Energy Saving Measures in Textile Mill

K. Balachander, A. Amudha

Abstract: ***This manuscript proposes a possible energy economy recommendations of a textile mill located at Udumalpet, Tirupur District. An electrical energy assessment is an examination survey and an investigation of energy flows for energy conservation in a building or industry. It may include a method or structure to trim down the amount of energy input into the system without harmfully affecting the output. In textile mill, voltage and current utilization is in rising trend, due to updated machinery and uninterrupted usage of the equipments in inefficient operating parameters. After the auditing, possible Energy Economy Recommendations were given.***

Index terms: Energy, Auditing, Textile Mill, Energy Economy

I. INTRODUCTION

An Energy review or audit, once in a while alluded to as a energy overview or a energy stock, is an examination of the all out energy utilized in a specific property. The investigation is intended to give a generally brisk and basic strategy for deciding how much energy is being devoured as well as where and when. The energy review will recognize lacks in working strategies and in physical arrangements. When these lacks have been distinguished, it will be obvious where to pack endeavors so as to spare vitality. The vitality review is the start of and the reason for a viable vitality the executives program [1-6].

II. AUDIT LOCATION AND LOAD DETAILS

The energy audit mill location is at Tiruppur District, Ponnari Village. Details are given in Table 1. Main source of power in the mill is TANGEDCO and Sanctioned demand is 500kVA. The Existing Electrical Load Profile is shown in Table 2. Existing Electrical Facility is described in Table 3.

III. MAJOR AREAS OF ENERGY SAVING POTENTIAL

In textile industries Ring frame, Humidification process, Electrical division network and compacted Air sharing areas are well-known power consuming areas. In this audit schedule covers following aspects: motor terminals phase voltage, the humidified air received at the premises end, auto coner for steady air and lighting [7-13].

IV. PROPOSED ENERGY SAVING AREAS

A. Humidification Plant

Humidification plants have become an essential part of spinning mills. In order to the ambient conditions in the department it is essential to operate a humidification plant in a very efficient manner.

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B. Relative Humidity

It is the ratio of definite water vapor to the unit volume of air mixture. Compare with saturated water vapor to the unit volume at the same temperature [14].

C. Operation, Maintenance and Energy Conservation in Humidification Plants

The following are some of the important points to be recommended in order to derive maximum benefit from an existing plant [15-25.

- Warm air discharged from pnuemafil system should be discharged outside, except in winter when heat is to be conserved.
- Saturated air from the air washer OR humidifier should show not more than 1 deg. Celsius difference between dry and wet bulb temperature after the eliminator sheets otherwise, it indicates that the air washer OR humidifier is inefficient.
- In winter, most effective and satisfactory method of heating and humidifying simultaneously is by recirculation of hot exhaust air.
- Spray nozzle, eliminator, air filter, damper, diffuser, etc., should be checked a periodical intervals and repaired OR replace if necessary.
- Recirculation of air helps in raising the ambient dry bulb temperature but the R H remains practically same. In other words, recirculation raises both dry and wet bulb temperature almost by same extent [26].

D. Energy Conservation in Humidification

The energy spent for humidification can be reduced by operating the plants scientifically and judiciously. As the modern textile machines are incorporated with sophisticated electronic control system and are operated at higher speeds, maintenance of correct envoi mental condition is compulsory. The average of 15 % of total power bill of a mill accounts for operating the humidification plants alone. It will increase further by 5 % if the plant system is automated. Therefore, it should be operated properly with minimum energy expenditure as it improves not only the production but also the quality. It is to be noted that by proper maintenance and upkeep of the plants, about 2 to 5 % of the total plant power can be saved [27-30].

E. Energy Study

The Overall humidification Power pattern of the mill is given below in Table 5.Exhaust Air Fan 3 Consumes excess power of 4 KW due to blocking of air in this system and Back pressure developed. The area of V Filter has to be increase and EAD area has to be increase to avoid Back pressure develops in this system [31-36].

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F. Energy saving potential

- The Annual Total Expected Saving will we 34000 Units

V. COMPRESSOR AND AIR DISTRIBUTION

The complete capacity details of compressor details are given in Table 6. Table 7 describes the details of Air Requirement for the present working Machinery [37-41].

A. Recommendations

- At presently compressor running at 7 to 7.5 Kg/cm2 bar due more air leakage in air distribution system and check the air leakages and arrest immediately, After that Pressure setting has to be changed to 6.8 to 7.2 Kg/cm^2
- The plan should ensure that the pressure drop should not be more than 0.5 kg/cm² (7 psi) in the longest line
- Record the Energy consumption day wise and capacity wise with running hours.
- All compressor Radiator was chocked and it will caused to increase the energy of compressor and it is advised to clean the radiator at regular interval.
- Better to replace the Screw compressor to BOP Compressor for better air quality and better energy consumption. All recommendations in Compressor and Air Distribution unit are tabulated in Table 8.

B. Energy saving potential

- The Annual Total Expected Saving will be 60000 Units

VI. POWER QUALITY IMPROVEMENT IN LOW VOLTAGE AC (LVAC) NETWORKS

Another major power saving area is Power Quality Improvement in LVAC Networks. Main electrical equipment is transformer. The total load at transformer (ABC Connection) is shown in Table 9. Feeder Wise Power Quality Parameters based on the present operating status of the plant is tabulated in table 10.

- The Total voltage harmonics (%V_{thd}) is 3.10 % with capacitors are within the limit as specified in the IEEE 519-1992.i.e 5%.
- The Total Current harmonics (% I_{thd}) is 10.40% with capacitors are Excess limit of 8% as specified in the IEEE 519-1992.
- The instantaneous power factor is 0.98 to 0.97 lagging with capacitor.

A. Recommendation

Connect 100 KVAR - Detune Harmonic filter with 7% Block reactor at M V Panel to maintain current harmonics within the limit 8% as specified in the IEEE 519-1992 and maintaining the unity power factor.

VII. LOAD PATTERN OF ELECTRICAL DISTRIBUTION NETWORK

A. Transformer

The Mill is equipped with 500 KVA outdoor transformer with Off Load Tap Changer. Loading Pattern is 406.4V 430 A300 KW P.f 0.97 (Table 11). At present transformer loading is more than 65% which is high and needs correction and this can be achieved through capacity augmentation OR load should be bifurcated to Another transformer by way to decreeing the transformer self losses [41-46].

B. Blow Room

Blow room is one of the most chief parts of textile spinning sector. Here number of machines which are sued in sequence to open and clean the cotton fibre according to the necessary quantity. In this section 40-70% waste is removed. Table 12 describes Power Consumption and Power Saving Recommendations in blow room.

C. Ring frame and Spinning Department

In Ring frame section, 9 machines are effectively working. Ring Frame Power Consumption and Power Saving Recommendations are tabulated in Table 14. Another main unit in textile industry is spinning. Table 13 shows Spinning Department - Power Consumption and Power Saving Recommendations.

Table 1. Audited Mill Details

Name of the Industry	M/s. Chennai Spinners
Factory and Regd. Office Address	Ponners, Udumalpet, Tirupur.
Location	

Table 2. Existing Electrical Load Profile

Source of Power Supply	Sanctioned Demand	Billed Demand (kVA)	Average Power Factor
TANGEDCO	500 KVA	450 KVA	0.96

Table 3. Existing Electrical Facility

Description	Nos.	Rating
Transformer (kVA)	1	500 KVA
DG (kVA)	0	NA
Capacitors (kVAr – HT/LT)	LT	207 KVAR
M V panel	1	900 A
Sub Switch Board	2	

Table 4 Relative Humidity and Temperature for Different Process

S. No.	Process	R H %	Temperature	
			Celsius	Fahrenheit
1	Opening and Mixing	50 to 65 %	27 to 35	80 to 95
2	Blow room	50 to 55 %	27 to 35	80 to 95
3	Spinning Preparatory	50 to 60 %	27 to 35	80 to 95
4	Spinning	50 to 60 %	27 to 35	80 to 95
5	Winding	60 to 65 %	27 to 32	80 to 90
6	Weaving Preparatory	60 to 65 %	27 to 32	80 to 90
7	Weaving	75 to 85 %	24 to 30	75 to 85

Table 5 Power Pattern of Humidification Plant

Department	System	Installed Motor in KW	Actual Load in KW	% of Load
Spinning	Exhaust Air Fan EAF - 1	11.00	5.80	52.72%
	EAF - 2	15 .00	5.30	48.18%
	EAF - 3	11.00	9.54	86.72%

Table 6 Load details of Compressor

S. No.	Description	Installed Motor (kW)	Actual Load (kW)	% of Load
1	Compressor 1	18.5	20.56	112%

Table 7 Air Requirement for the present working Machinery

S. No.	Name of the Machine	Con's in cfm	No. of Machines	Total cfm
1	Blow room	0.50	1	0.50
2	Carding LC 300 V 3	0.80	2	1.60
3	Simplex LF 1400	1.10	2	2.20
4	Spinning LR 6/S	0.75	9	6.75
5	Auto Coner - Savio polar	25.00	2	50.00
Total				61.05

Table 8 Recommendations

Pipe line losses in (Cubic feet/Minute) Cfm Allowable Air Leakages	5%	3.05
in CFM	10%	6.11
Total CFM		70.21
Compressor Available in CFM	E 18.5 Elgi	120.00
Present average Loading		106.80
Excess consumption in KWhr		13.20
Standard Power consumption/hour		13.50
Present Power consumption/hour		20.54
Excess Power consumption/hour		7.04

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Table 9 Transformer Load

Electrical Parameter	Value
Voltage (V)	406.4
Current (A)	430
Power (kW)	300
PF	0.97
$V_{Thd\%}$	3.10%
$I._{Thd\%}$	10.40%

Table 10 Feeder Wise Power Quality Parameters

Description	SSB 1 (Sub Switch Board)	SSB 2	PDB 1 (Power Distribution Board)	PDB 2	BCP (Blow room control panel)	SSB 3
Voltage (V)	405.5	406.6	406.8	406.6	404.8	408.9
Current (A)	106.2	132.5	20.9	42.6	20.12	87.96
Power (kW)	71.31	89.20	14.56	29.25	9.46	55.45
PF	0.97 lag	0.96 lag	0.87 lag	0.96 lag	0.76 lag	0.89 lag
$V_{Thd\%}$	0.08%	0.08%	0.09%	0.08%	0.09%	0.09%
$I._{Thd\%}$	1.30%	2.60%	2.90%	2.60%	1.80%	23.56%
Remarks	NIL	NIL	NIL	NIL	NIL	Connect 30 A Active Harmonic filter

Table 11 The Standards for the operating load and power factor for the transformer is given below.

Transformer Loading	50 - 60%
Transformer Power factor	Near to unity
Voltage Level	420 V at Transformer Secondary Side
Winding Temp.	Not exceeds 45 Deg of Celsius
Oil Temperature	Not exceeds 40 Deg of Celsius
Percentage Impedance	The % Impedance shall be 4.5% for transformers of 250KVA and 500KVA as per IS l180(Part 1):2014 with tolerance as per IS:2026
Taps	Tapings shall be provided on the HV voltage windings for variation for HV voltages as under. Voltage Ratio 11000/433v No. of tap positions 7 Range of variation +5% to -10% in steps of 2.5% for variation of HV.

Table 12 Power Consumption and Power Saving Recommendations

S. No.	Description	Volts	Amps	Power in KW	Power factor	Remarks	Expected Savings
1	Blow room - Lap Feed	401.5	201.12	9.46	0.67	Connect 15 KVAR Capacitor at Control panel All Transmission "V" belt has to be changed to Cogged Belt	2000 Units/Year
2	Carding 1 - C1/3	396.5	9.35	4.87	0.73	NIL	NIL
3	Carding 2 - C1/3	398.5	8.81	4.76	0.76	NIL	NIL
4	Carding 3 - C1/3	399.6	9.26	4.10	0.64	NIL	NIL
5	Carding 4 - LC300 A V3	395.6	14.14	7.25	0.74	NIL	NIL
6	Carding 5 - LC300 A V3	397.6	12.94	5.66	0.71	NIL	NIL
7	Drawing 1-SB 2	397.3	9.66	4.44	0.69	NIL	NIL

8	Drawing 2-LRSB 851	397.9	6.26	3.28	0.77	NIL	NIL
9	Simplex 1-LF 1400	395.6	10.50	9.20	0.70	All Transmission "V" belt has to be changed to Cogged Belt	800 Units/Year
10	Simplex 2 - LF 1400A	394.9	10.19	5.64	0.81	All Transmission "V" belt has to be changed to Cogged Belt	500 Units/Year

Table 13 Spinning Department - Power Consumption and Power Saving Recommendations

S. No.	Description	Volts	Amps	Power in KW	Power factor	Remarks	Expected Savings
1	Ring frame - 1 Fan Motor	396.3	4.15	2.31	0.81	NIL	NIL
2	Ring frame - 2 Fan Motor	404.5	3.76	2.62	0.95	NIL	NIL
3	Ring frame - 3 Fan Motor	407.4	5.41	3.59	0.95	NIL	NIL
4	Ring frame - 4 Fan Motor	404.6	4.39	2.83	0.92	NIL	NIL
5	Ring frame - 5 Fan Motor	399.7	4.54	2.28	0.71	NIL	NIL
6	Ring frame - 6 Fan Motor	399.7	5.02	2.73	0.78	NIL	NIL
7	Ring frame - 7 Fan Motor	392.7	7.40	4.50	0.89	Change the Impeller to Energy Efficient Impeller	17500 Units/Year
8	Ring frame - 8 Fan Motor	395.2	4.46	2.25	0.73	NIL	NIL
9	Ring frame - 9 Fan Motor	394.8	4.11	2.51	0.89	NIL	NIL
10	Ring frame - 1 OHTC	390.1	2.67	1.52	0.86	NIL	NIL
11	Ring frame - 2 OHTC	404.6	2.22	1.47	0.92	NIL	NIL
12	Ring frame - 3 OHTC	407.6	2.73	1.57	0.72	NIL	NIL
13	Ring frame - 4 OHTC	405.4	1.89	1.18	0.86	NIL	NIL
14	Ring frame - 5 OHTC	399.8	2.99	1.79	0.85	NIL	NIL
15	Ring frame - 6 OHTC	399.7	2.01	1.22	0.88	NIL	NIL
16	Ring frame - 7 OHTC	392.1	2.19	1.30	0.93	NIL	NIL
17	Ring frame - 8 OHTC	395.6	2.04	1.15	0.83	NIL	NIL
18	Ring frame - 9 OHTC	394.7	2.65	1.41	0.78	NIL	NIL

Table 14 Ring Frame - Power Consumption and Power Saving Recommendations

Parameters	M/c 1	M/c 2	M/c 3	M/c 4	M/c 5	M/c 6	M/c 7	M/c 8	M/c 9
No of Spindles	1200	1008	1008	1008	1200	1200	1200	1200	1200
Count	46 s	46 s	46 s	46 s	46 s	46 s	46 s	46 s	46 s
Actual Count	46 s	46 s	46 s	46 s	46 s	46 s	46 s	46 s	46 s
T P I	28.58	28.06	28.10	28.66	28.56	28.52	28.63	28.58	28.26
Tr.Wt in Mg100 Nos	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16
Spindle Speed in RPM	16617	12734	16617	14863	16369	16347	17045	17067	17000
Ring Dia in MM	38	40	38	38	38	38	38	38	38
Yarn Weight in grams	37.83	33.06	29.33	31.43	34.45	29.52	39.91	36.25	33.00
Standard KW	27.70	13.59	23.27	18.50	24.75	24.68	26.76	26.83	26.63
Volts	396	404	407	404	404	401	399	392	394
Actual KW-	26.16	16.84	20.12	16.29	24.64	24.34	27.99	27.42	27.60
Deviation in KW	- 1.54	+3.25	-3.15	-2.21	-0.11	-0.34	+1.23	+0.59	+0.97
Energy Saving Proposal	Nil	Service Main Motor & Tin roll Shaft	Nil	Nil	Nil	Nil	Service Main Motor	Service Main Motor	Service Main Motor
Saving Proposal in Units/Year	Nil	19000	Nil	Nil	Nil	Nil	9000	5000	6000

Table 15 Overall Mill Electrical Energy consumption Pattern

S. No.	Utility of Energy	Avg. Consumption/ Month in 2018	Cost/Unit	Consumption in %
1	TANGEDCO	199358	6.76	87.52%
2	Wind Mill	12900	5.50	4.60%
3	D.G Set	5985	20.28	0.81%
	Total	218243	7.05	

VIII. CONCLUSION

Improving working parameters of plant towards security and better effectiveness. The above are a portion of the better purposes of energy Preservation measures being attempted and to be attempted in the enterprises. Carefully, the above measures are gone for running our current supplies to the most extreme conceivable effectiveness. We need to lessen the avoidable misfortunes to the greatest in the transmission of vitality from one state to other in the hardware. So to state, we are endeavoring to coordinate our current effectiveness of types of gear to suit to process. At the same time we attempt to improve the current encompassing conditions encompassing the types of gear to suit and solace the supplies with the goal that they can give better yield to process. The suggestions are submitted to the administration of the plant.

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