

Energy Audit and Conservation Activities at Someshwar Sugar Mill

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ABSTRACT: The project highlights the energy generation & consumption pattern with respect to economic growth and presents challenges faced by Indian energy sector. Indian energy policies relating to industrial energy efficiency over the past 2 decades are briefly reviewed. The idea of the project is to conduct large scale energy audit study under state's energy conservation program in order to assess the level of awareness of energy efficiency and its possible economic benefits, implement the new technologies for saving electricity hence our resources. We try to maximum use the renewable energy for our implementations. This project starting from India's energy scenario explains the ever increasing growth in energy demand which is hurdled by economic & carbon emission constraints. It further explains how this problem can be effectively addressed with the tool of energy audit by achieving energy efficiency in the industry level. Walk through energy audit is to identify and address immediate energy saving measures which includes electrical energy management, electrical motors and lighting, compressor, tariff analysis. First detailed energy audit was conducted in SSSK Sugar mill campus. This paper concludes that current state's energy conservation programs can be effectively employed in resulting in huge savings by addressing immediate & targeted energy audits.

KEYWORDS: energy saving, audit, economical efficiency

I. INTRODUCTION

This project was selected in order to reach out to the industries/ commercial sector in order to achieve energy savings by carrying out energy audit. The core objective was to assess the level of awareness about the possible benefits of energy efficiency to different sectors of industries right from small & medium scale industry to large scale industry and address the possible energy efficiency measures right from economic & performance aspect. This is achieved by conducting large scale walk through energy audit in an industrial area and commercial fields in order to have the inclusive picture of the energy consumption scenario & scope of energy efficiency potential. The project is also aimed at conducting detailed energy audit at larger industries and commercial by quantitative assessment of the extent of rational use of energy and deriving recommendations by not only considering available data but also undertaking instrumented measurements and testing of major energy consuming sub-systems which are sensitive to energy cost of the product. The objective of the detailed energy audit is to the operations of energy intensive equipment/systems for identification of potential areas wherein energy savings are practically feasible.

II. RELATED WORK

What is Energy Audit?

According to Energy Conservation Act of 2001 (BEE 2008), an energy audit is defined as: "The verification, monitoring and analysis of the use of energy and submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption." An energy

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Vol. 6, Issue 5, May 2017

audit can be simply defined as a process to evaluate where a building or plant uses energy, and identify opportunities to reduce consumption. An energy audit involves a systematic study of energy consuming processes and equipment with a view to identify the flow of energy, efficiency of energy utilization, and areas and amounts of wastage of energy, thereby indicating possibilities for saving energy without negatively affecting the outputs. Beyond simply identifying the sources of energy use, an energy audit seeks to prioritize the energy uses according to the greatest to least cost effective opportunities for energy savings. The energy audit provides a benchmark, or reference point, for managing and accessing energy use across the organization and provides the basis for ensuring more effective use of energy. Energy audits do not provide the final answer to the problem.

III. MAIN OBJECTIVES OF ENERGY AUDIT

- i. Analyse the energy consumed and wasted
- ii. Develop ways and means to utilize the available energy in the most efficient manner by the use of energy efficient devices. To identify and analyse alternatives such as improved operational techniques and/or new Equipment that could substantially reduce energy costs.
- iii. To perform an economic analysis on those alternatives and determine which ones are cost-effective for the business or industry involved. Adopt suitable operational strategies, and time scheduling.

Types of Energy Audit:

The type of energy audit to be performed depends on the type of industry, the depth to which Final audit is needed, and the potential and magnitude of cost reduction desired. Thus energy Audit can be classified into the following types:

- Walk through Audit,
- Targeted Energy Audit,
- Detailed Energy Audit.

IV. SUGAR PROCESS

The process of sugar formation in sugar mill is as shown below flowchart of mill work

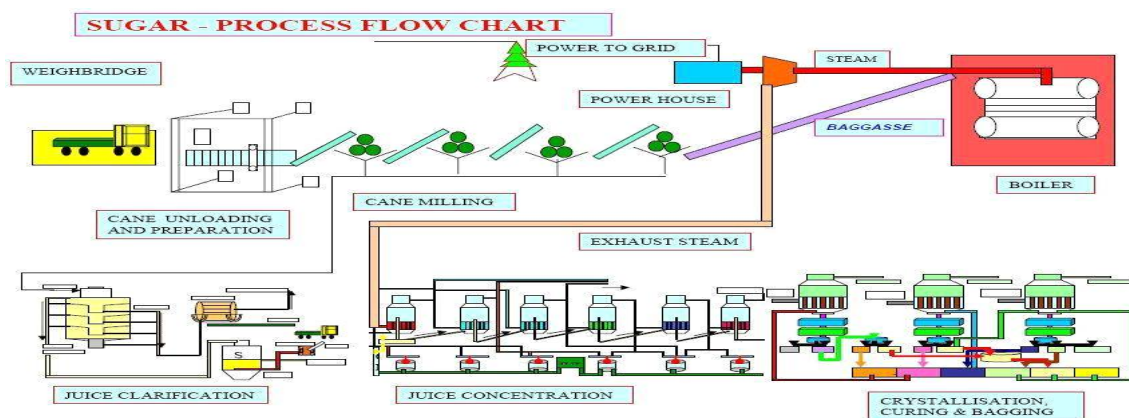


fig. sugar mill process

1. Cane receiving and unloading (receive the cane at the factory and unload it from the transport vehicles)
2. Cane preparation (cutting and shredding cane to prepare it for juice extraction)
3. Juice extraction (two technologies are in common use; milling or diffusion)

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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Vol. 6, Issue 5, May 2017

4. Juice clarification (remove suspended solids from the juice, typically mud, waxes, fibres)
5. Juice evaporation (to concentrate the juice to a thick syrup of about 65°brix)
6. Syrup clarification (remove suspended solids from the syrup, typically colloid syze of mud, waxes, fibres, etc.)
7. Crystallisation
8. Centrifugation (Separation of the sugar crystals from the mother liquor, done by centrifugal machines)
9. Sugar drying
10. Packaging and delivery

These processing steps will produce a brown or raw sugar. Mill white sugar also known as plantation white sugar can be produced by introducing some form of colour removal process (often sulphitation) between the juice clarification and the juice evaporation stages mentioned above.[1] The raw sugar produced is often refined to produce white sugar. This sugar refining can be done either at a completely separate factory or at a back-end refinery which is attached to the raw sugar factory.

V. LOAD ANALYSIS

Total connected load analysis shown below which shows that total connected load and percent loading of each part of loading section and the efficiency of various motors

Particulars	Voltage	Current	Power Measured KW	PF	Rated KW	% Loading of Motor
Mill Section						
Feeding Table 1	418	25	14.11	0.78	18.5	76%
Feeding Table 2	414	22.5	11.45	0.71	18.5	62%
Feeding Table 3	412	26	12.8	0.69	18.5	69%
Feeding Table 4	414	28	14.65	0.73	18.5	79%
Leveller	11193	60	561	0.48	1250	45%
Fibrizer.1	11235	53.6	743	0.71	1250	59%
Firizer.2	11200	52	708	0.68	1250	57%
Mill.1	664	551	480	0.75	750	64%
Mill.2	664	463	302	0.76	560	54%
Mill.3	615	635	386	0.77	560	69%
Mill.4	613	699	431	0.78	560	77%
Mill.5	661	631	403	0.74	560	72%
Rack Carrier 1	414	40.8	19.8	0.83	30	66%

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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Vol. 6, Issue 5, May 2017

Rack Carrier 2	418	38.1	18.6	0.83	30	62%
Rack Carrier 3	414	31.4	15.3	0.84	30	51%
Rack Carrier 4	416	25.9	12	0.79	30	40%
Cane Unloader 2	410	40	19.31	0.68	22	88%
Cane Cane Loader 2	411	45	19.86	0.62	22	90%
Cane Carrier	417	62	25	0.73	75	33%
Cane Chopper	414	310	101	0.45	375	27%
Cane Kicker	408	114	36.9	0.45	110	34%
Equilizer (Pusher)	411	20	12.24	0.86	15	82%
Straind Juice Pump	408	53.7	34	90	75	45%
Unstraind Juice Pump	407	18.6	7.65	0.58	30	26%
Unstraind Juice Pump	409	15.9	7.85	0.7	22	36%
Straind Juice Pump	410	143	87.4	0.85	132	66%
Straind Juice Pump	412	68	43	0.88	45	96%
Imbibition Juice Pump	418	20	12.45	0.86	15	83%
Imbibition Juice Pump	415	22	13.28	0.84	15	89%
Hot Water Pump	414	68.6	44.3	0.9	45	98%

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Issue 5, May 2017

Rotary Screen.1	414	17.8	11	0.88	11	100%
MCC 18 A						
Main Bagasse Carrier	413	85	49.2	0.81	90	55%
Return Bagasse Carrier	411	34.5	21.2	0.86	55	39%
New Mill Elevator.1	410	40.1	21.8	0.76	45	48%
New Mill Elevator.2	418	31.5	10.3	0.45	45	23%
Belt Carrier.1	415	7.36	2.2	0.42	11	20%
Belt Carrier.2	419	8.24	1.68	0.28	11	15%
Clarification						
						31%
Sulphar Juice Pump	419	66.8	41.3	0.85	132	
						98%
Syrup Bhatti Blower	414	30	17.6	0.82	18	
						73%
Clear Juice Pump	414	47.2	32.8	0.97	45	
						73%
Clear Juice Pump	404	54.6	32.7	0.85	45	
						87%
Vacuume Pump.11	416	103	65	0.88	75	
Evaporator						
						75%
Sulphate Syrup Pump	415	65	41.11	0.88	55	
						89%
Semikesner Juice Transfer Pump	415	25	16.1	0.9	18	

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Vol. 6, Issue 5, May 2017

						77%
Falling Film Condensate Pump	420	22	14.24	0.89	18.5	
Circulation Pump 2	415	150	94.87	0.88	112	85%
Transfer Pump	418	60	36.92	0.85	45	82%
Transfer Pump	415	55	33	0.84	37	89%
Circulation Pump	420	145	91.76	0.87	110	83%
Semikesner Condensate Pump	425	30	18.1	0.82	22	82%
Melter Pump	428	28	16.6	0.8	22	75%
Pan Reciver Pump	421	15	8.64	0.79	11	79%
Injection						
Service Water Pump.2	410	45	28.1	0.86	30	94%
Injection Pump	419	98	61	0.85	75	81%
Injection Water Pump	421	99	64	0.88	75	85%
Injection Water Pump	419	98	61	0.85	75	81%
Injection Water Pump	413	117	75	0.89	75	100%
Injection Water Pump	421	260	155	0.82	160	97%

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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Vol. 6, Issue 5, May 2017

						98%
Injection Water Pump	425	255	157	0.84	160	
						71%
Service Water Pump 1	424	66	39	0.81	55	
						73%
Service Water Pump 3	422	63	40	0.86	55	
						116%
Spray Pump	417	219	116	0.73	100	
						80%
Spray Pump	418	141	79.6	0.77	100	
						91%
Spray Pump	420	160	100	0.85	110	
						89%
Spray Pump	419	165	98	0.82	110	
Crystallizer						
						95%
C : Maskate Crystlizer : 1	410	18	10.4	0.82	11	
						93%
C : Maskate Crystlizer : 2	415	17	10.26	0.84	11	
B2 Stirrer	419	15	9.36	0.86	11	85%
						88%
B : Masket Crystlizer	411	16	9.68	0.85	11	
						94%
B : Masket Crystlizer	415	18	10.35	0.8	11	
						75%
C : Masket Vacuume Crystlizer	418	10	5.64	0.78	7.5	
						80%
B : Seed Masket Crstlizer	420	11	6	0.75	7.5	
						88%
B : Masket Crystlizer	415	17	9.65	0.79	11	

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Issue 5, May 2017

A : Heavy Stirrer	418	8.5	5.16	0.84	7.5	69%
B : Masket Crystlizer	420	15	9.38	0.86	11	85%
B : Masket Crystlizer	420	15	9.27	0.85	11	84%
C : Light Stirrer	420	9	5.23	0.8	7.5	70%
Dry Seed Crystlizer	419	12	6.79	0.78	7.5	91%
Vacuume Crystlizer	419	25	14.15	0.78	18	79%
A : Masket Crystlizer	422	17	10.56	0.85	11	96%
A : Masket Crystlizer	425	14	8.65	0.84	11	79%
A : Masket Crystlizer	419	18	11.23	0.86	15	75%
A : Masket Crystlizer	415	20	11.78	0.82	15	79%
A: Masket Crystlizer	415	22	12.65	0.8	15	84%
A : Masket Crystlizer	419	19	12	0.87	15	80%
B: Masket Crystlizer	419	35	21.58	0.85	30	72%
B : Masket Crystlizer	419	25	13.42	0.74	18	75%
A : Masket Crystlizer	418	18	10.94	0.84	15	73%
A : Masket Crystlizer	420	18	10.47	0.8	15	70%
Vacuume Crystlizer	415	25	14.01	0.78	18	78%

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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Vol. 6, Issue 5, May 2017

Centrifugal Section						
						43%
Contineous Machine No-10	423	81.8	56.33	0.94	132	
						45%
Contioneous Machine No- 11	416	81.8	50	0.85	110	
						50%
Contineous Machine No-13	422	80.8	55.51	0.94	110	
						98%
Contineous Machine No-14	422	181	129	0.98	132	
						70%
Contineous Machine No-15	413	134	92	0.96	132	
						75%
Contineous Machine No-16	422	145	99	0.94	132	
						47%
Contineous Machine No-20	416	91.7	62.1	0.94	132	
						46%
Contineous Machine No-21	417	92.4	60.72	0.91	132	
						78%
Contineous Machine No-22	410	180	103	0.81	132	
						87%
Batch type DC Drive 2	422	353	126	0.48	145	
						91%
Batch type DC Drive 3	420	255	132	0.71	145	
						83%
Batch type DC Drive 5	419	347	120	0.47	145	
						98%
Batch type DC Drive 6	411	294	142	0.68	145	

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 5, May 2017

						95%
Batch type DC Drive 7	420	448	138	0.42	145	
New Hopper	416	14.1	9.54	0.94	15	64%
New Hopper	422	16.7	11	0.91	15	73%
Old Hopper	421	13.2	9.04	0.94	15	60%
New Grader	408	15.1	9.92	0.93	15	66%
75 TPH Boiler						
ID Fan 1	415	250	177	0.99	187	95%
ID Fan 2	415	245	174	0.99	187	93%
SA Fan : 2	420	210	137	0.9	160	86%
Transfer Pump : 2	415	29	18.55	0.89	22.3	83%
FD Fan	418	165	108	0.91	125	86%
Feed Water Pump 1	421	151	97	0.88	125	78%
Feed Water Pump 3	418	149	96	88	132	73%
90 TPH Boiler						
Transfer Pump 3	420	29	19.19	0.91	22	87%
FD Fan	420	180	120	0.92	150	80%
Feed Water Pump 6	422	350	227	0.89	250	91%
ID Fan 3	425	295	190	0.88	225	84%
ID Fan 1	422	303	198	0.9	225	88%
ID Fan 2	422	284	155	0.75	225	69%
New PS Fan : 2	424	75	43	0.79	55	78%

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Vol. 6, Issue 5, May 2017

						91%
Air Compressor 2	418	15	9.99	0.92	11	
20TPH Boiler						
						75%
Feed Water Pump 1	415	65	41	0.89	55	
FD Fan	419	45	28	0.88	30	93%
ID Fan 1	419	215	131	0.84	150	87%
SA Fan	419	28	18.89	0.93	22	86%
New ETP						
Blower 2	402	22.5	15.5	0.99	30	52%
Treatet Pump	402	19	12.5	0.95	18.5	68%
Blower.4	404	14.6	8.83	0.87	15	59%
Jangamwadi Motor	406	28	17.91	0.91	18.6	96%
Holding Tank.1	396	29.6	17.4	0.86	18.6	94%
Old ETP						
						83%
Blower no.22	404	20	12.5	0.9	15	
Jackwell .Stage.1						
Pump.1	460	58.2	38.1	0.82	45	85%
Jackwell Stage.2						
Pump.1	429	41.8	16.4	0.53	30	55%
Pump.2	425	43.8	15.9	0.5	30	53%

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Issue 5, May 2017

Fig. Lightning load analysis

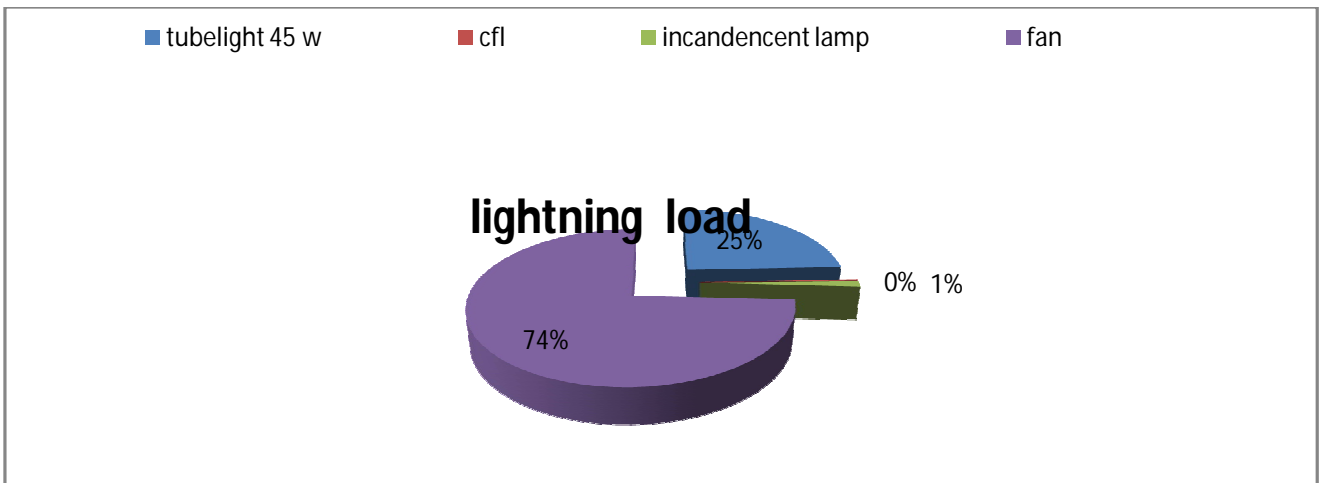
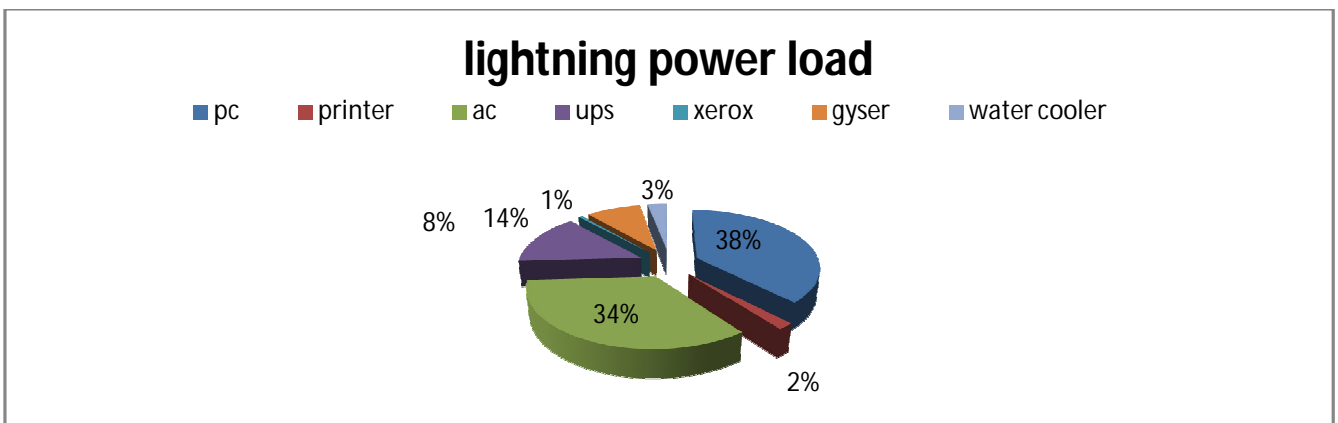


Fig. Power load analysis



VI. CONCLUSION

In this project, we studied and performed the detailed electrical energy audit of a Government entity. We found the potential areas where energy can be conserved in an efficient manner and thus formulated specific measures for proper utilization of energy.

We concluded that if the recommendations given in this case study are implemented, then the total annual energy saving can be achieved around 10-15% of the total energy consumption.

VII. FUTURE SCOPE

Taking into consideration the present energy scenario in India and the rapid increase in the demand for electrical energy, Energy Audit is extremely useful in finding the potential points that need to be focused in any sector so that optimum energy can be utilized.



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Since energy production is a very costly affair, every unit of energy must be saved and used appropriately so that energy can be spent efficiently. The audit gives considerable savings in the operational costs and maintenance costs of various devices/ equipments and also increases the life of devices and safe atmosphere for the staff and labour to continue their work.

Energy savings suggestions

- Energy saving in fiberiser with installation of vfd
- Installation of HT Capacitor at HT Busbar of Fibrizer
- Installation of Planetary Gear Box Instead of Traditional
- Fuel Saving By Increasing the Temperature of Boiler Feed Water by 4 Deg.C
- Use LED lamp instead of tubelight and incandescent lamp
- Covering insulation on steam flow pipe

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