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Client : PT. Cheil Jedang – Pasuruan

Location : Jl Raya Arjosari, Desa Arjosari RT.04 RW.02 Kec. Rejoso Kab. Pasuruan Jawa Timur

Type of audit : Walkthrough Energy Audit

Scope of Audit : Boiler – Coal fired 120T/Hr

Auditor : Antonius Agung Pramudiyantoro

Ramaiyer Ramachandran

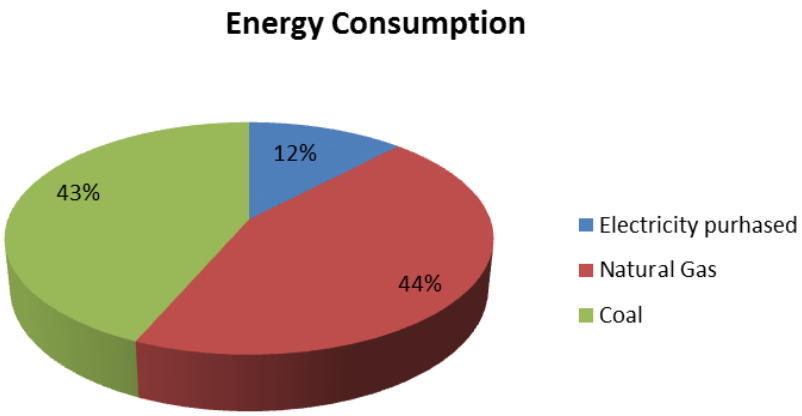
Agenda :
10.00 – 11.15 : Presentation for ISO 50001 certification
11.15 – 12.00 : Presentation for Energy Audit
12.00 – 13.15 : Break
13.15 – 15.15 : Walkthrough audit to Boiler
15.15 – 15.45 : Closing meeting

Energy Review :

- Annual consumption of Energy Sources:

Energy Use	Unit	Consumption	Ton oil equivalent (toe)
Electricity purhased	kWh	306,250,000	26,337.62
Natural Gas	m3	93,180,000	96,384.80
Coal	Kg	161,000,000	94,345.54
	Total consumption		**217,067.97**

Total Annual consumption of Energy Sources 217,067.97 toe



Largest energy consumption comes from the use of Natural Gas and Coal. Those area are very potential in energy saving.

- Preliminary data for Energy User

Equipment	Capacity	Qty	Running hours/day
Lighting system	1500 kW	-	-
Packaged ACs	41 PK/30.6 kW	-	2 h/m
Split AC	303 PK / 226 kW	-	8 h/d
Steam Boiler	175 T/h	5	5 h/d
	120 T/h	4	23 h/d
	120 T/h	4	20 h/d
Compressor	17,200 kW	18 (avg operation 11.6 unit/day)	24 h/d
Chiller	13,210 kW	19 (avg operation 11.4 unit/day)	24h/d

Based on energy sources data, annual electricity consumption is 25,500,00 kWh/year, and from table of Energy User, annual electricity consumption for Compressor is approx. 3,192,192 kWh/year (13% of total electricity purchased) and Chiller is approx. 2,282,688 kWh/year (9% of total electricity purchased)

Preliminary assumption for Significant Energy User is Compressor and Chiller.

Observation Result : Walkthrough audit to warehouse

- There is opportunity in saving lighting by replacing smoky sun roof

Walkthrough audit to boiler

- There is opportunity in saving compressed air consumption by replacing method in cleaning the spillage in the pulvarising area. with vacuum suction method. (note : cleaning the ash using compressed air is not solving the problem, but only remove the ash to other place)
- Loss of steam in distribution:
  - Several instances of steam leaks (in fitting and valves) observed.
  - Also reported loss in distribution line between Co-gen plant and end user.

  Prevention of loss of steam is high potential for Energy performance Improvement
- Insulation Failures:
- Insulation failures lead to heat loss, possible condensation, and drop in steam quality in the supply to the end user. Insulation need replacement in many places. Observed both in
  - Piping as well as Valves & Fittings (perhaps left open after maintenance) Explore using removable insulation.
  - Observed insulation damage to many instances where there is traffic of personnel and material crossing over piping.
- Steam pressure loss between Co-gen plant and end user is also reported. Steam leaks and insulation failures leading to excess condensation – possible cause. Needs more study to understand.
- Difficulties in maintaining steady steam temperature is also observed in operations.
- Incomplete combustion suspected , by observing emission from stack.
- One of the Boilers observed to be operating at 67.5 % efficiency (from the control panel readings)

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Steam System analysis using Steam System Scoping Tool :

During the audit, a quick analysis of the Boiler System, Operating practices and the, distribution system data was collected from the Energy Manager, and the Boiler Manager. This data was input to a software " Steam System Scoping Tool" approved by Dept Of energy , USA. So that Cheil Jedang practices are compared to 'Best Practices' in the Industry. Results of the comparison is tabulated below, followed by an analysis to arrive at recommendation for improvement .

The data collection was limited to 120T/Hr boiler.

STEAM SYSTEM SCOPING TOOL, Version 1.0d **2/10/2014**

STEAM SYSTEM BASIC DATA

BASIC DATA ABOUT YOUR SYSTEM

What To Do Document some of the basic operating information about your steam system.
Why Important Documenting basic steam system data is important to help you to identify the current conditions of your steam

		ANSWERS TO BASIC DATA	
a	Briefly describe the type of production that your plant does in the column to the right. If you know the Standard Industrial Code (SIC) for your industry, please include that in your	Chemicals for Food industry	
	IF YOU CONSUME STEAM BUT DO NOT GENERATE ANY OF YOUR OWN,	PLEASE ANSWERS TO BASIC DATA	
b	What Is Your Total Annual Steam Production?	NA	Million lbs/year
c	How Many Hours Per Year Is Your System In Operation?	8,520	hours/year
d	What Is Your Total Steam Generation Capacity?	120	T/hr
e	What Is Your Average Steam Generation Rate?	102	T/hr
f	What Is The % Distribution (On A Btu Basis) Of Your Fuel Sources For Steam Generation?		
	Coal	100.0	%
	Fuel Oil (#6)		%
	No. 2 Fuel Oil		%
	Natural Gas		%
	Process Waste Heat		%
	Biomass		%
	Solid Wastes		%
	Other		%
	TOTAL (Should add up to 100%)	100.0	%

STEAM SYSTEM SCOPING TOOL, Version 1.0d **2/10/2014**

	Total Capacity		kW
	Combustion Gas Turbines With HRSGs		
	Total Capacity		kW
	Other (specify type)		
	Total Capacity		kW
h	How Much Steam Do You Buy Annually From Others?		Million lbs/year
I	How Many Steam Traps Do You Have In Your Steam System?	362	
j	What is Your Average Boiler Blowdown Rate?	3	% of average feedwater flow rate

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STEAM SCOPING TOOL, Version 1.0d_Metric 10/1/2014

SUMMARY RESULTS

SCOPING TOOL QUESTIONS	POSSIBLE SCORE	YOUR SCORE
1. STEAM SYSTEM PROFILING		
STEAM COSTS		
SC1: Measure Fuel Cost To Generate Steam	10	10
SC2: Trend Fuel Cost To Generate Steam	10	10
STEAM/PRODUCT BENCHMARKS		
BM1: Measure Steam/Product Benchmarks	10	10
BM2: Trend Steam/Product Benchmarks	10	10
STEAM SYSTEM MEASUREMENTS		
MS1: Measure/Record Steam System Critical Energy Parameters	30	26
MS2: Intensity Of Measuring Steam Flows	20	16
STEAM SYSTEM PROFILING SCORE	90	82
2. STEAM SYSTEM OPERATING PRACTICES		
STEAM TRAP MAINTENANCE		
ST1: Steam Trap Maintenance Practices	40	40
WATER TREATMENT PROGRAM		
WT1: Water Treatment - Ensuring Function	10	10
WT2: Cleaning Boiler Fireside/Waterside Deposits	10	10
WT3: Measuring Boiler TDS, Top/Bottom Blowdown Rates	10	5
SYSTEM INSULATION		
IN1: Insulation - Boiler Plant	10	6
IN2: Insulation - Distribution/End Use/Recovery	20	0
STEAM LEAKS		
LK1: Steam Leaks - Severity	10	0
WATER HAMMER		
WH1: Water Hammer - How Often	10	10
MAINTAINING EFFECTIVE STEAM SYSTEM OPERATIONS		
MN1: Inspecting Important Steam Plant Equipment	20	20
STEAM SYSTEM OPERATING PRACTICES SCORE	140	101
3. BOILER PLANT OPERATING PRACTICES		
BOILER EFFICIENCY		
BE1: Measuring Boiler Efficiency - How Often	10	0
BE2: Flue Gas Temperature, O2, CO Measurement	15	10
BE3: Controlling Boiler Excess Air	10	10
HEAT RECOVERY EQUIPMENT		
HR1: Boiler Heat Recovery Equipment	15	5
GENERATING DRY STEAM		
DS1: Checking Boiler Steam Quality	10	0
GENERAL BOILER OPERATION		
GB1: Automatic Boiler Blowdown Control	5	5
GB2: Frequency Of Boiler High/Low Level Alarms	10	10
GB3: Frequency Of Boiler Steam Pressure Fluctuations	5	0
BOILER PLANT OPERATING PRACTICES SCORE	80	40

STEAM SCOPING TOOL, Version 1.0d_Metric 12/14/2010

SUMMARY RESULTS (page 2)

4. STEAM DISTRIBUTION, END USE, RECOVERY OPERATING PRACTICES		
MINIMIZE STEAM FLOW THROUGH PRVs		
PR1: Options For Reducing Steam Pressure	10	10

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RECOVER AND UTILIZE AVAILABLE CONDENSATE		
CR1: Recovering And Utilizing Available Condensate	10	0
USE HIGH-PRESSURE CONDENSATE TO MAKE LOW-PRESSURE STEAM		
FS1: Recovering And Utilizing Available Flash Steam	10	3
DISTRIBUTION, END USE, RECOVERY OP. PRACTICES SCORE	30	13

SUMMARY OF STEAM SCOPING TOOL RESULTS

	POSSIBLE SCORE	YOUR SCORE
STEAM SYSTEM PROFILING	90	82
STEAM SYSTEM OPERATING PRACTICES	140	101
BOILER PLANT OPERATING PRACTICES	80	40
DISTRIBUTION, END USE, RECOVERY OP. PRACTICES	30	13
TOTAL SCOPING TOOL QUESTIONAIRE SCORE	340	236
TOTAL SCOPING TOOL QUESTIONAIRE SCORE (%)		69.4%
Date That You Completed This Questionaire		12/14/2010

SUMMARY OF STEAM SCOPING TOOL RESULTS

	POSSIBLE SCORE	YOUR SCORE
STEAM SYSTEM PROFILING	90	82
STEAM SYSTEM OPERATING PRACTICES	140	101
BOILER PLANT OPERATING PRACTICES	80	40
DISTRIBUTION, END USE, RECOVERY OP. PRACTICES	30	13
TOTAL SCOPING TOOL QUESTIONAIRE SCORE	340	236
TOTAL SCOPING TOOL QUESTIONAIRE SCORE (%)		69.4%

Observation Results : From the table above it is observed that when bench marked with best practices in boiler operations, a high scope for improvement exist in the areas.

Steam Operating practices through

- Improvement in Insulation repair and maintenance
- Arresting and Preventing steam leaks,
- And controlling hammering by maintaining steam pressure. Recommend to monitor, control and maintain steam purity.

Boiler Plant Operating practices through

- Measuring Boiler efficiency Periodically
- Monitoring CO content in Flue gas,
- Blow down heat recovery,

Distribution, End use & Recovery through

- Improved condensate recovery
- Improving flash steam recovery.

Recommendation for Improvement :

- Replacing smoky sun roof, by fresh transparent roofing in the warehouse.
- Use vacuum suction method to clean the spillage in the pulvarising area. More effective, Saves compressed air consumption, possibly recyclable after check.
- Stop OR at least reduce the steam leaks in distribution lines, Valves and Fittings in particular , by attending to them as early as possible.
    - A system to constantly look for tiny(potential) leaks and arresting them before they become detectable visually is better.
    - Recommend, minor investment to detect tiny leakage in monitoring equipment, (Thermal Imager, Ultrasonic detector).
    - Implement a preventive maintenance program for continuous monitoring for steam leaks .
- Replace failed insulation ASAP (use the simple software provided to calculate the approximate ' cost and savings')
    - Avoid accidental damage to insulation by protecting the piping by providing (simple) cross-over bridge to go across the piping.
    - Explore the use of removable insulation for valves and fittings, progressively increasing the numbers to cover all the fittings. over a period of time. (refer to 'Tip Sheet' provided)
- Recommend to arrange for a special study, to investigate the reasons for loss of pressure between co-gen and end user. This will result in improving the steam quality, improve the boiler efficiency, steam purity which are all might be inter-related.
- Continuous blow down is practiced, which is good. However recovering heat from the blow down is not effective.
  Recommend to consider installing a simple standard system. to recover the heat/condensed water. Example :

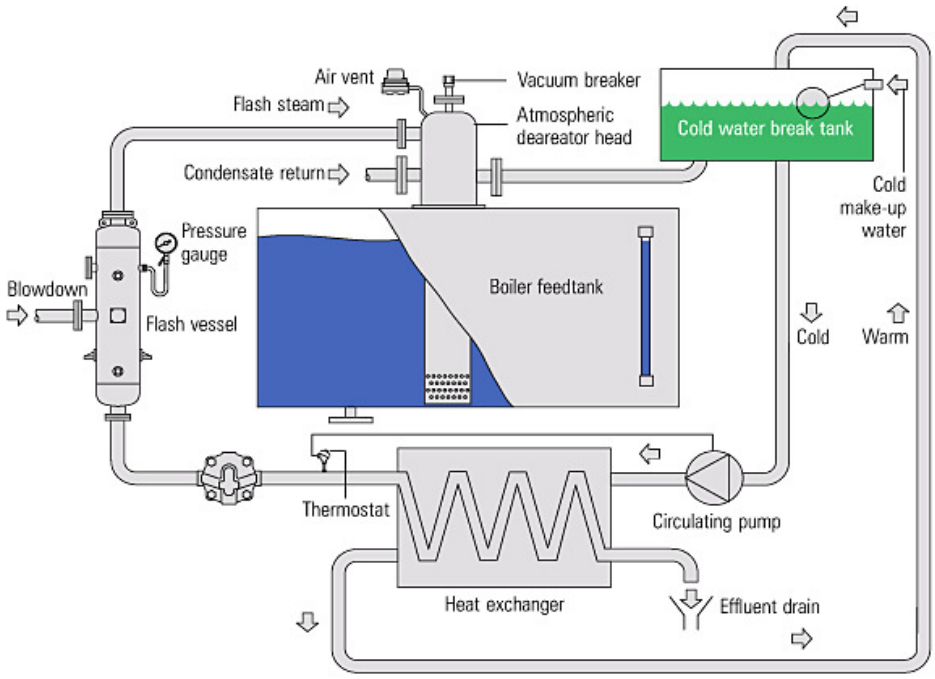

Fig. 3.13.4
Heating make-up water in a cold break tank (level controls have not been shown on the feedtank)