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[Compressed Air System Improvements and Action Plan]

By

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Webinar

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Sector/Industry:	Forging Industry
Production:	16,000～21,000ton/y
Operating hours:	24Hours/day(One weekly OFF)
Total electricity consumption:	47,059kWh/day(1,176,470kWh/month)
Power required for compressor:	Approx. 35% of total energy consumption (673kW)
Electric power unit price (Rs/kwh):	8.5~10.0 Rupees
Existing compressor:	ATLAS 110kW x 4(GA1107)
	ATLAS 200kW x 3(GA2007)
	CHICAGO 290kW x 1(2HN2-47x28)
	Sullair 150kW x 3(LS20S)
Supplemental equipment:	Air tank, Filter
Uses:	Air hammer, Forging Press, Coining Press, CNC VMC HMC Machines, Blasting Machines, Upsetter, blow guns, cylinder, Cleaning etc.

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Specification of each compressors; Power and operating hours

MC.NO.	MAKER	MODEL	RATED	FAD	FAD	PRESSURE	OPERATING	PUMP UP TIME
			KW	CFM	M3/min	Kg/cm2	PRESSURE	MINUTES
A1	ATLAS	GA1107	110	600	16.9	7	5.6	37.28
A2	ATLAS	GA1107	110	600	16.9	7	5.6	35.83
A3	ATLAS	GA1107	110	600	16.9	7	5.4	39.47
A4	ATLAS	GA2007	200	970	27.3	7	5.5	24.8
A5	ATLAS	GA2007	200	970	27.3	7	5.7	20.23
A6	ATLAS	GA2007	200	970	27.3	7	5.4	18.58
A7	ATLAS	GA1107	110	600	16.9	7	5.4	36
A8	CHIICAGO	2HN2 48x28	290	1215	34.3	7	5.8	14.78
A9	SULL-AIR	LS20S	150	990	27.9	7	5.5	18.25
A10	SULL-AIR	LS20S	150	990	27.9	7	5.7	22.23
A11	SULL-AIR	LS20S	150	990	27.9	8	5.7	18.15

1. The delivery year of each units is unknown.
2. FAD represents the catalog specification, which is different from the actual discharge air amount.
3. RATED KW is different from actual power consumption

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Summary of data analysis result from Japanese Expert Visit and TERI

1 From the data, it was confirmed that the starting and stopping frequency of the compressor was abnormally high, but it seems to be controlled unexpectedly well for energy saving. Therefore, it seems that the unit control proposed in the FS report is less effective for energy saving, rather it is better to shift to unmanned system by automatic operation, operation time leveling, and stable operation.

2 The effect by introduction of the inverter machine enables considerable power reduce, shows that **energy reduction of 271,488 kWh/year and cost reduction of 2,307,648 Rp/year can be expected.** As a whole, pressure control is individually performed, so there is waste because the whole pressure balance is not well gotten. In actual operation, smooth control can be done so that effect can be expected. **The effect of CO2 emissions reduction of 252 tons/year is expected.**

3 As other issue, starting frequency is also high for air compressors, Since this leads to deterioration and destruction of equipment, motors, etc, immediate measures need to be taken.

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Summary of actions plan after Japanese Expert & TERI intervention

Particulars of Points for Improvement	Actions Plan
1) - Replacing 3 compressors of 110kW or combined units of 110kW & 200kW with one inverter compressor of 280kW	Planning to replace Comp7 – 110 kW, Cp reciprocating 11 -200 kW , Comp 4 – 200 kW and Comp5 -200 kW with (CP removed now)
- Replacing all older compressors with new ones (Target: A1, A2, A3, A4, A5, A6, A7, and CP except for SULLAIR)	New air compressors with inverter 160 kW each initially and then step by step as per budget approval.
- Taking measures against broken screw rotor trouble (broken shaft)	For which existing CFM is 3408 CFM with power of 679.5 kW
- Improving environment for compressor	And new system will deliver 4336 CFM with power consumption of 679 kW
- Conducting inspection of receiver tank annualy and checking thickness of the tank over 10 or more years old	Project is under discussion and planning stage
	Hold due to Financial issue and market condition Covid problem
2) - Detecting the points causing air leakage and taking proper measures	Air leakages are controlled and when pneumatic hammers are not working remaining system works on one 1000 CFM air compressor, before air leakages it was working on 2 air compressors of 1000 CFM.
	Further they are taking action for pneumatic hammer sleeve and lining for reducing air leakages.
	(Pneumatic hammer sleeve work – reduced air leakage of almost 500 CFM- 90 kW equivalent)
4) - Adopting an efficient multiple-unit panel	It is in planning stage
- Adopting energy monitoring system	
5) Savings Achieved by controlling air leakages and air guns	8,10,000 kWh – Rs. 72.9 lakhs (656 tCO2 emission reduction)

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Data analysis; From Recent Air audit

INDIVIDUAL MACHINES AIR CONSUMPTION MEASURED SUMMARY [MACHINE WISE]

1. Individual machines air consumption measured with 100% production condition, in that air consumption measured with the machines air leakages and same quality mention separately. Air leakages consumption measured with the thermal mass compressed air flow meter with each machine wise

2. Each machines air leakage consumption measured with the idle condition [without production]. The cleaning air system is operating without air leakage [0 cfm]

Forge and post forge shop plants: Each machines wise air consumption measured with leakages summary

Sr.no	Machine description	Flow in cfm [measured with leakage]	Air leakage in cfm [only leakage]	Flow in cfm [actual consumption without leakage]
1	3-Ton hammer	1830	885	945
2	MPM A hammer	1244	234	1010
3	MPM B hammer	1183	303	880
4	Shearing maching-1	145	45	100
6	Post forge	203	40	163
7	Main-header pipeline leakage	-	50	-
Total		4605	1557	3098

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Data analysis; From Recent Air audit

Press, Upsetter and Machine shop: Each machines wise air consumption measured with leakages summary				
Sr.no	Machine description	Flow in cfm [measured with leakage]	Air leakage in cfm [only leakage]	Flow in cfm [actual consumption without leakage]
1	6-inch Upsetor A	119	24	95
2	6-Inch Upsetor B	-	15	-
3	Press 1000 B	233	34	199
4	Forging press 1600A	185	26	159
5	Triming press 1600A	-	39	-
6	Forging press 1600B	198	37	161
7	Triming press 1600B	152	12	140
8	Air grinder	43	2	41
9	Kurimoti upsetor	235	61	174
10	Machine shop	62	30	32
11	Main-header pipeline leakage	-	100	-
Total		1227	380	1001

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Action Plan and Energy Savings Proposals

1. Separate Air Line for each shop with loop and pressure regulation from the main air compressor station to avoid air leakages. Savings of 109 kW – Rs. 70.6 lakhs/annum (Pipe line investment cost Rs. 20 lakhs) , Payback period 4 months

2. Separate air line with 200 CFM air compressor for Machine shop – post forging during weekly off day – to avoid use of 1000 CFM (200 kW) air compressor – Savings -156000 kWh , Rs. 14 lakhs/annum , investment Rs. 20 lakhs , Payback period 17 months

3. Installation of new 3 inverter air compressors of 160 kW each (1088 CFM each), Savings – 111 kW, Rs. 71.9 lakhs/annum, investment Rs. 100 lakhs, Payback period 16 months.

4. Air Guns and Air leakage at machine level hammer is controlled one by one presently

5. Capital budget projects presently of due to market and finance problem due to Covid-19

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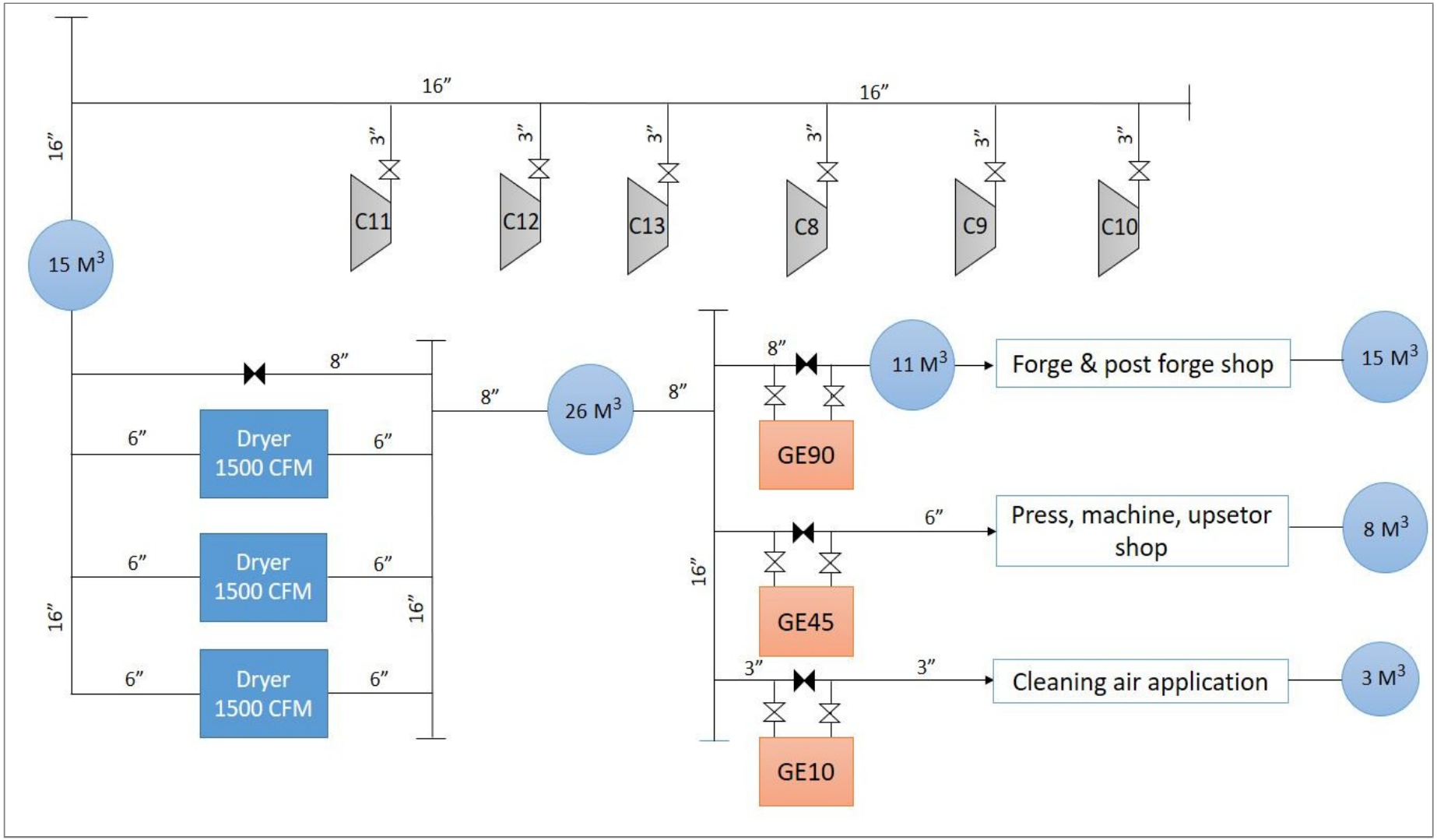
Action Plan and Energy Savings Proposals

PROPOSED COMPRESSED AIR SYSTEM SINGLE LINE DIAGRAM



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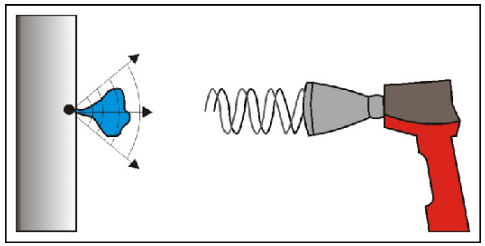
Action Plan and Energy Savings Proposals



Use of Ultrasonic air leak detector to identify air leakages in overhead lines.

Pneumatic Grinders are replaced by electric Grinders

Before audit 8 Water Pumps were used, Now only 2 water pumps are running.

1. 714 CFM air leakage observed, Araldite applied on sleeve for sealing the valve air leakage
2. Leakage reduced by 75 %
3. Further machining of bore/cylinder is planned to reduce total air leakage

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