WEL-COME TO

ENERGY MANAGEMENT SYSTEM

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Area of Presentations

A) Spinning
B) Weaving
C) General

Subjects:

1. Compressed Air System
2. Humidification System
3. Distribution System
4. Project Planning
5. DSM

Compressed Air System

Case Study-1

Modifcation of Compressed Air System-Spg Un it

S.N,	Pre-Condition			New Conditions		
A	Compressors					
	CFM	Nos	TTL CFM	CFM	Nos	TTL CFM
i)	155	7	1085	576	2	1152
ii)	120	1	120	460	1	460
iii)	460	1	460			0
			1665			1612
B	Pressure	8.5-9	Bar		6.8-7.1	Bar
C	Pressure Drop	0.7-1	Bar		0.3	Bar
D	Load HRs	100	%		85	%
E	Energy Cosn	8200	KWH		6000	KWH
G	Annual Saving				3465000	INR
H	Capex				**1750000**	**INR**
I	ROI				**6**	**Mths**

- Steps & Observations:
- 1. Replaced compressor by hi-eff machines
- 2. Modified Air Pipe lines and reduced Pressure drop.
- 3. Machines wise air consumption analysis and arrested leakages
- 4. Optimize the pressure
- 5. Daily monitoring of loading hrs and energy consumption

Case Study-2

Regulated Pressure Control

S.N.	Particulars	Specs	Unit
	Compressor Rating	806	CFM
	Type of Machine	Sphiral Valve regulated	
	Actual Air requirment	650	CFM
	Prev Energy Consumption	3700	KWH/Day
	Revised Energy Consn	3200	KWH/Day
	Annual Saving	175000	KWH
	Unit Rate	3.4	INR
	Saving	595000	INR
	Repairing Cost	30000	INR
	Pay Back	Immediate	

- Observations:
- 1. Auto regulating (Spiral) Valve defective.
- 2. Pressure became constant instead of 1 bar variation

Air Leakage Monitoring of Machine

S.N.	DATE	UNIT	MACHINE	AIR CONSUMPTION BEFORE MAINT(CFM)			AIR CONSUMPTION AFTER MAINT(CFM)		
				M/C IDLE	STARING	RUNNING	M/C IDLE	STARING	RUNNING
1	13.05.05	A	A/C-4	**72**	**105**	**103**		NOT ATTENDED	
2	14.05.05	C	A/C-4	**22.5**			5	17.5	
3	14.05.05	C	A/C-5	26			5	21	
4	14.05.05	C	A/C-6	47			5	42	
5	14.05.05	C	A/C-7	14			**5**	9	
6				5				89.5	
7	4.07.05	A	A/C-01	**64**	145	72	5	59	
8		A	A/C-03	44	65	35	5	39	
9		A	A/C-04	**12**	59	20	5	7	
10		A	A/C-05	**17**	90	20	5	12	
11		A	A/C-06	**37.5**	118	35	5	32.5	
				361					

- Observations:
- There was leakage of Air 4 Times of Normal requirement.
- Repairing/Replacement cost of defective part for on machine was Rs2500/ only
- Annual Loss of Rs 3.50Lac in one machine.
- By regular checks it can be avoided

- **General Recommendations for compressed Air system in Spinning Units**
- Install compressors at clean and free flowing air side
- Design Pipe line considering minimum pressure drop.
- Keep Optimum pressure(As Lower possible)
- Keep Air filter clean regularly
- Install efficient dryer for dry air.
- Use Zero loss drain valves
- Replace rubber kits of Pneumatic equipments periodically
- Arrest leakages
- Use regulators where low pressure is required
- Clean/Replace Line filter regularly to avoid pressure drop

Case Study of Air Jet Looms

Particulars	Previous	Post	
Installed Looms	96	96	
Running Looms	79	79	
Installed Compressors(CFM)	4183	4183	
Running Compressors(CFM)	3713	2632	
Avg. Consumption(CFM)	3160	2370	
Pressure(Bar)	6.90-7.50	5.80-6.10	
Average Production/day(Mtrs)	20500	20500	
Total Energy(KWH)	15100	10600	
Energy Cost(Rs/Day)	67950	47700	
Saving/Day(Rupees)		20250	
Annual Saving(Rupees)		**7087500**	
Investment(Rupees)		50000	
Pay Back	Days	2.5	

Observations

- **Problems detected**.
- 1.Operating at very high pressure at 6.8-7.5 bar while required 4.5-5.5 bar at machine.
  2.Leakages in machines up to 50% extra than normal consumption
- 3. Pressure drop up to 1.00 bar,with small changes reduced it to 0.3 bar
- 4.Replaced Defective Nozzles in the machines.

Case Study -2

Compressed Air System in Air Jet Looms-2			
Particulars	**Previous**	**Post**	
Installed Looms	30	30	
Running Looms	26	30	
Installed Compressors(CFM)	1040	1040	
Running Compressors(CFM)	1040	1040	
Avg. Consumption(CFM)	1040	1040	
Pressure(Bar)	5.80-6.10	5.80-6.10	
Average Production/day(Mtrs)	11180	12900	
Total Energy of Compressor(KW	4638	4368	
Energy Cost(Rs/Day)	19656	19656	
Energy Cost(RS/Mtr)	1.76	1.52	
Annual Saving(Rupees)		**1058400**	
Investment(Rupees)		25000	
Pay Back	Days	8.62	Days

Case study (Cont.):

- **Steps Taken**
- **1**. Reduced Pressure from 7.00 bar to 6.5 Bar
- 2. Arrest leakages
- 3. Setting of Nozzels to control the air
- 4. Replaced contnious operated drain valves to zero loss valves

- **Humidification System**

Case Study Humidification Plant of Spg Unit

Humidification Plant Analysis

Plant	**Heat Load**			Measured			
	Total	RH%	CFM Required	CFM	Power (KW)	RH%	CFM/Power
Finishing-A	813570	**65**	**81357**	71000	46.2	**35**	1536.797
Finishing-B	649082	**65**	**64908**	67800	28.2	**46**	2404.255
Finishing-C	832517	**65**	**83252**	86500	27.88	**46**	3102.582
R/F-A	940402	**50**	**67172**	57720	24.72	**35**	2334.951
R/F-C	840530	**50**	**60038**	36600	26.24	**36**	1394.817
Prep-C	375052	**50**	**26789**	22081	16.52	**35**	1336.622

Remark: Due to poor maintenance of the plant desired RH is not achieved even power consumed and air flow is normal.

Observations:

1. Air washer plant are not maintained.
2. RH after eliminators are below70% while it should be above 90%
3. Due to this overall plant operation is at higher side.
4. SA Ducting is damagd

Case Study on Fans selection

FRP/Alluminium Fans

Date 9.08.1998

A	Fan Type	Alluminium			
	S.N.	BKW	CFM	TP	CFM/KW
	1	14.65	86909	23.07	5932.355
	2	**18.05**	**67375**	**44.47**	**3732.687**
	3	17	55865	44.26	3286.176
	4	**16.83**	**51916**	**53.25**	**3084.73**
	5	18.54	23821	63.37	1284.844

B	Fan Type	FRP

I)

S.N.	BKW	CFM	TP	CFM/KW
1	13.72	92258	11.76	6724.344
2	**19.48**	**71463**	**45.15**	**3668.532**
3	**20.3**	**54580**	**53.09**	**2688.67**
4	20.29	49108	56.4	2420.306

Date 14.07.2004

ii)

S.N.	CFM		TP		BKW		CFM/KW	
	FRP	ALU	FRP	ALU	FRP	ALU	FRP	ALU
1	51205	51192	26.98	26.48	11.56	10.8	**4429.498**	**4740**
2	40726	41680	45.42	47.84	13.32	13.42	**3057.508**	**3105.812**
3	34378	37545	49.16	55.7	13.39	14.04	**2567.438**	**2674.145**
4	30716	32284	52.68	61.18	13.25	14.22	**2318.189**	**2270.323**
5	29055	31507	55.47	63.58	13.03	14.43	**2229.854**	**2183.437**

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Remark :

Whenever fans are replaced need to check its velocity and static and Total pressure to evaluate real performance. Velocity may quite high with same energy but pressure will reduced and

- it will effect the overall system performance.

- During selection of fans, check the efficiency comprising of velocity and Total pressure which is normally 45mmwc. If Pressure is less than standard then air will not pass to the whole area.
- Fan material is not important rather then its profile and application duty.

Case Study of Supply Air Fans

Optimisation of Humidifcation Plant

Fan Speed Control

Particulars	Pre-Condition	Post Conditions	
Fan Angle	16	12	
Fan Speed	1450	1450	
No.of Fans	1	2	
Motor HP(Each)	15	15	
Net KW	11	6	
Total Power	11	12	
Velocity(CFM)	32000	47000	
Deptt Temp	31	28	
Deptt RH	60%	65%	
SEC(KW/1000CFM)	0.34	0.26	
Energy Gain		**25.73**	%

Observations:

1 One fan motor was running overloaded

2 One Fan was not designed for such high velocity

3 Fans air flow and power ration increase at ratio 1:2.7

4 No proper commissioning of the plants

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Case Study on Spot Humidification

Options of Humidification System

S.N.	Particulars	Normal Humidifcation	SpotHumidifcation
1	Type of Plant	Air jet Weaving	Air jet Weaving
2	MachineRH Required	78+/-3%	78+/-3%
3	Room RH Reqd	60%	60%
4	Plant Recoomonded(CFM)	130000	80000
5	RA Sytem	Rotary Filter	Rotary Filter
6	BKW at Full Capacity	65	55
7	Total Power(KW)	72	61
8	L.F	70%	70%
9	Average Load(KW)	50	43
10	Average Run Hrs/Day	18	18
11	Annual working days	350	350
12	Annual Energy Consumption(KWH)	315000	270900
13	Capital cost (Rs in Lacs)	25	25
14	Annaul Energy Cost(Rupees)	1354500	1164870
15	Annaul Saving(Rupees)		**189630**

Tips On Humidification System

- 1. Design Parameters (Actual LF, Actual RH Required, Design of velocity at all the area like Damper, SA Ducts, Grill, Diffusers, Air washer),
- 2. Operation skill
- 3. Preventive maintenance. (Ensure above 90% RH after Air washer.
- 4. Insulation(Without insulation, building factor increase by 2.5Times)
- 5. Discharge of Pnumafil air out side the plant (During summr & Mansoon)

- DSM

Case Study of Improved Machines

Efficiency

SCOPE OF POWER SAVING AGAINST IMPROVED EFFICIENCY								
				Consumption		91000KWH/Day		
M/C	%TTL UNITS	KWH/DAY		ECTIMATED SCOPE OF SAVING				
			EFF.	WASTE	MISUSE	MAINT.	TTL	KWH/DAY
B/ROOM	5	4575	4	0.3	0.1	0.1	4.5	205.875
CDG	5.5	5032.5	5	0.5	0.2	0.2	5.9	296.9175
D/F	1.9	1738.5	2	0	0	0.1	2.1	36.5085
S/F	2.4	2196	4	0.5	0	0.1	4.6	101.016
R/F	24	21960	1.5	0.3	0.25	3	5.05	1108.98
AUTO/WDG	9	8235	9	0.3	0.25	1	10.55	868.7925
TFO	22	20130	3			0.5	3.5	704.55
DBLG	5	4575	2	0.2		0.2	2.4	109.8
							TOTAL	**3432.44**
	In Terms of Rs. 42.00 Lacs Per Annum							

Case Study for optimization of Machine speed(TFO)

Overall Proitibility of 8Nos 2x192 drums TFO machines						
Overall Calculations for		330	Days/Annum	No. of Machines		8
				Unit Rate	4.3	
	Options	**I**	**II**	**III**	**IV**	**V**
1	Speed	7000	7500	8000	8500	9000
2	Efficiency	85	85	85	85	85
3	Production/Day(Kgs)	412	442	471	500	530
4	Prodn/Annum(Kgs)	1087999	1165713	1243427	1321142	1398856
5	Total Units	861960	957000	1070018	1191066	1452733
6	Ukg	**0.79**	**0.82**	**0.86**	**0.90**	**1.04**
7	Enrgy Cost	4525290	5024250	5617597	6253095	7626846
8	Intt.	900000	900000	900000	900000	900000
9	Depriciation	1551000	1551000	1551000	1551000	1551000
10	Maintenance	600000	600000	600000	600000	600000
11	office Expenses	300000	300000	300000	300000	300000
12	Manpower cost	2275000	2275000	2275000	2275000	2275000
13	Packing & Cost	543999	582857	621714	660571	699428
14	Total cost/Annum	**10695289**	**11233107**	**11865310**	**12539666**	**13952274**
15	Rs/Kgs	9.83	9.64	9.54	9.49	9.97
16	S.P.	10.00	10.00	10.00	10.00	10.00
17	Profit(Rs/Kgs)	0.17	0.36	0.46	0.51	0.03
18	Total Profit/Annum	**184700**	**424025**	**568963**	**671750**	**36283**

DSM Recommendation

- 1. Optimize machine speed compare to energy consumption and overall profibility
- Concentrate on improvement of machine efficiency
- Energy V/S Production comparison
- Optimize the humidity requirement by spot humidification and direct water application wherever possible.
- Maintain machines properly to avoid jammings and air leakages
- Avoid idle running of machines.
- Minimize waste generation.
- Avoid cleaning by compressed air

Training

1. With management (To develop energy conservation cell and budget approvals)
2. For Supervision staff
3. For operators
4. For maintenance team

Involve each and every person of organization to implement the energy saving activities

- **Distribution System**

Case Study of Distribution Losses

Location of Transformers(Line Losses)							
A	**Previous Condition**						
	Transformer Capacity			1000KVA			
	Voltages	(HT/LT)		11000/415			
	Loading			600KVA		Cost	
	HT Cable Size			3Cx50 Sqmm	15Mtrs	6750	
	LT Cable			4Nosx3.5Cx240Sqmm	4x100Mt	280000	
						286750	
	Actual Current		(HT)	31.5	Amps		
	Actual Current		(LT)	834	Amps	208	Amps/Cabl
	Line Los	(HT)		25.4 watt			
	Line Los	(LT)		8490watt			
	Total			8515 watt			
	Annual Cost		Rupees	**306648**			
B	**By Change of Transformer Location**					Cost	
	HT Cable Size			3Cx50 Sqmm	90Mtrs	40500	
	LT Cable			4Nosx3.5Cx240Sqmm	4x25Mtrs	70000	
						110500	
	Line Los	(HT)		152.4 watt			
	Line Los	(LT)		2115 watt			
	Total			**2267.4 watt**			
	Annual Cost		Rupees	**81612**			
	Net Savings(In 1St Year)						
		Energy	Rupees	**225036**			
		Capital	Rupees	176250			
		Total	Rupees	**401286**			

Case Study on Transformer Loading

TRANSFORMER DETAIL				
	Transformer1	**Transformer2**		
LOCATION	HT Yard	HT Yard		
SR NO	333869	6611		
MAKE	Crompton	Crompton		
CAPACITY IN KVA	2000	1600		
YR OF MANUFACTURING	1984	1996		
COOLING ARRANGEMENT	ONAN	ONAN		
PRIMARY SIDE HT				
VOLTAGE	33000	33000		
AMPERE	35	28		
SECONDARY SIDE LT				
VOLTAGE	433.3	433.3		
AMPERE	2666.7	2134		
Vector Group	Dyn-II	Dyn-II		
RATED FREQUENCY	50	50		
RATED TEMP (OIL / WINDING)	45	50		
NO LOAD LOSSES AT RATED VOLTAGE	2.1	1.9		
FULL LOAD LOSSES AT RATED VOLTAGE	22.6	18.9		
IMPEDANCE %	6.49	6.49		
TAPING POSITION	10	10		
TAP CHANGING METHOD	OLTC	OLTC		
Loading(KVA)	1400	0		
Total Losses(KW)	13.174	0	**13.174**	
Revised Loading	800	600		
	5.72	4.56	**10.27**	
Net Saving			**2.900188**	KW
Annual Saving(8000hrs)			**23201.5**	KWH
		Rupees	**104406.8**	Per Annum
Investemt			0	
Payback			**Immidiate**	

Best Loading of Transformer= SQRT(Iron Loss/Copper Loss)x Transformer Rating(KVA)

- General Practice:

Most of Capacitors installed Near Main Distribution Panel with APFC

Resulting: PF maintained up to unity and PF incentive benefit avail up to the maximum level.

But benefit of internal line losses reduction due to high PF and low current is missing

Recommendation: As possible put capacitors parallel to load at load end.

General Recommendations

- 1. Maintain voltage drop below1% at load point.
- 2. Optimum loading on transformer considering total load losses

  (Tr Loss= NL Loss+ SQ(LF)xFL Loss
- 3. Installed capacitors at load end ,only , for fine correction minimum quantity at APFC
- 4. Keep optimum voltage.

Other Area of Saving

- 1. Lighting Systm
- 2. Pumps
- 3. Machines Maintenance

Project Planning

- A: Compressor:

1. Select Model according to air requirement i.e.Reci/Rotary/Cetri.
2. Keep rating of compressor close to the theoretical estimate.
3. Do not select Hi-Pressure machine than requirement.
4. Install compressors at clean, cool and ventilated room
5. At least one machine consider of variable capacity.
6. Design Air line for line loss less than 0.2 Bar.
7. Consider hi-efficiency low loss dryers
8. Use Zero loss drain valves
9. Keep weld all the joints

Project Planning (Contd..)

- B: Humidification Plants:

1. Optimum size of the plant (High contingency will cause of high operation cost, maint lagging, high energy consumption.)
2. Consider all IS parameters for all equipment quantity like ,air flow rate limits on Air washer, damper, diffusers, filters, ducting, grills etc.
3. Proper insulation on atic, false ceiling, ducting.
4. Use energy efficient pumps for air washer.
5. Keep provisions for seasonal changes, Like recycle of hot air for winter , Drives on pumps & fans.
6. If possible consider auto control system to avoid operation failure at increase efficiency.
7. Commissioning of plant with comparison of velocity, humidity, air changes and energy

Project Planning (Contd..)

- **C: Transformer**:

1. Keep transformer close to load centre.
2. Select Low loss transformer
3. Select optimum rating transformer with comparison to capital cost and running losses cost . For distribution transformer 60-70% loading is economical.
4. Consider OLTC/Auto transformrs

D. Motors:

1. Consider EFF1 motors for project, diff of cost with normal eff will recover in short period

E. Metering system:

1. Consider on line measuring and monitoring system like KWH meter, Air flow meters,

F. Cablings& Capacitors:

1. Select the cable considering line losses less than 1%
2. Install capacitor in parallel with higher load

G: Lighting:

1. Consider hi-eff low watt lights
2. Consider LED lights for street lights
3. Keep stabilizer on light circuit

Compare life cycle cost of equipment/Machine before selection

-
- OTHERS

Boiler Capacity		1.5TPH	
Make		Thermax	
Design Pressure		10.5Bar	
Working Pressure		7Bar	
Design For Fuel		Steam Coal	
Fuel using		Bhuj Lignite	
Specific Heat		3200Kcal/Kg	
Steam Application		Fibre Dying	
Boiler Efficiency(Calculated)		63%	
Fibre Dyed		80Tons/Month	
working days		15days/Month	
Steam Consumed		5Kgs/Kg fiber	
Lignite Consumed		150Tons/Month	
Feed water Temp		30 deg Cel	
Condensate Recovery		Zero	
After Installation of Steam Recovery system			
Feed water temprature		85deg Cel	
Feed Water Used/Month		400KL/Month	
Energy Saved		220Lac Kcal	
Fuel Saved		10.9Tons/Month	
Cost of Fuel		2100/Ton	
Net Saving(Rs/Mth)		0.23	Lacs
Cost of Condesate RecoverySyatem(RS)		3.2	Lacs
ROI		**14**	**Months**

Case Study of Eco-Ventilator in place of Exhaust Fans

	Location: Dye house		
S.N.	**Particulars**		**Units**
1	No.of Exhuast Fans Installed	14	Nos
2	Power Consumtion/Fan	0.75	KW
3	Avg Run Hrs	20	Hrs
4	Total Energy/Day	210	KWH
5	Operation Cost/Annum	330750	Rupees
6	No.of Eco-ventilators in place of Exhaust Fans	40	Nos
7	Cost of Fans	200000	Rupees
8	ROI	**7**	Months

Case Study of DG Set

DG Set Performance(Captive power contineous operated plant)

		FRP	FRP	SS	SS	New C.T.
Particulars	**Units**	**2001**	**2002**	**2003**	**2004**	**2005**
Charge Air Tempratures	Deg Celcius	75-81	75-81	68-73	65-70	60-65
Cooling water Temp(Inlet)	Deg Celcius	52	52	46	42	40
Cooling water Temp(Outlet)	Deg Celcius	42	42	35	32	30
Run Hrs	Annual Hrs	7819	7928	8339	8410	8561
Units Generated	MWH	29.05	29.399	30.77	32.236	32.53
Fuel Consumption	Gms/Kwh	**227.13**	**227.11**	**223.02**	**222.11**	**220.65**
Investments	RS in Lacs	**0.00**	**0.00**	**0.50**	**0.00**	**6.00**
Annual Savings	**RS in Lacs**		**0.06**	**12.65**	**16.18**	**21.08**

Steps Taken

1 Cooling system modified
   i) Replacement of fan by Hi-Eff Fan
   ii) Replacment of cooling tower

2 Charge air coolers modified

Monitoring & Measurments

For all these activities measurment and monitoring of energy parameter is very essential, Hence need contnious monitoring by suitable instruments

Thank You