CLEANER PRODUCTION ASSESSMENT AT AN INDONESIAN PLYWOOD FACILITY-A CASE STUDY

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SUMMARY

The cleaner production assessment at the plywood industry in the province of East Kalimantan was conducted in February 1997. The objective of the assessment was to propose a program of cleaner production that would:

(1) Reduce the quantity of toxic, raw materials, and energy used in the process,

(2) Demonstrate the environmental and economic value of cleaner production methods to the Plywood facility, and

(3) Improve operating efficiency and product quality.

The assessment team composed of an expert in plywood, a cleaner production specialist, and four local consultants.

Overall, the assessment identified 21 (twenty-one) cleaner production opportunities. Depending on their selection, the implementation costs for Plywood Mill A, are approximately between Rp 679.500.000, - and Rp 2.929.000.000, - with annual savings of approximately between Rp 2.849.000.000, - and Rp 5.956.000.000, -. (Note: US$ = RP 2.500, -). If implemented, these changes could reduce logs consumption, reduce glue consumption approx. 130 tons to 1600 tons per year, reduce waste water treatment cost, as with the reduced wasted glue approx. 5 tons to 36 tons a year, will reduce energy consumption and improve quality.

INTRODUCTION

The Indonesian Cleaner Production (ICIP) Program, that established the KMB (Indonesian Pollution Prevention Roundtable), was a USAID grant program launched in June 1995.

It provided Cleaner Production technical assistance to 6 plywood industries, where pollution prevention (process improvements) were recommended, resulting in significant savings in raw materials and energy consumption. Plywood Industry is one of the large foreign exchange earner for Indonesian. Cleaner Production (CP) implementation in this sector could realize significant financial savings, simultaneously resulting in Environmental benefits. There are 120 plywood industries in Indonesia, with a total annual production capacity of approximately 9.7 million cubic meters. About 90 % of the product was exported valued at US$ 3.41 billion in 1997.

This paper will discuss how cleaner production diagnosis and assessment was conducted for one of the six plywood facilities, plywood mill A, located in East Kalimantan, Indonesia.

The assessment team observed the background of the facility and identified their existing pollution problems. This mill produces about 180,000 m^3 plywood per year. Implementation costs, are approximately between Rp 679,500,000, - and Rp 2,929,000,000 with annual savings of approximately between Rp 2,849,000,000 and Rp 5,956,000,000 (Note: US$ = Rp. 2,500).

This facility (plywood mill A) implemented the higher priority cleaner production recommendations, those with no cost or low cost. If all CP recommendations are implemented, these changes could reduce consumption of logs and glue by approx. 130 tons to 1600 tons per year. It will also reduce waste water treatment cost, as with the reduced wasted glue approx. 5 tons to 36 tons a year, and will reduce energy consumption and improve quality. Description on flow of process and recommendations for improvements in the plant operations, starting from logs cutting, peeling, veneer cutting & jointing, drying, gluing, pressing, trimming and sanding is described in this paper. The assessment team identified 21 cleaner production opportunities to cope with the problems, which would provide significant economical benefits for the company's management.

ASSESSMENT PROCESS

Cleaner production assessment consists of four phases: *selection, pre-assessment, assessment, and implementation*. During *Selection* phase, an assessment team selects and determines a facility's suitability to obtain technical assistance, and prepare a memorandum of agreement to be signed by the selected facility and the team. Criteria used for facility's selection are:

(1) Facility's management commitment,

(2) The number of cleaner production opportunities,

(3) The financial value of the cleaner production opportunities,

(4) Health and environmental benefits, and

(5) The possibility of cleaner production opportunities used as example for the other facilities.

In *pre-assessment* phase, an assessment team will gather preliminary data. During *assessment*, a team comprised of U.S. and Indonesian experts in both cleaner production and the facility's industrial process, gathers more detailed information on sources of pollution, and identifies and analyzes opportunities for reducing this pollution, and prepares a report for the facility's management detailing its findings and recommendations related to the activities assessed.

The report on cleaner production activity, also presents cost savings, implementation costs, payback period, and health and environmental benefits. During *implementation* phase, an assessment team works with the facility's management in implementing cleaner production opportunities recommended in the report and together with the facility measures the results of the revised process, the cost and the benefits.

FACILITY BACKGROUND

Plywood mill A exported 90 % of their products, and the remainder for domestic consumption. The consumption of logs ranges between 12,000 up to 40,000 m^3 per month. Glue consumption is 500 – 1,800 ton per month, the product is 6,000 – 16,500 m^3 per month. The plant operates two shifts per day, and employs 1,300 – 2,800 employees.

PLYWOOD PROCESS DESCRIPTION

The plant operation as shown in Figure 1, can be divided into 9 main stages:

(1) Cutting,

(2) Peeling,

(3) Veneer cutting and jointing,

(4) Drying,

(5) Gluing,

(6) Pressing,

(7) Trimming,

(8) Sanding,

(9) Packaging,

Plywood manufacturing process begins with logs cutting, then peeling to produce veneers. Veneers are cut and joined to obtain the desired size of the veneers. Then followed by drying in the drier to achieve the desired moisture content. The dried veneers are kept for a while before gluing using roller glue spreaders. The quantity of glue used depends upon the standard practice of each facility. After gluing, then cold pressing is done, followed by hot pressing using hot steam. After pressing, the plywood is cut to size and the face and back surfaces are sanded. Finally the products are packed.

EXISTING POLLUTION PROBLEMS

At the time of the assessment, there were a number of pollution problems, typical in the Indonesian plywood mills, including:

(1) Excessive veneer cuts wasted during cutting,

(2) Excessive amount of rotten logs,

(3) Excessive amount of dried glue wasted during weekly maintenance, and

(4) Waste water generated during glue spreader cleaning.

CLEANER PRODUCTION OPPORTUNITIES

Overall, the assessment identified twenty-one Cleaner Production opportunities to solve the identified problems, which would produce significant economic benefits for the company's management. The assessment team prepared the priority of Cleaner Production opportunities and their implementation costs. Table 1 shows the opportunities recommended to the company and presents environmental benefits and the cost of the implementation for each recommendation.

Log handling

Logs are cut and trimmed in the forest concession. After trimming, logs are stored on the ground before being transported to the intermediate storage yards, then to the base camp. From here logs are transported through the river using raft logs or transported through the sea or reloaded onto a truck to the plant. Reduction in the number of rotten logs resulting from direct contact of the logs with the ground could be achieved by storing logs on runners made of low quality logs. As a result of no direct contact with the ground, the rotting caused by the

organism from the ground could be reduced. Using continuous water sprays to keep logs saturated, so that the organism could not survive without oxygen, will reduce rot. Higher frequency in logs handling would cause the logs to crack, and therefore logs handling from the base camp until the plant should be reduced. It is also recommended to adjust the harvest time of logs with the quantity of logs required by the plant, to reduce the length of time for storage, and the implementation of First In First Out (FIFO) which means that the first logs received in a storage are the first ones removed from the yard to be processed.

Logs cutting to produce log blocks

As saw dusts and log ends produced during the cutting process have not been fully utilized, it is recommended to utilize these wastes logs as boiler fuel or sold in the form of chips. It is also recommended that the saw mount equipment which functions to raise logs at cutting mount during cutting process, be modified to allow complete sawing.

Logs conditioning

Conditioning of the logs would improve the peeling process. To ensure proper conditions for conditioning of the logs, temperature and acidity of the water be maintained properly and all logs be fully submerged.

Knife sharpening

It is recommended to maintain and set the sharpening stone of the knife surface on the proper angle, as the improper knife sharpening will affect the result of peeling operation.

Veneer clipping and composing

To reduce waste veneers in this process, it is recommended to repair or replace scanners, improve the machine maintenance and train operators to work efficiently.

Drying

Several recommendations were given in this process in order to reduce steam leakage causing energy losses, firstly to repair or replace baffles, latches and gaskets on the doors. Secondly, enclose the spaces between the two dryer chambers. Thirdly, replace the steam coils in the dryer. To improve dryer efficiency, several recommendations were given as follows:

Firstly, to install Moisture Content (MC) detector and a Programmable Logic Controller (PLC) to control dryer speed. Secondly, to sort veneers based on moisture. It is also recommended to monitor more frequently the temperature in the dryer to ensure the desired temperature, to modify air cool ducting, and to increase the cooling capacity.

Gluing

Waste dried glue and wastewater are produced in the cleaning process of glue spreader. To recycle dried glue, it is recommended to install glue grinder to grind the dried glue, and the cleaning water could also be utilized as wet grinding is used in this process. Sawdust stuck on glue will also be ground and be mixed. Mixing the paste as the grinding result can be done if the purchased glue has high solid content. To optimize glue consumption, the speed of the doctor roller should be set according to the recommended requirement set by the machine manufacturer and improve rubber roller maintenance.

Boiler Operations

To improve combustion efficiency and fuel consumption requires sufficient air; therefore it is recommended to install automatic damper, to control air required for complete combustion. It is also required to install automated sampling equipment to continuously monitor the quality of the boiler feed-water.

Wood utilization

The problem being faced by plywood industry is the high quantity of waste wood generated. The recommendations given to solve the problem are to improve the utilization of core veneer, to utilize the low quality of log blocks as raw materials for blackboard, to look for opportunities utilizing waste wood and core veneer for new products, and to monitor the utilization of wood and the throughput produced in each operating unit.

Statistical Process Control

To monitor production efficiency and waste produced by each operating unit, and steps to be taken to improve the efficiency, it is recommended to design and implement statistical process control system. The step could be commenced by making data collection and processing system and establish target to assess regular equipment performance.

Operation Unit	Cleaner Production Action	Cost to Implement (million RP)	Financial Benefit (million RP)	Payback Period
Log Handling	1) Stack logs on log runners	33,9 to 136	649 to 3.083	Immediate
	2) Reduce logs transportation			
	3) Spray logs stored in the base camp, during river rafting, and while stored at the plant			
	4) Implement First In First Out (FIFO) System			
Log Sawing	1) Improve collection and utilization of saw Dust	42 to 780	36 to 695	8 months to 14 months
	2) Install device to raise log at cutting mount			
	3) Use log ends as boiler fuel or sold in Chips			
Log Conditioning	1) Install log conditioning before peeling	22 to 460	464 to 552,6	12 months
	Maintain constant temperature and water pH and submerge logs in the conditioning chambers			
Log Peeling	1) Refunctioning soft-stop on peeling Machine	20	1.548	Immediate

	2) Install X-Y Charger on newest lathe	1.312 to 2.255	1.339 to 1.741	12 to 16 months
	3) Install powered back-up roll on newest Lathe			
Knife Sharpening	Set and maintain the sharpening stone of the knife surface at the proper angel	23	24,5	11 months
Veneer Clipping and Composing	1) Repair or replace scanners	21,2 to 40	85 to 516	Immediate
	2) Improve maintenance of veneer clippers and composers	25	601 to 967	Immediate
	3) Train employees on proper alignment of veneer in clippers			
Veneer Drying	1) Repair or replace dryer baffles, door latches and door gaskets	368 to 425,5	324 to 514	9 to 15 months
	2) Install enclosures between the dryer Chambers			
	3) Install MC detector and PLC to control dryer speed			
	4) Sort dried veneer by moisture			
	5) Monitor the temperature of the dryer more frequently to ensure the desired temperature	52,6 to 510	54 to 608	5 to 12 months
	6) Modify cool air ducting			
	7) Increase cooling capacity			
	8) Repair and replace steam coils in dryer			
Core Jointing	Increase utilization of core veneer	2,2	54	Immediate
Gluing	1) Modify glue re-circulation system	65	350	months
	2) Install hood with fan on top of glue spreader machine			
	3) Use saw dust on glue formulation	12,5	13,5	12 months
	4) Install baffles on glue mixer			
	5) Improve maintenance on the glue rolls	24	155 to 542	0,5 to 2 months
	6) Optimize glue application			
	7) Install a wet glue grinder to recover and reuse dried glue			

	8) Set the speed of the doctor bar as recommended by the manufacturer			
Boiler Operation	1) Install automated controls for dampers	69 to80	Not enough data to calculate	Not calculated
	2) Monitor the quality and improve boiler feedwater treatment			
Energy/ Utility	Use purchased electric power during off-peak hours	10	180	Immediate
Wood Utilization	1) Utilizing reject logs to produce lumbers as raw materials of blockboard	5	1200	Immediate
	2) Monitor wood utilization and production on all operating units	115	541	3 months
	3) Identify and evaluate the potential and the new opportunities to utilize wood and waste wood			
	4) Use veneer core to make saleable product	100	1500	Immediate
Process Control	Design and implement a statistical process control system	165	541 to 1.168	2 to 4 months
T O T A L		**2.487,4 to 5.253,2**	**9.659 to 15.797,6**	**3 to 4 months**

Table 1: Summary of Cleaner Production Opportunities at Plywood Mill A

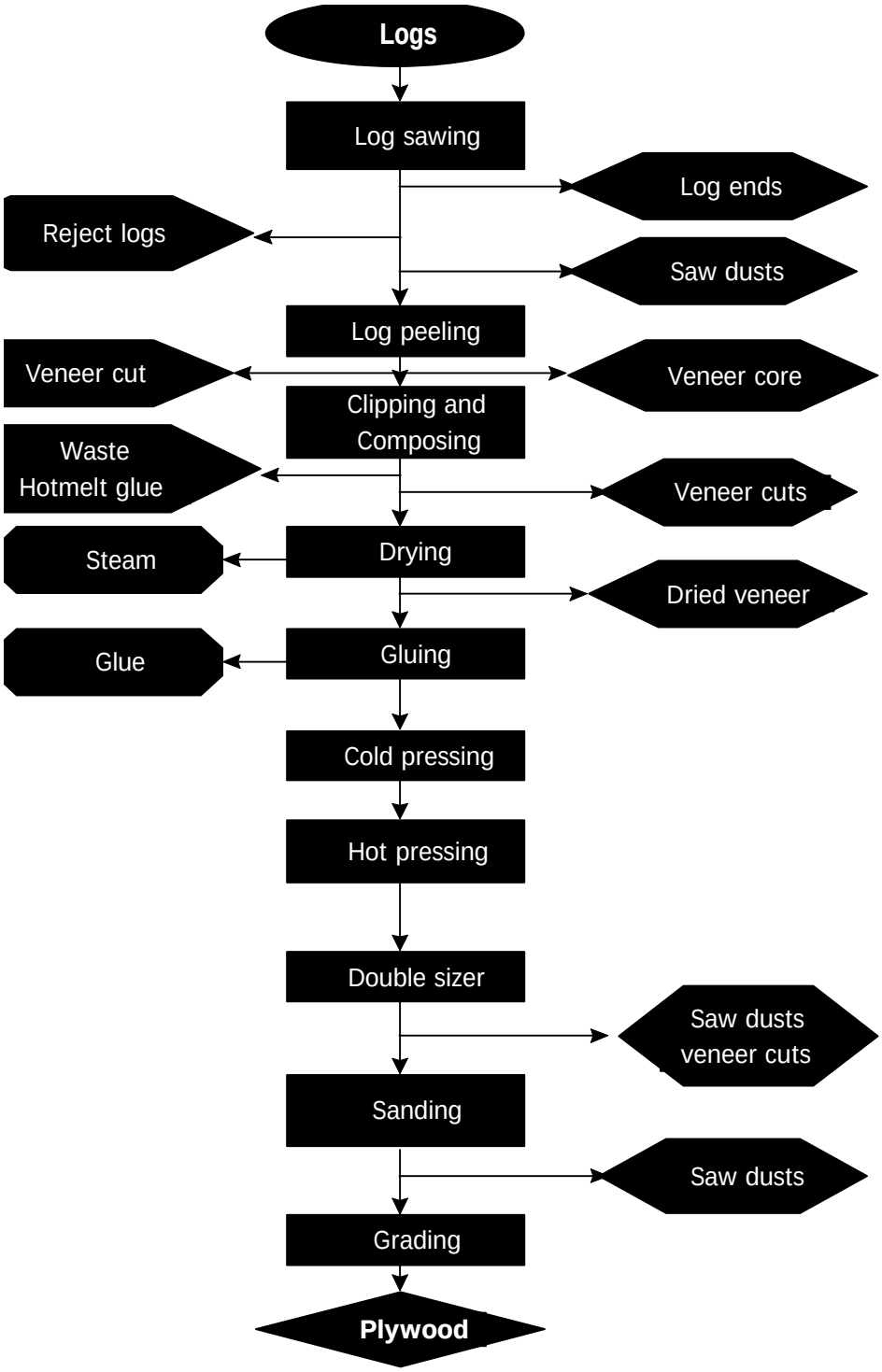

Figure 1: Overview of Facility's Plywood Process