ITC LIMITED

Increase of Heat Transfer Area in the Blow Heat Recovery System to Improve Heat Recovery

SUMMARY OF THE OPTION

M/s ITC Limited–Paperboards and Specialty Paper Division (ITC–PSPD), Bhadrachalam unit commenced its commercial production in October 1979. It is the largest and one of the best performing integrated pulp and paper plants in India with a design manufacturing capacity of 200,000 tons per year (TPA) of paper and paper boards and was actually producing around 238,000 – 240,000 TPA. Notwithstanding, the unit, plans for an immediate expansion with the addition of another Paper Machine, thus taking the manufacturing capacity to 2,85,000 TPA. The products range from Printing and writing paper of various grades, Poster paper, Uncoated paper board and Coated paper board. The annual electricity consumption is of the order of 242 million kWh and the thermal energy consumption totals 914913 million kCals/per year. The energy cost accounts for 5.12% of the manufacturing cost. The specific electricity consumption is 971 kWh/Ton and the specific thermal energy average is 3.87 million kCal/Ton.

The digester is blown once in every cycle (40 mins) for 15 to 20 mins. to discharge the cooked wood/bamboo. This results in nearly 10% (of the pressurized condensate liquor) of flash steam at a lower pressure (2 kg/cm^2), comprising of potential heat energy. However, this steam is considered foul due to presence of mercaptans, other chemicals and stray fibre. Hence its use is limited. The blow flash steam (fouled) was first condensed in condensers (three) using water spray to generate a resultant condensate (fouled) at around 85^0C.This source of energy was used to heat the clean process water (200 m^3/hr) by indirect heat from two existing plate heat exchangers. The process water was heated from a temperature of 38 ^{0}C (this is soft water from cooling of compressors etc.) to a temperature of 44.6 ^{0}C from the plate heat exchangers. Since the temperature requirement of the process water is 70 ^{0}C low pressure steam to the tune of 300–330 TPD was directly injected into the tank holding water so as to increase the temperature to 70 ^{0}C. However, it was felt that due to inadequate plate heat exchanger heat transfer area (presently two plate heat exchangers available), the process water was just being heated upto 44.6 ^{0}C. This could be increased so as to reduce the quantity of the LP steam which is tapped directly from the main steam feeder pipe line.

KEY WORDS

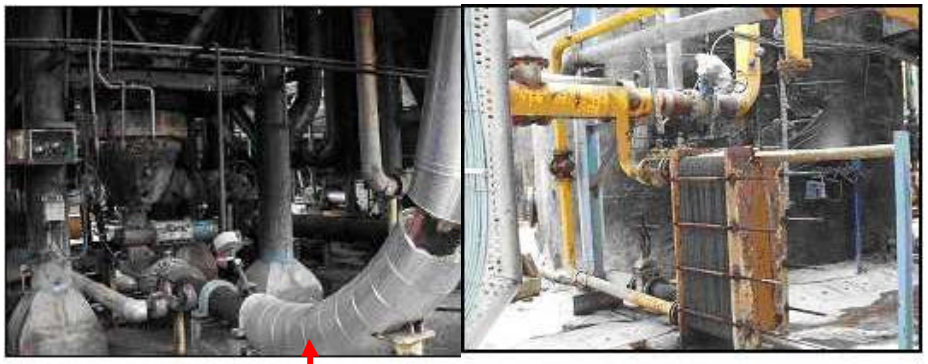
Pulp and Paper, India, Waste heat recovery, Steam distribution and utilization

OBSERVATIONS

The observations made during the process are as follows:

- The digester is blown 36 times a day for around 15 to 20 mins each time
- Total amount of pulp blown is 2891 TPD
- The flash steam from the digester blows was being condensed and the hot
  - resultant fouled condensate was being used in a secondary loop for heating
  - process water in two plate heat exchangers.
- Foul condensate flow was of the order of 86 – 95 m^3/hr at 85 ^{0}C, at 7.28 Mkcal/hr heat content

- The process water of 200 m3/hr quantity was being heated from 38 ^{o}C upto 44 45 ^{0}C in these plate heat exchangers.
- The desired process water outlet temperature is 70 ^{0}C
- This additional heat requirement in process water temperature was being
  - made up by LP steam (to the tune of 300 TPD, 8.25 MkCal/hr) directly
  - injected into the hot water tank
- There was large amount of wastage of steam from the hot water tank as heat
  - was being lost from the surface of the water tank in form of fugitive steam.



Blow Flash Steam Pipe

Old Heat Exchanger

OPTIONS

In order to maximize heat recovery from the hot foul condensate at 85 ^{0}C, generated from condensing digester blow flash steam, the existing secondary loop, plate heat exchanger heat transfer area of 45 m^2 was enhanced to 83 m^2 by adding an additional plate heat exchanger. Also, the steam losses from the surface of the hot water tank was reduced. This resulted in avoidance of use of expensive LP steam and thereby cost and coal savings.

Increased Heat Transfer Area

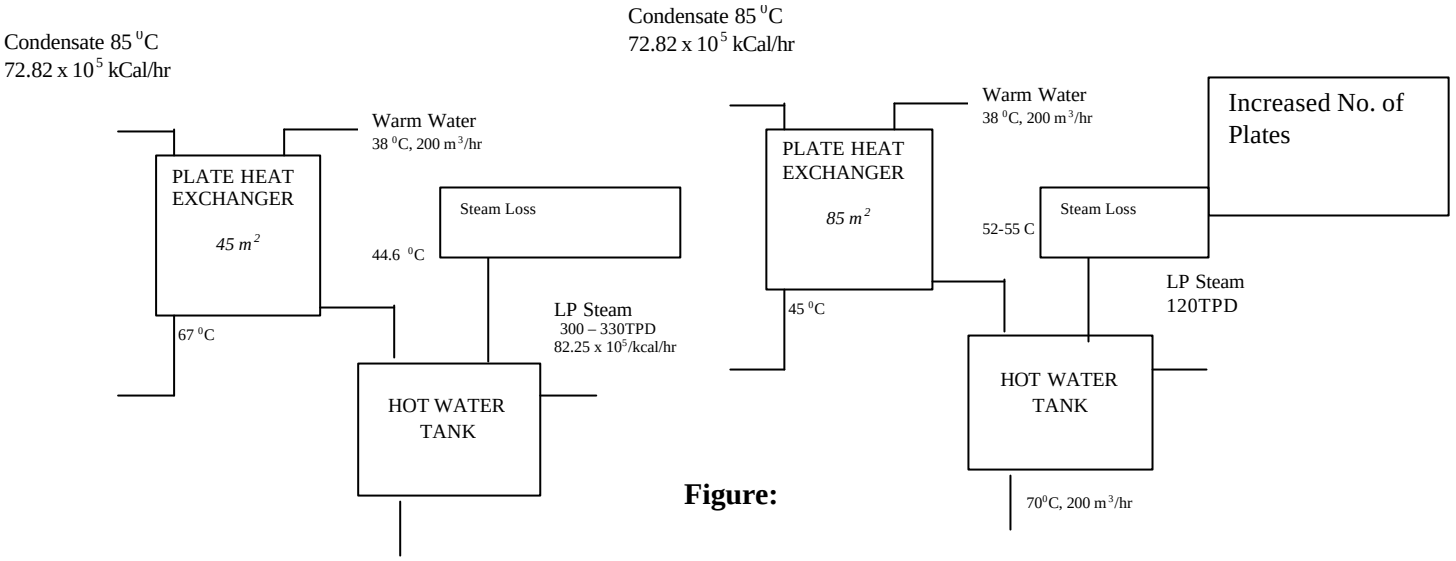


Figure:

RESULTS

Financial benefits

- Investment (includes cost of equipment., mechanical, electrical services, installation, commissioning charges): Rs.20 lakhs (US$ 46,512)
- Annual operating costs: none
- Annual cost savings: Rs. 172.08 Lakh (US $ 400,186), calculated as follows:
  - (7.5 TPH X 300 Rs./ ton of steam)-(59 kWh/hr X Rs. 1.67/kWh)
  - Rs. 2,151 per hour (US $ 50 per hour)
  - Rs. 2151 X 8000 operating hours per year
- Payback period: less than 2 months

Environmental benefits

- Annual steam savings: 60,000 TPY
- Annual equivalent coal savings: 11,520 TPY
- Annual additional power consumption: 472,000 kWh
- Annual GHG emission reduction: 17,200 tons CO2 (= (1.44 X1.53 tons CO_2/ton coal) – (59 kWh/hr X 0.000893 tons CO_2/kWh): 2.15 T CO_2 /hr) [1]

Energy savings were calculated as follows:

- Prevalent steam consumption: 12.5 TPH
- Existing power consumption (transfer and circulating pumps): 44 kW
- Steam consumption after modification: 5 TPH
- Power consumption after modification (due to additional Transfer and circulating pumps): 103 kW
- Net Steam savings: 7.5 TPH
- Net additional power consumption: 59 kW
- Net equivalent coal savings @ 5.2 steam to coal ratio :1.44 TPH

PARAMETERS	BEFORE IMPLEMENTATION	AFTER IMPLEMENTATION
STEAM	12.5 TPH	5 TPH
ELECTRICITY CONSUMPTION	44 KW	103 KW

[1] – Sourced from UNEP GHG calculator.
Electricity related GHG reduction – Specific to India
Coal related GHG reduction – General

FOR MORE INFORMATION

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