Water & Wastewater Management in Pulp & Paper Sector-FICCI Case Study

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The Pulp and Paper Industry is one of India's oldest and core industry sector. As per CPPRI, 2009 data, there are 706 Pulp & Paper mills in India, out of which about 50% of the Pulp & Paper industries are located in the States of Maharashtra, Gujarat & Uttar Pradesh. Paper manufacturing is a highly capital, energy and water intensive process. It is also a highly polluting process and requires substantial investments in pollution prevention & control equipment. It is observed that about more than 80% of the Pulp & Paper units operate on medium & small scale and majority of them lack adequate water & wastewater management practices. As per the FICCI experience, it is felt that these Pulp & Paper units need to be supported by providing hand holding support and technical guidance for adoption of water efficient technologies and implementation of water and wastewater management best practices to achieve reduction in freshwater & energy consumption, reduction in effluent generation and reducing operational cost.

Recognizing Pulp & Paper as one of the prominent sector with substantial potential of 'reduction in water use & effluent generation' in India, FICCI conducted a scoping study supported by WWF & HSBC under 'Living Ganga Program'. Under the study detailed water audits were conducted in selected Pulp & Paper units from the Ganga Basin States. The study identified various issues related to poor water & wastewater management in the Pulp & Paper sector. The study also identified/evolved best practices mainly to achieve reduction in fresh water consumption and generation of effluent.

Out of the various recommendations, the following Best Practices were suggested for pilot intervention and demonstration in one of the studied Pulp & Paper unit:

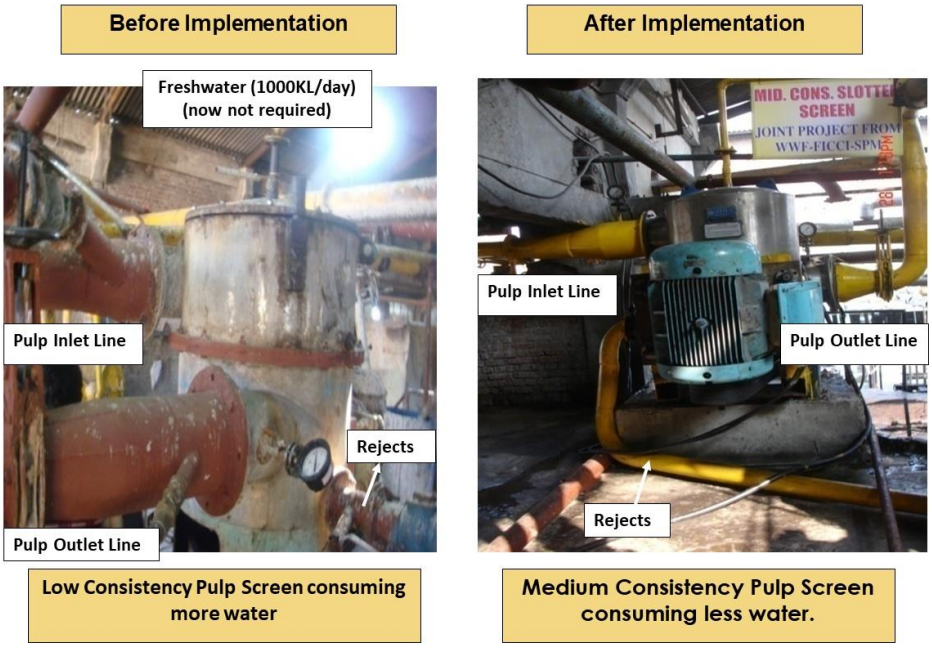
- Use of Medium Consistency Screening for Pulping instead of Conventional low consistency screen
- Use of Fan Jet Spray Showers and Wide Angle Spray in Paper Machines instead of conventional hole showers
- Segregation of colored effluents and adoption of color removal technology for recycling and reuse of treated effluent
- Providing training & awareness to the workers regarding water saving & conservation

In order to demonstrate the possible benefits & water savings the above schemes were implemented in one of the studied Pulp & Paper unit. After implementation of above schemes, a detailed measurement and monitoring was conducted and it was observed that the implementation of above mentioned best practices had led to about 50% reduction in freshwater consumption in the unit and reduction in effluent generation by 22%. The above schemes led to color removal & had improved the overall effluent treatment efficiency. The best practices had also helped in the capacity building of the unit's employees for conservation of raw material, water and energy. The details of implemented schemes, their estimated cost & benefits to the unit are explained here.

Schemes Implemented in the Pulp & Paper Unit by FICCI with Support of WWF

A. Installation of Modern Medium Consistency Pulp Screening Equipment

The studied unit was consuming 3000 KL/day of freshwater in the pulp screen instead of 2000 KL/day as per the design requirement. It was observed that due to conventional low consistency (1%) Pulp Screen an additional 1000 KL/day of freshwater is supplied for dilution of Pulp and large volume of wastewater was generated with more percentage of fiber losses. Therefore, it was proposed to replace the low consistency screening technology (1%) by medium consistency (2.5%) pulp screening technology which led to about 1000 KL/day of reduction in Freshwater consumption.



Benefits of the Modern Medium Consistency Pulp Screening Equipment: By using Modern Medium Consistency Pulp Screen, the freshwater requirement for dilution of Pulp was reduced by 1000 KL per day (33%). This led to the stoppage of 30 H.P. Borewell supplying the freshwater to the pulp screen directly. Also the effluent generation from the pulp screen was reduced leading to maximum fiber recovery in the process. The proposed scheme would save about 300000 KL of fresh water per year.

Table 1: Water & Energy Savings by Modern Pulp Screen Installation

Water & Energy Savings by Modern Pulp Screen Installation			
	Water Consumption (KL/day)	***Energy Consumption***	
Details		***Borewell (H.P./day)***	***Modern Pulping Screen KWh/day***
Before Installation	*3000*	*720*	*990 (60 HP)*
After Installation	*2000*	*480*	*490 (32.8 HP)*
Savings	***1000***	***240***	***500 (33.5 HP)***

B. **Installation of Water Efficient Showers at Paper Machines**

The studied unit had installed 2 nos. of Hole Showers in each Wire Part section of three Paper Machine lines. Earlier the unit was consuming around 1200 KL/day of freshwater and each Hole Shower was consuming water at the rate of 10 m3/hr. When these Conventional Freshwater Showers were replaced with Water Efficient Showers (Fan jet & Wide Angle spray) in the Paper Machine section, the freshwater consumption in Paper Machine sections was reduced to 720 KL/day which in turn reduced the amount of Backwater generation. The modern showers included 3 nos. of Modified Fan Jet Spray Showers (Bearing C/C 3500 mm) and 3 nos. of Wide Angle Spray Showers with self cleaning brushing system (Bearing C/C - 3500 mm) which consumed Freshwater at the rate of 5 m3/hr and 7 m3/hr respectively.

Before Implementation



Fig 3: Inefficient Hole Showers consuming more water

After Implementation



Fig 4: Water Efficient Wide Angle Spray Showers

Benefits of the Water Efficient Showers at Paper Machines: By replacing 6 nos. of Hole showers with modern water efficient showers in 3 paper machines, total fresh water savings of 480 KL/day (40%) was achieved. Also, the implemented scheme led to a subsequent reduction in Effluent Generation of about 240 KL/day. The scheme would save about 144000 KL of fresh water per year and it would lead to reduction in effluent generation to about 72000 KL per year.

Table 2: Water Savings & Reduction in Effluent Generation by Modern Water Efficient Showers

Water Savings & Reduction in Effluent Generation by Modern Water Efficient Showers		
Details	**Water Consumption (KL/day)**	**Effluent Generation (KL/day)**
Before Installation	1200	600
After Installation	720	360
Savings	**480**	**240**

C. **Implementation of Scheme for Segregation & Treatment of Colored Effluent**

Earlier the unit was sending 1200 KL/day of colored wastewater to ETP without any segregation and pre-treatment. The conventional ETP scheme was not equipped to remove the color in the wastewater completely; hence the treated effluent also carried color which created nuisance in the nearby surroundings due to colored wastewater discharge. To address the problem of colored effluent, a color effluent segregation & treatment scheme was implemented in the unit.

The colored effluent streams were segregated through separate channels and collected separately for color removal treatment by lime dosing in a Tank before mixing with the common effluent drain of the unit.

Benefits of the segregation and treatment of colored effluent scheme: The implementation of the proposed scheme had improved the efficiency of existing ETP by color removal from the segregated effluent and hence overall quality of the discharged effluent has improved.

D. Providing Training & Awareness to the Workers Regarding Water Saving & Conservation

A training & awareness workshop on 'Water Conservation and Wastewater Management' was conducted by FICCI for the unit's middle management.

The training covered various water issues like Global water scarcity, groundwater exploitation, water & wastewater management best practices, water audits & accounting, demand side management, water saving instruments, water conservation & rainwater harvesting etc.

Motivated by the FICCI training & awareness, the unit with its own initiative replaced many of the Freshwater Showers with Backwater Showers at different equipments like Decker Thickner, Potcher Washing Drums, Cylinder Press, etc. (Earlier the unit was using mostly Freshwater showers at various equipments and was not utilizing the excessive amount of generated Backwater). Now the unit is utilizing Backwater instead of Freshwater at these equipments.

Benefits of the Installed Backwater Showers

With the installation of Backwater Showers at various equipments, plant had been able to recycle 1500 KL/day of Backwater. This had reduced the Freshwater consumption by 1500 KL/day.

Overall Impact of the Project

Reduction in Freshwater Consumption upto 50%

Based on measurements and calculations it was observed that the unit was consuming around 6000 KL/day of Freshwater before installation of schemes. Successful installation of proposed schemes (i.e. medium consistency pulping Screen, Modern Showers & backwater showers) had lead to total water savings of 3000 KL/day. Hence, Water Consumption has reduced from 6000 KL/day to about 3000 KL/day. Therefore, the suggested schemes had reduced the fresh water consumption of the unit upto 50%.

Reduction in Specific Water Consumption upto 56%

The unit was consuming about 6000 KL/day of Freshwater before installation of proposed schemes and was producing 80 TPD of paper. After installation of the schemes the unit is now consuming around 3000 KL/day of Freshwater and has also increased its production capacity to around 90 TPD. Therefore, Specific Water Consumption of the mill was 75 KL/Ton of Paper produced before installation and it is 33 KL/Ton of paper produced in the present scenario, i.e., after installation of the schemes.

Reduction in Effluent Generation upto 22%

Based on measurements and calculations it was observed that mill was discharging around 3200 KL/day of Wastewater before installation of schemes. Successful installation of proposed schemes (i.e. Pressure Screen and Modern Showers) has led to an effluent discharge of 2500 KL/day instead of 3200 KL/day and, hence, Effluent Discharge has been reduced by 700 KL/day. Thus, Total reduction in Effluent Generation is about 22%.

Table 3: Cost Benefit Analysis of Implemented Best Practices

S.No.	***Best Management Practices***	***Operational & Environmental benefits***	***Annual Resource Savings***	***Investment (Rs. In lakhs)***	***Annual Monetary Savings (Rs. In lakhs)***	***Simple Payback Period (Years)***
1	*Replacement of Conventional Pulp Screen with Modern Pulp Screening Equipment having consistency 2.5%*	*Uses less fresh water and energy and also, less energy would be required to pump the fresh water from the borewells*	*- Water Savings 3,000,00 KL*	*9.5*	*12*	*0.8*
			- Energy Savings 226050 HP			
2	*Replacement of conventional hole showers with modern wide angle & fan jet spray Showers at Paper Machines*	*Uses less water and enable backwater recycling leading to less effluent generation & savings in effluent treatment*	*- Water Saving 1,440,00 KL*	*1.4*	*1.7*	*0.8*
			- Reduction in backwater generation 720,00 KL			
SUB-TOTAL				*15.4*	*18.9*	*0.8*
3	*Segregation of colored effluents for colour removal before treatment & reuse*	*Increased efficiency of existing ETP and improved quality of final Effluent.*		*4.1*	*Operating Cost (-7.5)*	*--*
TOTAL				***19.5***	***11.4***	***1.7***

The Way Forward

Sharing of the results of this successful case study is aimed at scale-up implementation by other pulp & paper units in this sector. The sector needs to take up 'Water Audit & Accounting' studies periodically to know their water usage and wastewater production & treatment and to identify the areas of improvement. In the long term, the sector needs to reduce its water footprint to become more sustainable and productive.

About the Authors



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