

# Energy Conservation Efforts in Soda Recovery Plant of SPM Ltd.

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## ABSTRACT

*The Article below mostly deals with efforts made to conserve energy with material available around us. Encouraging results are achieved by circulating 3% HCL with inhibitor Rodin Agromore-213 through evaporator tubes. SPM is replacing its old equipments with energy efficient equipments in search of saving more energy and this effort is still on.*

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## INTRODUCTION

Pulp & Paper industry is highly energy intensive. In view of the increasing fuel prices and rising power cost, there is an urgent need to conserve energy through better control of various operations in the plant. The present paper touches upon the efforts made to conserve and proper utilisation of power, steam and equipment without any heavy investment in the plant.

The Recovery plant of SPM consist of two set of evaporators first is Rosen blade make Short tube five effect evaporator of capacity 42 MT. Water evaporation. Second is L & T make long tube sextuple effect of capacity 50 MT water evaporation. L & T evaporator was installed in January 1982. Mill has two Recovery Boiler one is wall spray B & W type very old Tomlinson Boiler of 80 MT. Dry Solids capacity. it is run only at the time of BHEL Recovery Boiler cold shut down. Second is suspension firing. C E type BHEL Recovery Boiler of capacity 275 MT. Dry solids. It was commissioned in January 1984. We have old Dorr Oliver Causticizing plant of capacity 840 m<sup>3</sup> white liquor per day. Causticizing plant has white liquor clarifier of 2250 m<sup>3</sup> with five mud washers and three mud filters. Only one new sludge filter of 100 MT. Capacity is running and it was installed in September 1997.

Before 1984, The Recovery Plant of The Sirpur

Paper Mills was consisting of one B & W wall spray Tomlinson Boiler of 80 Tonnes Dry solids per day and five Rosters to handle around 200 TDS per day. Heavy Na<sub>2</sub>O losses and heat losses were apparent from the equipment which are mentioned above, except Tomlinson Boiler which was running with a crippled precipitator. Due to tremendous energy and Na<sub>2</sub>O losses the mill economy was in a very bad shape. It was for its own survival that the SPM commissioned BHEL Recovery Boiler of 275 TDS with twin cascade and two electrostatic precipitator in January 1984.

Capacity of evaporators was going down day by day due to low heat transfer and we have to change the steaming body frequently. Scale found in evaporator tube was finally analysed in our laboratory and found that scaling was due to silica and CaCO<sub>3</sub>. This change in performance of evaporator was observed after the changing cooking raw material took place. The ratio bamboo and hard wood was changed from 40:60 to 15:85. Due to heavy fines in WBL and poor quality of local lime (less than 50% available CaO% at table feeder) performance of evaporators got deteriorated day by day. Flat slanting screen of 100 mesh was

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## ENERGY CONSERVATION /CHEMICAL RECOVERY

installed in Pulp Mill to arrest pulp fibre to the extent of 3 mg/litter.

Since we are unable to get lime of better quality, the effect of poor quality of lime was observed on the performance of our evaporators. The capacity of our long tubes and short tube multiple effect evaporators was going down considerably due to hard scale formation on the liquor side of tube specially in the steaming bodies. We were unable to remove this hard scale with the help of Usha Telehoist high pressure jet pump. We were compelled to run one street of short tube multiple effect evaporator, two sets of finishers effects along with a long tube six effect L & T evaporator to handle the WBL received from pulp mill.

To overcome this problem we decided for acid circulation through evaporator tubes though it was not an accepted and recognised procedure. We experimented with 3% Hydrochloric acid and Rodin Agromore 213 inhibitor in our effects which was bypassed for tube cleaning. The procedure that we followed was as follows.

Date	1.1.98	24.01.98	13.2.98	10.1.98	10.3.98	10.3.98	21.2.98	22.1.98
Effects	E.1	E.2	E.3	E.4	E.5	E.6	FC.1	FC.2
Silica gpl	5.66	6.36	1.33	2.39	0.27	0.27	4.0	1.16
Ca as CaCO <sub>3</sub> gpl	24	14	5.0	10.60	4.50	4.50	Traces	Traces
Mg as MgCO <sub>3</sub> gpl	13.44	3.15	4.20	1.34	3.60	3.60	7.98	7.14
Fe <sub>3</sub> O <sub>3</sub> gpl	1.30	1.20	0.92	2.58	3.51	3.51	2.67	1.88

- a) 3.0% commercial HCL with 1% Rodin agromore, the inhibitor circulated through tube for four hours at 50°C.
- b) The entire volume was drained and Soda Ash solution of 1% was circulated for one hour.
- c) Again the entire volume was drained and liquor Ammonia with Hydrazine Hydrate was circulated for one hour.
- d) The effect was finally cleaned with high pressure

jet pump at 350 kg/cm<sup>2</sup> pressure.

- e) On hydraulic test, no tube was found leaking even in M.S. tubes.

After circulating HCL in all effect we achieved the designed feed rate of our long tube and short tube evaporator as a result two sets of finisher effects consuming 2.5 MT. Steam per hour each were stopped for good. Short tube multiple effect evaporator runs now for 12 days in a month instead of whole month which consumed 7.0 MT. Steam per hour. The sextuple effect long tube evaporator runs all the time and we are able to extract strong black liquor of higher solids for higher temperature for our precipitator of BHEL Recovery Boiler. The analysis of scales after acid circulation at liquor side, is given below.

### ENERGY GAIN AFTER ACID CIRCULATION

- 1) **By stopping finisher effects:-** Both the finishers effects used to run minimum 15 days a

month, is completely stopped and removed.

Power Saving      Avg. 216 units/day

Steam saving      Avg. 60 MT/day (MP steam of 5.0 kg/cm<sup>2</sup>)

- 2) **By stopping second street evaporator:-** Rosen Blade evaporator used to run through out the month, But after acid circulation we were able to stop it average 18 days in a month.

Power Saving      Avg. 3240 units/day

Steam Saving            Avg. 100MT./day (LP steam  
of 2.2 kg/cm<sup>2</sup>)

**3) Energy Saving by installing vacuum pump:-**

Steam consumed in ejector MP            9.0 MT/day  
steam of 9.0 kg/cm<sup>2</sup> at 179°C  
Power consumed in vacuum, pump    720 units/day  
Cost of steam Rs. 361.28/MT.  
And cost of power is Rs. 1.31/unit  
Amount saving due to same            Rs. 2308/day

**4) Energy saving by installing variable frequency drive (VFD) motor of FD fan in BHEL Recovery Boiler.**

Power consumption before VFD    1776 units/day  
Installation  
Power consumption after VFD        960 units/day  
Installation  
Power Saving after VFD                816 units/day  
installation

5) During cold shut down of Recovery Boiler we have to store strong B.L. as normal paper production continues. Sludge formation in the tank was observed due to loss of temperature. Brick lining from outside of this big BL storage tank (1050 m<sup>3</sup>) with the help of saw/bamboo dust was done for insulation purpose. The sludge formation was observed to be less. Brick lining & saw dust insulation was further done in hot water tank and white liquor supply tank and due to same around 8-10°C temperature gain was observed. Glass wool lagging was done to Recovery Boiler ESPs ducting, strong BL service tank of Recovery Boiler and WL supply line from Recovery to pulp mill as Pulp Mill is far away from Recovery Plant. All the SBL, WBL, GL, wash and steam lines were insulated to prevent heat losses due to radiation.

6) Regular maintenance of steam traps is done to avoid any steam and energy losses.

7) Apart from a hot water tank in causticizer where foul condensate of evaporator is received, another tank of 100 m<sup>3</sup> was commissioned to avoid drainage of hot water in case of less water consumption in causticizer due to any reasons.

8) Total Active Alkali (TAA) concentration was raised to 70 gpl from 65 gpl which gave slightly higher solids of WBL in return helping evaporation and rejects at knotters in cooking was also found low in pulp mill.

9) New mud filter of 100 MT dry sludge was commissioned as old mud filter (70 MT capacity) was insufficient and continuous Na<sub>2</sub>O losses were taking

place due to overflowing of filter feed tank. Na<sub>2</sub>O losses at new sludge filter is 0.4% as compared to 0.8% in old mud filters.

10) Both the Electrostatic Precipitators of Recovery Boiler are renovated which has boosted chemical recovery efficiency and air pollution is within the prescribed limits of the Govt. (i.e. 85 mg./Nm<sup>3</sup>)

By way of acid circulation in evaporators we are able to process all the WBL at the higher outlet solid without extra steam and power requirement. Installing vacuum pump and VFD motor for FD fan has saved considerable amount of steam and power. With the help of new sludge filter ESPs renovation and proper control and strict vigilance over plant operation and losses, our overall recovery efficiency has gone up from 87.25% to around 90.5%.

Efforts are on to install energy efficient pumps, modification of pipe line and use of maximum second grade effluents water in place of fresh water. We hope to make our Recovery unit most efficient as far as energy consumption is concerned though it is a very old mill.

## CONCLUSION

Improvement achieved due to:-

1. Acid cleaning - Power saving 3456 units/day and Steam saving 160 MT./day.
2. Installing vacuum pump in place of steam ejectors- Rs. 2308/day.
3. Installing VFD Motor for FD fan of BHEL Recovery Boiler-816 units/day.

## ACKNOWLEDGEMENT

The Authors are thankful to the management of the Sirpur Paper Mills for permitting to write the above article for IPPTA though the efforts made to save the energy has been in a "KAIZEN" way.

"KAIZEN" is a Japanese term which means improvement should start from smaller things.

## REFERENCE

1. Technical service data sheet for RODINE-213 received from M/s Metalworking Chemicals Division Agromore Limited, Mysore Road, Bangalore-560 026.