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Energy Efficient Measures in Textile Mill

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Article Info
Volume 82
Page Number: 6233 - 6239
Publication Issue:
January-February 2020

Article History
Article Received: *18 May 2019*
Revised: *14 July 2019*
Accepted: *22 December 2019*
Publication: *30 January 2020*

Abstract:

Progressively in the last numerous periods, industrial energy audits have detonated as the demand to lower increasingly affluent energy costs and move towards a supportable future have made energy audits significantly important. In Industrial sector, energy expense is the major expense and approximately ten percentage is the energy cost of the average manufacturing cost. This paper proposes a power quality audit recommendations of textile mill located at Coimbatore.

Keywords: *energy audit, power quality, textile mill, energy efficiency*

I. Site Location and Electrical Power Details

The audited site is located at Pollachi, Coimbatore. Address and Location of the mill is shown in Table 1. Table 2 and 3 describes the Electricity details and Energy consumption pattern of the Mill. The major power generation of the audited site is from the wind along with other energy forms. The Mills total energy consumption pattern is show in Fig 1.

Table 1**Site Location**

Name and Address of the Company	M/s. SURIYA SPINNING MILLS UNIT - B P1,P2 Sakthi Co-Operative Industrial Estate, Udumalpet Road, Pollachi - 642 003 Coimbatore D.T
Sector	Textile and Spinning

Table 2**Electricity Details**

Source of Power Supply	**Sanctioned Demand**	**Billed Demand kVA**	**Average Power Factor**
TANGEDCO	475 KVA	427.5 KVA	0.96

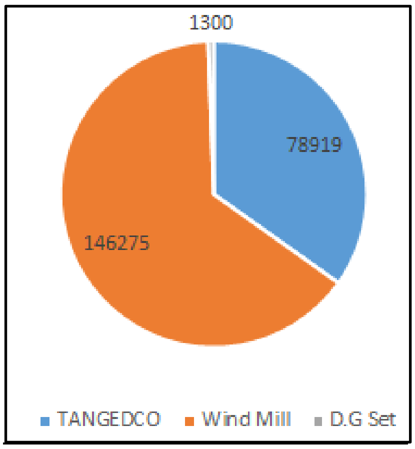

Figure 1 Energy Consumption Pattern

Table 3Electrical Energy Consumption and Cost

SL NO	**Utility of Energy**	**Avg. Consumption/ Month in 2018**	**Cost/ Unit**	**Contribution in %**
1	TANGEDCO	78919	6.76	34.85%
2	Wind Mill	146275	6.00	64.59%
3	D.G Set	1300	20.28	0.56%

Well established power generation infrastructure is maintained in the site with 2kV Diesel Generator as

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backup source. Details of electrical facility shown in Table 4.

Table 4 Electrical Facility

Description	Nos.	Rating
Transformer (kVA)	1	630 KVA
Diesel Generator (kVA)	2	250 KVA & 320 KVA
Capacitors (kVAr – HT/LT)	LT	170 KVAR
M V panel	1	1000 A
Sub Switch Board/Control Panel	7	

Energy Audit was conducted more than a month in various departments in the mill. Major area in the mill are Transformer, Humidification unit, Compressor, Blow room, Ring frame and Spinning unit. Based on the results of power audition, certain recommendations were suggested for improving energy efficiency in the mill(Table 5). Figure 2 shows the graphical representation of Area-wise Energy Efficiency measures.

Table 5: Area-wise Energy Efficiency measures

Energy efficiency measures (Suggested categories of areas energy efficiency improvement for obtaining details of savings)	Investment in Rs.	Life Cycle Years	Annual Energy Savings
Transformer Conventional Transformer has to be changed to Energy Efficient Level 2 Transformer	10,90,000.00	15 - 20 Years	16500 Units
Humidification Plant The area of V Filter and EAD area has to be increasedtoavoid back pressure develops in this system. Adjust the Blade angle of EAF 2 in Exhaust Plant 2 for reducing power to match the airvolume.	60000.00	15 Years	12500 Units
Compressors At presently compressor running continually at 8.9 Kg/cm2 bar through invertercontrol. In the more air leakage in air distribution system and check the air leakages and arrest immediately, after that Pressure setting has to be changed 7.5 Kg/cm^2	65000.00	5 Years	60000 Units
Blow room All Motor transmission "V"beltshas to bechanged to Cogged "V"belts. Connect 7.5 KVAR Capacitor at Controlpanel	25000.00	3 Years	1000 Units
VXL(WRS) All Motor transmission "Belts has to bechanged to Cogged "V"belts. Connect 7.5 KVAR Capacitor at Controlpanel	15000.00	3 Years	2000 Units
Simplex All Motor transmission "V"belts has to be changed to Cogged "V" belts	4500.00	3 Years	1700 Units
Spinning Machine no 1,2,3,5 & 7 Fan Motor impeller has to change to Energy Efficient Impeller	20000.00	5 years	48500 Units

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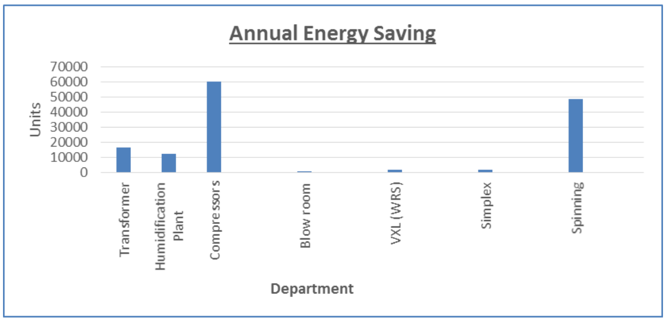

Figure 2 Annual Energy Saving

Table 5 describes department wise Energy efficiency measures, investment amount, Life cycle years and annual energy savings.

II. Detailed Study

Study – 1 - Humidification unit.

Humidification plants have become a critical part of spinning mills. Main load in humidification unit is Exhaust fan motor. The Overall humidification Power pattern of the mill is given in Table 6.

Table 6 Humidification unit Load details

Department	System	Installed Motor KW	Actual Load KW	Load %
Exhaust - Plant 1	EAF - 1	3.70	2.19	59.19%
	EAF - 2	3.70	2.47	66.75%
Exhaust - Plant 2	EAF - 1	3.70	2.73	73.78%
	EAF - 2	3.70	4.43	119.73%

Energy Saving Potential

- Exhaust Air Fan 2 Consumes Excess power of 1.93KWdue to blocking of air in this system and Back pressuredeveloped.
- The area of V Filter has to be increase and EAD area has to be increase to avoidBack pressure develops in this system.
- Adjust the Blade angle of EAF 2 in Exhaust Plant 2 for reducing power to match the air volume.

- The Annual Total Expected Saving will be 12500 Units

Study – 2 - Compressor Department

Table 7 Compressor Load Details

Description	Installed Motor KW	Actual Load KW	% of Load
Compressor	30.00	21.26	70.86%

Recommendations

- At present compressor running continually at 8.9 Kg/cm2 bar through invertercontrol.
- In the more air leakage in air distribution system and check the air leakages andarrest immediately,
- after that Pressure setting has to be changed 7.5 Kg/cm^2.
- The design should ensure that the pressure drop should not be more than 0.5kg/cm² (7 psi) in the longestline. Record the Energy consumption day wise and capacity wise with runninghours.
- The compressor Radiator was chocked and it will cause to increase the energy of compressor and it is advised to clean the radiator at regularinterval.

Table 8 tells air requirement for presently working compressor unit and energy saving recommendations were tabulated in Table 9.

Table 8Air Requirement for the present working Machinery

S. No.	Name of the Machine	Con's in cfm	No of M/c	Total cfm
1	Blow room	0.50	1	0.50
2	Carding LC 300 V 3	0.80	6	4.80
3	Drawing	0.3	2	0.60
4	Simplex LF 1400	1.10	4	4.40
5	Lap Former LH 10	1.20	1	1.20
6	Comber	0.80	4	3.20
7	Spinning	0.75	7	5.25
8	Auto conerSavio polar	25.00	1	25.00
	Total			**44.95**

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Table 9 Energy Saving Recommendations in Compressor unit

Pipe line losses in Cfm Allowable Air Leakages in	5%		2.25
CFM	10%		4.75
Total CFM			**52.00**
Compressor Available in CFM	E 30 Elgi		160.00
Present Avg.loading in CFM			109
Excess consumption in KWhr			**9.77**
Standard Power Consumption/hour		10.00	
Present Power consumption/hour		21.26	
Excess Power consumption/hour		11.26	
The Annual Total Expected Saving will be 80000 Units			

Study 3 - Transformer

Table 10 Transformer Audited Details

Voltage	415.6V
Current	448.8A
Power	307.50W
P.F	0.96
% of V_{Thd}	2.50%
% of I_{Thd}	12.56%

Observations (Table 10**)**

- The Total voltage harmonics (% of V_{thd}) is 2.50 % with capacitors are within the limit as specified in the IEEE 519-1992.i.e.,5%.
- The Total Current harmonics (% of I_{thd}) is 12.56% with capacitors are Excess limit of 8% as specified in the IEEE519-1992.
- The instantaneous power factor is 0.95 to 0.97 lagging withcapacitor.
- The Mill is equipped with 630 KVA outdoor transformer with On Load Tap Changer. Loading Pattern 415.6 V 448 A 307.5 KW P.f 0.97

Recommendation

- Connect 100A Active Harmonic filter at M V Panel to maintain current harmonics within the limit the of 8% as specified in the IEEE 519-1992and maintaining the unity powerfactor.

Study 4 –Feeder

Feeder wise power quality parameters of mill is shown in Table 11.

Table 11 Feeder Details

Description	**SSB 1**	**BRCP**	**VXL**	**SSB 3**	**SSB 2**
Voltage (V)	412.2	420.5	420.3	420.5	420.6
Current (A)	133.2	30.60	52.2	57.8	155.20
Power (W)	100.28	12.54	27.20	37.55	100.53
P.F	0.97 lagg	0.54 lagg	0.66 lagg	0.81 lagg	0.87 lagg
V_{thd}%	1.08%	0.09%	0.09%	0.08%	2.09%
I_{thd} %	21.30%	3.60%	3.90%	2.40%	21.80%
Cable Size	2 Runs of 31/2C,300 SqmmAl. XLPE	1 Runs of 31/2C,70 SqmmAl. XLPE	1 Runs of 31/2C,70 SqmmAl. XLPE	1 Runs of 31/2C,300 SqmmAl. XLPE	2 Runs of 31/2C,300 SqmmAl. XLPE
Remarks	Connect 30 A Active Harmonic filter	NIL	NIL	NIL	Connect 30 A Active Harmonic filter

III. Machine Wise Power Consumption and Saving Potential

In textile mill heart of the place is blow room and spinning unit. Major power saving possibilities are available in these areas. The detailed power consumption and saving potentials are show in Table 12.

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Table 12 Blow Room and Spinning unit expected saving details

Department	Description	Volts	Amps	Power in KW	Power factor	Remarks	Expected Savings
Blow Room	Blow room -	418.8	30.83	12.60	0.58	Connect 7.5 KVAR Capacitor at Control panel All Transmission "V" belt has to be changed to Cogged Belt	1000 Units/Year
	Carding 1 - LC 361	420.3	8.61	5.36	0.84	NIL	NIL
	Carding 2 - LC 361	420.3	8.44	5.04	0.84	NIL	NIL
	Carding 3 - LC300 A V3	420.4	11.37	4.90	0.79	NIL	NIL
	Carding 4 - LC300 A V3	423.5	10.98	4.89	0.74	NIL	NIL
	Carding 5 - LC300 A V3	424.6	11.45	5.66	0.71	NIL	NIL
	Carding 6 - LC300 A V3	424.6	11.67	5.86	0.76	NIL	NIL
	Drawing 1- LDA/1	412.8	6.73	3.65	0.82	NIL	NIL
	Drawing 2- LRSB 851	412.9	6.26	3.28	0.77	NIL	NIL
	Simplex 1- LF 1400	416.7	8.01	5.95	0.96	All Transmission "V" belt has to be changed to Cogged Belt	600 Units/Year
	Simplex 2 - LF 1400A	416.3	7.84	4.57	0.78	All Transmission "V" belt has to be changed to Cogged Belt	1100 Units/Year
Spinning	Ring frame - 1 Fan Motor	419.2	5.77	3.62	0.85	Change the Impeller to Energy Efficient Impeller	9500 Units/Year
	Ring frame - 2 Fan Motor	417.5	5.77	3.81	0.83	Change the Impeller to Energy Efficient Impeller	11000 Units/Year
	Ring frame - 3 Fan Motor	421.6	5.77	3.40	0.81	Change the Impeller to Energy Efficient Impeller	75000 Units/Year
	Ring frame - 4 Fan Motor	419.4	3.50	1.75	0.51	NIL	NIL
	Ring frame - 4A Fan Motor	418.6	3.52	1.50	0.56	NIL	NIL
	Ring frame - 5 Fan Motor	419.6	5.83	3.65	0.85	Change the Impeller to Energy Efficient Impeller	9500 Units/Year
	Ring frame - 6 Fan Motor	419.2	4.19	2.53	0.77	NIL	NIL

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	Ring frame - 7 Fan Motor	417.6	6.13	3.93	0.89	Change the Impeller to Energy Efficient Impeller	11000 Units/Year
	Ring frame - 1 OHTC	419.1	2.79	1.48	0.73	NIL	NIL
	Ring frame - 3 OHTC	421.4	2.45	1.54	0.84	NIL	NIL
	Ring frame - 5 OHTC	417.8	3.18	1.86	0.79	NIL	NIL
	Ring frame - 7 OHTC	417.6	3.06	1.82	0.82	NIL	NIL
	AutoconerM/c 1	418.7	23.60	16.70	0.97	NIL	NIL

Conclusion

Energy audit was conducted for more than a month in the above said textile mill. The detailed audit was conducted department wise and machine wise. Power quality parameters were recorded. Based on energy auditing parameters the recommendations were given. If all the above-mentioned recommendations were implemented the energy can be saved and it will be economical also. Saving energy in turn saves the natural resource of the nation. Currently the wind power is consumed by the mill in a large scale. Solar energy can be used in future.

REFERENCES

1. Joseph, T., Varghese, H. T., Panicker, C. Y., Thiemann, T., Viswanathan, K., Van Alsenoy, C., &Manojkumar, T. K. (2014). Spectroscopic (FT-IR, FT-Raman), first order hyperpolarizability, NBO analysis, HOMO and LUMO analysis of 2, 4-bis (2-methoxyphenyl)-1-phenylanthracene-9, 10-dione by ab initio HF and density functional methods. SpectrochimicaActa Part A: Molecular and Biomolecular Spectroscopy, 117, 413-421.
2. Kumar, M. S. R., Amudha, A., & Rajeev, R. (2016). Optimization For A Novel Single Switch Resonant Power Converter Using Ga To Improve Mppt Efficiency Of Pv Applications. International Journal of Applied Engineering Research, 11(9), 6485-6488.
3. Sridhar, K. P., Baskar, S., Shakeel, P. M., &Dhulipala, V. S. (2019). Developing brain abnormality recognize system using multi-objective pattern producing neural network. Journal of Ambient Intelligence and Humanized Computing, 10(8), 3287-3295.
4. BalachanderKalappan, D., &Ponnusamy, V. (2013). Optimization of Cost of Energy of Real Time Renewable Energy System Feeding Commercial Load Case Study: A Textile Show Room in Coimbatore, India. Life Science Journal, 10(7s).
5. Balachander, K., &Vijayakumar, P. (2012). Optimization, simulation and modeling of renewable electric energy system with HOMER. International Journal of Applied Engineering Research, 7(3), 247-256.
6. Sakthivel, N. R., Nair, B. B., &Sugumaran, V. (2012). Soft computing approach to fault diagnosis of centrifugal pump. Applied Soft Computing, 12(5), 1574-1581.
7. Manikandan, V., Shanmugasundaram, K., Shanmugan, S., Janarthanan, B., &Chandrasekaran, J. (2013). Wick type solar stills: A review. Renewable and sustainable energy reviews, 20, 322-335.
8. Baskar, S., Periyanayagi, S., Shakeel, P. M., &Dhulipala, V. S. (2019). An energy persistent range-dependent regulated transmission communication model for vehicular network applications. Computer Networks, 152, 144-153.
9. Sivakumar, D., Amudha, A., Balachander, K., Siva Ramkumar, M. 2019, Implementation of harmonic mitigation of grid connected modified MLI for variable-speed wind energy conversion system, Mathematical and Computational Forestry and Natural-Resource Sciences, 11(1), pp. 223-230.

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10. Sankar, N.A., Balachander, K., Amudha, A., Divyapriya, S., Siva Ramkumar, M. 2019, Compensation of voltage variations in distribution system during fault condition by using separate energy storage device based DVR, Mathematical and Computational Forestry and Natural-Resource Sciences, 11(1), pp. 1-256.
11. Balachander, K. 2019, Design and hardware implementation of portable generator using TEG, International Journal of Innovative Technology and Exploring Engineering, 8(10), pp. 843-846.
12. Balachander, K., Amudha, A. 2019, Energy saving measures in textile mill, International Journal of Innovative Technology and Exploring Engineering, 8(8), pp. 2026-2032.
13. Balachander, K., Amudha, A. 2019, Energy economy recommendations in textile mill, International Journal of Engineering and Advanced Technology, 8(4), pp. 168-176.
14. Kalaivani, M.N., Balachander, K. 2019, A performance analysis of the doubly-fed induction generator under unbalanced grid voltage conditions, Journal of Advanced Research in Dynamical and Control Systems, 11(3 Special Issue), pp. 1073-1083.