STUDY OF CHEMITHERMOMECHANICAL PULP (CTMP) PRODUCTION POTENTIAL FOR ALBERTA

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DISCLAIMER

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

The CTMP and TMP, chemithermomechanical and thermomechanical pulping processes have gained market shares at a phenomenal pace in the pulp and paper industry. Extensive changes in the Forest Products Industry have lately been received cautiously, amplified by the fact that capital investments are high and the payback time for the investor is normally long.

CTMP is obviously interesting, because with lower capital investment requirements compared to chemical pulp, it provides added opportunities for the papermaker, and also yields about twice as much in pulp per cubic meter of wood material.

New capacity is presently being built both at existing mills (by conversion and investments in additional pulping capacity) and as separate greenfield market pulp mills. An estimated 25% of the new CTMP capacity is market pulp. However, less than half of this capacity is available on the non-captive markets. Total worldwide CTMP capacity is about 20,000 tons/day, of which approximately 5,000 tons/day is market CTMP. Although 5,000 tons/day is classified as market pulp, it is assumed that only 2,000 tons/day is available to outside buyers; the rest of it, 3,000 tons/day, remaining within the "corporative market". The current worldwide production of 2,000 tons/day of CTMP for the free market is estimated to be about 4,000 tons/day in 1990. Out of the total worldwide production 2,000 tons/day, 600 tons/day is produced in Canada. The corresponding figure for 1990 is estimated to be 1,900 tons/day.

In 1984, the total CTMP production was 3.2 million tons per year. This production is expected to double by the year 1989, and could be 12-14 million tons per year by the year 2000, based on currently market scenarios.

Based on production cost, Alberta's comparative position in the CTMP market could be considered good, with potential markets among the midwestern states of the USA and on the Pacific Rim. With the uncertainties in the pulp market, however, integration with printing and writing paper, or liquid packaging board production on site should be considered.

Alberta's production costs are competitive with British Columbia and Northwest USA. The Scandinavian mills' wood cost will keep them out of these markets. The Australian and New Zealand producers have a clear cost advantage on the Pacific Rim market, but they have limited wood resources and will apparently convert all their pulp to paper products, as will the Scandinavians. The South American mills will have an edge over Alberta mills, but their own need will likely absorb a major part of their production capability. However, the various pulp products could be developed to become important export resources in which case bleached hardwood (eucalyptus) kraft and CTMP from South America could be a serious threat to the potential CTMP market for Alberta.

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INTRODUCTION

The Province of Alberta has identified several timber development areas that contain reserves of timber that could support a chemithermo-mechanical (CTMP) facility in the Province of Alberta.

In order to determine the production potential of CTMP in Alberta, the Alberta Forestry Department requested EKONO Consultants Ltd. carry out a study with the following objectives:

1. To assess current and future CTMP markets as well as industrial developments on a global basis.

2. To assess Alberta's competitive position as a supplier of CTMP.

This report presents the results of that study.

POTENTIAL USE OF CTMP IN DIFFERENT PAPER GRADES

CTMP pulp is produced for a variety of end use specifications. The primary user groups are newsprint producers, tissue and fluff pulp producers and the packaging industry.

The traditional paper grades have strict definitions and categories based on the requirements of the end users, i.e., the publishing industry and the paper industry. There are, however, emerging trends in the publishing industry, which may change the commodity paper maker away from standardized products. A typical example, is the newsprint used for "USA-Today" which must be a higher brightness than standard newsprint, and have a surface suitable for four colour printing.

Newsprint

The newspaper printer used to be concerned primarily with his printing press runability, and less with print quality. He used to be less interested in how the paper is made. Emerging new technologies, and advertiser requirements of four-color printing, have changed this attitude, and more quality-conscious printers have emerged.

Softwood CTMP does not adversely affect the newsprint quality. Therefore, it is the papermaker's decision what should be used in his newprint's furnish. CTMP should give a clear cost advantage in this respect.

Newsprint can be manufactured from 100% softwood CTMP. By using CTMP, the chemical pulp use in newsprint can be reduced to the point where the basic strength requirements of the paper are fulfilled. The more chemicals used, the lower the opacity in the final paper.

All softwoods in Alberta are suitable for newsprint production. Aspen-based pulp can be used, but only at the cost of lower paper opacity and less strength. Using softwood CTMP will improve the printability of paper.

Some fillers could be used to regain the lost opaciaty. When print quality requirements are raised, there will be additional use of other chemicals and additives.

Printing and writing papers

In printing and writing papers the paper quality specifications are the determining factors. The paper products in this category consist of four main paper grades: coated woodfree, uncoated woodfree, coated wood containing and uncoated wood containing papers.

The coated woodfree paper represents the best printing surface. The uncoated wood containing paper represents the most affordable quality of these grades. The term wood free indicates that the paper has less than 10% mechanically produced fibers, e.g., CTMP, TMP and their derivatives. All those grades have sale prices about 50-100% higher than the price of

newsprint. The papermakers and printers are concerned about the printing quality. One way for CTMP to gain acceptance is to demonstrate its economy to more conservative mills in the industry. The other, more likely, alternative is that papermaker and printers together develop a new paper grade, which would take full advantage of the CTMP.

The potential use of CTMP in printing papers, especially in wood-containing grades is sizeable. The high brightness and small brightness reversion of CTMP, as well as effects on paper opacity, are however the main concerns and have restricted the use of CTMP in these grades. The economic advantage of being able to use CTMP is remarkable and it is likely that CTMP-containing papers are going to be accepted.

All wood species growing in Alberta can be utilized for printing and writing paper. Aspen will be preferable in improving the formation but the softwood pulp will give strength. The dusting tendency of Aspen will be a cost factor for the papermaker. According to published data the only North American mill using aspen CTMP in printing and writing papers is Appleton Paper's Combined Locks' paper mill in Wisconsin.

We have estimated that at least 50% of fibre furnish for low brightness printing and writing paper grades could be CTMP. The higher the brightness level to which CTMP can be bleached, the more alternatives exist for its use. Additional efforts are also needed to eliminate the existing definitions of woodfree and wood-containing papers, as a quality criteria. The printing quality and the economy should be the only criteria. When the existing concerns mentioned above are eliminated, the market potential for CTMP will increase considerably in the printing and writing paper sector. We do not, however, expect major changes to take place in the North American marketplace in the near future.

The Scandinavian paper producers have traditionally reacted quickly to market changes thus benefiting from rising market opportunities. Consequently, they are also the most likely to introduce new paper grades. The Swedish companies SCA and Stora Kopparberg are in this category, since both have CTMP and extensive papermaking capabilities. The Europeans, in general, are currently producing more wood-containing, filled or coated papers than their North American counterparts.

Tissue and Fluffs

Tissue markets are highly concentrated in North America. The marketing strategies and the market reactions have determined the furnishes of the products. Brightness, regardless of cost, was in the past, the only market criterion. In recent years, competition has forced producers to consider the absorption capabilities of the products more frequently.

In general, CTMP has been accepted for a large variety of grades in Europe. For example, the Modo-Iggesund mill in Domsjo, Sweden is producing both tissue and fluff market pulp grades. CTMP has normally a visual (not functional) disadvantage, i.e., the brightness, which can be reduced by additional bleaching.

In the past, there has been a reluctance to use CTMP in the fluff pulp sector, because of its yellowish colour. This negative characteristic effect can be diminished by added bleaching the pulp. Absorbency, marketability and behavior of the pulp in the fluffing process have increasingly become the key quality criteria for the pulp maker.

The aspen fiber, when mixed with longer softwood fibers or chemical pulp, should be a potential raw material for various tissue and fluffed pulp products. Being a short, thin fiber, aspen will provide a large surface area for absorption. The softwood fibers are needed to give bulk for the end product. The bleachability of aspen is excellent. So far as we know, aspen CTMP is not used in fluff pulps.

Packaging papers and boards, molded products

The broad sector of papermaking has accepted the fact that the economics of the finished product is the only criterion to be used when evaluating the different raw material alternatives.

CTMP could be used, for example, in the middle layer of linerboard, where it would provide bulk. In liquid boards it can be mixed together or layered with the chemical pulps to give the desired properties. Molded products can be produced entirely by CTMP. Price then, becomes the determining factor in producers' willingness to use CTMP.

The industry sector is very competitive and CTMP will be used only on areas, where it will replace chemical pulp. In other areas, it has to compete against secondary fiber and TMP. The industry margins are low, thus it is most likely that the secondary fiber and other mechanical fibers will maintain their market share.

WORLD PAPER PRODUCTION AND FIBER USE

In 1984, the world consumption of paper products in 1984 was 192 million metric tons. The main product categories were newsprint, printing and writing papers, casemaking materials, wrapping and packaging papers, tissue and toweling papers, and various grades comprising a myriad of other papers and boards.

The worldwide consumption for different grades in 1984 is shown in Table 3-1. Figure 1 shows the world paper production development until year 1999 and corresponding productions in Canada and USA.

Table 3-1. World Paper Consumption (Production) in 1984 and 1989 million tons/year*

Paper grade	1984	1989	%/year
Newsprint (news)	27.8	29.7	1.3
Printing and writing papers (Pr & Wr)	48.9	55.0	2.4
Casemaking material (Casemaking)	46.3	48.8	1.1
Wrapping and Packaging Paper & Board (Wrp & Pkg)	15.5	15.8	0.4
Tissue and Toweling Papers (Tissue)	10.3	11.0	1.3
Other grades, paper, board (Oth P&B)	43.2	46.2	1.4
Total paper consumption	192.0	206.5	1.5

*(Sources P&P Int'l., EKONO)

FAO's paper products capacity survey for 1989 indicates that the world newsprint capacity would grow 1.4% annually, varying from 0.6% in centrally planned economies to 7.1% in developing countries. The printing and writing paper capacity increase is predicted to be from 1.0% in centrally planned economies to 3.3% in developing countries, while the total world growth is predicted to be 2.4% annually. The total paper and paperboard capacity is expected to grow about 1.4% annually between 1984 and 1989.

The capacity and actual production numbers are not always comparable. There is hidden capacity for some paper grades. Rapid

changes in the marketplace, caused by fast increase of paper and board consumption and production in developing market economies, create an atmosphere of considerable uncertainty. Additional disturbing factors are the recent developments in secondary, and especially in mechanical fiber processing technologies, which have lead to the development of such new pulps, as TMP, PGW, and CTMP. In later discussions PGW, or pressurized groundwood, is included in TMP statistics, and CMP, or chemimechanical pulp, when used for paper grades, is included in CTMP statistics.

The ever increasing use of secondary fiber, and the development of waste paper cleaning processes, is also causing uncertainty in predicting what type of pulps are going to be used for specific paper or board grades in the future.

In addition to the paper products, wood pulp fibers are used as raw material in the chemical industry and in non-woven products. The total market volume in this sector is about 6 million tons per year. In the non-woven sector, the world fluff pulp market presently is 1.6 million tons per year, of which 1.0 million tons is used in USA. So far, the fluff pulps in North American are made only from fully bleached Sulfite and draft pulps. Weyerhaeuser tried in the 1970's to introduce CTMP fluff pulp to the North American markets but failed. The mill in Washington has been dismantled.

Table 3-2. Estimated world use of various pulps in main paper grades in 1984 percent*

Paper grade	Chemical Pulp	Semichem Pulp	Mech. Pulp	Other Pulp	Secondary Fiber
News	10 - 15	0 - 1	59 - 64	0 - 4	11 - 16
Pr & Wr	48 - 53	0 - 0	13 - 18	0 - 1	5 - 10
Casemaking	50 - 55	5 - 10	0 - 1	0 - 5	23 - 28
Wrp & Pkg	75 - 80	0 - 5	0 - 0	0 - 1	8 - 13
Tissue	70 - 75	0 - 5	0 - 5	0 - 5	10 - 15
Oth P&B	28 - 33	0 - 2	0 - 4	0 - 5	48 - 53

*(Sources P&P Int'l., % estimates by EKONO)

Table 3-3. Estimated World use of Various Pulps in Main Paper Grades in 1989 Percent

Paper grade	Chemical Pulp	Semichem Pulp	Mech. Pulp	Other Pulp	Secondary Fiber
News	5 - 10	0 - 1	61 - 66	0 - 4	13 - 18
Pr & Wr	45 - 50	0 - 0	14 - 19	0 - 1	6 - 11
Casemaking	47 - 52	5 - 10	0 - 3	0 - 5	24 - 29
Wrp & Pkg	73 - 78	0 - 5	1 - 6	0 - 1	9 - 14
Tissue	67 - 72	0 - 5	1 - 6	0 - 5	11 - 16
Oth P&B	25 - 30	0 - 2	0 - 4	0 - 5	51 - 56

Tables 3-4 and 3-5 summarize the use of chemical and mechanical pulps in different paper grades by main producer region. There is a major shift to CTMP and TMP, replacing groundwood and chemical pulp. The shift will be felt strongly in newsprint producing areas like Canada. The mills used to make their product from a mixture of 75-80% of groundwood and the balance, chemical pulp. Now, several mills are producing newsprint from mechanical pulps alone thereby reducing their production cost substantially. It would seem that others will follow this trend. This change is supposed to affect the chemical pulp markets in the future. There has also been a significant move in market pulp mills toward integration with woodfree fine paper manufacturing. Fortunately, fine paper markets have been booming, decreasing the pressure in the chemical pulp markets. However, in the future, the woodcontaining papers will be entering the fine paper markets was well, creating an increasing competition.

Table 3-4. Estimated use of Chemical Pulps in Main Paper grades in 1984 percent

Paper grade	Canada	Scandinavia	W. Germany	Japan	N. America
News	14 - 19	3 - 8	3 - 8	3 - 8	13 - 18
Pr & Wr	68 - 73	61 - 66	37 - 42	50 - 55	69 - 74
Casemaking	50 - 55	45 - 50	25 - 30	41 - 46	66 - 71
Wrp & Pkg	80 - 85	76 - 81	75 - 80	77 - 82	87 - 92
Tissue	83 - 88	65 - 70	45 - 50	67 - 72	88 - 93
Oth P&B	30 - 35	47 - 52	5 - 10	25 - 30	38 - 43

Table 3-5. Estimated Use of Mechanical Pulps in Main Paper Grades in 1984 percent

Paper grade	Canada	Scandinavia	W. Germany	Japan	N. America
News	76 - 81	83 - 88	45 - 50	35 - 40	62 - 67
Pr & Wr	10 - 15	12 - 17	20 - 25	5 - 10	7 - 12
Casemaking	10 - 15	7 - 12	0 - 0	0 - 3	0 - 4
Wrp & Pkg	0 - 0	0 - 5	0 - 5	0 - 0	0 - 0
Tissue	0 - 5	0 - 5	0 - 5	0 - 5	0 - 1
Oth P&B	25 - 30	25 - 30	0 - 5	5 - 10	2 - 7

NORTH AMERICAN PAPER PRODUCTION AND FIBER FURNISH

The North American paper and board consumption in 1984 was 76.5 million tons. The estimated consumption in 1989 is 82.7 million tons. Consumption by grade is shown in Table 4-1.

The printing and writing paper production increase in North America will outpace the corresponding worldwide rate. Otherwise, it is estimated that the rates of production increase will follow the general world trends. Computerization of offices and factories was predicted to use less fine paper. The past and predicted development indicate the opposite, however.

Table 4-1. North America Paper Production in 1984 and 1989, million tones/year*

Paper grade	1984	1989	%/year
Newsprint (News)	14.0	14.9	1.3
Printing and Writing Papers (Pr & Wr)	18.3	21.2	3.0
Casemaking Material (Casemaking)	22.6	23.8	1.0
Wrapping and Packaging Paper & Board (Wrp & Pkg)	5.5	5.6	0.4
Tissue and Toweling Papers (Tissue)	4.8	5.2	1.6
Other grades, Paper and Board (Oth P&B)	11.2	12.0	1.4
Total paper consumption	76.5	82.7	1.6

*(Sources P&P Int'l., EKONO)

Tables 4-2, 4-3 and 4-4 summarize the estimated use of different pulps in the main paper grades in 1984 and 1989 respectively. The use of fillers and coatings is gaining strength in North America, a factor which will have an added impact on the already changing fiber furnish. The total use of fillers and coatings in the USA was 3.1 million tons in 1985, or 5% of the total paper production.

Table 4-2. Estimated North American use of Various Virgin Pulps in Main Paper Grades in 1984, in million tons/year.

Paper Grade	Chemical Pulp	Semichem Pulp	Mechanical Pulp	Other Pulp	Total Pulp
News	2.5	0.0	9.4	0.0	11.9
Pr & Wr	13.6	0.0	2.2	0.0	15.8
Casemaking	16.1	2.3	0.9	0.0	19.3
Wrp & Pkg	5.0	0.2	0.0	0.0	5.2
Tissue	4.5	0.1	0.1	0.1	7.3
Oth P&B	4.8	1.1	0.8	0.6	7.3
Total	46.5	3.7	13.4	0.7	64.3

Table 4-3. Estimated North American Use of Various Virgin Pulps in Main Paper Grades in 1984, percent

Paper Grade	Chemical Pulp	Semichem Pulp	Mechanical Pulp	Other Pulp
News	13 - 18	0 - 0	62 - 67	0 - 0
Pr & Wr	69 - 74	0 - 0	8 - 12	0 - 0
Casemaking	66 - 71	5 - 10	0 - 4	0 - 0
Wrp & Pkg	87 - 92	0 - 4	0 - 0	0 - 0
Tissue	88 - 93	0 - 2	0 - 1	0 - 3
Oth P&B	38 - 43	5 - 10	2 - 7	0 - 5

Table 4-4. Estimated North American use of Various Virgin Pulps in Main Paper Grades in 1989, percent.

Paper Grade	Chemical Pulp	Semichem Pulp	Mechanical Pulp	Other Pulp
News	6 - 11	0 - 0	65 - 70	0 - 0
Pr & Wr	64 - 69	0 - 0	10 - 15	0 - 0
Casemaking	61 - 66	5 - 10	0 - 5	0 - 0
Wrp & Pkg	85 - 90	0 - 4	0 - 1	0 - 0
Tissue	88 - 92	0 - 2	0 - 2	0 - 3
Oth P&B	35 - 40	5 - 10	2 - 7	0 - 5

Increased competition has forced North American papermakers to continue cutting costs. This has resulted in additional use of mechanical and secondary fibers in the processes. The fluctuating dollar has, during the past years, slowed the export of paper and flooded the market with imported paper grades, prompting even the most secure mill to check for alternative raw materials and process modifications.

MECHANICAL PULPS

The production capacity of mechanical pulp, excluding TMP and its derivatives has declined according to FAO's 1984-1989 capacity survey 2.5% annually between 1979 and 1984. For the period 1984 to 1989, FAO predicts an additional capacity loss of 0.2% annually. The mechanical woodpulp production and its estimated development is shown in Table 5-1. The estimated development of world and North American mechanical pulps consumption until 1999 is shown in Figure 2.

Table 5-1. Development of Mechanical Pulp use in World's Paper Industry million tons/year*

	1979	1984	1989
Groundwood-GWD/RMP	24.2	15.7	13.7
Thermomechanical pulps-TMP/PGW	4.9	10.2	13.7
Chemithermomechanical pulps-CMP/CTMP	0.8	3.2	6.4
Total	29.9	29.1	33.7

*(Sources P&P Int'l., EKONO)

Part of previously reported TMP capacity has in recent publications been changed to CTMP/CMP capacity. The 1979 production of CTMP pulp was almost non-existant. The 1984 figure shows a production about 1.5 million tons. The shifting from TMP towards CTMP/CMP is clearly visible and additional conversions can be expected in the future. The main driving force is the gain in pulp properties with almost neglible investment, and original TMP pulp can be manufactured at will.

The present and estimated development in mechanical pulp production by region is shown in Table 5-2.

Table 5-2. Present and Projected Mechanical Pulp Production in Different Regions of the World, million tons/year

	1984	1989
Canada	8.3	9.6
USA	5.4	5.9
Europe, incl. USSR	11.8	13.9
Asia, Australia, New Zealand	3.1	3.6
South America	0.3	0.4
Africa	0.3	0.3
Total	29.1	33.7

The estimated production of different mechanical pulps in different regions of the world is shown in Table 5-3.

Table 5-3. Mechanical Pulp Production in Different Regions of the World 1984, tons/year

	GWD	TMP	CTMP	Total
Canada	4.3	2.4	1.6	8.3
USA	2.9	2.1	0.4	5.4
Europe, Incl. USSR	7.5	3.5	0.8	11.8
Asia, Australia, New Zealand	0.9	1.9	0.3	3.1
South America	0.1	0.2	0.0	0.3
Africa	0.0	0.2	0.1	0.3
Total	15.7	10.2	3.2	29.1

The world total capacity of CTMP is about 20,000 tons/day, while the total TMP/CTMP capacity is about 60,000 tons/day. A detailed list of individual CTMP mills and their production capabilities can be found in Appendix A.

New CTMP and TMP pulping capacity is added at about an equal rate. Groundwood capacity growth is almost nonexistent and ageing groundwood mills are being replaced by TMP or CTMP mills. It is assumed this trend will continue.

CTMP, PRODUCERS AND USERS

The world total production of CTMP pulp and its market pulp portion of this is estimated until year 1999 and shown in Figure 3. The corresponding prediction is done for North America and shown in Figure 4.

The present and announced world CTMP production capacity is shown in Table 6-1. These capacity numbers include announced mill expansions until 1988. The regional percent distribution of the present production capacity is shown in Figure 5.

Table 6-1. Present CTMP Capacity in the World Number of Mills, tons/day

	Market		Integrated		Total	
	No	Tons	No	Tons	No	Tons
Canada	6	2705	18	7625	24	10330
USA	-	-	9	2387	9	2387
Europe, Incl., USSR	14	2680	15	3995	30	6675
Asia, Australia, N. Z.	2	430	15	2955	17	3385
South America	2	320	3	507	5	827
Africa	-	-	2	620	2	620
Total tons/day	24	6135	62	18589	87	24224

The main producers and users of CTMP pulp in North America and Canada are Abitibi-Price, Bowater and Consolidated Bathurst.

In this section, market CTMP capacity and production refers to mills producing pulp only as distinguished from integrated mills producing pulp and paper. As discussed later, most of the CTMP produced in market pulp mills goes to captive use, and only a small portion is real market pulp. The development in total CTMP production is shown in Table 6-2, and the corresponding figures for market CTMP in Table 6-3.

Table 6-2. Present and Projected CTMP Production in Different Regions of the World, million tons/year

	1982	1984	1986	1989
Canada	1.0	1.6	1.9	2.6
USA	0.4	0.4	0.4	0.8
Europe	0.4	0.8	1.4	1.9
Australia, New Zealand, Japan	0.1	0.3	0.4	0.6
South America	0.0	0.0	0.2	0.4
Africa	0.1	0.1	0.1	0.1
Total, million tons/year	2.1	3.2	4.3	6.4

Table 6-3. Present and Projected Market CTMP Production in Different Regions of the World, million tons/year

	1982	1984	1986	1989
Canada		0.3	0.5	0.7
USA				0.1
Europe, Incl., USSR	0.1	0.4	0.7	1.1
Asia, Australia, New Zealand		0.1	0.1	0.2
South America			0.1	0.1
Africa				0.0
Total, million tons/year	0.1	0.8	1.4	2.2

As can be seen from these figures the market CTMP capacity is about 25% of the total CTMP capacity, which was also the approximate production ratio in 1984. The present (or announced) market CTMP producers are listed in Table 6-4. There is minor outside ownership in CTMP or other market pulp business. Almost all of the companies listed can be directly recognized also as paper producers, and the remaining few may prove to be controlled by paper companies. These mills have been and are being built or acquired to fill the owners' strategic pulp needs. Excess pulp is available for outside buyers so long as the owner does not need it. The availability of pulp is therefore uncertain. Changing paper markets could change the owner's willingness to sell pulp almost overnight in the absence of long-term contracts. The only real market CTMP pulp mills in North American are the Quesnel River Pulp Mill (50% of capacity), Tembec (100% of capacity) and Consolidated Bathurst in Bathurst (Estimated 50%), which is adding a bleaching line to make CTMP more attractive. The other Consolidated Bathurst mills in Canada may use all of the production, eliminating the mill from real market pulp category. However, Consolidated's specific plans are not yet known.

Table 6-4. CTMP Market Pulp Producers, Production Capacities, tons/day

Company	Worldwide	Canada
Melhoramentos, Brazil	40	
Consolidated Bathurst, Canada		480
Quesnel River Pulp, Canada		530
Tembec, Canada		300
Cascade, Canada		300 (1987)
Millar, Western Ind., Canada		575 (1988)
Fibreco Export, Canada		520 N/A
Junkers Traekemi, Denmark	250	
Serlachius, Finland	250	
Rochette Hermitage, France	170	
Cellulosa Galabra, Italy	150	
SAICI, Italy	120	
Daishowa, Japan	30	
Groupo Ind. de Durango, Mexico	270	(1986)
Winstone Samsung, New Zealand	430	
Folla Bruk, Norway	240	
Opua, Spain	150	
Billerud-Uddeholm, Sweden	150	
MoDo-Iggesund, Sweden	300	
Rockhammars Bruk, Sweden	140	
Rottneros, Sweden	150	
Stora Kopparberg, Sweden	200	
Svenska bowater, Sweden	150	
Svenska Cellulosa, Sweden	240	
Total	3,430	2,705

Among Canadian producers, the Quesnel mill is jointly owned by Daishowa and West Fraser. Daishowa is using 50% of the production as TMP in Japan for newsprint manufacture and the other 50% is sold through MacMillan Bloedel's organization to MacMillan Bloedel, James River, etc.

The Consolidated Bathurst's New Brunswick mill was originally planned to produce CTMP for Consolidated Bathhurst's newsprint mill in United Kingdom. The cost for transporting pulp to the UK mill has proved to be higher than expected and the mill in UK is expanding its secondary fiber capacity to replace CTMP. The New Brunswick mill is building a 15 million dollar bleach plant to achieve 80% CTMP end brightness. The company has to find markets for an additional 80,000 tpy of bleached CTMP no longer required by its British newsprint mill.

Tembec has begun operations and announced its first sales. Cascade mill is not operating yet. Tembec has made an agreement with SCA, a Swedish pulp and paper manufacturer, to market all the production for the new mill.

The market CTMP pulp consumption distribution in 1984 is shown in Table 6-5. The rapid change in the production capacity of CTMP and the versatility for different end uses warrant caution. The most obvious grades, where CTMP is used, are newsprint and tissue. The Figure 6 illustrates the total use of CTMP pulp in different paper grades manufacture including the estimated consumption development until year 1999.

Table 6-5. Estimate of CTMP Market Pulp Consumption Distribution in 1984, percent.

Paper/CTMP grade	%
Newsprint	50
Printing and Writing Papers	10
Casemaking Material	10
Wrapping and Packaging Paper & Board	-
Tissue and Toweling Papers, Fluff Pulp	30
Other grades, Paper and Boards	-
Total consumption	100

The CTMP markets in Europe for locally produced CTMP are presently good, and the existing mills have been able to sell all of their production without difficulties. The price level in Europe for bleached market CTMP has been about 15-18% below that of the bleached kraft pulp. When production costs for CTMP are about 20% below those of kraft pulp, selling market CTMP has been more profitable than selling kraft pulp.

It is estimated that the rapid growth of CTMP market pulp production worldwide will slow somewhat. The growth will, however, still be noticeable compared to the growth in other parts of the pulp and paper industry. The reasons for the strong development in the past have been in the versatility of the CTMP pulp for various end uses. In the future, growth is expected to match the growth pace of the paper industry globally.

It is estimated that the total CTMP production in the year 2000 could be in the range of 12 to 14 million tons per year, provided that the conversion of TMP and RMP pulp facilities to CTMP is maintained at it's present pace.

If the bleaching technology for mechanical pulps advances according to indications, a major portion of new pulping capacity in the world between now and the year 2000 could be CTMP, TMP and their derivatives. In this case, the total CTMP production could be higher than 14 million tons per year by the turn of the century.

PRICES, COSTS AND INVESTMENT

Price Developments

The price development of different market pulps are shown in Table 7-1. The common factors affecting different pulp prices are the availability and price of bleached kraft pulp. Technically, the bleached kraft pulp is a superior pulp compared to any other grades available for the papermaker. The major drawbacks of kraft pulp are the price and the yield. The prices in Table 7-1 are only indicative and they are not to be taken as "official" pulp prices. The deviation of these prices may be considerable, especially during recessions when mills apply deep discounts to these prices.

Table 7-1. Various Market Pulps Price Development in the North America, US $/ton

	1981	1982	1983	1984	1985	1986
Bleached Kraft Pulp	538	413	366	458	420	450
CTMP, Bleached MP	295	295	295	375	330	330
TMP/MP	255	250	260	285	250	250

The price for bleached kraft pulp is CIF buyers plant and prices for mechanical pulps (CTMP and TMP) are FOB plant. CTMP and bleached MP prices are estimated to be at the same level. However, the European experience would justify slightly higher prices for bleached CTMP pulp than other mechanical pulps.

Considerable chemical market pulp capacities have been built up in various parts of the world and this, together with recessions on the US and Europe, has depressed pulp prices. South-American producers, especially in Brazil and Chile, have ambitious plans for capacity increases utilizing fast growing eucalyptus and pine forest plantations. It is in their interest to carry out those plans and, partially as a result of that, it is anticipated that market pulp prices will continue to be unstable in the foreseeable future.

Costs

The production costs of a market CTMP mill are shown in Table 7-2. When estimating the freight cost it was assumed that the main markets are in the Pacific Rim countries and in the midwestern states of USA, in addition to Canada.

The wood yield in CTMP process was estimated to be 90%, and power consumption 2000 kWh/ton. Fifty to sixty percent of the power is recovered to process heat.

Table 7-2. Production cost of CTMP, US $/ton

	Alberta	BC, Pac. Northwest	Australia New Zealand	Scandinavia
Wood	35 - 51	21 - 55	15 - 20	75 - 86
Power and Fuel	19 - 30	30 - 70	20 - 25	37 - 58
Operating & maint. supplies	18 - 20	17 - 19	20 - 22	17 - 19
Labor	22 - 25	22 - 25	16 - 20	18 - 20
Other	44 - 46	43 - 45	40 - 45	40 - 45
Sales & freight	60 - 80	45 - 65	45 - 60	75 - 90
Total Range	198-252	178-279	156-192	262-318
Average	220	220	180	280
Difference	-	0	-40	60

The Australian and New Zealand producers have an advantage over other parties selling to Pacific Rim countries, but on the other hand, their raw material resources are limited. Australia is today an importer of both pulp and paper products. That country imported about 225,000 tons of newsprint in 1985. This amount is predicted to increase by 1990 to about 300,000 tons.

British Columbia and the Pacific Northwest have an ample supply of both raw materials and power. If CTMP market pulp mills are built in these areas, they may provide serious competition for a market pulp mill in Alberta.

Production costs of bleached chemical pulp will be the determining factor for CTMP market price. The North American "rule of thumb" price for CTMP is about $100/ton below that of bleached kraft pulps. This difference will narrow if CTMP can be bleached to high brightness levels. Chemical pulp prices will determine how the CTMP pulp will be evaluated. In making chemical wood pulp the wood price is one of the main factors as can be seen from Table 7-3.

Table 7-3. Production Costs of Bleached Chemical Pulp, US $/ton

	Alberta	BC, Pac. Northwest	Scandinavia	South America
Wood	70 - 100	45 - 110	180 - 210	70 - 80
Power and Fuel	5 - 30	10 - 30	10 - 40	10 - 20
Labor	25 - 40	25 - 70	20 - 60	15 - 20
Other	60 - 110	60 - 110	60 - 110	70 - 110
Sales & Freight	60 - 80	45 - 65	75 - 90	60 - 80
Total range	220 - 360	185 - 385	345 - 530	225 - 310
Average	250	220	380	250
Difference	-	+30	-130	0

Capital Investment Costs

The capital investment cost for a 90,000 tons/year market CTMP mill is about $70 million US, Table 8-4. The minimum mill size is about 60,000 tons/year. The 90,000 tons/year mill is selected due to the fact it represents a mill size with a optimum in capital investment cost per ton. Exceeding the 90,000 tons/year CTMP limit will require a second flash dryer.

Table 7-4. Investment Cost of a Greenfield CTMP Mill, million US dollars

Mill type	Market pulp mill
Building and Site	10.6
Equipment, Tax, Freight	41.5
Engineering	5.0
Construction Mgmt. & Admin.	4.8
Contingency	7.9
Total	70.0
Total, $/ton	780

The capital investment cost for a large chemical market pulp mill is about U.S. $900 per ton of pulp, compared to U.S. $780 per ton for CTMP pulp.

ROI and Sensitivity Analysis

We have evaluated the economics for a 90,000 tons/year CTMP mill based on the following assumptions:

- The mill starts operation two years after the investment decision is made.
- During the first operating year (third year) the production is 60%. During the second year, it is correspondingly 90% of nominal capacity.
- The tax rate is 50%, combined federal and provincial taxes.
- Depreciation is calculated by the straight line method, based on a 20 year lifetime.
- Price and cost escalation are assumed to be 5% per year.
- Sales price of CTMP pulp is US. $350.

Return on investment is calculated using the discounted cash flow method. About 8% in operating capital is needed for the mill.

The sensitivity analyses were conducted to determine the impact of various operating costs on the ROI (discounted cash flow method), Table 8-5. The variation in Table 7-5 values represents the variation in variable costs costs in the Table 7-2.

Table 7-5. ROI Sensitivity Analyses of CTMP Mill (ROI %)

CTMP mill, base case	Discounted Cash Flow Rate 15.0 - 19.0
Capital Investment Cost + 20%	13.7 - 17.2
Transportation Cost + 20%	13.7 - 18.2
Wood Cost + 20%	14.2 - 18.5
Energy Cost + 20%	14.5 - 18.8
Sales Price + 20%	20.1 - 23.7

ALBERTA'S COMPETITIVE POSITION

The main markets for Alberta's CTMP pulp are presumably in the Pacific Rim countries, as well as California and the midwestern United States.

The Australian and New Zealand producers have a favorable position in Pacific Rim's market compared to Alberta, but are limited in their wood material resources, pine and eucalyptus.

Scandinavian competition is not going to affect the markets in Alberta's anticipated market areas. Their freight costs and wood prices are likely to be too high. In addition, the low margins for pulp compared to paper products will persuade them to integrate their chemical market pulp facilities with paper mills. Production from future investments in CTMP pulping facilities will then be used on local markets.

British Columbia and US Pacific Northwest mills are very competitive compared to Alberta's CTMP mill. They have wood resources and inexpensive power in some areas. Their access to potential markets is, in many cases, better.

Mills in British Columbia, like Belkin Paperboard in Burnaby, Island Paper Mills Ltd., in New Westminster, and Scott Paper in New Westminster could use part of the CTMP production. Alberta's mill has to carve its share in these markets from Quesnel's CTMP, and Finlay Forest Products Mackenzie market groundwood mill. The markets will be extremely competitive in quality and price, but some market share could be available once the quality of CTMP has reached the acceptable level. These markets, however, are small and cannot provide a permanent solution for an Alberta mill.

The BC newsprint producers, such as Crown Forest Industries mill in Elk Falls, BCF's mill in Crofton and MacMillan Bloedel's mills in Port Alberni and Powell River, could use CTMP. They are generally self-sufficient in pulp and are apparently in the process of converting their existing TMP lines to CTMP as already happened in Powell Rivre.

All other costs the same, freight costs are becoming increasingly important. The freight cost for a ton of baled pulp from Alberta to Vancouver currently is $23, to St. Paul, Minnesota U.S. $57, and to Chicago, Illinois, U.S. $55/ton and to China, about U.S. $80/ton.

The prices of bleached kraft pulps (softwood and hardwood) will determine the price of CTMP pulp. The strength properties and brightness of CTMP pulp are inferior compared to chemical pulps. CTMP, however, will have better opacity and better printing properties (in most cases) compared to bleached chemical pulps. The combination of these factors will determine the price a particular paper mill is willing to pay for the CTMP.

The Figures 7 and 8 show bleached kraft pulp production costs for hypothetical new mills located in various parts of the world. For comparison pulps shipped to western Europe are shown. When the capital investment costs are excluded, hardwoods from Brazil and Portugal (eucalyptus) can be produced at comparable price level to Alberta's CTMP. These pulps could then be made available in the North American marketplace at low prices.

As an example, the Aracruz Cellulose in Brazil claims to have wood costs of $45/ton from plantation forests with total production costs of $150-200/ton of bleached eucalyptus kraft. The mill plans to double its annual capacity of 460,000 tons by the year 1990. Other mills in Brazil and elsewhere in South America have similar expansion plans, but they will have restricted access to capital investment funds, which will cause extensive delays in the predicted time schedules.

Being in a disadvantaged location geographically with respect to the Pacific Rim markets compared to the B.C. and other potential Pacific Northwest mills, Alberta should consider integrating the CTMP mill with a paper mill at the earliest convenience. The benefits of coated wood containing paper grades for the region should be investigated together with the alcaline paper-making process. The main benefit of alcaline paper making process is its better optical quality and strength properties of the paper.

APPENDICES

APPENDIX A:

CTMP PULP PRODUCTION CAPACITIES IN CANADA, USA, EUROPE AND THE OTHER REGIONS OF THE WORLD

COUNTRY	Company	Mill	Species	Capacity tons/day	Product	Start-up
Canada	Abitibi-Price	Gaspesia, Que	Spruce	275	Newsprint	1986
Canada	Abitibi-Price	Beaupre, Que	Spruce, Balsam	600	Groundwood specialty	1983
Canada	Abitibi-Price	Kenogami, Que	Spruce, Balsam fir	400	Newsprint	1979
Canada	Abitibi-Price	Fort William, Ont	Mixed SWD	180		
Canada	Abitibi-Price	Stephenville, Nfld	Spruce, Balsam fir	500	Newsprint	1981
Canada	Abitibi-Price	Thunder Bay, Ont	Spruce	150	Newsprint	Oper
Canada	Bowater Newfoundland	Corner Brook	Spruce, Balsam fir	400	Newsprint	1976
Canada	Bowater Newfoundland	Corner Brook	Spruce, Balsam fir	400	Newsprint	1981
Canada	CIP	Gatineau, Que	Spruce	450	Newsprint	Oper
Canada	Cascade	Port Cartier, NB	Spruce, Balsam	300	Market Pulp	1988
Canada	Consolidated Bathurst	Bathurst, NB	Spruce, Balsam	480	Market Pulp, Newsprint	1983
Canada	Consolidated Bathurst	Grand'Mere, Que	Spruce, Balsam, (BiSI)	300	Newsgarde Pulp	1981
Canada	Consolidated Bathurst	Shawinigan, Que	Spruce, Balsam, Pine	675	Newsprint	1987
Canada	Domtar	Dolbeau, Que	Black Spr, Balsam, Jack Pine	600	Newsprint	1987
Canada	Fibreco Export	BC	Spruce, Balsam fir	500	Market Pulp	
Canada	MacMillan Bloedel	Powell River, BC	Hemlock, Balsam fir	490	Offset News	1980
Canada	MacMillan Bloedel	Powell River, BC		790		1985
Canada	Makin Project Initiators, Ltd	Brittania Beach	Aspen, Spruce	435	LWC	1988
Canada	Millar Western Industries Ltd	Whitecourt, Alta	Aspen, Spruce, Pine	575	Market Pulp	1988
Canada	New Brunswick Int. Paper Co	Dalhousie, NB	Spruce, Balsam	500	Newsprint	1981
Canada	Ontario Paper Co	Thorold, ONT	Poplar	200	Newsprint	1981
Canada	Quebec North Shore Paper Co	Baie Comeau, Que	Spruce, Balsam fir	280	Newsprint	1983
Canada	Quesnel River Pulp	Quesnel, BC	SWD	530	Market Pulp	1983
Canada	Tembec Inc.	Temiscaming, Que	Softwood, Hardwood	320	Market Pulp, Printing	1986
			Total Canada:	10330		
U.S.A	Bear Island Paper Co	Doswell, VA	Loblolly, Virginia Pine	524	Newsprint	1979
U.S.A	Bowater Southern	Calhoun, TN	Southern Pine	488	Newsprint	1979
U.S.A	Combined Paper MIlls	Combined Locks, WI	Poplar, (alk SI)	225	Specialty Papers	Oper
U.S.A	Georgia Pacific	Bellingham, WA	Red Alder	80	Offset News, Tissue	Oper
U.S.A	Georgia Pacific	Lyons Falls, NY	HWD Mixed	125	Printing Paper	Oper
U.S.A	Georgia Pacific	Plattsburgh, NY	HWD Mixed	125	Tissue, 65-75GE	Oper
U.S.A	Great Lakes Forest	Ponderay, WA	Mixed Pine	620	Newsprint	1987
U.S.A	Inland Empire Paper Co	Spokane, WA	White fir 60%, Spruce 25%, He	100	Newsprint fir	1985
U.S.A	International Paper	Pine Bluff, AR	Southern Pine	100		
			Total USA:	2387		
Belgium	KNP	Lanaken		225	LWC	1987
Denmark	Junkers Traekemi A/S	Koge	Beech	250	Market Pulp, 60-65 GE	Oper
Finland	Forest Research Institute	Espoo		20	Research	1986
Finland	Kajaani Oy	Kajaani	Picea Abies	550	Newsprint	1986
Finland			Pine	200	Specialty grades	1986
Finland	Rauma-Repola	Rauma	Pinus silvestris	225	Newsprint, SC	1980
Finland	Serlachius	Mantta	Spruce	250	Market Pulp, Fluff, tissue	1985
France	Rochette Hermitage	La Rochette	Spruce	170	Market Pulp	
Italy	Cellulosa Galabra	Crotone	Beech, Willow, Poplar	150	Market Pulp, 65-75GE	Oper
Italy	S A I C I	Torviscosa	Beech, Willow, Poplar	120	Market Pulp	Oper
Netherlands	KNP		Spruce	240	LWC	1987
Norway	Folla Bruk A/S	Follafoss	Spruce	240	Market Pulp	1984
Spain	Opua S A	Andoain	Pine, eucalyptus	150	Market Pulp, Pine, eucalyp	1979

Spain	PAMESA		Pine, Eucalyptus	100	Pr & Wr		1979
Sweden	Billerud-Uddeholm	Skoghall	SWD	150	Liquid Board		1977
Sweden	Billerud-Uddeholm	Skoghall	SWD	150	Market Pulp, Fluff		1981
Sweden	Folla Bruk	Folla		240	Market Pulp		1984
Sweden	Kopparfors AB	Fors	Spruce, Pine	225	Paperboard		1982
Sweden	MoDo-Iggesund	Domsjo	Spruce	300	Board, Tissue, Market Pulp		1985
Sweden	Rockhammers Bruk	Rockhammar	Pinus silvestris, Picea abies	130	Market Pulp		1985
Sweden	Rockhammers Bruk	Rockhammar	Pinus silvestris, Picea abies	140	Market Pulp		1979
Sweden	SD	Sundsvall			PILOT PLANT		1978
Sweden	Svenska Bowater	Umea	Spruce	150	Market Pulp		1985
Sweden	Svenska Cellulosa	Ostrand	Picea abies	240	Market Pulp, fluff grades		1983
Sweden	Svenska Cellulosa	Matfors	Picea abies	100	Magazine		1983
USSR	Balachus	Balachus	Spruce, Aspen	650	Newsprint		1988
USSR	Prommashimport	Sjasskij	Poplar, (alk SI)	300	Operating		
USSR	Prommashimport	Balachna	Spruce, Aspen	480	Printing, Writing, Magazin		1986
USSR	Syktyvkar Paper Complex	Syktyvkar	Spruce, Aspen	530	Printing, Writing, Magazin		1987
			Total Europe:	6675			
Argentina	Massuh S A I C	Buenos Aires	HWD Mixed	50	Bright Pulp	Oper	
Argentina	Papel Prensa S A		Poplar, alk SI	365		Oper	
Australia	APM	Petrie, Qu	Pine	30	Board	Oper	
Australia	Assoc P&P Mills Ltd	Wesley Vale	Eucalypt, (cold soda)	70	Publication Paper	Oper	
Bangladesh	Khulna Newsprint Mills	Khalispur, Khurna	Gewa wood	155	Newsprint, Magazine		1987
Brazil	Cia Melhoramentos De Sao Paulo	Sao Paulo	Cypress, Pine	120	Tissue		1979
China	Jijin Paper Mill	Jijin		145	Newsprint		1987
Costa Rica	Scott Paper de Costa Rica	San Jose	Pine, Gmelina	22	N/A		1986
India	Hindustan Paper Corp	Kerala	Eucalyptus, (cold soda)	235	Newsprint	Oper	
India	Mysore Paper MIlls	Bangalore	Eucalyptus, (cold soda)	330		Oper	
Iran	Mazandaran Forest Products Complex		Hornbeam	285			
Japan	Chuetsu Pulp	Chuetsu	SWD	240	Newsprint		1986
Japan	Jujo Paper	Kushiro	HWD Mixed	200	Newsprint	Oper	
Japan	Oji Paper Co	Tomakomai	Mixed HWD	350	Newsprint		1975
Japan	Sanyo Kokusaku	Yufutsu			Newsprint		1978
Japan	TAIO Seishi	Iyo-mishima	Douglas f, Hemlock, mixed swd	300	Magazine, Newsprint		1984
Mexico	Groupo Industrial de Durango	Durango	Ponderosa Pine	270	Market Pulp		1986
New Zealand	Forest Research Institute	Rotorua		65			1986
New Zealand	Winstone Samsung	Karioi	Pine	180	Market Pulp		1985
New Zealand	Winstone Samsung	Karioi	Pine	250	Market Pulp		1983
Nigeria	Nigerian Newsprint Mfg Co	Oku Iboku	Gmelina	320	Newsprint		1985
Nigeria	Nigerian Newsprint Mfg Co	Calabar	Gmelina	300	Newsprint		1981
Taiwan	Chung Hwa	Hualien		275	Newsprint		
Unpublished			Pine	275	Tissue		1986
			Total others:	4832			
			World Total:	24224			

FIGURES

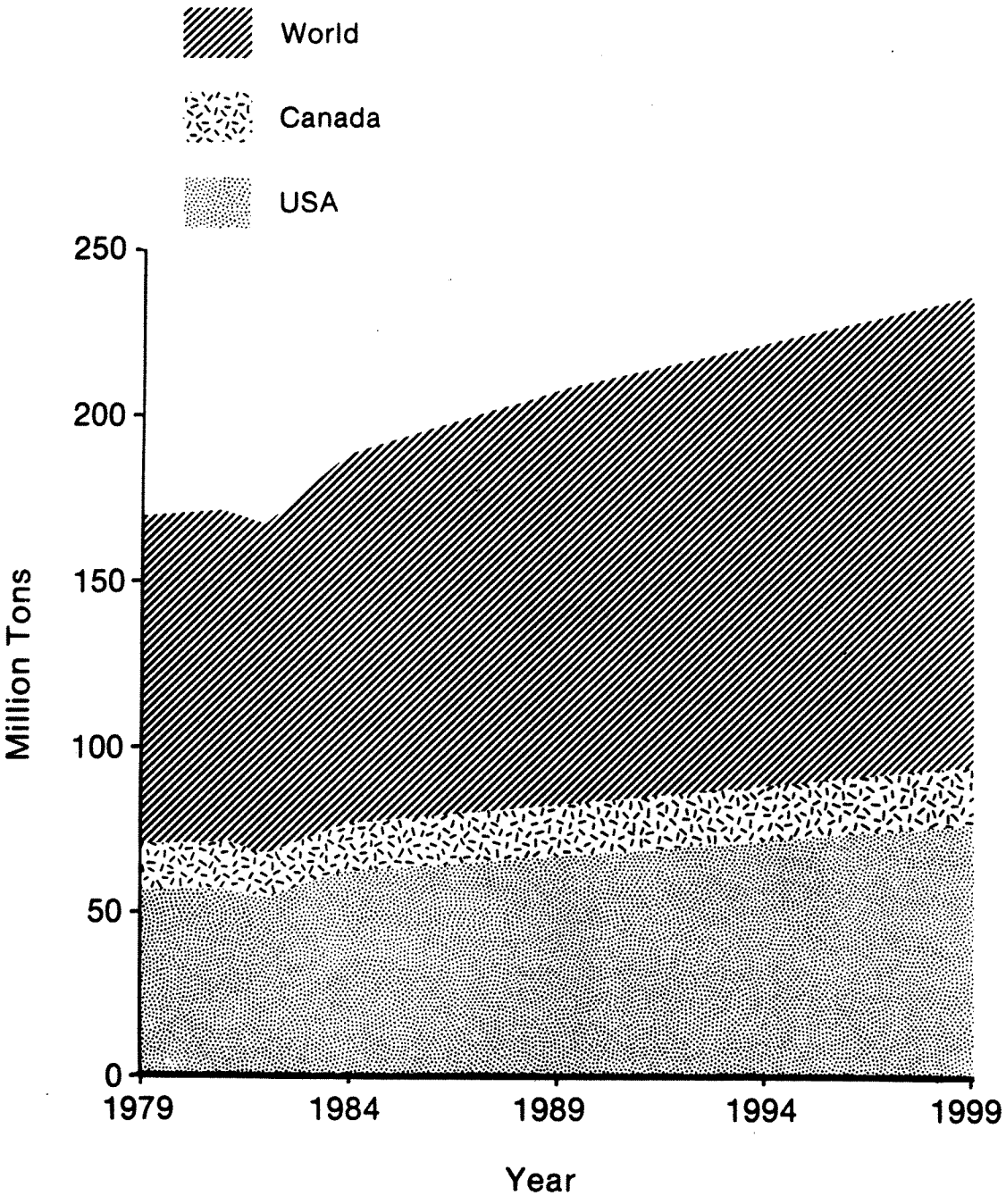


Figure 1. World Paper Production.

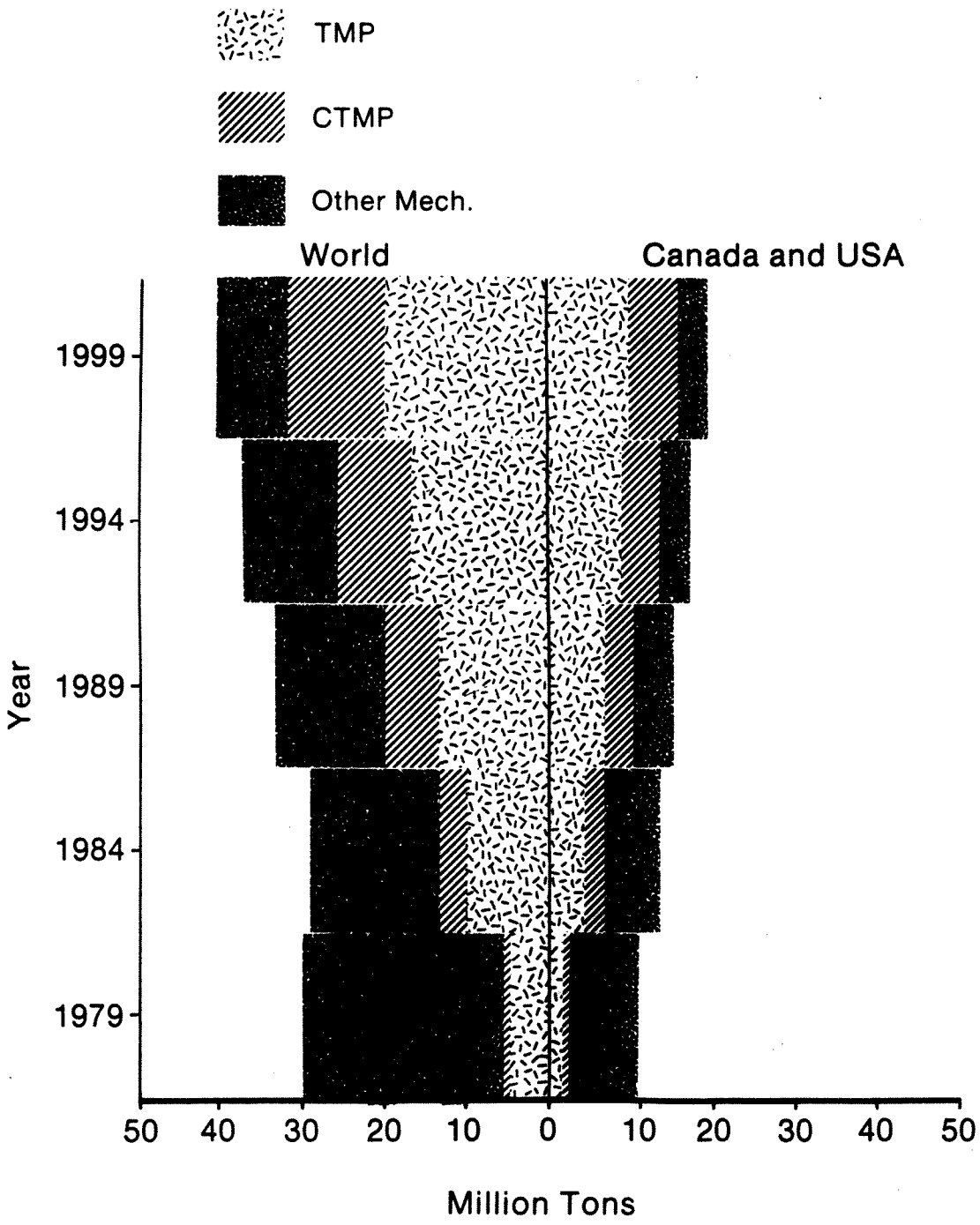


Figure 2. Mechanical Pulp Consumption.

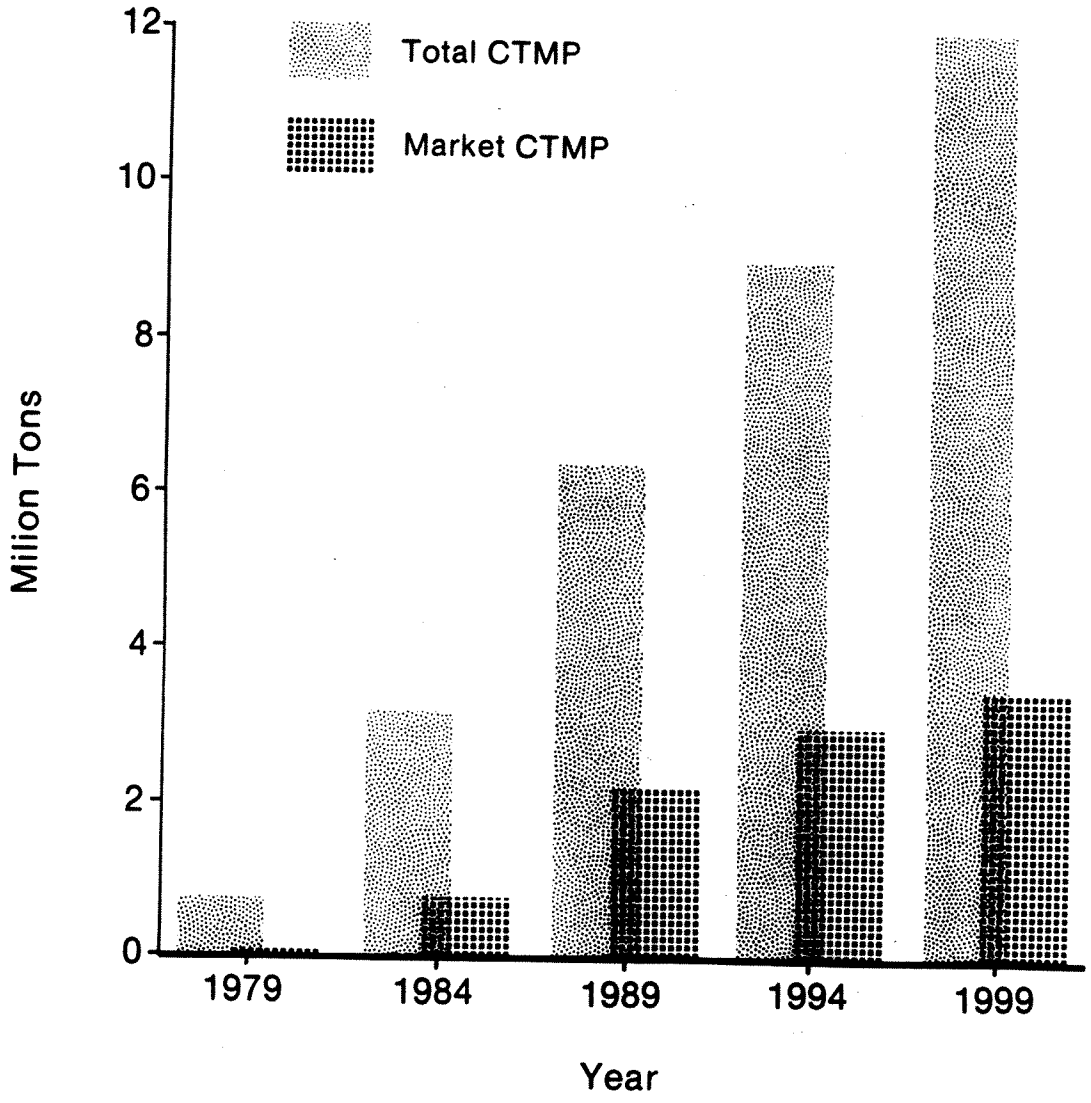


Figure 3. World Production of CTMP.

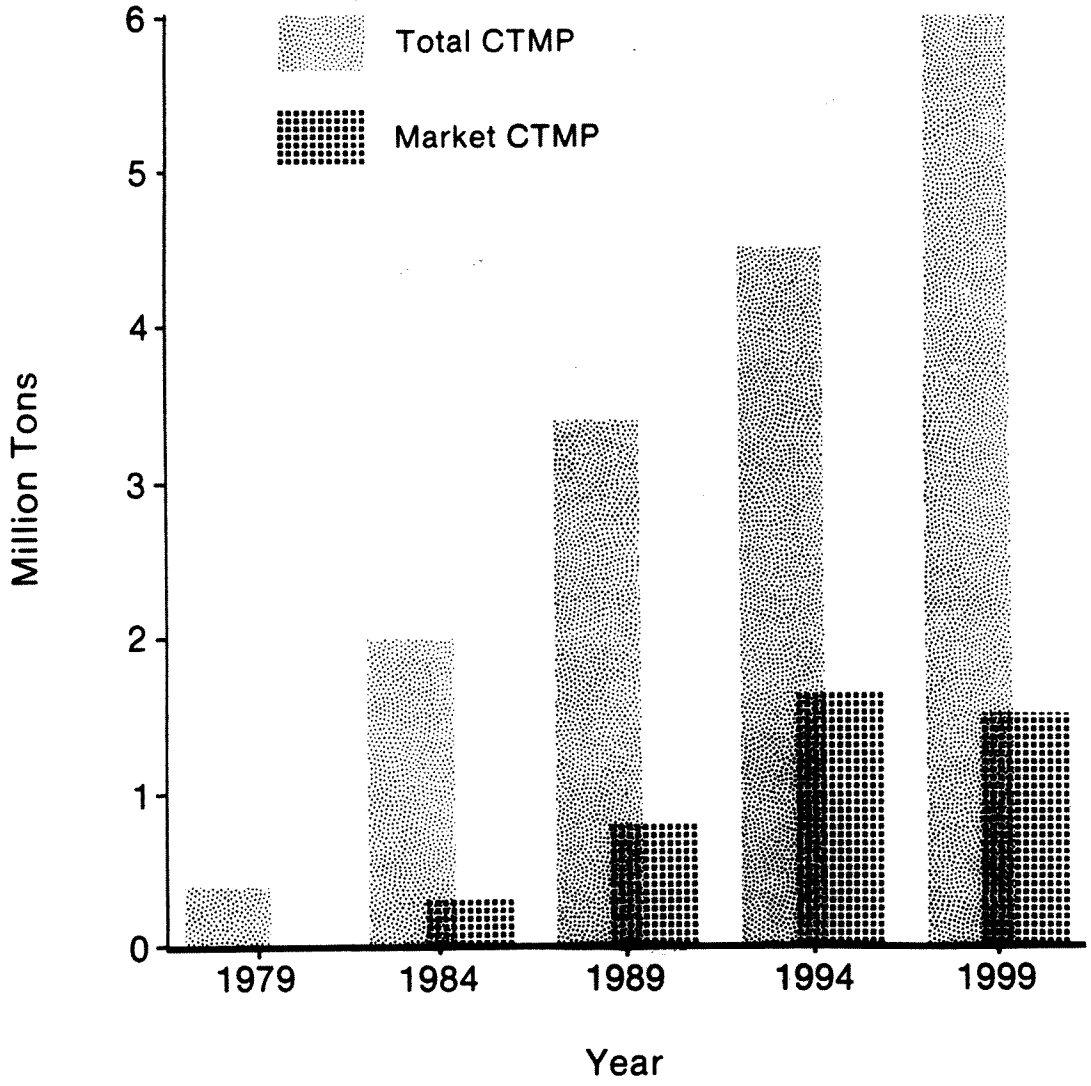
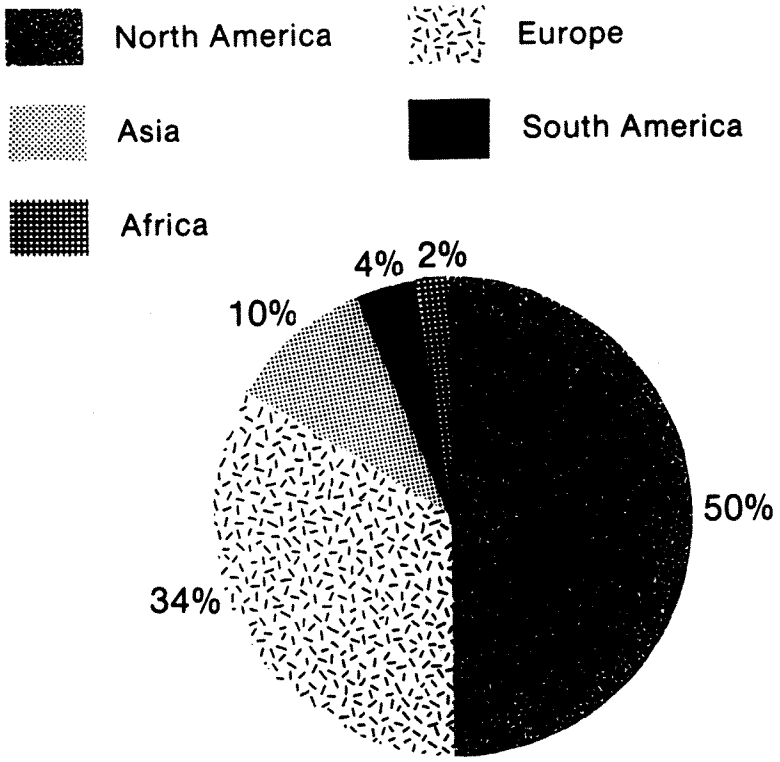
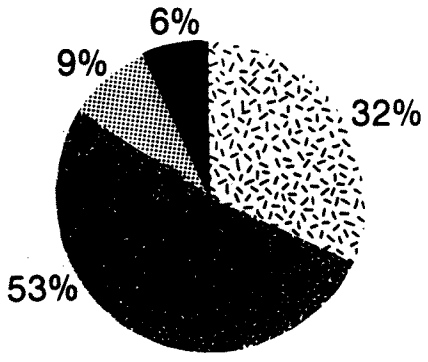


Figure 4. North American Production of CTMP.



World CTMP capacity in different regions, %.



World market CTMP capacity in different regions, %.

Figure 5. World CTMP Capacity in Different Regions, %.

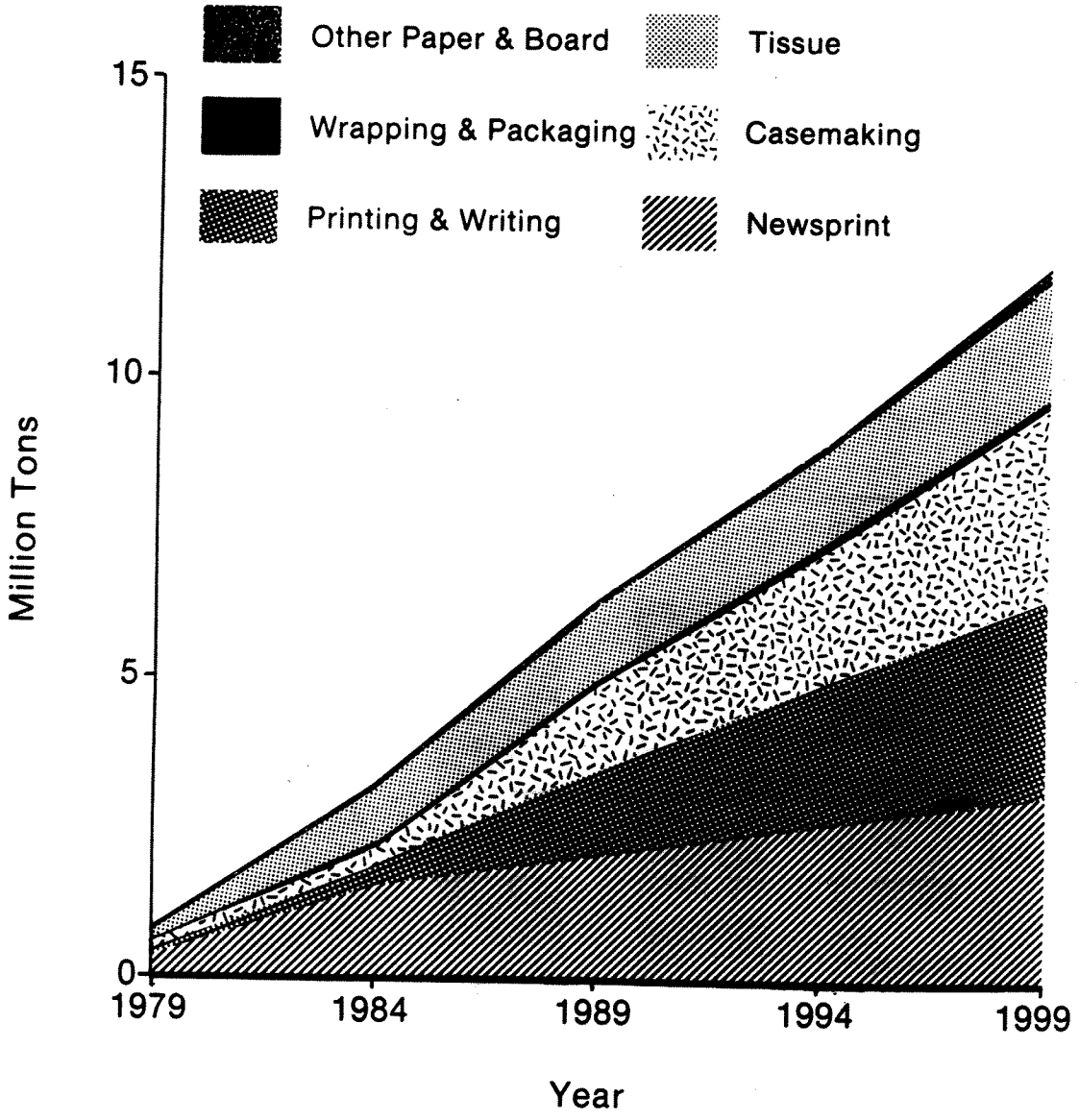


Figure 6. World CTMP Use in Different Paper Grades.

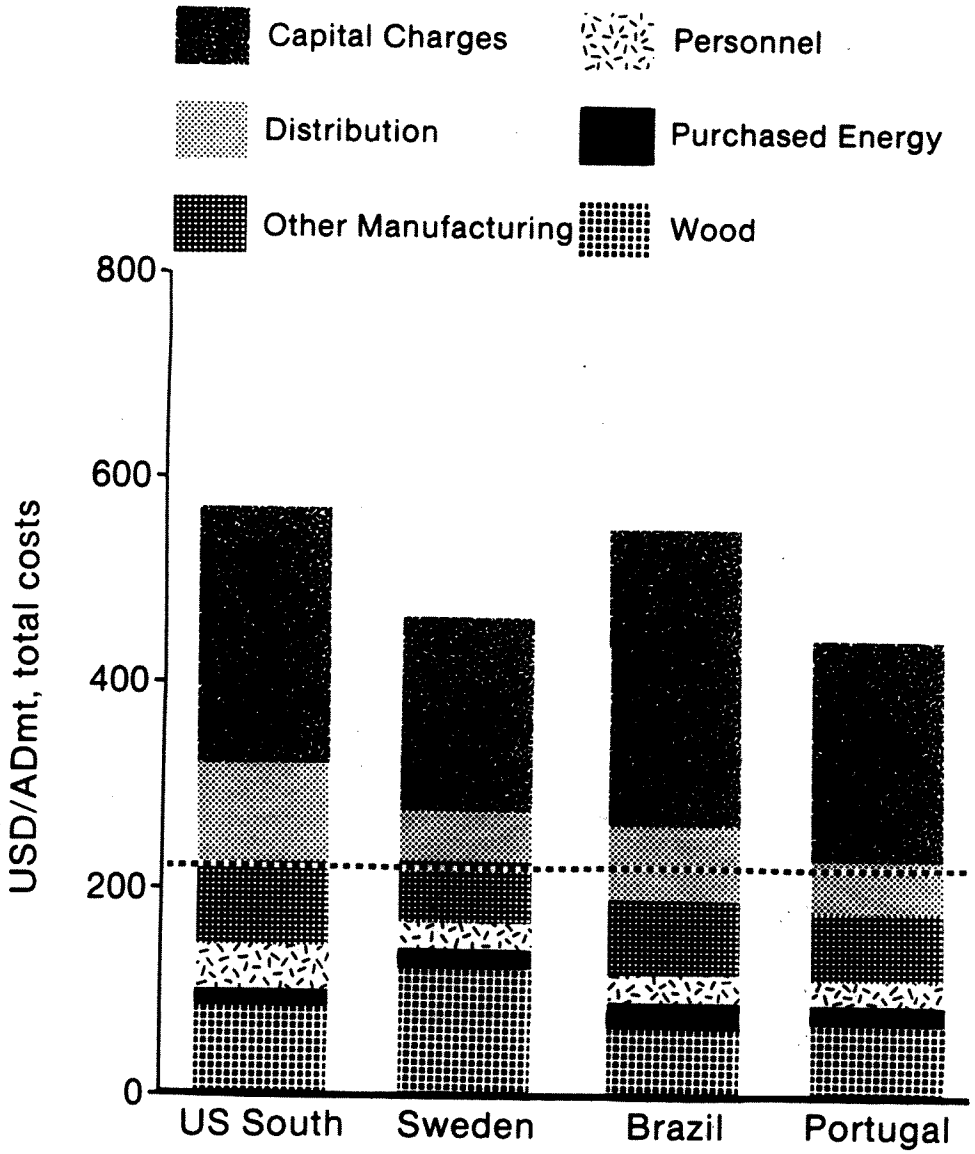


Figure 7. Costs for New Hardwood Pulp Mills USD/ADmt, total costs to CIF Western Europe, Cost Level

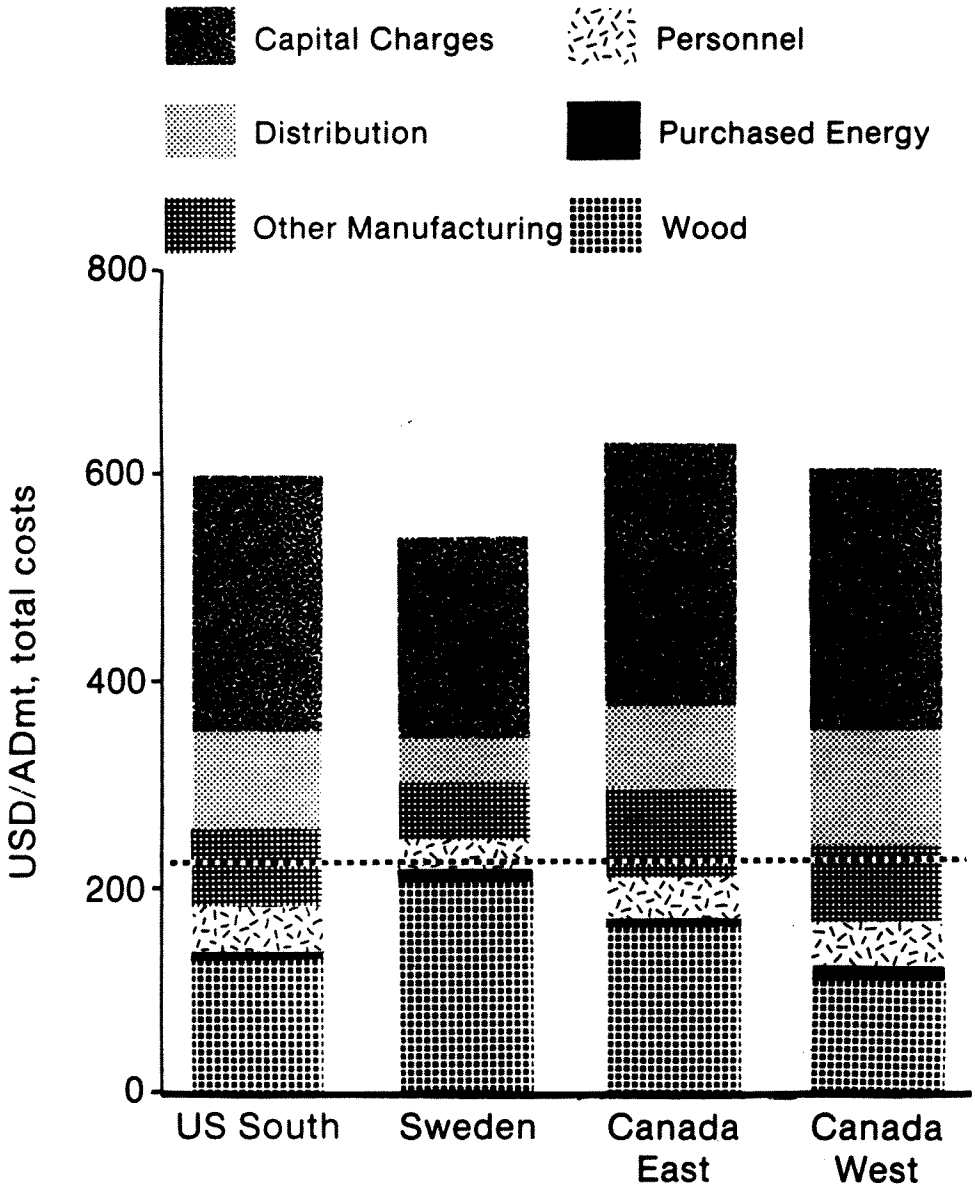


Figure 8. Costs for New Softwood Pulp Mills USD/ADmt,total costs to CIF Western Europe, Cost Level.