EFFECTS OF DECREASED WATER USE ON ENERGY USE

Kraft Mill Heat Balance

Most of the energy that enters a pulp and paper mill exits via effluent and cooling tower exhaust. Syberg and Barynin (1998) examined the impact of water reduction on the overall kraft mill heat balance. Theoretical steam reductions and equipment and process changes necessary to reduce water usage were discussed. The decrease in water usage in mills has resulted in a shift of the heat rejection from the wastewater treatment system to cooling towers. Table W1 shows the major kraft pulp mill heat sinks.

Table W1. Major Pulp Mill Heat Sinks, Mill Values (mill values from Syberg and Barynin 1998)

Heat Sink	Pulp Mill Total Heat to Process (%)1	Typical Range (%)
Cooling tower(s) and effluent	74	65-80
Dryer exhaust	13	6-27
Recovery boiler flue gas exhaust	9	6-12
Bleach plant scrubber vent gases	3	0-10
Pulp	<1	~1

The energy in effluents and removed via cooling towers is of low quality. From Table W1, approximately 70% of process heat at kraft mills is being discharged via the effluent stream and cooling tower(s) so there is the theoretical possibility for large heat recovery. Unfortunately, this heat is of low quality and of little value for use elsewhere in the mill process. Figure W2 shows that as the amount of heat to the process increases, the amount of heat that must be rejected, usually via a cooling tower water circuit, increases.

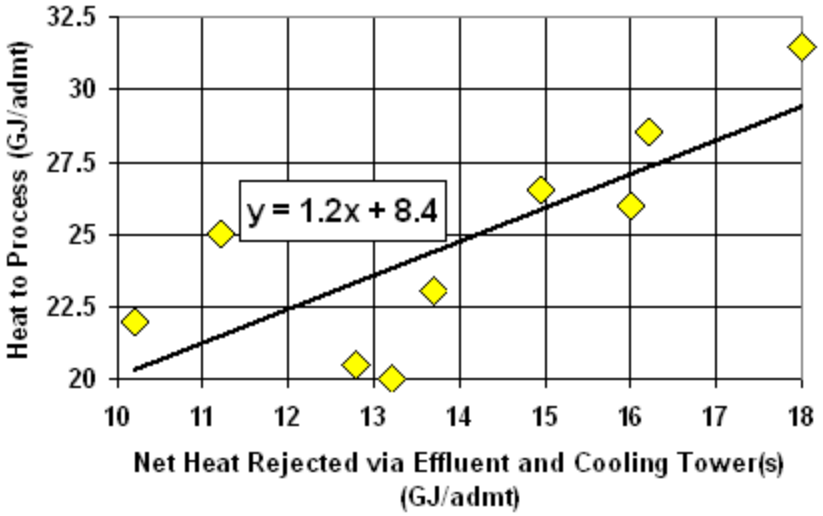

Figure W2. Heat to Process vs. Net Heat Rejected
(mill data from Syberg and Barynin 1998)

Mill energy and water balances are affected by local climate. There is a direct relationship between the raw water temperature at the mill and the fraction of heat discharge via a cooling tower (see Figure W3). In a temperate climate, cooling tower loads are approximately 25-35% of the total heat to the process. During winter months, this figure will decrease to approximately 15%. In temperate climates, water losses via cooling towers can reach 8% of the total mill water use during the summer months. In tropical climates, cooling tower loads can reach up to 45% of the total heat to the process and water losses can reach 20% of the total mill water use. This means that opportunities for recovering energy via water use reduction will be different for mills in different climates.

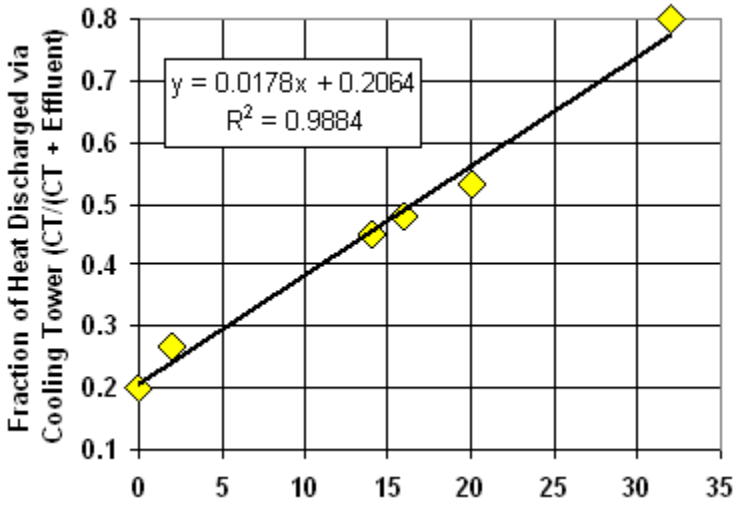

Figure W3. Fraction of Heat Discharge via Cooling Tower vs. Raw Water Temperature
(mill data from Syberg and Barynin 1998)

References

Syberg, O. and Barynin, J. 1998. Impact of water reduction on kraft mill heat balance. In *Proceedings of the 1998 Tappi Engineering Conference*, 1167-1172. Atlanta, GA: Tappi Press.