pith Outlet Conveyor Motor	0.61
Pith Outlet to Screener	0.56
Pith Screener	0.98
Final Pith Conveyor Motor	0.61

Table 2
Slippage losses of various motor

Machine name	Slippage loss (kWh)
Beater Motor	0.37
Polisher No.1	0.26
Polisher No.2	0.4
Fiber feeding Conveyor – Drum Motor	0.096
Inlet Belt Conveyor Motor	0.064
Drum Inlet Belt Conveyor Motor	0.049
Polisher 1 outlet conveyor	0.042
Screener to Polisher Conveyor Motor	0.029
Final Fibre Conveyor	0.029
Screener Motor	0.088
Polisher to Last conveyor Motor	0.031
Fibre Screener – Pith Outlet Conveyor motor	0.036
Polisher Pith Outlet Conveyor motor	0.083
Combined Pith Outlet Conveyor Motor	0.039
Pith Outlet to Screener	0.033
Pith Screener	0.074
Final Pith Conveyor Motor	0.036

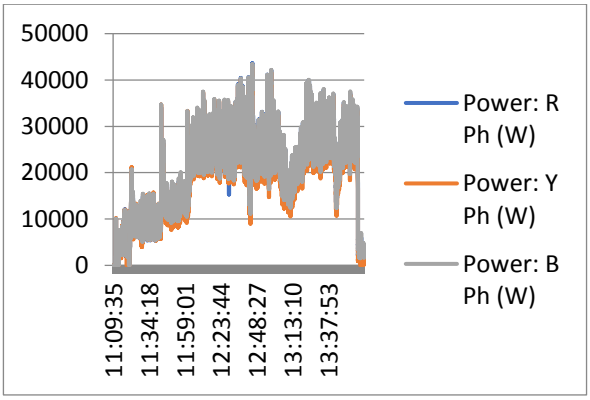

Fig. 8: Power trend of main incoming

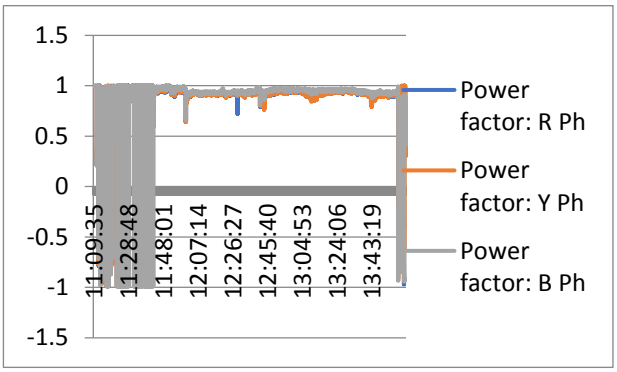

Fig. 9: Power factor trend of main incoming

The per hour energy consumption of various motors in the unit are listed in the table 3.

Table 3
Per hour Energy consumption of various motors

Machine name	Per hour Energy consumption (kWh)
Beater Motor	12.384
Polisher No.1	19.6
Polisher No.2	8.9
Husk Conveyor No.1	0.6
Husk Conveyor No.2	0.6
Beater Outlet Conveyor	0.8
Fiber Feeding Belt Conveyor	0.6
Fiber Feeding – Drum Motor	0.7
Polisher 1 – Incoming Conveyor	0.64
Polisher 1 Outlet Conveyor	0.74
Beater Pith Outlet Conveyor No.1	0.62
Beater Pith Outlet Conveyor No.2	0.42
Final Pith Outlet Conveyor	1.07
Screener to fiber inlet Conveyor	0.48
Pith Screener	0.62
Fiber Outlet Conveyor	0.31
Fiber Screener	0.57
Curling Machine No.1	0.42
Curling Machine No.2	0.39
Curling Machine No.3	0.39
Curling Machine No.4	1.72

The associated slippage losses of the machines are calculated and its corresponding values are listed in table 4.

Table 4
Slippage losses of various motors

Machine name	Per hour Energy consumption (kWh)
Beater Motor	0.42
Polisher No.1	0.32
Polisher No.2	0.37
Husk Conveyor No.1	0.085
Husk Conveyor No.2	0.057
Beater Outlet Conveyor	0.051
Fiber Feeding Belt Conveyor	0.041
Fiber Feeding – Drum Motor	0.032
Polisher 1 – Incoming Conveyor	0.028
Polisher 1 Outlet Conveyor	0.091
Beater Pith Outlet Conveyor No.1	0.033
Beater Pith Outlet Conveyor No.2	0.039
Final Pith Outlet Conveyor	0.087
Screener to fiber inlet Conveyor	0.035
Pith Screener	0.037
Fiber Outlet Conveyor	0.077
Fiber Screener	0.064
Curling Machine No.1	0.13
Curling Machine No.2	0.15
Curling Machine No.3	0.22
Curling Machine No.4	0.23

Recommendation

The slippage losses in the motors of the two units can be avoided by changing the v belt to cogged belt. It helps to achieve higher speed ratios with smaller pulley, less weight, energy savings of 5-10%.

Based on the analysis energy consumption per hour of case study 1 is 57.9 kWh and production is in the range of 450 to 500Kgs per hour. Hence the specific energy consumption for fiber manufacturing is 0.132 kWh. It cost may be around 83 paisa per kg of fibre. In the Beater and polisher motors, install load side capacitors. Thereby the energy consumption can be reduced by 0.1kWh per hour. The annual energy saving will be 300 kWh and annual cost saving will be Rs.1905.

Based on the analysis, the energy consumption per hour of case study 2 is 74.75 kWh and production will be in the range of 400Kgs per hour. Hence the specific energy consumption of the fibre manufacturing is 0.186 KWH. Its cost may be around 118 paisa per kg of fibre. In the Beater, Polisher and curling machine motors, install load side capacitors. Thereby the energy consumption can be reduced by 0.2 kWh per hour. The annual energy saving will be 600 kWh and annual cost saving will be Rs.3810.

Conclusion

The energy auditing study was carried at the two different Coir industries. From the analysis of the two different units, potential areas for energy conservation are identified and recommendations are proposed. The recommendations are carried out in the respective industries and their savings are seen by the post audit phase. The visible loss (4-8%) in the motors of coir industry is belt and pulleys. So, the attention has to be paid for selecting the belt and pulleys for maximizing the machine efficiency and minimizing the energy consumption. And also, higher capacity motors can be installed with the load side capacitors for reducing the energy consumption.

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