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Adoption of ESTs: A Study of India's Paper and Pulp Industry

Final Report

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Adoption of ESTs: A Study of India's Paper and Pulp Industry

1. Introduction

Indian paper and pulp industry is extremely fragmented. Presently, there are more than 400 registered paper and pulp mills, with a total installed capacity of about 4.3 million tons per annum. [1] In addition to the registered mills, it is estimated that there are approximately 1000 small, unorganised mills with a production capacity of 1 ton per day. [2]

Based on installed capacity, paper mills are classified as large and small mills. According to the definition adopted by the Indian Paper Manufacturers Association (IPMA), large mills are those who have installed capacity of 33,000 tons per annum (100 tons per day, tpd) or above. Presently, there are 34 such mills in India. The raw material for these mills are primarily forest based, with bamboo accounting for 60-65% and hard wood about 30-35%. By and large, they do not use other fibres.

Medium paper mills are defined as having installed capacity between 10,000-33,000 tpa(30-100 tpd). There are about 120 medium paper mills in India. These mills typically use 80% agricultural residues (straw, bagasse), 15% waste paper and 5% purchased pulp.

Small paper mills are defined as having installed capacity of less than 10,000 tpa (30 tpd). These mills are either agro-based (straw, bagasse) or utilise waste paper, purchased pulp etc. as raw material for paper production. There are about 252 paper mills having capacity below 10,000 tpa.

Paper mills can also be categorised according to the raw material usage. In 1994-95, there were 28 forest based, 111 agro-based and 241 waste paper based paper mills in India.

2. Environmental Instruments

India largely relies on command and control measures in its efforts to contain industrial pollution. The control measures are supported by a number of legislation, which empower the governmental agencies to set and enforce environmental standards.

2. 1 Regulations

One of the first environmental legislation passed by the Indian Parliament was Wildlife Protection Act, 1972 and Water (Prevention and Control of Pollution) Act, 1974, which was amended in 1986. Since then, a number of new regulations have been introduced. These include: Water (Prevention & Control of Pollution) Cess Act 1977, amended in

[1] USADID, "Report on Pulp and paper Industry: Survey of Industrial Environment", February, 2001 at http://www.cleantechindia.com/neweic/bhup.htm

[2] "paper-The Worst may be over", Money Line, September 6, 1999 at http://www.dhan.com/moneyline/990906-paper.html

1988; Air (Prevention & Control of Pollution) Act, 1981, amended in 1988 and the Environmental Protection Act, 1986. The other related laws include: Hazardous Waste (Management and Handling) Rules, 1989 and the Public Liability Insurance Act, 1991.[3]

The regulatory instruments used in India include no-objection certificates, consent and standards. All projects are are required to obtain No Objection Certificate from the state Pollution Control Board (PCB). The expansion of existing industries also requires prior environmental clearance. Furthermore, companies are required to get approval to their environment assessment and environmental management plans.

All industrial plants require consent from the Pollution Control Board. This is required at the time of commissioning. It is also required to be renewed every year. In theory, consent is given only when the PCB is convinced that the equipment required to control pollution have been installed and the plant is shown to comply with environmental standards. However, in some instance, the consent may be given conditional to the adoption of measure to improve environmental performance by the plant. It may be refused or withdrawn if the measures to control pollution are found to inadequate.

The requirement of "consent" is not always adhered to, and many industries belonging to highly polluting categories are reported to be operating without consent. For example, in a resent survey of paper and pulp industry it was found that out of 24 large plants surveyed, five did not have any "consent". Another five plants had receive only "deemed consent". One plant was found to have been operating without consent since 1974.[4]

India has environmental standards with regard to disposal, discharge and emission of solid, liquid, gaseous waste into the environment. Until the early 1990s, the standards were based on concentration of pollutants. Given the very low water charges, this led to the practice of the dilution of effluent by industry, causing a large waste of water. In order to counter this process, the law was amended in 1993 to make several types of standards mandatory, including load, concentration and process.

Although environmental standards are supposed to be revised every five years (in accordance with change in technology etc.), this does not always happen. Also, the process of setting up of standards is a highly politicised process in which the industry has strong influence. In many cases the governmental proposals to introduce stricter standards have been diluted on the representation and pressure from the industry. In most cases the industry argues that a) standards can not be met with the existing technology and b) the cost of compliance will make the industry non-viable.

For Standards applicable to paper and pulp industry, see Table.

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[3] Kathuria Vinish and G S Haripriya (2000), "Industrial Pollution Control: Choosing the Right Option", *Economic Political Weekly*", Bombay, October 28

[4] Down To Earth (1999), "The Five Leaf Award: The Green Rating Project", *Down To Earth,* New Delhi, Vol. 8, No. 5, July 31.

Table

Minimum National Standards (MINAS) for small pulp and paper industry:

Parameters	Concentration
PH	6-9
Suspended solid	100 mg/l
Bio-chemical oxygen demand	50 mg/l

Source: CBPCWP (undated), "Minimal National Standard: Small Pulp and Paper Industry", Central Board for the Prevention and Control of Water Pollution, New Delhi.

Under the Water Act, non-compliance with environmental standards is punishable by imprisonment of up to 3 years and a fine of up to Rs. 10,000. An additional daily fine of Rs. 5,000 can be imposed on continuous non-compliance. Non-compliance for one year after the conviction can lead to increased fine and 2-7 years of imprisonment.

2.2 Economic instruments

In addition to regulatory instruments, Indian government also uses economic instruments which include charge and subsidies.

The most important example of charge used in India is the charge on water consumed by industry. The main objectives the charge is to discourage the use of water and to increase the income of PCBs. The charge rates varies from 0.015 Rs/cubic meter to 0.095 Rs/cubic meter of water consumed, depending on the degree of toxicity and bio-degradability. The evasion of charge is punishable by six months imprisonment and fine up to Rs. 1000. However, as the rate of water charges is very low, it has not had any impact on water consumption. For example, according to the study of paper and pulp mentioned above, the water consumption has remained between 250-300 cum per tonne of paper during the last ten years. in the US the water consumption has come down from 152 cum per tonne of paper in 1980 to 72 cum per tonne in 1995. [5]

The installation of pollution reduction equipment entitles companies to special depreciation and tax benefits. However, the contribution of this provision to pollution reduction is also small as the benefits are linked to the installation of pollution reducing equipment and not its operation. This has led to a situation where companies have installed equipment but do not operate it. [6]

3. Regulatory Authorities

India's environmental regulatory set-up include the Ministry of Environment, Central pollution Board and the state level Pollution Boards. The Ministry of Environment, which is the prime policy making body, was created in 1980.

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[5] Down To Earth (1999), "The Five Leaf Award: The Green Rating Project", *Down To Earth,* New Delhi, Vol. 8, No. 5, July 31.

[6] Kathuria Vinish and G S Haripriya (2000), "Industrial Pollution Control: Choosing the Right Option", *Economic Political Weekly*", Bombay, October 28

The Department was expanded to full fledge Ministry in 1985. This led to large increase in the resources devoted to the protection of environment. For example, the number of employees increased from 684 in 1985 to 1,171in 1989. The budget of the Ministry, including the expenditure on pollution control, also saw a large increase during the 1990s.[7]

The Central Pollution Board (CPCB) and the state PCBs were created by the Water Pollution Act of 1974. The Central Pollution Board is responsible for: co-ordinating activities of state PCBs; providing technical assistance; carrying out investigations; setting up laboratories to analyse samples and set testing fee; training of personnel; and conducting public awareness campaigns. It must be pointed out that the Central PCB has limited power to enforce standards. Also, it can not force the sate PCBs to adopt certain standards. In its relations with the state PCBs, its role is mainly advisory.

The state PCBs are primarily responsible for the plant level monitoring and inspection and enforcement of environmental standards. They have the authority to collect information and samples from plants and can take action wherever necessary. They can also demand information on the nature and extent of pollutants being discharged and pollution control measures adopted by a company.

Although the state PCBs do not have the power to close a polluting facility, they can approach judiciary to order the company to meet standards. This could eventually lead to the closure of the plant.[8]

4. Implementation of Environmental Laws

Although India has an elaborate regulatory framework and the Pollution Boards have extensive powers, enforcement in India is often criticised as lax. Until the late 1980s the state PCBs were weak and their powers to take action against non-complying units were limited. Since 1988 the powers of the state PCBs have been increased and they now have the powers to cut water and electricity and to close down non complying units.[9] However, the enforcement of environmental standards continues to be lax.[10]

This is for a number of reasons. These include the following:

- In many states, the Boards are not equipped to carry out inspection, sample collection and testing facilities. This seriously limits their effectiveness.

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[7] Shaman David (1996), "India's Pollution Regulatory Structure and Background", January 5, 1996 at http://www.worldbank.org/nipr/india/india-back.htm

[8] Shaman David (1996), "India's Pollution Regulatory Structure and Background", January 5, 1996 at http://www.worldbank.org/nipr/india/india-back.htm

[9] Kathuria Vinish and G S Haripriya (2000), "Industrial Pollution Control: Choosing the Right Option", *Economic Political Weekly*", Bombay, October 28

[10] Kathuria Vinish and G S Haripriya (2000), "Industrial Pollution Control: Choosing the Right Option", *Economic Political Weekly*", Bombay, October 28

- As a result of slow progress of court cases in India, even when action is taken, its implementation is delayed for a long time. For example, of the 1600 prosecutions launched by the state PCBs between 1974 and 1988, less than 300 had been decided. [11] Furthermore, even in the cases which have been decided the effect has been very small. In most of these cases, the companies have been directed by the courts to install effluent treatment plants (ETPs). While companies have installed ETP plants, most do not operate these. They find that the cost of operating ETP plants (and other EOPs) is more than the fines likely to be imposed for non-compliance. Incidentally, in none of the case the company managers have been jailed for non-compliance.

- The burden of proof is on the Pollution Control Boards, and not on the polluters.

- The state PCBS are primarily funded by the state governments. This dependence on the state government (and politicians) has often compromised the effectiveness of the PCBs.

5. Paper Production Process

The production of paper includes the following steps:

i) **Wood preparation.** Wood is broken down into small pieces suitable for pulping. The process includes chipping and screening.

ii) **Pulping.** wood (or agricultural products such bagass and straw) is converted into pulp by the use of chemical, mechanical or a combination of the two processes. The main objective of pulping is to free cellulose from fibres from lignin, which binds them together. Pulping is done by cooking chips with chemicals at high temperature and pressure. Most Indian mills use one of the two processes: Kraft pulping process, which is commonly used by wood based mills and soda process, which is used by agro-based mills.

iii) **Bleaching.** Due to the presence of lignin, the colour of pulp is grey. This has to be bleached to make white paper. In conventional bleaching process, chlorine is used. Almost all Indian mills use elemental chlorine to bleach pulp, leading to the presence of highly polluting chemicals in their effluent. In developed countries this process has been replaced by total chlorine free (TCF) bleaching and elemental chlorine free bleaching (ECF). In TCF the use of chlorine is completely replaced by environmentally friendly bleaching agents such as ozone and hydrogen peroxide. In ECF process chlorine is replaced by chlorine dioxide. The use of both these processes requires comparatively costly equipment. Only one Indian mill uses ECF process. The TCF process is not used in India.

iv) **Chemical recovery.** Chemical pulping produces inorganic chemicals and wood residues, which are together known as black liquor. Chemical recovery is used to regenerate the chemicals contained in black liquor. The black liquor is

[11] Shaman David (1996), "India's Pollution Regulatory Structure and Background", January 5, 1996 at http://www.worldbank.org/nipr/india/india-back.htm

concentrated in evaporators and then incinerated in recovery furnaces, which may be connected to steam turbine cogeneration systems. The wood residues provide the fuel and the chemicals are separated and can be reused.

v) Paper Making.

6. Environmental Impact of Paper and Pulp industry

The potential pollutants from a pulp and paper mill can be classified into four categories: (1) liquid effluents, (2) air pollutants, (3) solid wastes and (4) noise pollution. Paper and pulp industry has been included in a list of 17 most polluting industries in India. The problem of pollution is particularly serious in case of small scale mills as they use outdated technology and do not have resources to adopt ESTs.

A recent study of Indian paper industry found that most the companies had poor environmental performance. It found that, compared to the world norms, the Indian companies used a considerably large amount of raw material, water and energy to make same amount of paper. It also produced and discharged larger amounts of polluting effluents and emissions. [12]

The major pollution problems associated with paper and pulp industry in India are:[13]

i. Treatment of black liquor in the effluent

The presence of caustic in black liquor results in increased dissolved solids in wastewater streams, thus rendering the receiving body unfit for drinking and other uses. The discharge of black liquor along with effluent also results in high levels of biological and chemical oxygen demand in the effluent.

The problem of black liquor effluent is especially serious in the case of small, agro-based mills, as they do not have recovery plants. There are a number of economic and technical reasons for this. These include:
- The high cost of recovery plants and long payback period make them unattractive for small mills;
- The Presence of high silica content and fibre fines in the black liquor of agro-based mills make recovery technically difficult;

The discharge of black liquor results in a loss of valuable chemicals and also increase the pollution load in the effluent.

ii. High percentage of oxygenated halogens in the effluent As mentioned above, almost all paper mills in India use conventional chlorine based bleaching process. The

[12] Down To Earth (1999), "The Five Leaf Award: The Green Rating Project", *Down To Earth,* New Delhi, Vol. 8, No. 5, July 31.
[13] "India: Pulp and Paper Mill Pollution Control", United States Department of State, 1999 at http://www.tradeport.org/ts/countries/india/isa/isar0014.html

Indian mills use about 100 kilogram of elemental chlorine per tonne of paper. [14] The effluents produced by the bleaching plants in India contains large amount of oxygenated halogens and other associated carcinogen compounds.

iii. Air Pollution. This is considered to be a major problem largely in the wood based pulp and paper mills. The pulping section in these mills contributes to air pollution in the form of hydrogen disulfides, mercaptans and other sulfide based gaseous fugitive emissions. The bleaching section generally poses the problem of fugitive emissions in the form of chlorine and other chloro organic compounds. The soda recovery boilers and boilers used for generating steam for use in the pulping process and for producing electricity are also sources of fugitive emissions. In-house lime kilns are also sources of fugitive emissions.

iv) Solid Waste. This include sludge from the effluent treatment plants, and lime mud from the the causticizing section in the chemical recovery unit. The lime mud is usually disposed in the form of slurry in ponds made for this purpose. Very few Indian paperand pulp mills recover and recycle lime. This is because the Indian wood has a high silica content, which makes recovery of lime difficult.

The boiler ash is also a major problem.

v. Poor Plant Efficiency. The average efficiency of Indian paper mills is reported to be less than 35 percent. Compared to this the world average is reported to bo about 52%. This results in excessive use of raw material, water and energy. For example, compared to the world average of 55 cum water per ton, some of the Indian mills use more than 400 cum water per tonne of paper. [15]The average specific energy consumption of Indian pulp and paper mill is 35 GJ/ton against 23 GJ/ton in Japan, which has a similar pulp to paper ration.[16]

The environmental problems caused by small mills are generally more serious than the problem caused by large, wood based mills. As mentioned above, chemical recovery in these units is not economically viable and therefore black liquor and lime sludge are not being burned for heat recovery. The black liquor and the unrecovered chemicals discharged by these mills are difficult to treat biologically as the lignin present in the black liquor is non-biodegradable. For these reasons, it is estimated that a 30 tpd small,

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[14] . Compared to this, JK Paper Mill, the only mill which has replaced elemental chlorine with chlorine dioxide, uses only 10 kg of chlorinf per tonne of paper. See: Down To Earth (1999), "The Five Leaf Award: The Green Rating Project", *Down To Earth,* New Delhi, Vol. 8, No. 5, July 31.

[15] Down To Earth (1999), "The Five Leaf Award: The Green Rating Project", *Down To Earth,* New Delhi, Vol. 8, No. 5, July 31.

[16] USAID, "Report on Pulp and paper Industry: Survey of Industrial Environment", at `http://www.cleantechindia.com/neweic/bhup.htm`

agro-based paper mill can be almost three times as polluting as an integrated paper mill of 200 tpd.[17]

[17] Schumacher Katja and Jayant Sathaye (1999), "India's Pilp and paper Industry: productivity and Energy Efficiency", Ernest Orlando lawrence Berkeley National laboratory, July 1999 at http://eetd.lbl.gov/ea/ies/suni6/industry/41843.pdf

For comparison of effluents from mills of different sizes, see Table.

Characteristics of Effluent from Pulp and Paper Mills

	Integrated Paper and Pulp Mills	Newsprint Mills	Agro-based Small Mills	Waste Paper Mills
Raw Material	Bamboo, Hardwood	Bamboo, Hardwood	Rice Straw, Wheat Straw, Bagasse etc.	Waste Paper
Waste Water (cubic meter/tonne)	230-250	200	200-380	70-150
PH	6.0-9.0	7.2-7.3	6.0-8.5	6.0-8.5
Pollution Load(kg/tonne of paper)				
Suspended Solids	100-150	100	90-240	50-80
BOD	35-50	45	85-270	10-40
COD	150-200	135	500-1100	50-90

Source: Kulkarni A.G., "Pollution Prevention Issues in Indian Pulp and Paper Industry", Central Paper and Pulp Research Institute.

7. Technology Development and Acquisition of ESTs

Technological status [18]

India's paper industry is more than 100 years old, and plants use technologies which ranges from very old to conventions. Only a handful of Indian mills use modern technologies such as continuous digesters and high-speed paper machines with sophisticated instrumentation. As a result, the efficiency of most Indian plants is comparably low.

9. Mode of technology transfer

Paper production technology is largely embodied in plant and equipment. Major technological improvements in paper production are carried out by the equipment manufacturers. Technology diffusion largely takes place through the installation of new/modified equipment.

As the paper market is depressed and there is a shortage of raw material, new paper mills are not being set up. Most the demand for technology comes from a need to increase productivity, reduce production cost and improve quality.

Research on paper technology is carried out at two centres: Central Paper and Pulp Research Institute and Institute of Paper Technology. While the former is a part of the

[18] USADID, "Report on Pulp and paper Industry: Survey of Industrial Environment", February, 2001 at http://www.cleantechindia.com/neweic/bhup.htm

Federal Ministry of Industry, the latter is a department of a technical university. Both carry out research on the development of ESTs pertaining to paper industry. However, very little technology is being transferred by these institutes to industry. There is feeling in the industry that the research being done by these institutes is not relevant to the needs of industry and that that their attitude and work culture is not suitable for effective technology transfer.

The demand for technology by Indian mills is primarily met through two sources: Employment of consultants and installation of new machines. The consultants advise on the economics of new technology while the machine manufacturers advise on the choice of technology. The machine producers also provide training when necessary.

Both foreign and Indian equipment manufacturers are present in India. The three leading international companies, Andriz Ahlstrom, Metso and Black Clawson have marketing subsidiaries/partners in India. A number of Indian companies also produce and market equipment, which are primarily copies of foreign designs. We find that these firms, both Indian and foreign, are the most important source of technology for the paper industry.

Adoption of ESTs

Pollution from paper mills can be abated in two ways:

a) Improvements in production process to reduce water consumption and pollutant discharge load. These improvements include the use of: energy efficient chipping machines; continuous pulping mills, oxygen de-lignification process; partial or complete substitution of chlorine by other, less polluting bleaching agents, use of efficient screening and washing facilities. The overall economic and environmental performance of the plant can also be improved by the use of co-generation to use excess steam for power generation.

b) Installation of EOP equipment, which include effluent treatment plant (ETP) and ESPs to conatin the emission of pollutants.

8. Level of adoption of ESTs.

The degree of adoption of ESTs by paper industry is very low. Most plants continue to use obsolete technologies, which consist of inefficient and polluting processes and equipment. These include the use of batch digesters, elemental chlorine in bleaching and inefficient paper making machine. However, most large mills have installed modern and efficient chemical recovery plants. The recovery of chemicals in these plants is up to 95%, which is comparable to international norms. The large scale adoption of chemical recovery plants in these mills is due to the economic benefits resulting from the recovery of costly chemicals, and the reduction of pollutants in the effluents.

Very few mills have fluidised bed boiler and lime kiln, which will enable them to handle their solid waste in a more profitable and environmentally way.

The focus of the adoption of ESTs is on EOP equipment. All large and most medium size plants have ETP plants but their capacity is often inadequate to treat their effluent. Also,

in most instances they are not used regularly: they are run only at the time of inspection by pollution control agencies.

10. Factors which influence the adoption of ESTs:

i) Inadequate financial resources. The problem of the shortage of funds have become especially acute in recent year. The paper industry is currently undergoing recession and this had made the mills very reluctant to invest in new technology. Most firms feel that the it will be difficult to justify large investments on technology during the current business environment. The uncertainity caused by the economic liberalization, and the resulting increase in the import of paper, has also made the industry reluctant to invest in ESTs. Only those investments which are considered essential for the operation of the plant are being considerd. Small and medium sized mills, who are not part of large and diverse business houses are particularly faced with the problem of limited financial resources. This effects their ability to invest in technologies which improve both the environmental and economic performance of the plant, such as co-generation. Due to the cyclical nature of the industry, banks and financial institutions are also reportedly reluctant to lend money for technological upgradation. Furthermore, when available, the cost of raising funds is considered to be too high by the industry.

ii) Lax implementation of environmental regulations. While most mills have invested in end-of-the-pipe equipment, there is little pressure to invest on environmentally friendly processes. In many cases the companies find it cheaper to "manage" the pollution control agencies than invest in ESTs, whose contribution to the economic performance of the plant is considered to be uncertain. Also, there is not enough pressure from the community and NGOs.

iii) The quality of raw material received by the mills is highly variable. This makes it difficult to stabilise the production process and concentrate on improving environmental and economic performance of the mill. pollution reduction methods.

iv) Most of the small and medium mills are agro-based. The raw material used by these mills is high in silica content. This produces effluent which is not easy to treat. Although the Central Paper and Pulp Research Institute has developed technology to handle these raw materials in a more environmentally friendly manner, the technology is yet to be proven on a large scale.

v) Economically viable technology for chemical recovery in small mills is not available. The currently available chemical recovery plants are of large size and are not economical for use in small paper mills. There is a need to develop technology to undertake chemical recovery in small plants.

vi) The role of the pollution control authorities is largely punitive. They do not advise industry on how to improve environmental performance. The companies feel that the pollution Board should take a more positive and pro-active role in providing the industry with information on how to reduce pollution and meet standards.

11. Methodology and Sample Profile

The selection of the firms for inclusion in the study was primarily based on the environmental performance rating given by a Delhi based environmental NGO, the

Centre For Science and Environment (CSE) in 1999. These ratings were based on company's performance with regard to:

- Corporate environmental policy;
- Efficiency of the use of raw materials, water and energy.
- The quality and quantity of effluent and emissions.

In addition to the firms selected from the CSE sample, we have also included a number of firms in consultation with the industry associations and consultants. This was necessary for two reasons: firstly, some of the firms included in the CSE sample have closed down since the ratings were announced; secondly, most of the firms included in the CSE ratings were large. We have used information provided by the industry associations and consultants to include small and medium sized firms.

We have selected 15 firms. These include 9 large firms (production more than 33,000 tonnes/year) and six small/medium firms. In terms of environmental performance, 4 firms are reported to show good performance. The numbers of firms with moderate and bad performance were 6 and 5 respectively. In terms of state-wise breakup, these companies have plants located in five states in India. For characteristics of the firms in tabular form, please see the following tables.

List of Firms

No.	Name	State	Capacity	Small/ Large*	Perfo-rmance**	Process
1	Star Paper Mill	Saharanpur **Uttar Pradesh**	46,000 t/y	L	B	Chemical Soda
2	Devpriya Mills	Meerut **Uttar Pradesh**	12,000 t/y	S	M	Chemical Soda
3	Shiva Paper	Rampur **Uttar Pradesh**	14,868 t/y	S	B	Chemical Soda
4.	Century Paper Mills	Lal Kuan Uttar Pradesh	35,840 t/y	L	M	Kraft
5	Nath Paper and Pulp Mills	Aurangabad **Maharashtra**	41,950 t/y	L	B	Chemical Soda
6	Pudamjee Pulp and Paper	Pune **Maharashtra**	38,500 t/y	L	G	Kraft
7	BILT Ballarpur	Ballarpur **Maharashtra**	1,10,00 t/y	L	G	Kraft
8	Siv Industries	Coimbatore Tamil Nadu	60,000 t/y	L	B	Sulphite
9	Servalakshmai Mills	Coimbatore Tamil Nadu	15,000 t/y	S	M	Hydropulping
10	Seshayee Paper and Board Ltd.	Salem Tamil Nadu	60,000 t/y	L	M	Sulphite
11	Emami Paper Mills	Cuttack **Orissa**	32,200 t/y	S	M	Chemical Soda
12	JK Mills	Rayagarh **Orissa**	90,000 t/y	L	G	Chemical Soda
13	BILT Sewa	Sewa Orissa	30,000 t/y	S	B	Kraft
14	Hindustan Newsprint	Kottayam **Kerala**	1,00,00 t/y	L	G	Chemi-mechanical
15	Shri Shakti Papers	Ernakulum **Kerala**	14,000 t/y	S	M	Hydropulping

Notes:
* According to the industry association, plants with a capacity of 33,000 t/y or more are classified as large.
**Environmental performance is based on a) CSE ratings, discussions with industry associations and consultants. G=good, B=bad, M=moderate

Distribution of Firms according to size and states

No	State	Small	Large	Total
1	UP	2	2	4
2	Maharashtra	-	3	3
3	TN	1	2	3
4	Orissa	2	1	3
5	Kerala	1	1	2
	Total	**6**	**9**	**15**

Distribution of Firms according to Pulping process

Process	Number of Firms	Percentage of Firms
Chemical Soda	7	47
Kraft	3	20
Hydropulping	2	13
Sulphite	2	13
Chemi-Mechanical	1	7
Total	15	100

Compiled from : "Directory of Indian Paper and Allied Industries", INPAPER PROTECH, New Delhi, 1999-2000.

Sectoral /Business Associations.

The paper and pulp sector has two industry associations. These are:

- Indian Agro Paper Mills Association, New Delhi. The Association primarily represents mills which use agro based products as raw materials.
- Indian Paper Manufacturers Association, New Delhi. This Association mainly represent large, wood-based mills.

Both the associations are being covered by the study.

There are three main research institutes, about six consultants and ten major machine suppliers. Most of the consultants and machine suppliers have technical collaborations with foreign companies. The research institutes covered by the study are:

- Central Pulp and Paper Research Institute, Saharanpur.
- Cellulose and Paper Division, Forest Research Institute, Dehradun.
- Institute of Paper Technology, Saharanpur.

The following consultancy companies and machine suppliers are being covered:

- Chemprojects, New Delhi
- SPB Consultants, Chennai
- Agro Pulping Machine Co. Chennai
- Ahlstrom
- Enmas Ahlstrom, Chennai
- Ruby Macons, Mumbai
- Andraz-Ahlstrom

In addition to these, the following agencies are also being covered:

- Central Pollution Control Board, New Delhi.
- State level Pollution Control Boards
- Ministry of Environment and Forest, New Delhi
- National Productivity Council, New Delhi.

12. Conclusions

i) India's paper industry is highly fragmented. A majority of the mills are very small and do not have financial and technical resources to invest in ESTs. Although there is trend in favour of large mills, the average mill size is unlikely to increase significantly in near future.

ii) The industry is faced with serious recession. The increase in import of paper has worsened the problem of over capacity faced by the sector. This problem is particularly serious in the case of cultural (printing and writing) and industrial (packaging paper). Most mills are reported to be faced with shortage of capital, making it difficult to invest in modern technology. The problem has been made more difficult by the fact the banks and financial institutions are reluctant to provide loans for technology up-gradation of paper industry. The industry feels that it needs to be provided with subsidized loans to carry out technical up-gradation in general and the use of ESTs in particular.

However, it must be pointed out that some of the mills have used the problems caused by an increase in competition to introduce efficient technology to enhance their production and productivity and improve quality. But the number of such mills is very small.

iii) Most Indian mills use obsolete and inefficient technology and equipment. Compared to international norms, these mills consume large amount of energy, water and raw material, and the quality of paper is poor. They also produce comparably large amount of pollutants. Although, most mills have installed EOP equipment, the quality of their effluents is reported to be bad. On the whole, Indian paper industry's environmental performance is poor.

iv) Indian mills have adequate access to modern production technology and equipment. By and large, paper technology is embodied in plant and equipment. As world's leading producers of machinery (who are also the leading technology developers) are represented in India, Indian firms can acquire advanced

technologies from them. However, due to the reasons mentioned above, the demand for new, efficient paper making technologies is small.

v) By and large Indian mills do not have serious in-house R&D facilities. Even in largest mills, R&D activities are confined to the testing of raw material and paper products. The lack of technical expertise limits Indian mills' ability to improve their efficiency and environmental performance through incremental technical changes.

The contribution of research centres to the technical upgradation of paper industry is also small. Even the Federal Paper and Pulp Research Institutes, which is reported to be one of the largest of its kind in the world, has made little contribution to the technology upgradation of the industry. Although the institute is re-orienting itself to meet the needs of the industry, very little transfer of technology has taken place yet.

vi) Large scale adoption of ESTs is limited to those technologies which provide assured and immediate economic return. The most important and common example of this is the adoption of chemical recovery plants by Indian mills. As these plants lead to a large saving of raw materials, most large plants have installed. On the other hand, mills are reluctant to invest on ESTs, whose benefits are considered to be uncertain (such as environmentally friendly bleaching technologies).

vii) The enforcement of environmental standards is very lax. Although there are state-wise variations, the general feeling is that the state PCBs lack the resources and political support to carry out their job efficiently and honestly. Moreover, the role of PCBs is largely punitive: they do not provide industry with advice and information (and other support) on how to reduce pollution.

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RAW MATERIAL/ TECHNOLOGY SUPPLIERS

Version 15/11/01

Section 1: Basic data (semi-structured)

1.1 Name of organization:
Agro-Pulping Machinery Ltd.

1.2 Year established in this (x) country
1991
1.3 Main products
Moist de-pithing machinery, Wet washing plant, chenmical recovery systems, fibre recovery system, continuos digesters, Incinerators
1.4 What resources are available to the supplier in x country ?

(i) Budget: Rs. 10 million (2000-2001)
(ii) Personnel / labor force (106 (2000-2001)
(iii) Do they have any links to international organizations or personnel?

Yes. The company has a collaboration with Enders Process Eng. Co. (USA) for the manufacture of chemical recovery technology.

1.5 How is the supplier organized?

(i) How many divisions, and what are the divisions (organigram)
Two Divisions: production and marketing
(ii) Vertically integrated subsidiary of parent company?
No

1.6 Ownership: national / international (what proportion)

National

Section 2: Market trends (semi-structured)

2.1 Who are your main customers, market?
Most of the customers are those who are interested in low-price machinery.

Please elaborate on the profile of your customers. Are they

(i) National / international (what proportion of sales):
National
(ii) Small/medium/large scale firms (what proportion of sales):
Small and medium firms
(iii) Do you have large trading contracts with specific well-known firms?

No

2.2 What are the main factors underlying your market?
The growth in paper industry is the main factors which influences their market.

What is the niche it occupies?

The company has a niche in the market for low cost paper machinery.

2.3 What factors challenges your profitability?

The recession in the paper industry, which has reduced the demand for paper, is the main challenge to profitability.

2.4 How has the underlying demand for its services changed over the last ten years?

There has been a recession in the paper machinery market since 1996. As a result, the demand has come down. On the whole, the demand for ESTs has also not increased. However, the demand for their equipment has seen an increase during 2001-2002. Part of this is because they have received a large order to export washing systems to a paper mill in Turkeminstan under a World Bank project.

Section 3: Environmental issues, objectives, and technology (semi-structured)

3.1 Do you supply services to firms? Yes

Do you offer advice on raw material and equipment selection to firms? Yes

Or provide engineering advice in terms of equipment installation and operation? Yes

3.2 Do environmental issues play a role in your market?

No. Although the firm produces machines and equipment which can be termed environmentally friendly, the demand for these is small.

If so, how important is it and does it vary according to the profile of enterprises in the sector?

The role of environmental issues is not very important in their market.

3.3 In your view, what are the reasons that firm x[19] implemented technology changes? Please elaborate (and rank in importance):

Reasons for technology changes	1=not important, 5=very important
Cost reduction (specify if labor costs /energy consumption/ consumption of raw materials)	5
productivity increase (in terms of increased volume of output)	2
Quality improvements (specify whether process / product quality)	5
meeting environmental regulations /standards	3

[19] Firm x denotes one/more particular firm/s of the sample

opening up new markets	1
extending the product range	1
environmental pressure from NGOs, local community, business associations/other firms	3
Other (specify)	1

3.4 In what way have developments in the prices for water/energy/raw materials influenced firm-level technological changes? *(only if applicable- that is if significant changes have occurred over the last ten years in raw material/water or energy prices)*, NA

3.5 What is restricting (if anything) the adoption or development of cleaner technologies[20]?
The adoption of ESTs is limited by two factors: Recession in the paper industry and lax implementation of environmental regulations.

(please let the interviewee elaborate first, and then perhaps suggest the following options as suggestion.

LET THE interviewee SPECIFY THE REASONS, but the following may be mentioned by them, or by you in order to suggest options...	RANK IMPORTANCE 1-5
Lack of information?	2
High implementation cost?	5
No alternative chemical/raw material input?	1
No alternative process technology?	1
Uncertainty about performance impact?	3
Lack of tradition/skills?	1
Other: specify (lax implementation of environmental standards)	5

3.6 What changes in services, regulation, or other market characteristics would you like to see in order to assure greater adoption of environmental technology?

Provision of financial support to paper industry to adopt ESTs.
Strict implementation of environmental standards.

3.7 Is it helpful, actually, to refer to your technology as 'environmental' or would you prefer it presented in different terms, such as 'more competitive'?

[20] Please refer to annex 4 for an initial list of CP options –this list needs to be revised and updated by the national institutions (sectoral technology specialist and cleaner production specialist)

In most cases the technologies and equipment produced by the company improve environmental performance, reduce cost and improve quality. For example chemical recovery and continuos digesters do both. Most technologies are sold as both environmentally friendly and efficient.

3.8 In what ways do you interrelate with the specific firms in our sample?
List firms... list interactions

Shreyans Mills. The company has supplied a chemical recovery plant to Shreyans.
3.9 Do you have any specific comments about the firms in the sample?
It is considered to be a technologically dynamic firm, willing to take risk with new technology. This is not very usual in India.

Section 4: Future directions: changes in market and expectations (open, unstructured)

4.1 What future changes and challenges do you expect over the next few years?

It is difficult to say. The firm is faced with serious challenge as the demand for paper machinery has stagnated for a number of years (except in 2001-2, when it received a World Bank order. These challenges will continue until the recession in the paper industry is over.
4.2 Do you see environmental issues as a key part of your market planning? How and why.

Yes. The firm feels that the implementation of environmental standards is likely to become more strict in the coming years. This will increase the demand for ESTs.
4.3 How will your services change to accommodate expected changes in market and demand

As the firm already has a number of technologies which are environmentally friendly, it does not need to make major changes in its planning and strategy.

REGULATORS Questionnaire Version 15/11/01

Section 1: Basic data (semi-structured)

1.1 Name of organization
Maharashtra State Pollution Control Board
1.2 Year established
1970
1.3 Position and rank in government hierarchy, which department; whether at the state or provincial level

Who (which office, ministry) do you report to?

Ministry of Environment, Maharashtra State Government. The Board prepares regular report for the state government. Reports are sent to the Central Pollution Control Board (in Delhi) only if requested by the Central Board. This usually happens when there are specific complaints or reports in the media.

1.4 Objectives of organization regarding environmental performance
The main objective is to implement various environmental regulations passed by the state and the central (federal) government. The other objectives include: monitoring of air quality, effluent, municipal solid waste, biomedical waste.

1.5 What resources are available to you?

Budget: Rs. 251.9 million (2000-01)

Personnel: 661 (of which 223 are technical personnel)

Do you have any links to international organizations or personnel?

No

1.6 How is the regulator organized?

How many divisions, and what are the divisions (e.g. inspection, legal)

The Board has 11 regional offices. Each of these has sub regional offices. These have field offices which do the monitoring work. The Board also has a legal department which initiates legal action against the non-complying firms.

1.7 How does the organization report findings?

Publication of information, reporting, etc.

Usually the findings are not made public. They are kept as reports in the office. The important findings are given to the state government.

Section 2: Environmental issues: problems, objectives, statements, policies, regulations (semi-structured)

2.1 What are the key objectives of the regulator?

- Legislation? Yes. The state government seeks their advice when environmental legislation is prepared.
- Alternative (non-command and control) forms of regulation? Yes.

- Information and support? Yes. But the support is small. For example, if a company meet all the conditions stipulated in the consent document, the company is given 75% relief on water cess.

  There are no incentives linked to process improvements or the use of ESTs. This is because the Board believes that the companies benefit from these improvements, and do not need additional incentives to implement these incentives. However, tax incentives on the installation of ETPs and ESPs are available from the federal government.

  Very limited technical support is given. The Board is not equipped to provide technical support.

2.2 What forms of regulation exist, or are planned for?

Is regulation restricted to legislation, or are there alternative forms?

Are these changing/ evolving?

The regulations pertains to the level of pollutants in air, effluent, solid waste, noise level. In addition to regulations, the central and state pollution Boards introduce regulations to meet the changing conditions.

2.3 How is legislation/ regulation established? The state government forms a committee to frame the legislation. In addition to the Pollution Board, the committee consults technical and legal expert. The draft legislation is presented for enactment to the state legislative assembly.

Are private-sector companies involved?

No, but representatives of industry associations are consulted.

Are international organizations consulted, e.g. ISO?

No

2.4 What are the key areas of environmental concern, at the levels of:

- Local? Municipal and industrial pollution.
- State (region)? Industrial pollution, deforestation.
- Federal level? same

2.5 What are the key industrial sectors of concern?

The industry has been divided according to environmental impact into three categories.

These are: Red (highly polluting), Orange (medium polluting) and green (non polluting). The most polluting industries, which are of main concerns are:

Distillery; Sugar, Cement, Thermal power plants, paper mills, steel conversion mills.

Why?

Because they are highly polluting and the state has many of these units.

What are the areas of concern (e.g. air and/or water pollution?; workers' and/or consumers' safety?)

The main concerns are water and air pollution.

2.6 In environmental terms, would it be possible to indicate how far the chosen industry sector is seen to be associated with the following forms of pollution? Please rank these 1-5 (where 1 is not at all; and 5 is very much)

Type of pollution	*1*	*2*	*3*	*4*	*5*
Noise pollution		*x*			
Air pollution			*x*		
Water pollution (please state: river/lake/sea)					*X (river)*

2.7 What environmental standards (limits to discharge, effluents and disposal of solid waste) apply to the sector as per law and regulations? Please specify the environmental standards that the sampled firms have to meet.

Large mills
Air: H2S 10 mg/cu meter
Particulate matter 150 mg/cu meter

Effluent
PH 7.0-8.0
BOD 30
COD 350
Suspended Solids 50
TOCL 2.0 kg/ton of paper
Total water discharge 200 cum/ton of paper

Small Mills (up to 24000 mt/year production capacity)

(Discharging effluent in inland water bodies)

pH 5.5-9.0
Suspended solids 100
BOD 30

(Discharging on land)

pH 8.5-9.0
Suspended solids 100
BOD 100

All the Maharashtra based mills in our sample are large. They have to meet the standards for large mills.

2.8 Have licenses been issued to (or refused to) any of the sampled firms?

Pudumjee. The mill does not have consent from the Board. It was refused consent in 1997. It is operating after giving an undertaking to the court that it will adopt a chemical recovery technology by 2003.
Nath Paper Mill. The mill has never been refused consent. It is always making efforts to improve its environmental performance.

Section 3: Monitoring, inspection (semi-structured)

3.1 How is monitoring organized? I.e.

(i) who does the monitoring?

Monitoring is carried out by the field officers of the Board.

(ii) Are they part of your organization, or are they separate?

They are part of the organization

(iii) How much staff do they have

They are very understaffed. Each district (which may have hundreds of factories) has only two field officers. For this reason monitoring is selective and not regular.

(iv) Do staffing levels vary according to the numbers and sizes of firms monitored? No.

(v) How are staff trained or selected for monitoring?

There is no special training. What do they monitor in each firm? They take samples of effluent from the ETP for monitoring.

(vi) What events may cause each occasion of being monitored?

The red listed factories are monitored once a month. The factories in orange list are monitored every 3 months. The green firms are monitored every 6 months. In addition to this, court directives and media exposure may also lead to additional monitoring. Also, factories which have attracted attention of the NGOs and politicians are targeted for monitoring.

3.2 Are there particular sectors or kinds of firms that you want to monitor more regularly or comprehensively than others?

Yes. The industries categorized as highly polluting (in the red list) are given priority. The firms which do not have the suitable technology to reduce pollutants (lack of chemical recovery plant, inadequate ETPs, lack of ESPs for example) are also given special attention.

3.3 Are there different monitoring rules, or standards, for different firms?

E.g. National or international? No

Firms in special zones, e.g. Export Processing Zones; Industrial Estates?

No

3.4 What systems are in place-automated, computerized?

There are no automated, computerized monitoring systems in place. The Board does not have resources to do this. The monitoring is done by collecting samples, which are sent to the regional labs for analysis.

3.5 How is monitoring linked specifically to environmental technology, or the problems that environmental technology could address?

????
3.6 What are the technological obstacles to effective monitoring?
The monitoring is based on samples. This does not give a correct picture of the environmental performance of the firm, as the performance varies from day to day. It will be better to have continuos monitoring. But the Board does not have resources to do this.
3.7 What guidelines do they follow for inspection (multi-sector or single sector inspectors)?
Multisector inspectors.

3.8 What is the policy for monitoring and inspection?
Collaboration / negotiation? Yes
Or repressive / imposed? No

3.9 What monitoring data do you have for the sampled firms?
And is it possible to see this?

Not possible to see this.

Section 4: Penalties and legal process (semi-structured)

4.1 What is the penalty process based on inspection?

The penalty process is as follows:

1.When the Board's monitoring suggests that a mill is not following the standards/consent conditions , it is given a notice.
2. The mill is given 45 days to reply to the notice. The mill is also given a chance to make a personal representation to explain why it has failed to meet the conditions. This is usually followed by the Board giving the mill a certain time to comply with the standards/conditions. The time given varies with the complexity and cost of technology, market conditions and financial resources of the company. Usually, 1-3 years are given to comply.

In order to keep pressure during this period, the company is also required to give the Board Bank guarantee, which is forfeited, if the mill does not show progress. The value of bank guarantee is : small mills-Rs. 10, 000 to 20,000; Medium mills: Rs. 25,000 to Rs. 50,000; Large mills: Rs. 50,000 to Rs. 500,000. (The sum is too small to act as a significant pressure on the firm. Alam).

If the mill does not show signs of making efforts to improve its environmental performance, it is given a closure notice. This is followed by the closure of the mill. In practice, the closure is used as a threat. Once it is closed, the mill comes to see the Board and gives a detailed plan of how it proposes to improve its performance. The closure usually lasts 10-15 days.

4.2 Are any penalties specifically related to technology?

Which? Details?

No

4.3 What suggestions can you make concerning improving the effectiveness of the penalty system? Are there any aspects of the system that you feel can work better, if changes are made?

The Board feels that the system is OK. The system is largely based on persuasion (not on penalty). The Board has to take into account of social cost and political compulsions. It can not use the ultimate penalty (closure) in most cases as the impact on employment will be large. So, although the Board is aware of the fact that the system has not been very effective, given the socio- economic conditions and political compulsions, it does not think that much improvement is possible.

4.4 Is the legislative process effective in assisting the regulator?

Yes. It provides the Board with the legitimacy to monitor and regulate the environmental standards.

4.5 Is there opposition to fining local companies, in case this impacts negatively on competitiveness?

No, there is no opposition to finning the local companies. The opposition is to closure of local firms.

4.6 How does the judiciary view environmental issues and environmental law?

The judiciary has become very active in this regard during the last ten years. Their action has forced the Pollution Board to take steps to implement the standards more strictly.

4.7 Have any of the sampled firms received compliance enforcement actions?

Which?

Other details... history, implications, apparent impacts...

Yes. Pudumjee has been given closure orders as it has failed to take steps to adopt chemical recovery technology.

Section 5: Technology, finance and information initiatives: access to capital, or human resources, information (semi-structured)

5.1 What assistance does the regulator offer to the firm? (if any)

- Advice and information (Yes, but limited)
- Access to official, government, schemes such as subsidies Yes

5.2 Does the regulator work with other centers of technological expertise: (please rank):

Collaborator	1=not important, 5=very important
Universities	2
Go vernment technology offices and agencies	3

Standards and quality control agencies	3
International organizations	1
Private-sector firms	2
Private-sector consultancies	1
NGOs	1
Other (specify)	1

5.3 What official mechanisms and assistance programs are available?
There are some awareness increasing programmes. But the resources devoted to these programmes are very limited and they are not very effective.
5.4 How do firms generate technical information? What can the regulator offer the firm in terms of advice and information support?
The firms get information from consultants and from other firms. The Pollution Board does not have technical and financial resources to provide the firms with advice and support. However, as the Board is aware of the experience of other firms, it may make suggestions on standard technologies (such as chemical recovery and ETP). But it usually tries not to commit itself to particular technology as it does not want to be held responsible for the performance of a particular technology.
5.5 What are –in your view- the main reasons why firms implement technology changes? Please elaborate (and rank in importance):

Reasons for technology changes	1=not important, 5=very important
cost reduction (specify if labor costs /energy consumption/ consumption of raw materials)	3
productivity increase (in terms of increased volume of output)	4
Quality improvements (specify whether process / product quality)	3
meeting environmental regulations /standards	3
opening up new markets	1
extending the product range	1
environmental pressure from NGOs, local community, business associations/other firms	3
Other (specify)	

5.6 What is restricting (if anything) the adoption or development of cleaner technologies[21]?
(please let the interviewee elaborate first, and then perhaps suggest the following options as suggestion.

LET THE organization SPECIFY THE REASONS, but the following may be mentioned by them, or by you in order to suggest options...	RANK IMPORTANCE 1-5
Lack of information?	1
High implementation cost?	4
No alternative chemical/raw material input?	1
No alternative process technology?	3
Uncertainty about performance impact?	2
Lack of tradition/skills?	1
Other: specify	1

5.7 If some firms have not adopted new EST in recent years, can you explain why not? (this is the same table as before, but other factors may be important)

LET THE organization SPECIFY THE REASONS, but the following may be mentioned by them, or by you in order to suggest options...	RANK IMPORTANCE 1-5
Lack of information?	1
High implementation cost?	4
No alternative chemical/raw material input?	1
No alternative process technology?	3
Uncertainty about performance impact?	2
Lack of tradition/skills?	1
Other: specify	

5.8 In what ways do you interrelate with the specific firms in our sample?
List firms... list interactions
5.9 Do you have any specific comments about the firms in the sample?
Pudumjee Paper Mill: Environmentally conscious firm. But the size is too small to adopt chemical recovery technology. Facing closure as unable to find suitable chemical recovery technology.

Nath Paper Mill: The mill has always shown willingness to improve its environmental performance. Has installed a chemical recovery plant. Satisfactory environmental performance.

[21] Please refer to annex 4 for an initial list of CP options –this list needs to be revised and updated by the national institutions (sectoral technology specialist and cleaner production specialist)

Section 6: Future directions: changes in regulations and legislation, agency structure (open, unstructured)

6.1 What changes are required to improve the current regulatory framework?
Satisfied with the current regulatory framework.
6.2 What are the obstacles to these changes?
NA
6.3 How far will trends towards increasing international sales, and international ownership of firms, impact on the ability of the government to regulate firms?
It will not have any impact.
6.4 Do you think the regulatory system may become more environmental in the future? How will environmental issues be seen in the future?

Yes, the system will become more concerned with environmental performance in future. Environmental issues will be seen as critical to the desirability of any project.
6.5 Do you believe that the industry/sector benefits from working with this regulatory system, or that it suffers in terms of international competitiveness?
The impact on international competitiveness, if any, is small.
6.6 What will be the most powerful in the future? (and please rank)

Form of regulation	1=not important, 5=very important
National regulatory system	5
Firm-based systems of regulation	2
International systems of regulation	1
Other (specify)	

PROJECT 1

1.Project Title	**: Augmentation of Effluent Treatment Plant with** Activated Sludge Process
2.Year Started	: 1992
3.Year Completed	: 1994
4.Cost in Rs .Lakh	: 900
5.Environmental Benefits	:Reduced B.O.D from 130 ppm to below 10 ppm and facilitate for recycling of Treated Effluent Water. The final outlet characteristics of treated effluent water was maintained well within the norms prescribed by regulatory agencies.
6.Annual cost savings due to project (Rs.Lakh)(e.g.Fuel Costs,Material Savings, reduced cost of effluent treatment)	: ----

7.Source of project financing (If possible , please give the percentage of the following)

Source	**%**
Internal resources of the company	: 100
Commercial Loan	: --
Government Loans	: --
Subsidy	: --
Others (please specify)	: --

PROJECT 2

1.Project Title and	**: Installation of RCC Chimneys Electrostatic precipitator for Power Bilers**
2.Year Started	: 1991
3.Year Completed	: 1993
4.Cost in Rs .Lakh	: 400
5.Environmental Benefits	:Reduced the ground level of particulate matter.The SPM, SO2 and Nox in the ambient air quality is maintained within the norms prescribed by regulatory agencies.
6.Annual cost savings due to project (Rs.Lakh)(e.g.Fuel Costs,Material Savings, reduced cost of effluent treatment)	: ----
7.Source of project financing (If possible , please give the percentage of the following)	
Source	**%**
Internal resources of the company	: 100
Commercial Loan	: --
Government Loans	: --
Subsidy	: --
Others (please specify)	: --

PROJECT 3

1.Project Title	**: Energy Efficient Falling Film Evaparotor**
2.Year Started	: 1993
3.Year Completed	: 1995
4.Cost in Rs .Lakh	: 1000
5.Environmental Benefits	: Lower Steam Cinsumption
6.Annual cost savings due to project (Rs.Lakh)(e.g.Fuel Costs,Material Savings, reduced cost of effluent treatment)	: Rs 400 Lakhs /Annum

7.Source of project financing (If possible , please give the percentage of the following)

Source	**%**
Internal resources of the company	: 100
Commercial Loan	: --
Government Loans	: --
Subsidy	: --
Others (please specify)	: --

PROJECT 4

1.Project Title with	**: Installation of LimeKiln along Electostatic Precipitator**
2.Year Started	: 1994
3.Year Completed	: 1996
4.Cost in Rs .Lakh	: 1200
5.Environmental Benefits	:Reduced the Solid waste by way of reburning of Lime sludge of 75,000 Mt/Annum
6.Annual cost savings due to project (Rs.Lakh)(e.g.Fuel Costs,Material Savings, reduced cost of effluent treatment)	: Rs 40 Lakhs /Annum. There is saving of Rs 100 /Tonne of burnt Lime.

7.Source of project financing (If possible , please give the percentage of the following)

Source	**%**
Internal resources of the company	: 100
Commercial Loan	: --
Government Loans	: --
Subsidy	: --
Others (please specify)	: --

PROJECT 5

1.Project Title	**: Installation of screw press for reducing moisture of pith discharged from pulp mill**
2.Year Started	: 1998
3.Year Completed	: 1998
4.Cost in Rs .Lakh	: Cannibalising of existing screw presses
5.Environmental Benefits	: The pith with moisture reduced from 70% to 50% could be utilised in boiler thereby generating energy as well as reducing solid waste load.
6.Annual cost savings due to project (Rs.Lakh)(e.g.Fuel Costs,Material Savings, reduced cost of effluent treatment)	: Rs 50 Lakhs /Annum.

7.Source of project financing (If possible , please give the percentage of the following)

Source	**%**
Internal resources of the company	: --
Commercial Loan	: --
Government Loans	: --
Subsidy	: --
Others (please specify)	: --

PROJECT 6

1.Project Title Plant	**: Installation of Biomethanation**
2.Year Started	: 2002
3.Year Completed	: To be completed by March 2003
4.Cost in Rs .Lakh	: 400
5.Environmental Benefits	: Generation of Biogas to substitute furnace oil /fossil fuels .Reduces the odor pollution in the atmosphere as the Process is carried out in the closed reactor.
6.Annual cost savings due to project (Rs.Lakh)(e.g.Fuel Costs,Material Savings, reduced cost of effluent treatment)	:Estimated Rs180 Lakhs/annum.

7.Source of project financing (If possible , please give the percentage of the following)

Source	**%**
Internal resources of the company	: 50
Commercial Loan	: --
Government Loans	: --
Subsidy	: 50 ((Ministry of Non conventional Sources).
Others (please specify)	: --

PROJECT 7

1.Project Title	**: Green Belt Development**
2.Year Started	: From Commissioning period
3.Year Completed	: Ongoing Project. Around 2 lakhs saplings developed
4.Cost in Rs .Lakh	: 2
5.Environmental Benefits	:Reduced the dust polluton problem and Noise levels
6.Annual cost savings due to project (Rs.Lakh)(e.g.Fuel Costs,Material Savings, reduced cost of effluent treatment)	: ---

7.Source of project financing (If possible , please give the percentage of the following)

Source	**%**
Internal resources of the company	: 100
Commercial Loan	: --
Government Loans	: --
Subsidy	: --
Others (please specify)	: --