ENERGY EFFICIENCY AND ENVIRONMENTAL MANAGEMENT IN PULP AND PAPER INDUSTRIES IN THE PHILIPPINES

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Introduction

The pulp and paper industry in the Philippines has played a vital role in the socio-economic development of the country. The subsector's end user segments include printing, publishing, converting, and packaging. The enormity of its services and the rapidly growing consumption of the products of the industry indicate the need to ensure stability of future supply in a sustainable manner – economically, environmentally, and socially.

This paper presents the results of assessment made on the Development of Energy Efficient and Environmentally Sound Industrial Technologies (E^3STs) in the pulp and paper industry in the Philippines. The study examines the factors affecting intra-firm's decision making process in adopting E^3STs and the external factors that have influenced them. The report presents part of the results of the research project on the Development of E^3STs in Asia sponsored by the Swedish International Development Cooperation Agency (SIDA).

1. Current Structure of the Philippine Pulp and Paper Industry

The pulp and paper industry in the Philippines consists of 4 nonintegrated pulp mills, 2 integrated pulp and paper mills and 24 paper mills. All pulp mills rely on abaca for their raw material requirements. One integrated pulp and paper mill uses tropical hardwoods in producing mechanical and kraft pulp while the other uses bagasse as raw materials. All the paper mills in the country use waste paper as the main raw material. The total pulp and paper mill capacities in the country are 213,000 tons per year (tpy) and 69,000 tpy respectively.

Local paper mills are generally small. Of the 26 mills, 11 have capacities below 10,000 tpy, 9 operate from 10,000 to 20,000 tpy and the remaining 7 have capacities greater than 20,000 tpy. The ages of paper machines range from 8 to 55 years. It must be noted that it is difficult to estimate the age of some machines because most of them were bought second-hand. Table 1 summarizes the production and consumption of domestic grade paper as of 1993.

The total consumption of waste paper is about 380,000 tpy, 39.5% of which is supplied domestically. This implies that if the waste paper supplied locally is only 150,000 t in 1993, only about 20% of 793,000 t of paper consumed is recovered. The

low recovery rate in the Philippines is due to the export of packaging materials, geographic location which makes waste paper collection expensive, and use of waste paper as fuel in the rural areas.

There are 11 paper mill expansion projects projected to start-up between 1993 to 1996 with the total capacity addition of 573,000 tons per year. Most of these projects are waste paper based and the additional supply must be based mainly on import. The economy of all these projects is highly vulnerable to prices of secondary fiber in the world market.

Table 1. Production and Consumption of Domestic Grade Paper (1993)

Paper Grade	Production (1000 tpy)	Net Import (1000 tpy)	Consumption (1000 tpy)
Newsprint	105	18	123
Printing/Writing	103	50	153
Corrugating Material	253	190	443
Other kraft and board	26	48	74
Total	487	306	793

Source: PULPAPEL

Environmental Performance

Most of the pulp and paper industries in the Philippines are located in Metro Manila with limited pollution control facilities. Metro Manila has a more pronounced pollution problem than any part of the country thus, there is more pressure on industries to meet both the effluent and ambient standards set by the Department of Environment and Natural Resources (DENR).

The main pollutants found in pulp and paper industry are the total suspended solids (TSS), and dissolved organic substance (expressed as BOD and/or COD). The ranges of concentrations of pollutants measured in seven pulp and paper mills and the corresponding environmental standards are shown in Table 2.

Table 2. Pollutant Concentration in Plant Effluents

Parameter	Effluent Concentration	Inland Water, Class C	Coastal Water, Class SC
Color (PCU)	80-2000	200	(a)
PH	6.32 – 7.5	6 – 9	5 – 9
TSS (mg/L)	6 – 1900	90	200
TDS (mg/L)	630 – 2930	-	2000
BOD (mg/L)	260 – 2220	80	120

Source: DENR AO 35 (Series of 1990)
Inland water (Class C) – for fishery water, recreational and industrial water supply-with treatment
Coastal water (Class SC) – for recreational use, fishery water and marshy and/or mangrove areas (a) Discharge will not cause discoloration outside mixing zone (defined by DENR)

The mills in the Philippines are mostly old and obsolete with limited pollution control facilities. In-plant measures alone cannot adequately control the presence of effluents and pollutants in water. It is necessary to undertake further treatment of effluent

before final discharge. A Development Bank of the Philippines study in 1992 showed that environmental protection for the projected paper capacity in the year 2000 is estimated to be about US$ 70 million.

Evolution of Energy Efficiency

The energy consumption of pulp and paper industry varies with respect to the manufacturing operation and process involved. Energy intensity expressed in kilo oil equivalent per ton (koe/t) per million pesos from 1984 to 1992 is shown in Figure 1.

Total consumption of energy for the pulp and paper sector had an increasing trend from 1984 to 1992, with energy intensity growth note of 1.2% from 1985 to 1990. Oil, non-oil and electricity consumption comprise 40%, 35% and 25% of the total energy consumption in the industry, respectively. The industry is also considered one of the high fuel oil consuming sub-sectors with a share of 2.5% of the total fuel oil consumption in the Philippines.

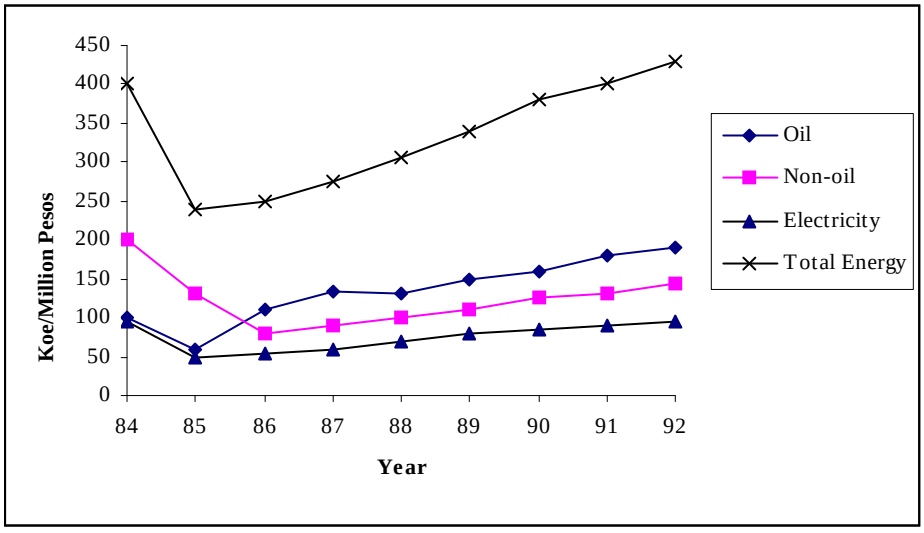

Figure 1 Historical Energy Consumption in the Pulp and Paper Sector, koe
(1984 to 1992)

Based on six paper mills, the average specific energy consumption of the paper mills in the Philippines is 476 koe/t with specific fuel consumption of 365 koe/t and specific electrical consumption of 1084 kWh/t.

2. The Case Study – United Pulp and Paper Corporation

The selected enterprise to represent the industry is the United Pulp and Paper Corporation. A field survey was conducted to determine the intra-firm's decision making mechanism and the external factors influencing the adoption of E³STs.

UPPC utilizes waste paper to produce multiwall sack kraft paper. It has a capacity of 120 tons per day (tpd) for extensible sack kraft (X-10) and 214 tpd for corrugating medium. UPPC started operation in August 1995 and had undergone several conversion and rehabilitation procedures.

The plant is managed and operated by PHINMA which is the highest shareholder of the company. The principal stockholders include several major cement companies which are also users of multiwall sack kraft paper.

Adoption of E³STs

The factors which influenced the decision to adopt E³STs in the plant are: (a) increase in production capacity; (b) environmental constraints; (c) economic feasibility; (d) sustenance of good quality paper; (e) reduction in water consumption; (f) expensive but unreliable electrical supply; (g) recommendations made by research studies conducted in the plant; (h) availability of water, fuel, and electricity supply, and (I) experiences of Siam Kraft Paper Ltd. in Thailand.

UPPC has improved its production capacity by upgrading the existing machines. The rehabilitation in 1990 to 1995 consisted of four stages involving improvements in refining process and press configuration and installation of on-line measurement and control system.

The techno-economic characteristics of the adopted E³STs are summarized in Table 3.

The implementation of the project took about one year from conceptualization to implementation. The high internal rate of return of 34.4% and environmental gains derived in improving the plant resulted to faster decision making and high credibility to the financing institution.

Adopter's Organizational Environment

The UPPC's organizational environment can be described as strongly encouraging in terms of adoption of E³STs. The firm's organizational structure, business strategies, manpower capabilities, culture and financial status are geared towards internalization of total quality management and efficient operation.

The organization is managed by PHINMA, a management firm running and operating 40 corporations with production, marketing an distribution facilities spread around the Philippine archipelago. A project planning group was created to design strategies including the plant expansion program.

Commitment to environmental protection has been expressed by the top management and included in the company's mission statement. UPPC has been open to DENR, Department of Energy, academe, and research institutions to conduct studies, assessment and research on plant operation.

Technology sharing with a modern foreign plant that can demonstrate to UPPC new technologies and offer on-the-job training has made the company confident in adopting new technologies and therefore, allowed the firm to build up technically competent people.

The credibility of the company and its ability to generate funds internally to supplement the loan are important to creditors. UPPC was established by the

collective funds put in by various cement plants in the country. The cooperative effort of the shareholders and the ability of UPPC to collect funding from the affiliated banks of PHINMA resulted to easier generation of funds.

Table 3. Techno-Economic Characteristics of the Proposed/Adopted E³STs

No.	1	2	3
E³STs	Double Disc Refiners + Basis Weight/Moisture Machine	Coarse/Fine Pressure Screens + Fiber Recovery System	Improved Press Configuration (combination of Tri-nip Press)
Status	operating	operating	operating
Financial - Investment Benefits (Expected)	P32.749M (1990) IRR - 34.4%	P108.71M (1990) IRR – 34.4%	P134.56M (1990) IRR – 34.4%
Output (Expected)	Production Capacity increase: X-10-90 to 105 tpd CMT - 110 to 120 tpd	Production Capacity Increase (includes E³ST #3): X-10-105 to 120 tpd CMT - 120 to 214 tpd	Contribution to capacity Increase included in #2
Energy Savings (Expected)	(included in E³ST #2)	- 105 kWh/t (X-10)	110 kWh/t (X-10) 60 kWh/t (CMT) Steam consumption reduced to: X-10-1 t/t of paper CMT – 0.84 t/t of paper
Environmental Gains (Expected)	Fresh water consumption reduced by 50 to 60 m³ per ton Reduction in emissions due to energy savings included in column 3 - E³ST #2	Reduction of SOx-1.67 x 10^3 kg/year NOx-541 kg/year Fibre Recovery – 393 Mg of fibre per litre of process water System removes 87% of SS with clarified effluent TSS conc. Of 54 mg/L	Reduction of : SOx -12.06 x 10^3kg/year NOx-1.3x 10^3 kg/year

Notes:

1. Investment costs also include replacement of the headbox and replacement of table rolls with vacuum aided drainage elements.
   Energy and environmental savings are included in E³ST #2. IRR includes E³ST #2 and #3.
2. Reduction of emission from a Bunker C fired power plant supplying the grid based on 1995 production rate.
3. Reduction of emission from a Bunker C fired power plant supplying the grid. Additional environmental gains (but not included) are SOx and NOx reduction of steam consumption emitted by the UPPC boilers.

Adopter's External Environment

The firm's external environment comprises equipment suppliers, consultants, R & D organisations, information providers, industry associations, affiliated industries, NGOs, government agencies and funding institutions, and regulatory bodies. The role(s) played by each of these external actors in the promotion of E³STs are to promote awareness, give advice, stimulate adoption, provide financial incentives, and enforce regulation.

Industry associations has strongly influenced the plant by advicing, improving awareness, and providing incentives to the company. Likewise, DENR has provided adequate advice an raised environmental awareness of the plant management. This promoted the company's compliance to environmental standards. The proactive stand of the company to community development and environmental protection made the plant acceptable to the general public.

4. Conclusion

The case of UPPC can serve as an example to other pulp and paper industries in the Philippines. Organizational and management commitment to energy efficiency and environmental protection indeed reap economic gains and social acceptability.

Constant interaction with external actors that can bring awareness and provide assistance and advice are beneficial to the company.

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