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Thai Kraft Paper Industry, Wangsala – Significant cost savings by upgrading the approach flow systems of 4 paper machines to Voith C-bar technology

The Siam Pulp and Paper Public Company Ltd is Thailand's oldest and largest producer and converter of packaging and fine papers. Companies in the Group include the paper mills SKIC (Siam Kraft Industry Co) Bangpong, TKIC (Thai Kraft Paper Industry Co) Wangsala, TUPI (Thai Union Paper Industries) Wangsala and Bangkok, as well as TPC (Thai Paper Co.) Bangpong. The paper mill UPPC in Calumpit, Philippines also belongs to the Group.

Voith Paper and Siam Pulp and Paper have enjoyed a close and trustful partnership for decades. A number of Voith stock preparation lines and paper machines are installed in the customer's mills.

Upgrading the stock approach flows of PM 4, 5, 6 and 7 in Wangsala

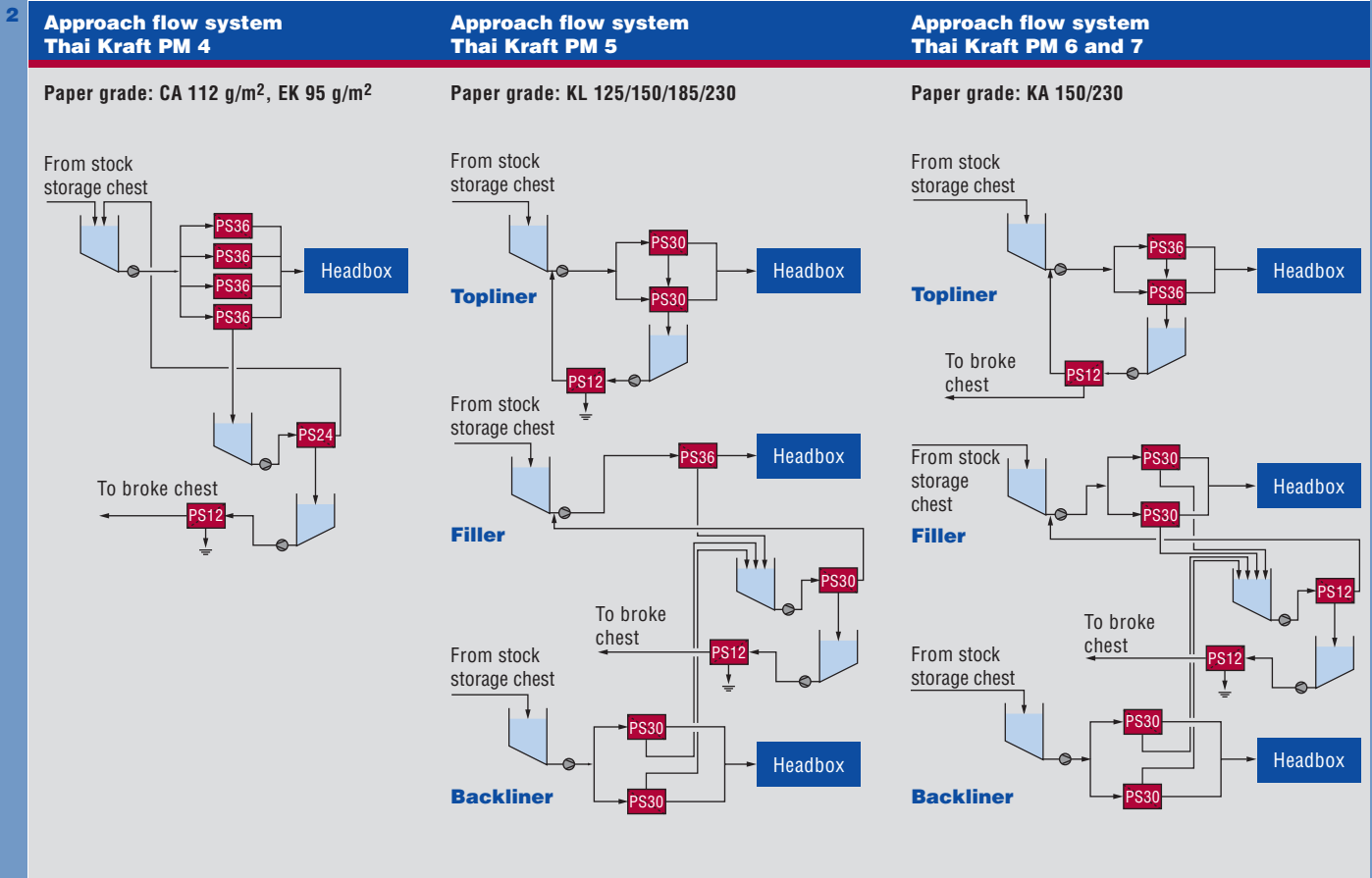
To keep up with the constantly increasing demands on paper quality and at the



Fig. 1: Thai Kraft Paper Industry, Wangsala.

Fig. 2: Layout of the stock approach flow systems for PM 4, 5, 6 and 7.

Fig. 3: Screen upgrade package for the backliner of PM 6, consisting of C-bar basket, MultiFoil rotor and belt pulley.



same time reduce production costs, Thai Kraft initiated an optimization programme for the approach flow systems in Wangsala. This involved upgrading all the competitor pressure screens in the approach flow systems of PM 4, 5, 6 and 7 to Voith C-bar technology.

Up till then the screens all operated with rotors with four continuous foils each, together with milled baskets. Despite large slot widths of 0.45 mm, the mill could only achieve the required throughputs by running the screens with very

high rotor speeds which meant a high specific energy consumption.

This resulted in disturbing pulsations, while screening efficiency was not sufficient for the high paper qualities demanded by the market. In addition, the rotors and screen baskets exhibited very heavy wear.

Fig. 2 shows the approach flow layouts of PM 4, 5, 6 and 7 together with the paper grades produced. PM 6 and 7 are identical.

Energy savings using C-bar technology

Trial delivery for PM 6 backliner

The optimization phase began in February 2002 with a trial delivery of two optimization packages for the screens in the backliner system of PM 6 approach flow (Fig. 3). These were upgraded to Voith MultiFoil rotors and 0.30 mm C-bar slotted baskets. At the same time the rotor speed was reduced by 29 %. Motor load dropped immediately by 47 % from 75 to

4	Location		Machines			Power consumption [kW]			kWh saved per year (350 days)	5	
			before	after	ΔP						
Topliner	1st stage	2 x size 36	2 x 92	2 x 57	2 x 35			588,000	PM 4	1,354,920 kWh/year	
	2nd stage	1 x size 12	16	12	4			33,600	PM 5	1,873,200 kWh/year	
Filler	1st stage	2 x size 30	2 x 74	2 x 40	2 x 34			571,200	PM 6	1,797,600 kWh/year	
	2nd stage	1 x size 12	21	20	1			8,400	PM 7	1,797,600 kWh/year	
	3rd stage	1 x size 12	21	20	1			8,400	Total	6,823,320 kWh/year	
Backliner	1st stage	2 x size 30	2 x 75	2 x 40	2 x 35			588,000			
Paper grade: KA 150/230								Total 1,797,600	Overall cost savings	Euro 103,600 per year	

40 kW, representing energy savings of 588,000 kWh per year.

In view of this enormous reduction in energy and the technological improvements described in the following, the mill completely converted the approach flow systems of PM 4, 5, 6 and 7 to C-bar technology.

Energy balance for PM 6 and 7

Fig. 4 shows the energy balance for the approach flows of PM 6 and 7, – a total saving of 1,797,600 kWh per PM and year.

Overall energy balance for PM 4, 5, 6 and 7

The energy balance shows overall energy savings of 6,823,320 kWh per year for all four approach flows (Fig. 5), representing energy cost savings of approximately Euro 103,600 per year.

Overall energy balance in the light of the Kyoto Protocol

At this point it is interesting to consider the significant reduction in energy requirements in the light of the reduced CO₂ emissions and the Kyoto Protocol. The following observation is based on 100 % power supply from a coal-fired power station.

Certain parameters such as the relationship between energy output in the form of electrical and thermal energy and primary energy input (overall power station efficiency) and the relationship of electrical energy to thermal energy output (power coefficient), are based on values taken from similar plants and therefore may vary from those in Wangsala. The fol-

lowing estimate is therefore intended to give an idea of the additional potential cost savings as a result of the savings in electrical energy. The following figures have been used as basis:

- CO₂ emission from coal combustion per kWh primary energy = 0.335 kg CO₂
- Overall power station efficiency = 75 %
- Power coefficient = 0.5
- Expected emission charges = between Euro 5 and Euro 12.5 per ton CO₂.

The previously mentioned energy saving of 6,823,320 kWh per year is equivalent to a primary energy requirement of 27,293,280 kWh per year. The resultant CO₂ emission amounts to 9,143 metric tons per year.

Assuming an emission charge of Euro 8 per ton CO₂ for the emission certificates, an additional savings potential of Euro 73,146 per year is possible.

Technological improvements by upgrading to C-bar

The following describes the improvements in quality obtained in terms of stickies removal efficiency. In the backliner trials for PM 6, the stickies removal efficiency was improved from 25 % to 63 %. This can be attributed to the following:

- MultiFoil rotor speed reduced by 29 %
- Gentle operation of the MultiFoil rotors
- High screening efficiency of the C-bar basket thanks to its flow-optimized profile
- Slot width reduction from 0.45 mm to 0.30 mm.

Based on the positive trial results with PM 6 in Wangsala, PM 4 was the first paper machine to be completely upgraded, achieving an impressive increase in stickies removal efficiency.

For example, stickies removal efficiencies of 13 % and 34 % in the first screening stage of PM 4 improved to 63 % and 75 % respectively. The residual stickies content dropped to less than half the original value (Fig. 6).

The resultant reduction in deposits on the drying cylinders and doctors significantly reduced the number of paper breaks and considerably increased the overall production efficiency of PM 4. The same very welcome improvements were also obtained on upgrading the approach flow systems on the other PM's 5, 6 and 7.

The optimization with C-bar technology also reduced overall fibre losses. Taking PM 4 as an example, overall fibre losses (Bauer McNett R14/R30/R50) dropped from 0.4 % to less than 0.1 % (Fig. 7). There was not much change in CSF accepts freeness either compared with the inlet values, despite the significantly reduced slot width. This was a further welcome factor.

Overall fibre losses were much lower than the forecast and guaranteed values, providing a further appreciable cost savings advantage.

The reduction in overall fibre losses from 0.4 % to 0.1 % means a savings in raw material of 1,507 b.d. metric tons per year. Raw material costs in Thailand are about Euro 85 per metric ton and pro-



Fig. 8: From left to right: Wiriyaumpaiwong Sangchai, Production Department II Manager, TKIC Wangsala. Dheerakiatkumchorn Dumrongsak, Engineering Division Director. Günter Held, Voith Paper Fiber Systems. Kao-U-Thai Montri, TKIC Wangsala Mill Director. Manomayanggoon Nakorn, Production Department I Manager, TKIC Wangsala.

		Before rebuild		After rebuild	
		0.45 mm milled basket + 4-foil rotor		0.30 mm C-bar basket and MultiFoil rotor	
		5.9.2002	6.9.2002	18.9.2002, 2 pm	18.9.2002, 6 pm
Paper grade	[g/m ²]	CA 112	CA 115	EK 95	EK 95
Stickies in inlet, 1st stage	[mm ² /kg]	8,809	22,538	11,462	14,379
Stickies in accepts, 1st stage	[mm ² /kg]	8,147	15,663	4,501	3,923
Screening efficiency*	[%]	13	34	63	75
Stickies in inlet, 2nd stage	[mm ² /kg]	37,591	58,147	103,186	117,487
Stickies in accepts, 2nd stage	[mm ² /kg]	28,424	33,771	24,689	25,176
Screening efficiency*	[%]	46	59	89	83
Stickies in inlet, 3rd stage	[mm ² /kg]	824,027	833,463	1,226,880	819,463
Stickies in accepts, 3rd stage	[mm ² /kg]	738,889	482,037	100,626	108,728
Screening efficiency*	[%]	30	55	93	87
		*mass flow related			

		Before rebuild		After rebuild	
		0.45 mm milled basket + 4-foil rotor		0.30 mm C-bar basket and MultiFoil rotor	
		5.9.2002	6.9.2002	18.9.2002, 2 pm	18.9.2002, 6 pm
Paper grade	[g/m ²]	CA 112	CA 115	EK 95	EK 95
Freeness in inlet, 1st stage	[CSF]	123	141	138	162
Freeness in accepts, 1st stage	[CSF]	105	113	131	147
Overall fibre losses	[%]	< 0.4	< 0.4	< 0.1	< 0.1

Fig. 4: Energy balance for the approach flows of PM 6 and 7.

Fig. 5: Overall energy savings for the approach flows of PM 4, 5, 6 and 7.

Fig. 6: Improvement in stickies removal efficiency for PM 4.

Fig. 7: CSF freeness and fibre losses in the approach flow of PM 4.

Fig. 9: Total cost savings of Euro 428,315 per year.

cessing costs are around Euro 82 per metric ton. Overall savings attributable to the reduction in fibre losses total about Euro 251,715 per year at Wangsala.

Summary of the advantages gained

- The extremely low pulsation characteristics of MultiFoil rotors provide an improved MD/CD profile of the finished paper
- The higher screening efficiency of C-bar baskets ensures better paper machine runnability, and therefore increased tonnage off the reel

- Reduced speed means reduced wear of rotors, baskets and bearings
- Cost savings due to reduced energy consumption, reduced CO₂ emission and higher fibre yield (Fig. 9).

