### GENERAL OUTLOOK OF KOREAN PAPER INDUSTRY

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#### I. Growing of Korean Paper Industry during Past Decade

The Korean paper industry has been continuously expanded both in the capacity and the production output over last 10 years; the annual growing rate in production marked between 5.4 percent in minimum and even 37 percent in maximum during the term, except one minus grown year in 1982, which was the year of rock bottom depression in this country.

The average growing rate was 19 percent in years of 1970s, and was 16.3 percent in 1983, and 11.3 percent in 1984.

The production in the year 1975 was 661,722 metric tons, which has been gradually increased to 2,206,791 metric tons in 1984, which means that it was expanded more than three times during the last decade, 1975 -1984. (Table I)

#### II. Present Status of Korean Paper Industry

The number of paper mills in this country has been increased from 61 to 140 mills during the decade, the figure is based on the member companies joined to Korea Paper Manufacturers' Association and Korea Paper Industry Cooperative. The operation rate performed to the mill capacity has been also improved from 78 percent in 1975 to 92.3 percent in 1984, and the actual tonnage by kinds of paper is as shown in Table II.

The official total mill capacity is 2,393,000 tons presently, consists of 213,000 tons for Newsprint, 606,000 tons for Printing and Writing, 243,000 tons for Kraft, 1,129,000 tons for various Paperboards, and 202,000 tons for miscellaneous kinds of paper such as sanitary tissues and oneside wrappings, etc.

Korea is being producing most kinds of paper and paperboards by those local mills except some specialties, such as electric insulation paper and thermosensitive papers, etc. The total paper import was about 60,000 tons in the last year, which was merely 2.7 percent to the paper consumption. (Table III)

In 1975, the total paper consumption amounted to only 664,729 tons, but it rose to 2,196,000 tons in 1984. Per capita consumption of paper amounted to only 18.3 Kg in 1975, but the figure rose to about 53 Kg level, though it is still very low compared with most industrialized countries. (Table IV)

#### III. Raw Material Demand and Supply

In splte of such a high rate annual increase in the paper production, there is, unfortunately, only one pulp mill started a few years ago, the capacity is merely 350 tons day of bleached sulphate, so the most of the fibrous raw materials required to the industry have to be imported mainly from some norscan countries and Chile, Japan, etc.

In 1983 the industry has imported 478,179 tons of pulp which was equivalent to US\$166,633,000 and also has imported 579,196 tons of waste papers of various grades, was equivalent to US\$93,856,000. The detailed picture of the raw material demand and supply appeared in Table V -  $1\sim3$ .

Domestically produced groundwood covered 77 percent of the total demand for the groundwood, and in case of chemical pulp the self sufficiency rate was mere 19.4 percent last year.

The total demand for waste paper in 1983 reached 1,259,000 tons, of which domestically recovered waste paper filled 685,000 tons, and imports 574,000 tons. Of the total imports, 89.7 percent came from the United States, and the remaining 10.3 percent from Hong Kong, Canada, Japan, etc. (Table V-4, V-5)

#### IV. Problems faced by Korean Paper Industry

With the respect of the future demand and supply prospect, the Korean paper industry will be continuously grown in future. Despite of such a growning market demand the industry has several problems as we can easily imagine. (Table VI, VII)

One big problem faced is how to enhance the self-sufficiency rate for the major raw materials, pulp, and how to level up the recovery rate of domestic waste paper.

As a partial solution, the expansion of Donghae Pulp mill has been under consideration, and investment in overseas facilities has also been promoted, but no one understand it is an easy matter.

Another problem is how to develop paper specialties domestically and to improve the quality of the products. As a way to develop the specialties, the demand of which has been met with imports, overseas training of engineers and invitation of foreign engineers have been under consideration. Campaign for quality control and computerization of both paper mill facilities and management side are part of the various efforts to improve the productivity of paper. More accumulation of advanced technology and know-how is also needed.

In addition, in connection with the Asian Game and 1988 Olympics, both scheduled for Secul, multiple plans have been under study to develop new products and installing the Total Energy System to reduce the cost of energy. In this light, we expect that our paper industry will make a big strides in the future.

#### ENERGY STATUS REPORT RELATED WITH KOREAN PAPER INDUSTRY

#### I. Present Status of National Energy Consumption

Because of lack of oil energy resources in this country, and we have experienced twice of oil shock, the energy has been one of the most important subject of the government policy.

Government organized a energy control center, The Korea Energy Management Corporation in 1974 and tried to centerize the energy management in a nationwide scale. Also government established a new ministry level organization, Ministry of Energy and Resources a few years ago.

As we know well that the pulp and paper industry is one of the big energy consuming industries, we have been faced hard condition in the production cost. The occupation rates of energy cost in the direct manufacturing cost are: Newsprint - 25 to 26, woodfree printing and writing - 9 to 20, Kraft -12 to 13, board - 16 to 17 percent respectively.

The trend of energy occupation ratio in pulp and paper industry against whole Korean industries during the past decade is as Table VIII. The ratio of electric power is 6.49 percent and the oil consumption stands 1.83 percent is average. Because of the small scale of production capacities of the mills comparing with developed industrial countries, the industry is placed at a great disadvantage in effective utilization of energy.

#### I - 1. Status of receiving electricity

Upon our investigation, the total receiving electric capacity is 359,826 Kw / 106 paper mills, with average of 3,394.5 Kw per mill. The small scale mills of less than 3,000 Kw receiving capacity are 75 mills, which figures 70.8 percent of all.

The mills over 3,000 Kw are figure 29.2 percent, and both 30,000 to 40,000 Kw class and 10,000 to 20,000 Kw capacities appear each two mills only.

One appearent tendency is that the 17 of relatively large mills are concentrated 5,000 to 10,000 Kw level of receiving capacity.

#### I - 2. Status of Boiler

Our investigated data shows that 99 mills have 205 boilers, of which water tube type is most popular, 109 units, with 53.2 percent, smoke tube type occupies 34.1 percent and counts 70 units, and the remaining 26 units are of miscellaneous types such as non-drum style.

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The mill number by the classification of boiler capacity is as follows:

Less than 160 tons steam / hr - 1 mill Range between 100 - 80 t./ hr - 1 mill " " 80 - 60 " / hr - 3 mills " " 60 - 40 " / hr - 9 mills Less than 40 tons steam / hr - 92 mills

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The mill number by the number of unit of boiler held is as follows:

6	boilers	-	1	mill
5	••		2	mills
4	88 - <sub>1</sub>	-	- 4	mills
3	**	-	18	mills
2	••	-	38	mills
1	boiler	-	43	mills

I. - 3 Status of Water Consumption

Total fresh-water consumption in 106 mills figures 231,450 m<sup>3</sup> per day. The detailed distribution picture is as follows:

-			- 3			
Less	than	15,000	M	-	2	mills
· •	**	10,000	**	-	1	mill
	. 40	8,000		-	17	mills
	11	4,000	81	•	2	H
**		3,000	**	-	12	**
	*/	2,000	\$1		27	**
••	41	1,000	**	-	6	
		800	**	-	2	**
••	.93	600	••		9	<b>11</b>
••		400	**	-	18	18
**	11	200		_	5	**
**	<b>11</b> - 1	100	**	-	5	

I. - 4. The Capacity of Paper Machines

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As shown in the Table IX, the paper machines having the capacity of more than 100 tons day number 44 unit, which is about 22 percent of the total machines, whereas most number of machines are concentrated to less than 30 tons day capacity level. The printing and writing paper machines are spreaded evenly but the paperboard machines and miscellaneous paper machines are placed into the small capacities. As a whole, the capacity of paper machines is quite smaller than that of the internationally competitive level.

# II. Present Major Energy Saving Policy by Government

Just after oil shocks, our government made every efforts to reduce energy cost and tried to find any available energy resources from foreign countries. This has been and will be continued in future. Besides, the two major items of present energy saving are being led by our government.

#### A). Change to Fuel Alternatives

A price data implies a possibility of saving energy cost when we use the alternative coal as shown below:

	Recent Tr	end of F	uel Cost	
	Calorifi	.c Year		
	Value	83	84	
0i1 (\$/T)	10,000%	₩182.4	₩182.4	Sp.Gr. : 0.96
Coal (\$/T)	6,800	₩60.0	₩58.8	
	*Kcal/Kg	ζ		

The tentative cost analysis of the coal boiler operation can be shown as follows. When we pretend that it is needed 70 liter (67.2 Kg) of B-C oil to produce 1 ton of saturated steam (dryness 95 - 98), the calculation of fuel cost saving will be:

(1) B-C oil price per 1 ton of steam (based on 1984)

Total required heat capacity	: 10,000 Kcal/Kg x 67.2 Kg = $6.72 \times 10^5$ Kcal
Oil price	: 182.4\$/T x 0.0672T = \$12. <u>26</u>
(2) Coal price per 1 ton of steam (	based on 1984)
Coal required	$\frac{6.72 \times 10^5 \text{ Kcal}}{6000 \text{ Kcal}} = 98.82 \text{ Kg}$

	-		6800 Kcal/Kg = 93.82 K	в
Coal	price	:	58.8\$/T x 0.09882T - \$5.8	1

When the boiler efficiency is not considered, in comparing two fuel costs in producing 1 ton of saturated steam, we probably can reduce fuel cost up to around 50 percent. The final saving is estimated at least 30 to 40 percent when we consider the difference of the efficiency of two types of boilers.

#### B). Installation of Cogeneration System

As we know well, cogeneration is the coincidental generation of electric power required for the mill in conjunction with the production of process steam, saturated or super heated.

As for the relatively large scale mills having over 30 tons per hour of process steam which is required to paper mill, the most reasonable way of getting energy to be considered is to alternate conventional system by cogeneration.

Pulp and paper industry will be able to gain more merits than before by the system, because generated electric power as well as saturated or super heated steam needed in papermaking process can be steadily used. However, frankly speaking, the cogeneration is just in an embrio stage, only two mills which facilitated the system are existed in this country. The brief outline is as follows:

Name of Company	Electric Capacity (Kw)	Soiler Capacity (T/Hr)	Boiler Pressure (Kg/Cm <sup>2</sup> )	Starting Operation
Donghae Fulp Co., Ltd.	14,400 x 1	85 x 1 50 x 1	64	Sept. 1980
Chonju Paper Mfg. Co., Ltd	11,500 x 1	82 x 1	90	Oct. 1983

For our reference, Chonju Paper mill invested about 8 million dollars for the system, and the annual cost saving of the mill reached 1.34 million dollars. We assume that this mill could be saved more than double in their energy cost if the boiler existed using oil can be altered into coal boiler.

# III. Status and Trend of Energy Cost Unit

As mentioned before the Korean paper industry is located in a disadvantageous position regarding of energy cost, the cost unit of mills is sufficiently high than that of internationally competitive level.

For the reference, the average energy cost unit by the representing mills producing different kind of paper is as follows:

Kind of Paper	Capacity	Fuel El	ectricity	Energy
	(M/T)	(1)	(Kwh)	(10 <sup>3</sup> Kcal)
Newsprint	400	135	1,100.3	4,100.8
Woodfree Printing & Writing	200	225	580	3,700
Coated Paper (Off-Machine)	100	110	<b>3</b> 80	2,050
Kraft	300	182(154)	* 628	3,380
Liner	135	170	600	3,250
Manila board	235	182	521	3,122.5

The improving rate during past 10 years marked from 18.5 percent to 23.4 percent in fuel, from 6.71 percent to 22.6 percent in electricity, which is depend on how much effort put for the energy cut in each mill. However, these figure are not always meaningful since the mills of initially well managed could not be changed much the percentages.

(\*One extre case)

# IV. Some of the Successful Energy Saving Examples

There must be a lots of way for energy conservation in pulp and paper mill. Some of the successful examples are to be introduced hereunder.

#### Example A - Improvement of Boiler Efficiency

By removing of inner scale of water tube boiler which capacity is 10 T/Hr, a remarkable reducing of fuel cost unit in a printing paper mill producing 50 tons day, from 230 liters per ton of paper to 185 liters within a year. A hydrodynamic device was installed at the delivery side of the water supply pump. Some others mills could obtain the result at least 5 percent improvement by the same way.

#### Example 3 - Press Part Modernization

One printing paper machine, 150 tons day capacity was converted existing press part of conventional type to Binip press type recently. It was the result that the wet web moisture content at the press end was decreased by 2%, which means 10% of steam saving. This improvement was done without any further electric power required, since a squeeze roll unit could be omitted by this converting work. The machine speed was also improved by 80 m/min. Two sideness of the paper produced was remarkably improved too.

#### V. Conclusion

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It can be said that the energy saving movement has just started for the Korean paper industry in a way, the writers of this report feel frankly that there would be a wider room we have to do for more saving energy for the industry, and we recognize more efforts have to be done by the mill side as well as the management.

Especially for the middle scale industries, The Korea Energy Management Corporation have been doing the energy survey and instruction project for the industries more than 10,000 cases every year, and paper industry has been the subject of the project too. Government has been leading strongly the project of replacing old fashioned boilers by modern type more than 750 units every year, for example. So we can promise you our better future in the paper industry in Korea. -The End-

			Supply					
Year	Production	Growing Rate	Domestic	Growing Rate	Export	Growing Rate	Total	Growing Rate
70	329,530	15.4	329,480	15.5	50	92.3	329,530	15.4
75	661,722	7.1	628,562	14.8	36,167	18.0	664,729	15.0
76	906,692	37.0	859,665	36.8	65,439	80.9	925,104	39.2
, 77	1,124,747	24.0	1,066,048	24.0	59,773	-8.7	1,125,781	21.7
78	1,305,173	21.4	1,314,476	23.3	59,870	0.2	1,374,346	22.1
79	1,593,652	16.7	1,529,067	16.3	52,590	-12.1	1,581,657	15.1
80	1,680,025	5.4	1,509,264	-1.3	154,231	93.3	1,663,495	5.2
81	1,782,909	6.1	1,583,451	4.9	179,138	16.1	1,762,589	5.9
82	1,736,619	-2.6	1,621,700	2.4	115,247	-35.7	1,736,726	-14.0
83	1,982,170	14.1	1,886,700	16.3	99,026	-14.1	1,985,726	14.3
84	2,206,791	11.3	2,091,961	10.3	96,000	-3.1	2,187,961	10.2

Table I. Production & Supply of Paper (Unit: M/I, %)

# Table II. Paper Production during 1975 - 1984 (Unit: M/T)

Year	Total Production	Newsprint	Printing &	Kraft Paper	Paperboard	Others
75	661,722	155,181	131,932	87,228	235,666	51,715
76	906,692	165,462	158,479	119,003	401,269	63.279
77	1,124,747	188,321	197,084	148,835	508,348	82.159
78	1,365,173	182,899	247,120	150,472	655,336	129.346
79	1,593,652	193, 825	297,804	179,736	780,908	141.379
80	1,680,025	249,316	292,541	184,222	789,214	164.732
. 81	1,782,909	270,205	302,897	152,567	884,367	172.873
82	1,736,619	243,703	332,730	152,184	844,188	163.814
83	1,982,176	231,624	415,717	182,400	947,063	205.372
84	2,206,791	219,924	474,764	174,275	1,087,983	249,845

Table III. Paper Imports (Unit: M/T)

Year	[ota]	Newspri pt	Printing Writing	& Vraft	Pananhaand	0-1
		<u>Henoprine</u>	MITCING	Mait	raperboard	Uthers
75	18,011	5	. 121	327	<b>8,9</b> 86	8,572
76	23 <b>,</b> 926	-	787	412	5,388	17,339
77	18,973		83	136	2,260	16,494
78	24,728	-	1,072	2	6,750	16,904
79	30,050	-	459	278	11,479	17,834
80	31,494	-	425	514	14,390	16,165
81	36,460	-	717	410	14,999	20,334
82	37,918	_	1,110	365	13,034	23,359
83	52,131	-	1,413	95	18,763	31,855

Table IV. Per Capita GNP and Paper Consumption

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		1975	1977	<u>1978</u>	<u>1979</u>	1980	1981	<u>1932</u>	1983	1984
Per Capita	GNP (\$)	591	1,028	1,406	1,662	1,605	1,735	1,300	1,884	1,977
Per Capita of Paper &	Consumption Paperboard(Kg)	18.3	29.8	36.2	41.5	40.4	42.0	42.2	48.5	53,1

# Table V.-1 Pulp Demand & Supply Demand (Unit: M/T)

	-Total						Imports		
		······	Chemical			Chemical		······································	Chemical
Year	Total	Groundwood	Pulp	Total	Groundwood	Pulp	Total	Groundwood	Pulp
75	325,250	102,026	223,224	93, 302	87,109	6,693	231,448	14,917	216.531
77	447,812	115,039	332,773	128,993	110,401	18,592	318,819	4.638	314.181
78	478,169	100,190	377,979	98,643	93,805	4,838	379,526	6.385	373.141
79	584,238	149,658	434,580	139,319	139,319	. –	444,919	10,339	434.580
80	620,264	149,202	471,062	167,097	137,441	29,656	453,167	11.761	441,406
81	608,686	152,529	456,157	205,974	137,188	68,786	402.712	15.341	387.371
82	659,012	158,720	500,292	248,304	127.418	120.886	410.708	31.302	379,406
83	745,495	155,170	590,325	266,172	125,858	140.314	479.323	29.312	450.011
84	807,898	177,542	630,356	264,121	136,697	127,424	543,777	40,845	502,932

Table V.-2 Pulp Import Trend by Country (Unit: %)

									,
	1975	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	1982	<u>1983</u>	1984
Total	100	100	100	100	100	100	100	100	100
Japan	13.6	23.9	15.9	17.8	18.2	18.1	11.9	7.1	
Canada	24.7	21.9	26.1	19.6	17.4	14.0	11.6	14.1	
W.Germany	-	· _	0.3	-	-	_	<b></b> '	-	
Sweden	1.4	0.4	12.1	8.5	6.2	4.2	9.5	13.0	
China	8.4	3.9	4.6	2.2	1.5	5.7	5.7	3.3	
Thailand	-	-	-	4.7	2.7	1.0	-	-	
New Zealand	6.1	2.8	3.7	5.4	6.1	6.0	9.2	5.1	
Finland	-		-	2.6	2.0	0.8	1.1	0.3	
Pakistan	1.0	0.3	0.1		. ° <b>-</b>	-	-	-	
Swaziland	8.1	6.0	5.5	5.9	2.3	.4.5	6.4	6.2	
Chile	-	16.1	10.7	9.4	8.9	7.7	7.7	11.2	
Others	0.5	0.5	1.9	0.6	1.7	4.8	4.8	7.3	

Table V.-3 Pulp Production Capacity & Output (Unit: 1,000N/T)

<u>Groundwood</u> Capacity Output	<u>1975</u> 120.5 87	<u>1977</u> 172.5 110	<u>1978</u> 172.5 93	<u>1979</u> 199 139	<u>1980</u> 199 137	<u>1981</u> 199 137	<u>1982</u> 202 127	<u>1983</u> 202 126	<u>1984</u> 202 137
Chemical Pulp	· ·			``					
Capacity	13	19	3	· •	105	105	105	105	105
Output	7	20	3	-	49	84	107	116	121
Total									
Capacity	133.5	191.5	175.5	199	304	<b>3</b> 04	307	307	307
Output	94	130	96	139	186	221	- 234	242	253

· · ·						(Unit: )	41)
Supply Source		1977	1979	1980	1981	1982	1983_
	domestic	34,595 (16.0)	51,017 (18.1)	46,591 (16.6)	44,269 (15.3)	40, 182 (15. 3)	49, 442 (18. 0)
0. N. P.	import	180, 537 (84.0)	230, 328 (81, 9)	234, 384 (83, 4)	245,786 (84.7)	221,866 (84.7)	224,894 (82.0)
	total	215, 132 (100, 0)	281,345 (100,0)	280, 975 (100. 0)	290.055 (100.0)	262,048 (100.0)	274,336 (100.0)
	domestic	115, 312 (49. 2)	242, 629 (60, 6)	220, 891 (57.7)	223,974 (48.5)	214,052 (49.8)	261,754 (54.3)
0. C. C.	import	119,081 (50.8)	158, 054 (39, 4)	162, 190 (42. 3)	237,778 (51.5)	215,921 (50.2)	220, 240 \(45. 7)
	total	234, 393 (100. 0)	400, 683 (100. 0)	383,081 (100.0)	461,752 (100.0)	429, 973 (100. 0)	481, 994 (100. 0)
	domestic	253,969 (79.4)	309, 126 (79, 3)	314,553 (77,1)	294, 453 (70.0)	298,676 (70.1)	373, 204 (?4.3)
Others	import	65,964 (20.6)	80,834 (20.7)	93, 355 (22, 9)	126, 134 (30. 0)	127,220 (29.9)	129,063 (25.7)
	total	319,933 (100.0)	389,960 (100.0)	407,908 (100.0)	420,587 (100.0)	425, 896 (100.0)	502,267 (100.0)
	domestic	403,786 (52.5)	602,772 (56.2)	582,035 (54.3)	562,696 (48.0)	552,910 (49.5)	684,400 (54.4)
Total	import	365, 582 (47.5)	469,216 (43.8)	489,929 (45,7)	609,698 (52.0)	565,007 (50.5)	574,197 (45.6)
	total	769,458	1,071,988	1,071,964	1,172,394	1,117,917 (100,0)	1,258,597

Table V-4. Trend of Waste Paper Supply & Demand

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Table	V-5.	Waste	Paper	Recyclin	g Rate
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	1977	1978	1979	1980	1981	1982	1983
Waste Paper Collected (1,000M/T)	404	523	603	582	563	553	684
Recovery Rate (%)	36.9	39.1	38.7	37.8	34.7	33.3	35.3

# Table VI. Pulp Demand Forecast

(Unit: 000M/T) Imports Production Total Ground Wood Pulp Ground Wood Pulp Gorund Wood Pulp Chemical Pulp Chemical Pulp Chemical Pulp Ýеаг Total Total Total 1,032 1.135 

Table VII. Waste Paper Demand Forecast

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(Unit: 000M/T)

Year	ar Total		0.C.C.	Others	
1094	1 430	311	548	571	
1964	1,557	343	592	622	
1986	1,757	387	668	702	
1987	ì, 933	425	735	723	

Table	VIII.	National	Energy	Consumpti	lon

					(Unit: 000)	wh, 0003b1)
		Electricity		:	Fuel (3-C	<u>0i1)</u>
Year	Whole Industry •	Paper Industry	Rate of Occupation	Whole Industry	Paper Industry	Rate of Occupation
1975	11,261,502	751,790	6.63	60,238	843	1.39
1976	14,218,266	956,665	6.73	66,817	935	1.39
1977	16,548,761	1,109,936	6.71	76,511	1,071	1.39
1978	22,157,004	1,208,179	5.45	82,915	1,161	1.40
1979	21,739,355	1,326,451	6.10	92,679	1,292	1.39
1980	22,045,167	1,531,134	6.94	92,955	1,339	1.49
1981	23, 325, 319	1,590,173	6.82	92,376	1,332	1.44
1982	24, 324, 414	1,597,515	6.57	87 <b>,</b> 954	2,156	2.45
1983	27,128,000	1,776,000	6.55	83 <b>,</b> 205	2,384	2.70
1984	29,377,000	1,878,000	6.39	79,773	2,584	3,24

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Machine Capacity		Total	Newsprint	Printing Writing	& <u>Kraft</u>	Paperboard	Others
Below	300	3	2	1	-	-	
••	200	15	-	7	5	3	_
**	100	26	2	5	1	18	_
**	50	29	-	6	_	20	2
	30	123	-	1	-	54	65
Total		196	4	23	6	96	67

Table IX. Paper Machines by Capacity and kinds of Paper (Unit: unit)

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