	REPORT
	ON
ECOLOGIC/	L & ENVIRONMENTAL FACTORS
	IN PAPER INDUSTRY
	VOLUME-II
STATUS &	PERSPECTIVES OF PAPER INDUSTRY: A GLOBAL SCENARIO
	PREPARED
	FOR
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# **VOLUME-II**

Page

# STATUS & PERSPECTIVES OF PAPER INDUSTRY: GLOBAL & INDIAN SCENARIO

Cont	ents	
I.	PAPER INDUSTRY – A GLOBAL SCENARIO	1
1.0	Growth Of Pulp & Paper Industry	1
2.0	Present Status of Paper Industry	2
3.0	Row Material Availability & Consumption Patterns	4
3.0	Wood Fibers	4
3.1	Plantation Programs - Incentives & Advantages	5
3.1.1	Status of Non-wood Fibres	6
3.2 3.3	Recycled Fibres	7
4.0	Status of Technology & Modernization	9
50	Current Environmental Issues & Challenges	12
J.U	Facing the Paper Industry	
II.	INDIAN PAPER INDUSTRY	15
1.0	Growth of Indian Paper Industry	16
2.0	Present Status of Pulp & Paper Industry	17
2.0	Structure of Paper Industry	19
2.2	Demand Forecast of Paper, Paperboard & Newsprint	22
3.0	Raw Material Scenario	23
3.1	Wood based Raw Materials & Indian Forestry	24
3.2	Agro Residues	24
3.3	Recycled Fibres	24
4.0	Current Level of Technology & Required Upgradation	25
4.1	Major Challenges Confronting the Indian Paper Industry	20
5.0	Environmental Issues and Indian Paper Industry	29
5.1	Environmental issues in large paper mill	29
5.2	Environmental issues in medium sized units	29

5.3	Environmental issues in small paper mill	30
III.	Source of data incorporated in figurdes	31

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### I. GLOBAL PAPER INDUSTRY

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### **1.0 Growth Of Pulp & Paper Industry:**

The world pulp & paper and paper board industry has gone through a lot of changes from 1962 to 1998. One fundamental aspect is the scale of the sector, which has gone dramatically to take consumption level around the world far in excess of those in 1960. Overall pulp and paper demand has gone up at a fairly steadily pace over the last few decades, but still a difficult period of the mid 1970's when the oil crisis hit and another dip in the early 1980's reflect the economic slow down of the period. But macro economic events have considerably taken place to shape today's industry. The figures illustrate the current average new machine size in the world is about 100,000 tons/yr, whereas it was just 40,000 tons/yr in the early 1980s. Clearly, a significant increase in machine size has taken place. Mainly, it has been pulp and paper makers that have forced changes on the structure of the sector as they griplled with and fed the famous industry paper cycle. Fig.-1 shows the growth in demand for pulp & paper. From 73 million tonnes in 1960, total paper & paper board consumption has reached over 300 million tons in 1999-2000.



FAO forecast and other projections reflect continued increase in global paper and board demand. Specifically, FAO predicts an increase in paper and paperboard demand of about 200 million tons between 1991 and 2010 as shown below.

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Year	1991	2010
Demand	243	443
Growth	-	200
	(Figures in Mil	lion Tonnes. MT)

Cumulative annual growth rate (CAGR) will average 3.1%, but will vary from a modest 2.3% for industrially developed countries to a spectacular 5.8% for many developing countries, such as China and other Asian and South American Countries.

The growth of the paper and board consumption in most Asian countries has shown that they were about three times that of world demand growth and about 1.5 times as fast as that of the Asia pacific region. The paper and board demand in Asian region is forcing to grow from 8.4 million tonnes in 1995 to 12.8 million tonnes in 2000, upto 29.7 million tonnes in 2010. Compared with that of Asia Pacific Region, the share of the paper and board consumption in Asian countries tends to be more rapid. This may result from the more rapid increase in Asian popultaion and economic growth, coupled with higher literacy rate which will increase the demand for newsprint printing and writing paper.

### 2.0 Present Status of Paper Industry:

World over, 14,260 paper mills with a total installed capacity of around 295 million tonnes (MT), recorded a combined production of about 269 million tonnes of various varieties of paper, thus registering an overall capacity utilization of as high as 91%.



# FIG.:2 GLOBAL SCENARIO OF INSTALLED CAPACITY & PRODUCTION

Global scenario of installed capacity & production are brought out in Fig.-2 and the percentage of world demand share of writing & printing grades of paper is shown in Fig.-3, which shows that developed countries account for 76% of world demand.



The trend of higher capacity utilization and higher per capita consumption continued throughout 1995, until struck by global recession in 1996, which continued unabated till mid-1997. Further analysis of the scenario confirm that:

West (both Europe and North America) is going through a consolidation phase with paper mills improving their efficiency and attempting to meet the ever- increasing environmental demands. South East Asia has attracted new investments and booming growth levels seem to be the order of the day. While in Japan and South Korea over production has resulted in huge stocks getting piled up, growth in Indonesia and Thailand seems unabated.

In China, the effects of rapid growth in the eighties and early nineties have taken their toll in the form of slowdown in economy and production. In 1995, there were more than 9000 mills producing 5000 tonnes/ year or less. By the end 1996, 4000 of these were either closed, integrated with large mills or expanded capacity wise. All this was to meet the new and stringent pollution norms.

Latin America appears to have warded off the 1996 global paper slumps. Pulp Production in Brazil and Mexico are higher than the 1995 levels, while in Chile and Argentina prospects of emerging markets, after an economic down turn in 1996, appear bright. In Australia, environmental concerns and low economic growth have slowed down industrial production. In Africa, the fast growing home market is sending positive signals to paper producers, especially Kenya, who hope to take advantage of this situation. The reverse of this trend is true in South Africa, which is looking at the global market which has saturated.

3

# 3.0 Raw Material Availability & Consumption Pattern:

Although virgin wood is the dominant fibre source for paper manufacture, the global fibre furnish comprises about 54-58 % virgin wood fibre, 34-38% wastepaper & 4-8 % non-wood material.

Of the world's total harvest (including fuelwood), paper products consumed only 14% or less than one third of the wood production for industrial uses. Table-1 shows the raw material consumption pattern worldwide.

#### TABLE –1

### **RAW MATERIAL CONSUMPTION PATTERN**

Type of Raw Material	Contribution, %
Wood fibre	54- 58
Non - Wood Fibre	34-38
Recycled fibre	4-8
No. of Mills	14,260
Installed Canacity (MT)	295
Actual Production (MT)	269
Capacity Utilization (%)	91

#### 3.1 Wood Fibers:

The wood consumption in the world in the year 2010 is expected to increase by 40% from that of 1995. World demand of wood will increase from 861 million tonnes in 1995 to 1368 million tonnes in 2010. There is the concern that one of the obstacle for future paper industry growth might be the shortage of wood based raw material and this intensifies the use of :

- 1. Effective forestry plantation management
- 2. Use of Agro waste products for paper manufacturing.
- 3. Recovery rate enhancement (secondary fibre)

Table-2 shows the world demand of wood pulp & paper from 1991-2010. Table-3 shows fibre sources for woods.

#### TABLE-2

#### WORLD DEMAND OF PULP WOOD IN THE YEAR 2010

Million Tonnes	1991	1995	2010
World paper Demand	239	276	476
Wood pulp Demand	151	172	277
World demand	757	861	1,368
wood			

#### TABLE-3

Forest Type	Hardwood	Softwood	Total	
Forest Produced	1	15	16	
<b>Plantation Grown</b>	1	17	18	
<b>Exotic Plantation</b>	6	5	11	
Managed Natural	12	25	37	
Unmanaged	10	7	17	
Mixed Tropical	1		1	
Total	31	69	100	

### **GLOBAL WOOD PULPWOOD FIBER SOURCES (%)**

### 3.1.1 Plantation Programs – Incentives & Advantages:

Government of many countries have provided incentives to private sector industries to promote commercial forest plantations in degraded forest lands. Such incentives include security of tenure, cheap long term credits & subsidies. The industry community partnership initiative (ICPI) for developing high yielding fast growing plantations/proposed is based on a three pronged strategy.

- a change in the existing policy of the government which would enable leasing out or use of degraded forest land to the private sector industry with proven track records for wood fiber production;
- financial, management and technological inputs from the industry for the establishment, management, harvesting and re-development of resources on a sustainable basis; and
- ensuring participation and commitment from the community living in and around the forest areas through an innovative benefit-sharing mechanism which would enable sharing of the produce as well as gainful employment opportunities of the community in the plantation activities.

5

The most common types of incentives offered to private investors are: **Type of Incentive Countries** 

*	Direct subsidies Tax deductions	<ul> <li>Chile, Uruguay, New Zealand.</li> <li>Brazil, Chile, Uruguay, Argentina, Australia, Potugal &amp; South Africa.</li> </ul>
*	Subsidised loans	-Indonesia, Phillipines, New Zealand, Uruguay, South Africa
•	Secured tenure of Govt. forest land through innovative tenurial instruments	-Phillipines & Indonesia.

#### 3.2 Status Of Non-Wood Fibres :

The share of nonwood fibres used as a proportion of the total fibre used for papermaking around the world stands at 4-8% and is expected to increase to 10% by the year 2010. While this may appear relatively small at first glance, nonwood fibres play an important role in the global pulp and paper business. For example, nonwood fiber pulp plays an important part in balancing regional fiber deficits in China and India.

China currently produces 77% of the world's nonwood pulp, and plant - based fibers will continue to be an important raw material source for paper making in the country long into the future. China will remain the largest producer in years to come, although its share of world-wide non wood pulp production is expected to decrease from the current 77% level to 72% in 2010. It is forecast that the production of non-wood pulp (based on straw and new industrial crop) will double by 2010 in Eastern European countries from the current level of less than 400,000 tons/yr. In western Europe, current levels of non-wood pulp production are expected to increase by 300% by 2010. Fig.-4 shows the % distribution of various non-wood raw materials used in pulp & paper industry worldwide.



### Fig.-4 GLOBAL CONTRIBUTION OF NONWOOD PULP

6

Globally, non wood pulp production is based primarily on straw (46%), bagasse (14%) and bamboo (6%). Global share of non-wood pulp production is shown in Fig.-5.



Among agricultural by products most of the straw pulp production capacity is located in China. Bagasse pulp production capacity is distributed between China, India, Colombia, Mexico and Argentina. Industrial crops including kenaf, hemp, flex and jute - account for a smaller portion of the production capacity at just 4.4 million tons and are based for the most part in China. The major part of the production capacity based on naturally growing plants, particularly bamboo in India.

There are only 11 mills in the world producing 100,000 air dry tons/yr or more of nonwood pulp. Integrating a nonwood fiber line into a mill cooking wood brings a scale benefit, such as has been witnessed at the Phoenix mill in Thailand. In fact, most nonwood pulp production is integrated into wood based pulp and paper mills.

#### 3.3 Recycled Fibres:

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Global activities and interest in paper recycling has grown rapidly. World recovered paper consumption has increased from about 50 million tonnes in 1982 to about 110 million tonnes in 1994 and is expected to grow to almost 200 million tonnes by the year 2010. Since 1990, the consumption of recovered fibre in Asian countries has increased from 15 million tonnes to 22 million tonnes. To meet the global demand of fibre which is projected to increase to 420 million tonnes, 85-95 million tonnes of waste paper will be needed to satisfy the projected demand for paper.

The waste paper recovery world average at about 35% with Japan having highest recycling of paper (about 54%). Generation of waste paper within India estimated at about 0.5 million tonnes, the recovery rate working to about 20%. Recovery of waste paper is expected to go up to 25% by the year 2005. There is lot of scope in improving in the recycling of waste paper in India through effective collection mechanism, public awareness of waste paper as raw material resource and require legislative pressure to improve recycling. Fig.-6 shows the Bubble diagram of waste paper consumption & recovery rate in different countries.



The potential use of waste paper is evident from the fact that mills in South Korea and Taiwan are dependent on waste paper as a raw material to the extent of about 90%. A study conducted by Sorda Cell of Sweden shows that waste paper will meet 50% of the increased demand for raw materials by 2000. About 12-13 tonnes of 14% of the world's waste paper consumption is traded internationally, of which 50% is provided by U.S.

In many parts of the world, realising the importance of recycling, efforts have been made to get back as much recycled fibres as possible. Recovered paper accounted for one third, i.e.86 million tonnes of the total fibre input. Even countries rich in wood supply like the US, Finland and Sweden have evolved means by which recovery rates can be improved. Japan has the best recycling rates in the world.

#### 4.0 Status of Technology And Modernization:

Developed countries have made a significant progress in process technology. Although developed countries also started from low scale of operation of 50-100 tonnes/day capacity, but to enhance the process efficiency and to achieve better economy, the scale of operation has been tremendously increased even upto3000 tonnes/day. With much higher scale of operations & with the advent of new technologies, these countries are reaching the goal of achieving economic use of wood supply reduction in basic items and therefore less pollution. Remarkable developments have been made through improvised process technologies. The technological developments are primarily for :

- Increased process efficiency
- Improve maintenance &

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- Enhanced life of equipment

Today pulp & paper industry in developed countries is no more regarded as a smoke stack industry but has emerged as one of the most sophisticated and high tech industries in the world with high speed machines, efficacy, automation and quality control. Continuous efforts are being taken to minimise man power, optimise quality & improve the process efficiency which has ultimately resulted in improved environmental situation. Effective Forest management with controlled management planning has resulted in Forest reserves for the next hundred years in most of Scandinavian countries.

# Some of the major technological changes that have been brought are through:

Improved Wood Handling Practices: With new generation of debarker, chippers and chip pile system, the wood handling has been efficiently managed, therefore, there is significant improvement in pulp yield and reduced fiber losses.

**Pulping & Bleaching:** This is one of the major thrust area where lot of development from process side have taken place. A number of pulping & bleaching changes have been implemented which has resulted in reduced energy consumption, less discharge of effluents containing toxic compounds compounds. Fig.: 7a shows some of the in-plant control measures for at source reduction of pollution loads and end of pipe technologies, which has resulted in controlled discharge of AOX. Some of the significant modifications include:

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10

-Modified continuous & batch cooking that has resulted in lower kappa number of unbleached pulp. Other changes include introduction of oxygen delignification, adoption of ECF & TCF bleaching concepts besides biotechnological applications including bio-pulping using fungal pretreatment technique & bio-bleaching using pre-bleaching enzymes. Fig. 7b shows the development in AOX discharges in Sweden & Finland over a period of time.





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Improved Washing System & System Closure: With new washing techniques like vacuum filter, diffuser washer, press plants & max system closure practices, considerable reduction in flows, water & energy consumption and chemical savings have been reported. Fig. 7c, 7d, shows the effluent volume and color discharges and the BOD loads of the effluent by employing state of the art technologies.



Stock Preparation & Paper Making: Some of the major developments have been brought through the use of energy efficient refiners, greater use of fillers, greater automation, improved head box design, increase machine and newer press configurations.

**Chemical Recovery:** The new trends in chemical recovery includes the elimination of direct contact evaporators installation of 7-8 effects of falling film evaporators, high solids firing which has resulted in improved steam & power generation and lower obnoxious air emissions, etc. Kraft mill odor are often controlled by recovery and incineration of non combustible gases to oxidized TRS compounds to elemental sulfur.

Utilities: With new generation of boiler operating at high steam pressure, total cogeneration of power better management of water-steam and condensates has resulted in considerable energy savings.

# 5.0 Current Environmental Issues & Challenges Facing the Paper Industry:

Pulp & paper mills throughout the world are facing challenges on multiple such as:

- global competition
- consumer's demand
- . community & compliance for environmental regulation and
- requirement of environmental groups

The basic environmental issues world wide are sustainable development, acid rain, global warming & release of toxic compounds.

Increased Concerns About The Release Of Chlorinated Organics: Most pulp producing countries have begun to regulate the release of chlorinated organic compounds especially 2,3,7,8 tetrachlorodibenzo-p-dioxin (dioxin) and its chemical relative, furan. Presently 12 polychlorinated phenols have been brought under regulations by EPA, U.S.

Since it is difficult to analytically identify all of these compounds, most regulatory officials have tended to use more convenient analytical measures such as adsorbable organic halides (AOX) for control of wastewater discharges. Other analytical classes of compounds such as extractable organic halides (EOX) are also being evaluated as possible substitutes for the AOX. The control of chlorinated organic discharges to other media are also anticipated in certain pulp producing countries. Regulations to control chloroform and dioxin are expected for air emissions and dioxin limits are being prescribed for land disposal of pulp and paper sludges and boiler ash. Other concern in some countries is about residual chlorinated organics in paper products.

Life Cycle Assessment of Paper: These analyses are intended to show the selection of initial fibre source, the paper manufacturing process and the ultimate disposal of the product to ensure that the overall environmental impact is minimized.

Mounting Pressures And Need To Increase Recycled Fibre Use: Pressures to reduce the amount of waste going to landfills and to conserve natural resources have led to an increased demand for paper products that include a significant percentage of recycled fibre. In the US for example, some states have legislated that news print contain up to 50%secondary fibre.

Greater Environmental Pressures for New Mills: A new pulp mill anywhere in the world may need to comply with more stringent treatment standards that the host country requires. This is because major lending agencies, including the World Bank, have set environmental control guidelines for the mills that they finance. Consequently, the use of the best available control technology (BACT) may be required for any new mill in order to get financing and to operate.

Public Image & Perception: Many companies are becoming very concerned about their public image as it relates to environmental issues.

Traditional Pulp & Paper Waste Management Practices: Best Available Control Technology (BACT) in recent years has included primary and secondary treatment prior to discharge of process waste water.

13

Air Emission Control: Requirements for control of air emissions have traditionally concentrated on particulate matter, opacity and in some cases, odour. Particulate emissions and opacity from hog fuel boilers are most often controlled by stack scrubbers. Electrostatic precipitators on recovery boilers are frequently used to maintain compliance from this source.

Solid Waste Disposal: Mills abroad using hog fuel boilers frequently find that burning the wastewater treatments sludges along with the hog fuel is a less costly and an environmentally superior alternative. The sludges do have a heat value if they are effectively dewatered by selected mechanical dewatering equipment. It is not uncommon, however, to add fuel to maintain burning consistency. In extreme cases incinerators are being used for the disposal of the sludges.

Global Focus on Greenhouse Gases: The level of CO2 in the atmosphere has risen about a quarter to 350 ppm since the start of industrialization, with the rate of increase being 1.6 ppm per annum. As a result of this, there is accelerated build-up of green house gases in the atmosphere. Fig.--8a shows the global warming trends from a period between 1950-2000. The region wise contribution of energy related CO2 emission is shown in Fig.-8b



14



### II. INDIAN PAPER INDUSTRY:

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During the phase of industrialization after the independence, the immediate focus of the industry was essentially on growth and expansion. In a regulated market under a mixed economy, it had developed a feeling of complacence. For a long time, it often came to compromise with quality. This complacent attitude could be attributed squarely to the monopoly and lack of competition in the closed market.

But, in the wake of the economic liberalization, triggered by the new economic policy of the Govt. in 1991, the Indian industry found itself confronted with international competition. All of a sudden, the Indian industry faced an uphill task to integrate itself into the global economy, the new challenge subjected the traditional Indian management style to a serious designing of its strategy for survival.

The Indian Paper Industry is at the cross - roads today. To understand its implications, one has to consider the current domestic economic situation in the context of a market driven economy that has been ushered in the process of liberalization in the early nineties. For several decades, a major part of the Indian industry never really felt the compulsion to realize the significance of terms like market forces, economies of scale, quality and customer satisfaction. Today, the concept of globalization, eco-cycle compatibility & other environmental issues have exposed the Indian companies to an intense international competition.

### **1.0** Growth of Paper Industry:

It was towards the second half of the nineteenth century that the paper mills mostly based on utilization of bamboo as the raw material, were established in India. At the beginning of the twentieth century, production of paper had reached a level of 19000 tonnes. In five year plan of 1950, after independence when country launched its program, there were only 17 paper mills with a total capacity of 1,37000 Tonnes and production of about 116000 tonnes. The country was dependent to large extent on imports which amounted to about 90,000 tonnes in the year 1951 -52.

From Table -4, it is evident that there is only marginal growth in the first decade i.e. 1950 -60. Whereas in the second decade between 1960-70, the no. of units doubled from 25-57 and capacity also from 400,000 tonnes to 768,000 indicating an almost hundred percent increase. The period between 1970-75 shows a slow growth in capacity and production. The decade 1965-75 was a period of stagnation which didn't witness much investment even increase in capacity was partly due to Govt. directives under which the mills were asked to revive their capacities based on maximum production achieved and addition of balancing equipment. Thereafter, the growth of the paper industry gathered the momentum and during 1975-80, the numbers of units went from 74-123 registering an increase of about 66% while capacity went up back about 50%. The pace of growth of capacity was even more pronounced in the next five year plan that is 1980-85 when no. of units doubled from 123 to 251 (almost 100% increase, while capacity went up by 50%).

In 1970 when the total no. of paper mills were only fifty with the higher proportion of large mills, capacity utilisation was 98.7%. Thereafter, with increasing no. of small paper mills, rapid growth, and infrastructure constraints, there has been a continuous decline of capacity utilisation to 64% by 1985. The paper industry shows significant progress during successive five year plans. By 1985, there were 23 large mills, mostly based on utilization of forest raw materials, viz. bamboo, reeds and hardwoods, and 228 small paper mills based on agricultural residue and waste paper, with a total capacity of 2,360,655 t.p.a. The growth of the paper industry during the period 1950-85 is indicated in the Table -4.

The year 1990 registered very low growth only about 20%. Some of the small paper mills expanded their capacity to about 20,000 tonnes per annum and a few marginal expansions were also effected. The no. of waste paper based small mills in particular, increased substantially, presumably due to liberalised import of waste paper at duty of 20% (presently 30%) being permitted by Government.

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#### **TABLE 4**

Year	No. of Units	Capacity	Production	Capacity Utilization (%)
1050	17	137.000	116,000	84.7
1950	21	186,000	185,000	99.3
1955	25	400,000	345,000	86.3
1960	52	644 000	539,000	83.7
1965	57	768 000	758,000	98.7
1970	71	1 042 000	829,000	79.5
1975	122	1,538,000	1,112,000	72.3
1980	251	2 361 000	1,500,000	63.5
1985	210	3 049 559	1,956,000	64.1
1990	310	3 700 000	2,300,000	60.5
1995	380	3,790,000	3 05 000	66.0
1998	382	4,97,3000	3,03,000	

# **CAPACITY AND PRODUCTION IN TONNES (1950-1998)**

The year wise production of writing & printing grades of paper, newsprint, packaging paper & board and other paper and board variety is shown in Table -5.

#### TABLE-5

							the second se	
	1001	1002	1993	1994	1995	1996	1997	1998
Type of Paper	1991	1992	210	262	402	365	350	371
News Print	300	300			402	1 210	1 450	1 504
Drinting/Writing	990	1010	1,125	1,175	1,265	1,310	1,450	1,504
rinning winning	218	243	1 025	1 075	1,330	1,370	1,383	*1,657
PackagingP&B	210	245	1,025	100	120	124	124	-
Other P&B	16	51	95	100	120	1		

# YEAR WISE PRODUCTION OF PAPER IN INDIA

Including both packaging paper board & other paper board.

# 2.0 Present Status Of Pulp & Paper Industry:

**Paper Consumption Pattern:** By International standards, India is a very low producer & consumer of paper. The country's per capita consumption of paper in 1998 stood at a meagre 4 kg as against the global average of 45 Kg., with U.S., Western Europe & Japan accounting for 30 %, 20 % & 12 % respectively of the total demand. Compared to its poulation figures of over 900 million. India's total paper & paper board requirements from a marginal 1.25 % share in the global market. Fig.-9 shows the per capita consumption of paper in India & its comparison with other countries.



The aggregate capacity of the Indian mills is not enough to meet the demands. Even pulp is in short supply & it is usually imported. The demand for paper was expected to go upto 4 Kg by the year 2000, but according to a survey done by an independent market surveyor, India has already reached that figure. By 2010, the demand for paper is expected to touch 6 million tonnes per annum with an extra demand of 1.6 million tonnes. But even that is negligible compared to its Asian counter parts having twice these demand figures. For instance, China's current consumption is 14 kg per capita which is expected to rise to 20 kg by 2000. Similarly, East Asia's paper consumption has zoomed to 200 kg per year from less than a tenth of this figure two decdes ago. Even the average per capita consumption in Asia is (18kg) six times higher than that of India.

By 2010, the per capita consumption of paper in India is likely to be 8 Kg. So the basic problem confronting the paper industry is: -

- sustained raw material availability
- quality products from indigenously available raw materials like agro residues
- Inability of the Industry to keep pace with technologies and one of the serious challenges the Industry is facing is due to environmental issues. How the industry will address these issues will depend on the future growth and sustainability of the paper industry.

18

### 2.1 Structure Of Paper Industry:

The Pulp & Paper Industry is one of the India's key industry. Although the paper industry is 100 years old, but till early 70's industry was primarily depending on bamboo, subsequently it switched over to hard woods like Eucalyptus & in the beginning of the 70's, it was forced to utilise other resources like agro residues in view of shortages & sustained availability of fibrous raw materials.

Presently about 382 paper mills are in existence in India with an installed capacity of about 4.0 million tonnes per annum as per records of Govt. of India. But according to an independent survey report, there are as many as 679, mostly small scale mills. As per Indian standards, mill with a capacity of 33,000 tonnes per annum is in general considered large in India compared to Brazil & Sweden where the largest mills have a capacity between 300,000 to one million tonnes per annum. This poses potential financial problems for upgrading technology to reach International Environmental Standards.

Based on the capacity, the mills are classified as under:-

**Large Paper Mills**: These mills are invariably based on bamboo, wood and other forest raw materials ,although there are some wood based mills ,which have a capacity of less than 33,000 tpa. Also, in recent years ,large agro based mills are being set up and several of the small agro based mills are gradually expanding their capacities to 33,000 tpa and above.

Medium Paper Mills: These mills are primarily based on agro based raw materials and indigenous/imported waste paper respectively. The annual installed capacity of these mills are between 16500-33000.

**Small Paper Mills:** Large number of small paper mills of capacity below 16500 tonnes/annum are operating employing both indigenously available as well as imported waste paper and they contribute to nearly 26% of the paper production.

Table-6 shows the category wise split up of the production, production capacity within three groups of forest based, agro based & waste paper based mills. Fig.-10 shows the raw material consumption pattern of the various raw materials.

#### **TABLE-6**

Type Of Raw Material	No. Of Mills	Installed Capacity (MT)	Production (MT)	Production, %
Forest Based (Wood & Bamboo)	28	1.449	0.95	38
Agro Based (Straw,	111	1.24	0.91	36
Others (Waste Paper	241	1.265	0.65	26
Etc.)	380*	3.954	2.51*	100

# **PRODUCTION OF PAPER & PAPER BOARD IN INDIA.**

The total registered no. of mills are 382 with production of 2.934 million tons PPI, July, 1999.

## FIG.-10 CONSUMPTION PATTERN OF VARIOUS RAW MATERIALS IN INDIA



Presently as many as 135 nos. in total, of large, medium & small paper mills are lying closed. The total capacity of the remaining 245 mills which are in operation is about 2.934 million tonnes. The total capacity of the closed mills is about 1.02 million tonnes per annum.

Against the effective capacity of 2.934 million tonnes, the production of Paper in 1997-98 was 2.9 million tonnes, as per the statement of Indian Paper Makers Association.

### Newsprint:

As few mills can switch production between printing & writing papers and newsprint according to market demand, it is therefore difficult to assess the actual level of indigenous production accurately, without a centralised statistical data base. Based on available information the projected newsprint demand & supply is detailed in Fig.-11. It is expected that the growth rate of newsprint in India will be around 3%. As per the experts group's projections in 1996, the demand & supply trends of paper and newsprint combined up to year 2011 is shown in Fig.-12.



It may be observed from the above that there would be a continuous increase in the required additional capacity. The present sluggish market does not indicate any hope of these projections being realized. However, because of the high capital intensive nature of the paper industry, no green field pulp & paper mill has been established in India in the past decade. One of the reason for the unwillingness of the private interference is the non-availability of the fibrous raw material on a sustained basis at economical price. Thus, it is expected that India will be a buffer state for exporting paper & newsprint in future for foreign suppliers.

# 2.2 Demand Forecast of Paper, Paperboard & Newsprint:-

The figures pertinent to the demand & supply of paper and paperboards vary by source. Upto date statistical data on production & demand is made available by various agencies both in public E private sectors, such as the Development council under the Govt. of India, the experts group constitute at the behest of the Govt. in 1995 & the INFAC, a renowned consultancy firm on the health & Economy of the industry in India.

Future demand is worked out based on anticipated growth rates of paper and newsprint . According to the experts, the present growth rate of printing & writing papers is expected to be between 4% and 6% per annum. Industrial paper is predicted to grow at around 12% per annum. This higher growth projection is due to the substitution of conventional packaging of agro products from paper & board. Based on a survey by INFAC, the demand & supply of paper & paperboard are projected as shown in Fig.-13.

However, the experts group predicted that the demand of paper & board by the end of year 2000 is likely to shoot up above 4.0 million tons. In that event, the indigenous paper supply has to be enhanced as the existing recession in the Indian paper industry is expected to end by the year 2000.



22

#### **Raw Material Scenario:** 3.0

The production based on domestic raw material was 2.408 million tons in 1994-95, of which about 1.2 million tons was wood based, 1.09 million tons was bagasse based, 0.25 million tons was straw based and about 0.68 million ton was waste paper based. It is now estimated that paper produced out of domestic raw material would be 3.2 5 million tons in 2000-2001 and 4.16 million tons in 2005-2006. The details are given in Table-7.

The shortage in paper production due to restricted availability of raw materials is likely to be of the order of around 3.64 million tons by 2010-11.

The massive shortages would require import of paper as well as waste paper / pulp for domestic conversion into paper.

#### **TABLE-7**

### USAGE OF INDIGENOUS FIBROUS RAW MATERIALS AND POSSIBLE **PRODUCTION OF PAPER**

Million Tons									
Year	Forest based Ra material		Bagasse		Straw		Waste Paper		Total possib Production paper
	R.M	Paper Prod	R.M	Paper Prod	R.M	Paper Prod	R.M	Paper Prod	
1004-00	3 146	1 21	3.1	0.56	0.75	0.25	0.51	0.38	2.408
2000 01	3 210	1 235	60	1.09	0.75	0.25	0.911	0.683	3.258
2000-01	2 210	1.235	9.0	1 636	0.75	0.25	1.387	1.04	4.161
2003-00	3.210	1.235	1.08	1.963	0.75	0.25	1.950	1.462	4.910

#### TABLE-7a

### PAPER AVAILABILITY: SHORTFALL BETWEEN DEMAND AND SUPPLY **BASED ON DOMESTIC RAW MATERIALS**

Years	Demand for paper	Possible Production of paper	Short fall
1994-95	3.278	2.408	0.87
2000-01	4.95	3.258	1.692
2005-06	6.7	4.161	2.539
2010-11	8.55	4.91	3.64
2015-16	10.88	5.801	5.07

**\*Figures in Million Tons** 

### 3.1 Wood Based Raw Materials & Indian Forestry:

Area covered as forests in India is approximately 64 million hectares. Out of this, about 3 million hectares are degraded forests. These degraded forest lands are badly eroded. They have already ceased to be of material use to the Society or to the Industry or to the government. The proposal of Indian Paper Industry is to take up afforestation of these degraded lands in close association with the Government.

#### 3.2 Agro Residues:

#### 3.2.1 Bagasse:

Among the agricultural residues, bagasse occupies a pride of place. It has been regarded, for long, as the most suitable alternate Bagasse raw material for paper making. India has the distinction of being the largest sugarcane producer in the world.

It is estimated that bagasse currently supports production of approximately 1.0 million ton of paper per annum which may move to about 1.1 million tons in the year 2000 to 1.6 million tons during the year 2005 and to 2.0 million tons in the year 2010. Possible production of paper from bagasse, as estimated by the Expert Group is included as Table-7.

### 3.2.2 Wheat Straw & Rice Straw:

Wheat and rice straw are currently supporting production of 0.25 million tons of paper annually. Due to inherent constraints in its collection and transportation, as well as its primary use as fodder, use of wheat/rice straw is not expected to register significant increases in the years to come. Use of agricultural residues currently entails certain fiscal concessions to offset the additional cost involved in the use of these unconventional raw materials. There is a need for these concessions to stay atleast another ten years, lest the pressure on the indian forestry and dependendence on imported materials would increase dramatically. There are also larger technical issues associated with usage of these agricultural residues which shold be looked into with a view to arrive at solutions which are contempary and cost effective.

#### 3.3 Recyled fibre:

In 1994-95, Indian Paper Industry produced about 6.5 lacs tons of paper and boards from recycled paper. During that year about 2.75 lacs tons of waste paper was imported. Generation of waste paper within India is estimated at about 5 lacs tons, the recovery rate working out to 20% approximately. It is expected that this recovery rate would go up to 22.5% by the year 2000, 25% in the year 2005 and reach 30% by the year 2015. This would mean that waste paper can play a significant role in meeting the additional raw material requirements of the Indian Paper Industry. Use of agricultural residues currently

24	
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entails certain fiscal concessions, to offset the additional cost involved in the use of these unconventional raw materials. There is a need for these concessions to stay at least for another 10 years, lest the pressure of the Indian Forestry and dependence on imported materials, would increase dramatically. There are also larger technical issues associated with usage of these agricultural residues which should be looked into by the technology leaders in the country with a view to arrive at solutions which are contemporary and costeffective.

# 4.0 Current Level Of Technology And Required Up-gradation:

The paper mills which are in existence today, which were installed over a span of more than 100 years have been practising technologies falling in a wide spectrum, obsolete to ultra modern. Basically, the Indian Paper industry, has adopted technologies developed elsewhere, generally in Europe and North America, for pulping and paper making from soft woods to Indian raw materials, namely, bamboo tropical hard woods, bagasse, straws and other agricultural residues. Most of the machinery installed was imported from reputed companies from outside the country.

In the last 20-25 years, a few of the machinery manufacturers have developed fabrication facilities for the equipment required for the paper mills. However, even today, the continuous digesters for bamboo as well as agricultural residues are being supplied basically with a major portion of foreign components. The high speed paper machines, with sophisticated instrumentation and technology, are supplied to Indian industry by reputed foreign manufacturers in collaboration with the local machinery manufacturers. Adequate expertise has been developed in the country, to supply auxiliary machinery, like power boilers, chemical recovery boilers and turbines, indigenously. This machinery is already performing successfully and satisfactorily in various units of the industry.

As mentioned above, the age and origin of the machinery in some cases is more than 20-30 years old. This requires up-gradation, to gain the benefits of modern development in instrumentation and process technology. A large scale rebuilding of the paper machines may be taken up only after an upward turn in the paper market, which will enable the industry to regain its financial health to an extent, to afford investments in rebuilding as well as modernisation.

In the course of adopting and inventing the technology, remarkable expertise has been gained by the Indian industry in paper and newsprint manufacturing from bamboo, hard woods, straws and bagasse. Specially noteworthy is the technology developed for manufacturing the mechanical pulp from bagasse, which is being used for newsprint manufacture. In the knowledge of the authors, Tamil Nadu Newsprint and Papers Limited, which is located in Tamil Nadu, Southern part of India is the only mill in the world, successfully producing newsprint from bagasse mechanical pulp in combination with wood mechanical pulp and chemical pulp.

Various industrial groups in the sector using agricultural residues for pulp and paper manufacture, have been able to develop chemical recovery systems, particularly the Recovery boilers for small scale operation of 50 tonnes of pulp per day, circumventing the problems created by the presence of silica. Today, utilising the modern technology, quality papers, including photocopier paper, are being made from the indigenous raw materials.

#### Major Challenges Confronting Indian Paper Industry: 4.1

Paper industry is facing severe market recession. Steep hike in the cost of almost all the inputs of paper industry is posing serious threat to very existence of paper mills.

Rising cost of inputs, stringent environmental regulations, poor infrastructure facilities have resulted in closure of many paper mills. Drastic reduction in the custom duty on paper and paper boards from 140% to 30% during recent years has resulted in low annual growth rate of paper industry and it is now faced with problems of clandestine imports.

Custom duty structure on paper & board and newsprint prior to budget & present policy is given in Table -8.

#### **TABLE-8**

### PRESENT IMPORT DUTY STRUCTURE AND FUTURE DEMAND OF **PAPER INDUSTRY**

Particulars	Prior to Budget	Present Policy after Budget
Custom duty on paper and paper board	30%	35%
Newsprint	Nil	5%
LWC (70 GSM)	Nil for magazine publisher	5%

Energy, chemical and raw material cost in Indian paper industry is quite high as compared to the paper mills in developed countries. There has been also steep rise in the cost of cellulosic raw materials cost also. Comparison of energy, chemical and raw material consumption norms in paper mills in India and abroad is given in Table-9.

#### **TABLE-9**

## COMPARISON OF ENERGY, CHEMICAL AND RAW MATERIAL CONSUMPTION NORMS OF PAPER MILLS IN INDIA AND ABROAD.

Mills in India	Mills Abroad
9 to 14	6.5 to 8.5
1300 to 1800	1150-1250
150-250	50-100
88-94	95 to 98
2.0 to 2.4	1.8 to 2.0
	Mills in India 9 to 14 1300 to 1800 150-250 88-94 2.0 to 2.4

Trends in rise of cost of coal, fuel oil, caustic soda and chlorine is given in Fig. 14a, 14b. Average capacity of Indian paper mills is low as compared to paper mills in developed countries as well as Asia pacific region. As of 1995, average size of paper mill in India was 10,400 tonnes/year compared with 85,000 tonnes/year in Asia and Pacific and 300,000 tonnes in Europe and North America. Some of the major problems, which are responsible for poor growth of paper industries, are:

Poor infrastructure

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- Low availability of forest raw materials & poor forest management
- Fair to non-existent commitment to innovation
- High cost of normal method of financing.
- Rising cost of inputs-fibrous raw materials, chemical, labour, energy
- Uneconomic size & obsolete technology in many mills
- High cost of production
- Higher consumption of basic input items
- High Energy Consumption.
- Poor recycling of waste paper
- Recovery of chemicals from agro based black liquors
- Poor productivity
- Poor Instrumentation
- Environmental problems especially due to higher discharges of water, solid waste & air emissions of mercaptans, TRS, particulates, etc.





28

### 5.0 Environmental Issues and Indian Paper Industry:

Rapid industrialization has resulted in three dimensional environmental crisis:

- Environmental pollution
- Ecological decay

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- Resource depletion

Pulp & paper industry is amongst the top 20 highly polluting industries in India. During the various stage of operation, wide variety of pollutants are discharged to the environment and have serious impact on various component of environment-water air & land

The quantity and quality of pollutants released in air, water and soil from different mills varies considerably and are dependent on the size of plant, complexity and quality of the product, raw materials, process technology used, age of plants, general maintenance and house keeping standards in the factory.

Environmental issues in developed countries are confined to AOX and Odor control, however the environmental issues associated with Indian paper industry are :

- Sustainable development
- Upgradation of technology
- Large use of water and discharge of colored effluent
- Odor control
- Acid deposition and stack emission
- Solid waste

The details are covered in volume-III of the report

The Indian pulp and paper Industry segment is confronted with environmental issues which differ from one segment to another which are listed below:

### 5.1 Environmental Issues In Large Paper Mills:

This segment of the pulp & paper industry is confronted with problems of -

- high volume of effluent
- economically viable color removal techniques
- chlorinated organic compounds/AOX
- Solid waste due to lime sludge generation

### 5.2 Environmental Issues in Medium Sized Units:

One of the major problem before this segment of the industry is the installation of an economically viable chemical recovery system because of the low scale of operation

and due to this there is large burden on the effluent treatment plant. Besides due to the high sodium content of the final effluent, it is not consider suitable for land irrigation.

#### **Environmental Issues in Small Paper Mills:** 5.3

Although, the environmental problems from this segment of the paper industry are not very severe but still these units lack in cleaner production techniques.

Although, there is additional quantity required but due to the persisting environmental problems, nearly 1 million Tonne of the capacity is closed. Therefore, these issues are required to be addressed immediately.

# SOURCES OF DATA INCORPORATED IN FIGURES

Figures	Details	Source
Fig. 1	Growth of global Pulp & Paper Industry	PPI Feb., 1999
Fig. 2	Global Scenario of Installed Capacity &	Pulping Conference Book 3,
	Production	1998.
Fig. 3.	World Demand Share Printing/Writing	PIMA
-	Papers (excl. newsprint);	Paper Maker (Feb.'1998)
Fig. 4.	Global Contribution of Non-wood pulp;	PPI June, 1998.
Fig. 5.	Global Share of Non-wood Fibre;	Pulping Conference Book 1, 1998. (Martial Quebee
		Uanada Danan Malan March 1000
Fig. 6.	Asia Pacific : Waste Paper Consumption & Recovery 1997	Paper Maker March, 1999.
Fig 7b	Development of AOX Discharges from	IPPTA Conventional Issue,
11 <u>5</u> . 70.	Puln & Paper Industry:	1996.
Fig 7c	Effluent flow & Color per ton paper	Sund's Broucher
Fig 7d	Development of BOD Discharger in Paper	
1.15. 7.4.	& Pulp Industry	
Fig. 8a.	Accelerated Build of Green House Gases in	Statistics Down To Earth
8. 04.	the Atmosphere	January, 2000.
Fig. 8b.	Contribution of different reasons to Energy	Appita, 1994.
	related UU <sub>2</sub> emissions, 1990.	PPI July
Fig. 9.	Per Capita Consumption of Paper in India	Development Council for
Fig. 10.	Consumption Patterns of Various Naw	Paner Puln & Allied
	Materials in mola	Industries
<b>.</b>	Designed Novement Demand & Sunniv	Paper Asia Nov '98
Fig. 11.	Projected Newspillit Demand & Supply Designed Domand & Supply Trends of	Paper Asia Nov.'98
F1g. 12.	Projected Demain & Supply Trends of	1 upor 1.1010, 1.1011 2.0
E. 10	Propert & Interspiring Brosent Demand of Newsprint in India	Paper Asia, Nov.'98
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The Institute has made its best efforts to include the most realistic data and information. Some of the information was rare and is subject to verification before consideration for recommendation.

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