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Energy Audit for Industries and Institution

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***Abstract*—An Energy Audit is an inspection, survey and analysis of energy flows for energy conservation in a building to reduce the amount of energy input into the system without negatively affecting the output. In other words energy audit is simply a study of a plant or facility to determine how and where energy is used and also to identify various methods for energy saving. This audit conducted to seek the opportunities to improve the energy efficiency of the campus & industry. The purpose of energy audit is to identify, and prioritize cost saving and measures relating to energy use in each section the industry. Reduction of energy consumption while maintaining or improving human comfort, health and safety were of primary concern. Beyond simply identifying the energy consumption pattern, energy audit also helps to identify the most energy efficient appliances. The purpose of this energy audit is to identify, quantify, describe and prioritize cost saving measures relating to energy use on the industry of "Textile mill" and also in the campus of "Kamaraj College of Engineering and Technology (KCET)". The only feasible way to handle energy crisis apart from capacity addition is the efficient use of available energy requirement per unit of output. The report accounts for the energy consumption patterns of the Industry and our campus based on actual survey and detailed analysis during the audit. It also includes the identification of areas of energy wastage and estimation of energy saving potential. There are several type of audit.**

Keywords – Energy Audit; Voltage Optimization;

I. INTRODUCTION

A Textile Mill- Aruppukottai evinced interest in availing the services of KCET students-virudhunagar for conducting a detailed Energy Audit at the Textile Mill specific areas. And also conducting a energy audit for college campus at KCET power house. The methodology adopted for conducting the detailed energy audit at following steps.

- Basic data collection on list of EB bill, consuming equipment, capacities of the major equipment and operating parameters.
- Measurement of operating parameters for various equipment to estimate their operating efficiency
- Power measurements of major electrical equipment's
- Analysis of data collected and measurements to develop specific energy saving proposals.
- Presentation on the finding of the detailed Energy Audit to the textile mill personnel and KCET power house personnel.

II. RELATED WORKS

M.Fasiuddin, i.budaiwi were discussed energy efficient design and operation of HVAC systems in commercial buildings can offer major oppertunties for reduced energy consumption [2].Eneshosgor,paul s.fischbeck were discussed an iterative regression approach to complete there energy efficiency reservoir map across individual homes [3]paolo principi,robertofioretti,alessandro carbonari were proposed evalution of energy conservation opportunities through energy performance contracting a case study the development model to breakdown the overall consumption and to estimate potential savings [4]. Energy monitoring and conservation potential in school bullidings in the c' climate zone of greace to assess the energy performance based the monitored data of school bulidings in the c' climate zone of Greece a region with the lowest air temperature during winter period. The objective of the proposed work is to conduct energy audit in industry and KCET. An energy audit is an inspection, survey and analysis of Energy flows, for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the outputs.

III. INDUSTRY DETAILS

The Textile mill was incorporated in 2005 by a well established family under HUF. Since its inception it has vowed to become one of the leading Yarn & Fabric manufacturing industries and produce only quality products catering to the global textile market.

TABLE I. INDUSTRY DETAILS

Individual	Spinning
Permitted demand	1210KVA
Service type	HT(High Tension)
Major role	Spinning

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A. Possible loads for energy concervation

- Supplier fan-1
- Supplier fan-2
- Spinning motor

We have set the voltage at 420V in the main supply and measured voltage, current, frequency and power in the supplier fan 1 by using power and harmonic meter shown in Fig. 1. and also measured the wind speed by using anemometer Fig.

Phases	Input voltage (V)	Motor voltage(V)	Current (A)	Power(kW)	Wind Speed (m/s)
R	400	399	13	7.1	11.1
Y		399	13.7		
B		401	13		
R	413	416	13.3	7.6	11.4
Y		413	13.7		
B		412	13.5		
R	420	420	13.4	7.8	11.8
Y		415	13.8		
B		415	13.5		

Fig. 1. Snapshot during Power Measurement

TABLE II. SPECIFICATION FOR SUPPLIER FAN - 1

Name Plate Details	
Motor Type	Induction Motor
Rated Voltage	390-440V
Rated Current	20A
Power Rating	15HP
Kw	11 KW
Connection	Delta
Efficiency	0.95

Name Plate Details	
Motor Type	Cage Induction Motor
Rated Voltage	425 V
Rated Current	11 A
Power Rating	7.5HP
Kw	5.5 KW
Rated Speed	960 rpm
Efficiency	0.95

TABLE III. POWER ANALYSIS

TABLE IV. ENERGY CONSERVATION

S.No	Average Voltage	Average Current	Average Power
1.	400 V	13.1 A	7.1 KW
2.	415 V	13.6 A	7.6KW

Load Duty = 24 Hours
Power Savings per supplier fan= 500Watts
Power Savings in two supplier fans= 1kW
Energy Savings = 24kWh
Energy Cost Savings per day = 5.42*24= Rs.130
Energy Cost Savings per month = Rs.3900
Energy Cost Savings per year = Rs.46800

B. Energy and Cost savings

TABLE V. ENERGY AND COST SAVINGS

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S.No	Energy saving/ Wh	Cost saving/month	Cost saving/year
1.	500	3900	46800

2. Supplier fan – 2

TABLE VI. SPECIFICATION FOR SUPPLIER FAN - 2

Name Plate Details:	
Motor Type	Induction Motor
Rated Voltage	390-440V
Rated Current	20A
Power Rating	15HP
Kw	11 KW
Connection	Delta

Fig 2. *Snapshot during* Wind Speed *Measurement*

TABLE VII. POWER ANALYSIS FOR SUPPLIER FOR - 2

Phases	Input voltage (V)	Motor voltage(V)	Current (A)	Power (kW)	Wind Speed (m/s)
R	398	389	9.0	**4.1**	11.3
Y		386.3	8.9		
B		385.9	9.2		
R	411	407.2	9.1	4.3	11.6
Y		406.3	9.1		
B		405.3	9.5		
R	423	423	9.3	4.6	11.9
Y		421.9	9.3		
B		420.4	9.4		

A.Energy conservation

TABLE VIII. ENERGY CONSERVATION

S.No	Average Voltage	Average Current	Average Power
1.	400 V	9.1A	4.1 KW
2.	420 V	9.4 A	4.3KW

Load Duty = 24 Hours
Power Savings per supplier fan= 200Watts
Power Savings in three supplier fans= 600W
Energy Savings = 14.4kWh
Energy Cost Savings per day = 5.42*24= Rs.78
Energy Cost Savings per month = Rs.2341
Energy Cost Savings per Year = Rs.28097

B. Energy and Cost savings

TABLE IX. ENERGY AND COST SAVING

S.No	Energy saving/ kWh	Cost saving/month	Cost saving/year
1.	14.4	2341	28097

3. Over Head Cleaner Motor

TABLE X. SPECIFICATION FOR OHC MOTOR

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(b)

Fig 3. *Snapshot for blower motor*

TABLE XI. POWER ANALYSIS FOR OHC MOTOR

A.Energy conservation

TABLE XII. ENERGY CONSERVATION

S.No	Average Voltage	Average Current	Average Power
1.	400 V	2.5A	1.29KW
2.	415 V	2.6A	1.40KW

Load Duty = 24 Hours
Power Savings per OHC motor = 110Watts
Power Savings in 18 OHC motor = 400W
Energy Savings = 7.2kWh
Energy Cost Savings per day = 5.42*24= Rs.39
Energy Cost Savings per month = Rs.1170
Energy Cost Savings per Year = Rs.14048

IV. ENERGY AUDIT AT KAMARAJ COLLEGE OF ENGINEERING AND TECHNOLOGY

Our College was established in the year 1998. It is promoted and supported by virudhunagar Hindu Nadars' devasthanam, various Hindu Nadars' mahamai Tharappus in virudhunagar and other places and educational institutions of virudhunagar. The management of the institution consists of the elected members of various Mahamai Tharappus and ex-officio members of various educational institutions of virudhunagar. The office bearers, the president, the vice-president, the secretary, the join secretary and the treasurer - are elected by the managing board members.Presently,the college spans to 45 acres of land.

B .Specialties

TABLE XIII. INSTITUTION DETAILS

Individual types	Institute
Permitted demand	500KVA
Service type	HT(high tension)service
Major role	Educational Institute

C.Energy Conservation Loads

1. Different voltage setting analysis in transformer.
2. Capacitor bank analysis in power house.

1. Different Voltage setting analysis in transformer

S.No	Input voltage (V)	Motor voltage(V)	Current (A)	Power (kW)	Wind Speed (m/s)
R	398	389	2.6	**1.29**	6.22
Y		386.3	2.5		
B		385.9	2.6		
R	411	407.2	2.6	1.4	6.22
Y		406.3	2.7		
B		405.3	2.7		
R	423	420	2.7	1.51	6.21
Y		418	2.8		
B		419	2.7		

The institute runs at 415v before our analysis.we measured the energy consumption per day and also we analysed from monday to friday at evening 5:30pm.Next week we did the same procedure at 400v by using On load tap changing transformer(OLTC).

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Fig 4. *Snapshot during unit measurement*

TABLE XIV. MEASUREMENT FOR DIFFERENT VOLTAGE

S. No	Date	Day	Time	Voltage (V)	Energy Meter Reading (kW)	Net Unit (kW)
1	09/01/2017	Monday	5.30	404	1591629-1595143	3514
2	10/01/2017	Tuesday	5.30	402	1595143-1598687	3544
3	11/01/2017	Wednesday	5.30	402	1598687-1602296	3609
4	12/01/2017	Thursday	5.30	402	1602296-1605436	3140
5	03/02/2017	Friday	5.30	403	1650593.7-1654146.4	3552.3
6	30/01/2017	Monday	5.30	413	1635236.9-1639083.7	3846.8
7	31/01/2017	Tuesday	5.30	412	1639083.7-1643084.2	4000.5
8	24/01/2017	Wednesday	5.30	413	1619543.0-1623507.5	3964.5
9	08/02/2017	Thursday	5.30	413	1666007.0-1669787.0	3780
10	27/01/2017	Friday	5.30	414	1625617-1629659.5	4042.5

A.Energy Conservation:

TABLE XV. AVERAGE UNIT BETWEEN 400V AND 415

S.No	Average Unit in 400 V	Average Unit in 415 V
1.	17359.3	19634.3

19634.3 – 17359.3 = 2275

TABLE XVI. ENERGY AND COST SAVINGS

S.No	Energy saving/week	Cost saving/month	Cost saving/year
1.	611.2	Rs.8316.68	99800.23

1 unit = Rs.6.35
2275 * 6.35 = 14446.25 /week

B. Energy and Cost Saving Table:

TABLE XVII. ENERGY AND COST SAVINGS

S.No	Energy Saving/week	Cost saving/ Month	Cost saving/ Year
1.	2275	Rs.57,786	Rs.693433

we measured the energy consumption at capacitor on and off condition during night time for two weeks.

1. First week we measured the energy consumption-on load capacitor at 7:00 P.M.
2. Next week we measured the energy consumption-off load capacitor at 7:00 P.M.

TABLE XVIII. CAPACITOR BANK ANALYSIS IN POWER HOUSE

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S.No	Day	Voltage	Capacitor Bank		Energy Meter Reading		Net Unit
			On	Off	Night(7 pm)	Morning (7 am)	
1.	Monday	402			1595384.0	1596559.0	1175.0
2.	Tuesday	403			1598901.0	1600076.0	1175.0
3.	Wednesday	402			1623730.0	1624781.0	1051.0
4.	Thursday	402			11625777.9	1626856.7	1078.8
5.	Friday	402			1587168.4	1588237.7	1069.3
6.	Monday	413			1639264.9	1640577.8	1312.1
7.	Tuesday	415			1643303.0	1644544.7	1241.7
8.	Wednesday	413			1647179.7	1648412.2	1232.5
9.	Thursday	413			1650755.7	165196.2	1213.9
10.	Friday	415			1629796.0	1630953.0	1159.0

Fig 4. *Snapshot during unit measurement*

B.Energy Concervation

TABLE XIX. AVERAGE BETWEEN 400V AND 415V

S.No	Average unit in 400V	Average unit in 415V
1	5548	6159

A. Energy and Cost Saving Table:
6159.2 – 5548 = 611.2 unit.
1 unit = Rs.6.35
611.2* 6.35 = 3881.12 / week.

A. Energy Saving Bill:

TABLE XX. ENERGY SAVING BILL

S.No	Year - Month	Cost of Year	Cost of Savings
1.	2016 - Feb	Rs.9,34,704.00	Rs.82316
2.	2017 - Feb	Rs.8,52,388.00	

V. CONCLUSION

Energy conservation is achieved in both Industry and Institution. The energy saving cost of Rs.89,945/year in the textile industry and 82,000/month in KCET.

REFERENCES

[1] M.Fasiuddin, I.Budaiwi, "HVAC system strategies for conservation in commercial buildings in Saudi Arabia," Architectural Engineering Department,King Fahd university of Petroleum and minerals,Dhahran,Saudi Arabia, Energy Buildings 42 (2011) 3457-3466.

[2] Enes Hosgor, Paul S.Fischbeck, "Virtual home energy auditing at scale:Predicting residential energy efficiency using publicly available data," Department of Enginering and public policy, Carnegie mellonuniv, pihs bursh,PA,USA,EEme,LLc, Energy builidings 92 (2015) 67-80.

[3] Paolo Primcipi,Roberto Fioretti,Alessandro Carbonari,Massimolemma. "Evaluation of Energy Conservation Oppertunities through energy performance contracting A Case Study," Renewable Energy 128 (2016) 886-889.

[4] A.Dimoudi, P.Kostarela, "Energy Monitoring and conservation potential in school buildings in the C' Climatic zone of Greece," Hellenic open university, MSC Course "Environmental Design of cities and Buildings; pora Greece, Energy Buildings 34(2009) 289 -296.

[5] D.P. Winston, M. Saravanan, "Single parameter fault identification technique for DC motor through wavelet analysis and fuzzy logic", Journal of Electrical Engineering Technology, Vol.8 (5), 2013, pp. 1049–1055.

[6] M. Mahendran, V. Anandharaj, K. Vijayavel and D. Prince Winston, "Permanent Mismatch Fault Identification of Photovoltaic Cells Using Arduino"

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

ICTACT Journal on Microelectronics, July 2015, VOL: 01, ISSUE: 02.

[7] P Pounraj, D Prince Winston, S Cynthia Christabel, R Ramaraj "A Continuous Health Monitoring System for Photovoltaic Array Using Arduino Microcontroller", Circuits and Systems, Vol.7, Issue.11, 2016, pp.3494.

[8] D Prince Winston, M Saravanan, "A Modified Energy Conservation Circuit for Chopper fed DC Motor Drive", Przegląd Elektrotechniczny, Vol. 88, Issue.12a, 2012, pp.295-296.

[9] D Prince Winston, M Saravanan, S Arockia Edwin Xavier, "Neural Network Based New Energy Conservation Scheme for Three Phase Induction Motor Operating under Varying Load Torques", International Conference on Process Automation, Control and Computing (PACC), 2011, pp.1-6.

[10] D Prince Winston, M. Saravanan, "Novel Energy Conservation Scheme for Three Phase Induction Motor Drives Employed in Constant Speed Applications", Przegląd Elektrotechniczny, Vol. 88, Issue.11a, 2012, pp.243-247.

[11] K. Gurumoorthy, D. Prince Winston, D. Edison Selvaraj and Lieutenant. J. Ganesan, "Reduction of Harmonic Distortion by applying various PWM and Neural Network Techniques in Grid connected Photovoltaic Systems," IJAREEIE, vol. 2, Issue 12, December 2013.

[12] O. Jeba Singh, D. Prince Winston, "A Survey on Classification of Power Quality Disturbances in a Power System" Journal of Engineering Research and Applications, Vol. 4, Issue 8(Version 2), August 2014, pp.80-84.

[13] P. Manikandan, V. Neviya, Lieutenant.J. Ganesan, D.Prince Winston "Experimental Analysis of Total Harmonic Distortion by Applying Various PWM Techniques on Three Phase Squirrel Cage Motor", International Journal of Research in Computer Applications and Robotics, Vol.2 Issue.2, pp. 82-92 February 2014.