ISSN: 0379-5462
IPPTA: Quarterly Journal of Indian Pulp and Paper Technical Association
Vol. 36, E1, 2024, p. 168-171

SUSTAINABLE PRACTICES FOR ENVIRONMENTAL STEWARDSHIP - A CASE STUDY IN WCPM

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Abstract:

*This paper addresses with aim of **Utility conservation**[1] in the pulp & paper industry, through demonstrated measures as well as partly implemented in West Coast Paper Mills. The paper industry, a significant consumer of these vital resources, is at a pivotal point where adopting sustainable practices is not only beneficial but essential for environmental stewardship. Our innovative conservation measures led to a remarkable reduction in water usage of 40m3/ton of paper and improvement in **energy**[2] efficiency, reflecting our commitment to reducing ecological footprints.*

Having a systematic approach towards the advanced Technologies, West Coast Paper Mills is aggressively being adopting these. WCPM approach always be of best utilization of natural resources as well as implementation small kaizens in plant whether pulp mill, paper machines, recovery and power house. The results are encouraging in steps related to organic cooking aid in pulp mill, chipper dust utilization and overall water saving schemes. Besides this major change can be considered with the inclusion of advance technology as AI/APC, boiler efficiency and micro turbine etc.

These initiatives not only represent significant advancements in Utility conservation, but also under scope the industry's role in environmental protection. Our results demonstrate the potential for substantial conservation in industrial settings and provide a road map for sustainable resource management in paper manufacturing

Key words: *Utility conservation, energy, Advanced Technology*

Introduction

Energy is a dominant factor that effects the economics and environment performance of the pulp and paper industry. Pulp and paper mills not only use huge amount of energy in the form of power/or fuel but they often have huge supplier of energy as well. In case of Kraft mills a major source of energy, the lignin removed from the cellulose during pulping mostly converted in to steam during chemical recovery operation. This steam can be used for generating power/ running the process. By improving the overall efficiency of operations the industry can come somewhat closer to energy self-sufficiency.

The pulp and paper industry known as an energy intensive sector which accounted for approximately 6% of global industrial energy consumption in 2017(International Energy Agency).Regardless of a continuous increase in renewable fuel use, pulp and paper mills still rely on fossil fuels and emit a significant amount of CO2. In line with the Paris Agreement target, the European Union aims to be climate neutral by 2050.The target call the PPI to transform towards carbon –negative operation. The transition is important also for maintain the competitiveness of the sector.

Energy prices have been on increasing trend and optimization of energy consumption is needed of the hour for all the mills.

The goal of the present paper is to review the energy usage in the pulp and paper sector and possible initiatives in terms of the current state by art and prospect for the future.

Present power consumption in Indian Integrated paper mills (Table No.1)

Sl No	Section	Power consumption kWh/t of paper
1	Pulp Mill	300-325
2	Recovery section	250-300
3	Stock preparation &Paper Machine	350-450
4	Effluent treatment plant	75-100
5	Power generation plant	150-200
6	Total	1126-1300

Present power consumption of West coast paper Mills is 1180-1225kWH/T

Best performances of PAT-II (Table No.2)

Sl No	Top 5DCs having maximum number of ESCerts	Number
1	BILT Ballarpur unit Maharashtra	33842
2	Century pulp& paper Lalkua Uttarakhand	29649
3	Tamil Nadu Newsprint Ltd Karur TamilNadu	26352
4	Sheshasayee paper and Boards Erode Tamil Nadu	21057
5	West coast paper Mills Dandeli Karnataka	18780

Energy:

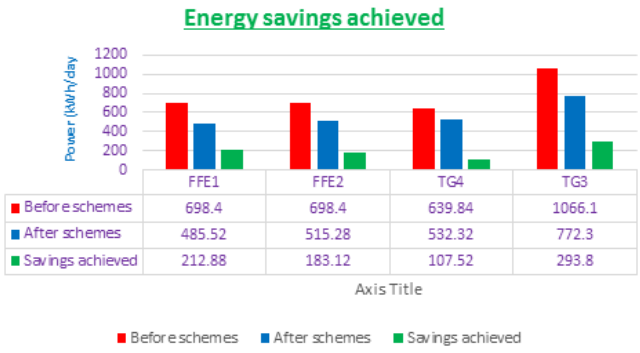
Keeping in view of paper plant as energy intensive the WCPM has also implemented various initiatives based on the brain storming session in the department as well as on plant level. Some case studies are highlighted as;

Case Study I: Cooling tower Fan

Lot of technological advancement in the cooling tower fan, we have also studied our cooling tower & taken initiative to replace the existing fan with high energy efficient fan (modified angle with lesser weight)

Cooling tower fans replaced with less weight 6 No.s blades (Picture No.1) with modified design to maintain the same operating Parameters as earlier with low energy consumption. (Graph No.1)

Before 08 No's Blades **After 06 No's Blades**



Graph No.1 Power consumption before and after fan blade modification

Case Study 2:

Using Organic cooking aid and Bio dispersant in mixed hard wood cooking

One of the major initiative was taken of using the organic cooking aid and Bio dispersant in the mixed hard wood cooking.

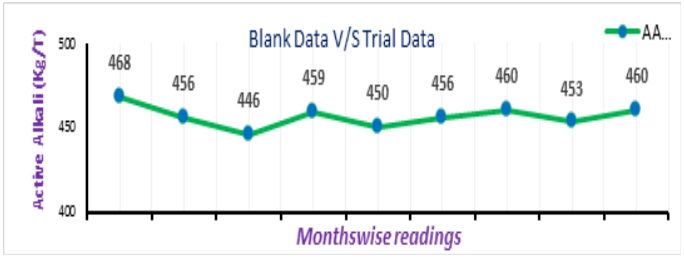
The organic cooking aid play an important role in terms of odor reduction through mercaptans & sulphide removal. This microbes can serve at high cooking temperature due to its nature. The mercaptans generated during the cooking process are effectively quenched by these microbes resulting in the reduced odor at the coking stage.

The Bio dispersant role is to reduce the surface tension and that supports to enhance the wettability as well as increasing the capillary action across the wood chips (better penetration). It enhances the delignification at the reactions thereby reducing the effective cooking liquor quantity. Also the bio-dispersant effectively keeps the pitch from getting released during the cooking process in dispersed form, not in aggregation form.

The use of organic cooking aid supports us in the reduction of Active Alkali, less generation of WBL/MT of pulp .This has supported the steam reduction in both raw material cooking also at MEE.

Active alkali reduction achieved approximately 0.5% (Graph No.2)

White liquor volume reduced approximately 6-8M3/digester & that also reflective in low WBL volume generated per digester



Graph No.2 Active alkali reduction

Observations:

Approximately 60% reduction in odor

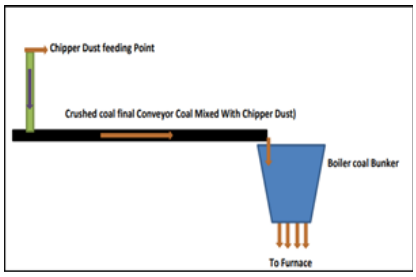
Case Study 3:

Using of Alternative fuel (Chipper Dust) for existing AFBC boilers

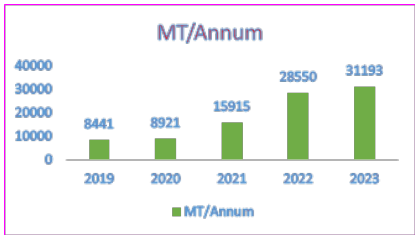
West coast paper Mills is based on the mixed hard wood raw material and as an average 3% (as such) chipper dust is being generated per day with gross calorific value of 2500Kcal/Kg.

Keeping in view of best utilization of available waste (chipper dust), we have modified its mixing system (Picture 2) with the coal at the power house and that had resulted increase in consumption (Graph 3) near to generation.

- providing pneumatic purging system at bunker
- Proper screening of wood dust at source to separate small chips/shives



Picture 2: mixing of Chipper dust



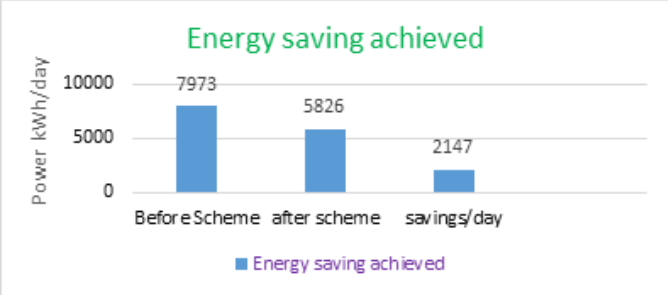
Graph 3: Chipper Dust Consumption

Case Study 4:

Oversize impeller trimming to reduce the power consumption.

AS the WCPM has great focus on conservation of natural resource water, that also reflects in results good saving in fresh water consumption, so the need to minimize water intake through intake feed water impeller trimming.

Power savings achieved /day: 2147 kwh/day (Graph No. 4)



Graph No. 4: Power savings achieved

Water Conservation:

Water is one of the most important climatic factor. West Coast Paper Mill is one of the leading paper manufacturer in India, is adopting innovative conservation measures led to remarkable reduction in water usage.

Key strategies include

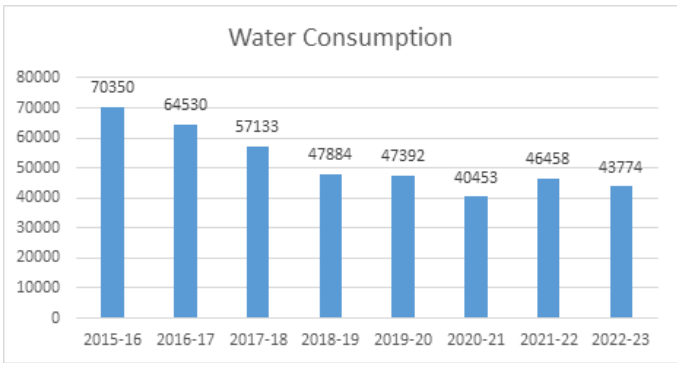
- An eco- friendly water management systems involves the conservation, recycling, and efficient use of water
- Systematic fresh water distribution header with individual water supply line to respective machine with flow meter to monitor the consumption
- Water and Energy Audit with Internal expert team
- Micro filtered machine back water for wire cleaning showers

Case Study 5:

Systematic distribution of fresh water to process

Earlier we were not having proper distribution system of fresh water. Now at filter house we have provided one main header with different water supply line to individual machines and other sections. (Picture No.3) We have provided flow meters to individual line and provided pressure control system with pressure transmitter and VFD to supply pump. With the arrangement we are able to supply fresh water uniformly and monitor the water consumption in individual section. We have saved more than 2500M3/day fresh water with this arrangements. (Graph No. 4)

Picture No.3 Systematic Water Distribution



Graph No. 5: Water Consumption (Excluding domestic)

These initiatives not only represent significant advancements in water and energy conservation, but also under scope the industry's role in environmental protection. Our results demonstrate the potential for substantial conservation in industrial settings and provide a road map for sustainable resource management in paper manufacturing sector.

Advance Technology Adoption

A. Micro turbine in place of Pressure reducing valve

Area of Improvement:

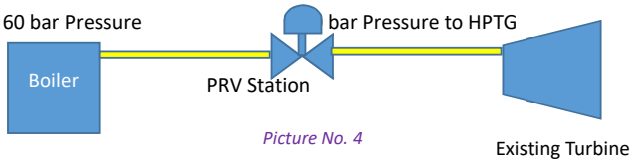
Steam was being produced from boiler at 60 bar pressure Steam was majorly used for steam turbines pressure is 40 bar. (Picture 4)

Observation:

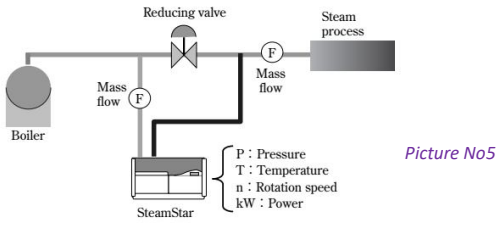
High pressure steam was transferred to majorly for Turbine at different pressure and temperatures. Major part of steam was being used at 40 bar pressure at Turbine inlet. Pneumatic operated PRV was in use for reducing steam pressure to 40 bar. After PRV station steam was 40 bar with 400 Degree. The location of PRV was just before the user block, after PRV steam was used in different turbine. Kinetic energy of high pressure steam was being lost at PRV station. (Picture No. 5)

Energy Conservation Measure:

Back pressure micro turbine can be installed in place of PRV



Picture No. 4



Picture No5

B. Use of catalyst prior to furnace oil addition (Already trail taken)

At a temperature between 250ºC and 300ºC the unique catalyst breaks the longer chain hydrocarbons in the oil to lower weight hydrocarbons which are easily combustible. This further improves combustion.

When the fuel is injected into the operating system, the surfactant present in the catalyst reduces the fuel droplet size thereby improving

the atomization. The increased atomization reduces the excess air requirements for the complete combustion. This also further improves combustion efficiency.

The main tangible benefit with the use of catalyst is reduction in fuel consumption by approximately 4%.

C. Use of thermal resistance paint at the lime kiln shell

This thermal resistance paint will further minimize the shell outlet temperature by 8-10 degree. Paint UGAM HRTI600 Enhance energy efficiency through reduction thermal losses effectively. It significantly reduce the exterior surface temperature of shell. This translate into a direct reduction in exterior heat transfer efficiently driving low energy consumption.

D. Advance process control system for the furnace oil optimization at lime kiln

Lime re burning is the process of converting lime mud sludge generated in the caustisizing plant to re burnt lime (CaO) that takes place at high temperature in a rotary lime kiln which is a chemical reactor and heat transfer device.

In WCPM earlier we had tried with control loops taking clue from APC concept O2 in Exit flue gas. And calcination zone temperature controlled by fuel flow rate. But not successful in continuous run for reason like the time taken by the material inside the kiln in travelling from feed end to discharge point need to be maintain higher O2 for short period if Kiln temperature is on lower side.

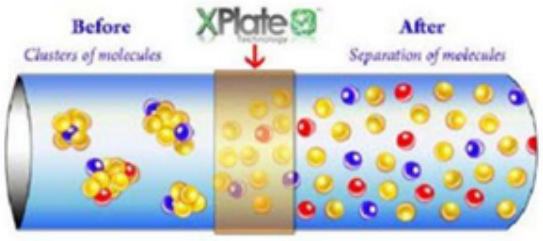
Advance process control with automatic generation of set points, works according to thermodynamic principles of lime kiln operation and based on the physic- chemical of combustion and calcination reactions

APC is a multi-variable feedback control & optimization of Industrial process having several input & output variables, based on Model Predictive Control technology. The main objective of the APC are close control of Flue gas temperature, Optimal control of ID Fan & Fuel, Control excess Oxygen in the flue gases and maintain the Lime quality We can get more than 3% reduction of fuel consumption, less variability in the amount of residual carbonate in the lime.

E. Improve in Boiler Efficiency and Energy Saving using of X-Plate Technology

The X Plate Nano Technology based on the separation of O2 molecules from the clusters so that they are available for combustion. (Picture No. 6)

- Free Oxygen molecules are available for reaction with Carbon.
- Carbon Monoxide will reduce and the amount of O2 present in air supply will be completely utilized for combustion.
- O2 is completely consumed from the air supply giving Complete Combustion
- Reduction in Fuel consumption.
- Reduction in Electricity consumption.
- Reduce NOx, Sox & CO2 emission (Ton/day)



Picture No. 6: XPlate working

Air molecules (oxygen, nitrogen) originally form clusters. After passing through XPLATE, these molecules Split out from each other becoming single molecules, which subsequently increase their surface Areas readily available to react with fuel carbon.

F.VFD at all HT Motors in phase manner.

WCPM is already using VFD on L.T motors of different suppliers. Smooth control process parameters as well as energy savings are being achieved with these VFDs. M/s Control Technique is very good organization and developed H, T VFDs. They are already supplied these VFDs in abroad and in few locations in India. We have already installed VFDs on both FBC III and BHEL recovery boiler and achieved desired energy savings. By installing these we can further achieve savings of 650000KWH/year.

Conclusion:

The results of specific measures taken on utility front are encouraging. Also proper selection of cooking aid with respect to RM mix is a better choice of the system. Advance technology including AI has a good scope of optimization and further reduction of utility, still needs proper study of any adverse impact on the process and product quality.

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