P. T. PINDO DELI PULP & PAPER MILLS

COMPANY DESCRIPTION

PT. Pindo Deli Pulp and Paper Mills is a large private national paper mills company located in Ciampel-Karawang, West-Java, Indonesia. This company was established in 1976 and currently has 7672 employees working in three shifts of eight hours per shift. PT. Pindo Deli produces photo copy paper, specialty paper and tissue paper with a production capacity of 1,465,000 tons per year, which includes 240,000 tons per year produced from PM8 and PM9 which started operation in 1997, and 400,000 tons per year of tissue paper produced from PM11 which started operation in 1998. The company was interested to participate in the GERIAP project because energy efficiency fits in the company's strategy to be an efficient and competitive company.

PROCESS DESCRIPTION

The pulp and paper industry converts fibrous raw materials into pulp, paper, and paperboard. The processes involved in papermaking include raw materials preparation, pulping (chemical, semi-chemical, mechanical, or waste paper), bleaching, chemical recovery, pulp drying, and papermaking.
A schematic diagram of the processes is shown in Figure 1, below. The most significant energy-consuming processes are pulping and the drying section of papermaking.

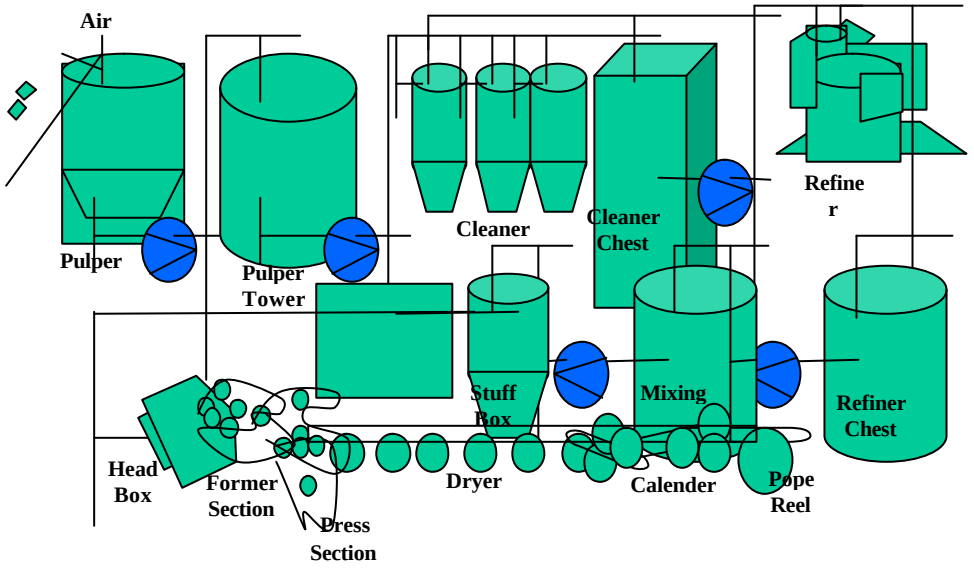

Figure 1. Process flow diagram for PT. Pindo Deli Pulp and Paper mills

The main steps and simplified process in pulp and papermaking are described below:

- ***Pulping at Pulper:*** In a *pulp beater*, pulp is mixed with water into a slurry. The slurry is further refined and then sent to the paper machine. The raw material goes to PULPER for defiberization and to accelerate beating and fibrillation caused by the swelling of the fiber.

- ***Cleaner:*** A typical bleaching sequence for Kraft pulp includes several **towers** where the pulp is mixed with different chemicals. In between stages, the chemical is removed, and the pulp is washed.
- ***Refining:*** The pulp passes between the rotating plates of a disc refiner. The mechanical action of the refiner unravels the fiber cell wall, making the fibers more flexible. The amount of refining the pulp receives determines the quality of the paper. The refining imparts the desired qualities to the paper to be manufactured in accordance with its end use.
- ***Forming:*** It is followed by sizing and coloring to meet the desired specification. Sizing is intended to improve the feel and printability of paper; while in coloring stage, pigments, dyes and filler material are added. It is then followed by sheet formation, i.e. the paper web is formed. The paper sheet formation begins in the headbox, where wet fibers are spread across a moving screen.
- ***Pressing:*** Dried sheets obtained by pressing sheets between the cylinders of a calendar stack.
- ***Drying:*** Most of the remaining water is removed as the sheet passes over steam-heated cylinders.
- ***Calender Stack:*** The last stage in the papermaking process is the **calendar** stack, which is a series of carefully spaced rollers that control the thickness and smoothness of the final paper.
- ***Pope Reel:*** The last steps in the paper manufacturing process are the roll of paper is cut into sheets in this section. In other words, the paper is wound into large **reels**, slit into required widths, cut into sheets, trimmed and then packaged.

METHODOLOGY APPLICATION

The draft *Company Energy Efficiency Methodology* was used as a basis for the plant assessment to identify and implement options to reduce energy and other materials and wastes. Some of the interesting experiences are:

- ***Task 1b – Form a team and inform staff***

The Team comprised of members of the already existing Energy Saving Project Team under the Engineering Division, which is responsible for energy management and consists of 49 staff, including:

- A Team Leader who is responsible for communicating Environmental and Quality compliance issues to their respective departments
- Second-in-command production leaders of different departments on site
- Six staffs dedicated to maintaining the ISO14001 environmental management system
- Four staff dedicated to maintaining the ISO9001 quality management system

Lesson learnt: Building the Team on existing organizational structures will result in a more successful assessment.

- ***Task 1d – Select focus areas***

Compressed air supply was considered as a possible focus area but was not selected because this is contracted out to a third party and if an energy assessment is to be successful then cooperation from the contractor is essential. A possible barrier is that contractors earn more money if they can sell more compressed air, and therefore they should be given some monetary incentive to assist the company with reducing consumption.

Lesson learnt: When selecting focus areas, consider if the cooperation of contractors or suppliers is needed for the assessment and if they are likely to cooperate.

- ***Task 2a – Staff meeting and training***

Several meetings, reviews and communication channels were identified through which staff could be informed and trained about energy efficiency.

- Management discusses environmental and energy issues at their weekly meeting
- The Efficiency Department conducts monthly reviews of KPIs (key performance indicators) for each production unit, including for productions, energy and water
- "Energy Intensity Reports" and a quality ISO Newsletter is published and disseminated to staff

Lesson learnt: Find out what meetings, reviews and reports exist for the company as these can be useful to inform and train staff about energy efficiency.

- ***Task 4a – Technical, economic and environmental evaluation of options***

Paper sludge is a serious problem for this company. The Team and external facilitators held a brainstorm session to evaluate what could be done with this waste stream and what the advantages and disadvantages are of each possible solution. The results are summarized in the table below:

No	Option	Timeframe to implement	Economic	Technical / practical	Environmental
1	Use as fuel on site (in new CFB Boilers as 5% mix in coal).	> 2 years	Cost neutral Reduce energy cost Cement plant need ash Reduce land fill	Pindo # 1 OK (being considered for the new boiler) Pindo # 2 no need for additional boiler 1800 t/month Depends on moisture content	Permanent solution & sale of ash
2	Work with cement plants for using sludge as kiln fuel.	Up to 1 year	▪ US $ 5 on site costs ▪ US$ 5 / t transport ▪ US $/t to cement plant	High moisture content, need pre drying before use. Pre drying options at cement plant or at Pindo # 2 (Identify & Study)	Permanent solution
3	Use as Land fill	Now but need new land in 2006	US $ 100 /t cost new land fill	Space Permit, monitoring Reputation	Temporary solution Worst case option
4	Survey other company who have coal fired boiler within reach	< few months	▪ US $ 5 /t on site ▪ US $ 5 /t transport	Many small users Risk of continuity Could be interim solution or stand by Permit required	Combustion Efficiency control
5	Build new paper m/c that can recycle the sludge into low grade paper	> 2 years	Income from low grade paper Reduced land fill and transport costs Cost neutral	Enough space at Pindo #1 and 2 Capacity 400 t/month – 50 % sludge and – 50 % fresh pulp. Can be used in combination with other option (not enough volume to get rid of all sludge).	Environmentally best solution because recycling of waste
6	Identify opportunity on site to minimize	Continuous	Depend on option (but probably high)	Pindo #2 is a modern plant so opportunity is bigger at Pindo #1 (old	Reduce waste at source

No	Option	Timeframe to implement	Economic	Technical / practical	Environmental
	sludge run off into effluent			plant) BENCH MARKING % sludge / ton production (3.7 % Pindo #2) Can be used in combination with other options	
7	Use as Compost in mushroom plantations	Already done (stopped since Nov 03 by Ministry of Environment for health reasons)	US $10 /t	No longer have permit (discontinued) Can use for cassava plantations (i.e. not in food chain) but only in small scale & far away plantations	Composition of compost is importance (Lead, Pb, is present, and is a major health hazard)
8	Incinerate on/off site & capture waste heat (e.g. heat air head dryer or boiler water feed)	Up to 1 year	Need study Operation cost	Off the shelf incinerators may be available. Need permit Need to dry sludge first (what %)	Need high combustion other wise emissions are too toxic

- ***Step 6 – Continuous improvement***

Top management takes energy efficiency seriously because it wants the company to remain competitive. To achieve this, they established a target to reduce the monthly energy cost from US$ 5.5 million to US$ 4 million per month, which is combined with a plan to identify and implement a range of energy saving measures.

Lesson learnt: Setting targets for energy consumption and/or cost reduction gives clarity to management and staff where the company wants to go. This will allow staff to be more focused on improving energy efficiency and management on measuring progress against targets.

OPTIONS

- The Team selected three focus areas for Pindo Deli: (1) Pindo #2 Powerhouse, (2) Paper Machine #8 and (3) Process Sludge.
- There were eight sub focus areas/ options under the above three focus areas, that were (1) Auxiliary Boiler Efficiency, (2) Boiler Blowdown Heat Recovery, (3) Generating Power from HP to MP Steam Pressure Letdown Station, (4) Steam Distribution Unccounted Losses, (5) Replacement of 4P Press with a Shoe Press at Pindo 2 Machine #8, (6) Condensate Recovery System, (7) Variable Speed Drives for Pumps and Fans, (8) Re-use of Process Sludge as Boiler Fuel. The successful options have been recorded as long and short case studies.
- For the four options implemented/ or with potential to implement, the total investment cost were US$ 42,200,000 (Rp.379,800,000,000*), annual savings were US$ 3,875,424 (Rp.34,878,816,000*) and total payback period was under 3.5 yrs.
- Total energy reductions for the options implemented were 248,183 tons natural gas and the total GHG reductions were 727,176 tons CO2 emissions.

Table 1 provides an overview of implemented and “potential for implementation” options.

Table 1: EXAMPLES OF OPTIONS IMPLEMENTED AND INVESTIGATED

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Pindo #2 Powerhouse/ Improved boiler burning efficiency, firing rates and exhaust gas metering *(see case study)*	Good housekeeping	▪ Investment: none (using existing portable analyzer) ▪ Cost saving: not determined ▪ Payback period: not determined	▪ Energy: not determined. ▪ GHG emission: not determined	▪ Results difficult to calculate because the auxiliary boiler is used as an emergency boiler that operates about 2 x 8 hour per month ▪ Regular inspected on combustion gas analysis is done 2 times a yr
Pindo #2 Powerhouse/ Steam loss reduction through pipe insulation, repairing steam trap leakages and steam trap management *(see case study)*	Good housekeeping	▪ Investment: US$ 200,000 (Rp.1,800,000,000) ▪ Cost saving: US$ 366,624 (Rp.3,299,616,000*) ▪ Payback period: 6 months	▪ Natural gas saving: 106,199 t/yr ▪ GHG emission reduction: 311,163 tCO_2/yr	▪ Implemented by repair/ replace leaks on pipe, steam traps and pipe insulation. ▪ Reducing steam losses from 10,179 tones to 8,165 tones per month.
Paper Machine #8/ Replacement of 4P Press with Shoe Press to increase paper dewatering *(see case study)*	Production process/ equipment modification	▪ Investment: US$ 10 million (Rp.90,000,000,000) ▪ Cost savings: US$ 3,420,000 /yr (Rp.40,780,000,000) ▪ Payback period: 3.4 yrs	▪ Natural gas savings: 70176 tons/yr ▪ Steam savings: 40,800 t/yr ▪ GHG emission reduction: 416,013 tCO_2/yr.	▪ Increased paper production : 141,984 t/yr. ▪ Technically feasible. ▪ Potentially implemented when payback period under 3 yrs.
Process Sludge/ Installation of CFB boiler and use of paper sludge as alternative fuel *(see case study)*	▪ New technology/ equipment	▪ Investment: US$ 32 million Rp.288,000,000,000) ▪ Cost savings for landfilling sludge (US $ 1.7/ ton sludge = Rp.15,300,-*) and benefit for selling fly ash ▪ Payback period: not determined	▪ Energy savings: for drying paper sludge ▪ GHG emission reduction: not determined ▪ Others: Reduce landfill area for paper sludge landfilling	▪ Start implementation in 2005 ▪ Sludge is used as substitute fuel (max 5%) in CFB Boiler ▪ No need pre dryer for maximum 5% mix in coal.
Process Sludge/ Water conservation in paper mills to reduce paper sludge *(see case study)*	Improved process management	▪ Investment: cannot be calculated yet (the project is still in progress until end of 2005 ▪ Cost saving (price of water saving):	▪ Electricity savings ▪ GHG emission reductions: not determined. ▪ Water savings: 888,000 m^3 /yr	▪ The target for 2005 is to reduce water consumption on PM #8 from 11.2 to 7.5 m^3 per ton product.

		US$ 88,800 (Rp.799,200,000*) ▪ Payback period: not determined	▪ Reduction of fiber run-off into effluent.	▪ Before reuse, wastewater is screened, fiber retained on the screen is put back into the process, therefore fiber in effluent is reduced
Process Sludge/ Use paper sludge as compost or mushroom fertilizer *(see case study)*	▪ Improved process management	▪ Investment: nil. ▪ Cost saving: US$ 1.7/ ton material ▪ Payback period: immediate	▪ Energy savings: for drying paper sludge ▪ GHG emission: not determined ▪ Reduced landfill area needed	The permission of this activity was withdrawn by Ministry of Environment due to heavy metal content found in sludge, although the amount of heavy metal still under the permission value

Note:
1 US$ = Rp 9000
GHG emission factor calculated by simplified GHG calculator, source from UNEP GHG Indicator: www.uneptie.org/energy/tools/ghgin/

FOR MORE INFORMATION

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