R.C. DEVGAN

Introduction

In industrially advanced countries such as U. S. A., Canada, Sweden, Paper Mills are usually planned for a productive capacity of several hundred tonnes a day not only to meet the growing demand but also to make the new units more economic. With this view in mind some times there is a tendency to consider that it would be uneconomic to set up paper mills with capacity less than 100 Tonnes per day even in an under developed country. Such a view ignores the fact that the size of paper mills ought to depend on the Natural and Financial resources of the country, demand pattern, the standard of Technical know how and the distances over which the raw materials and the finished goods have to be moved rather than on merely copying the pattern of industrial set up prevalent in more advanced countries. Unnecessary haulage can be also reduced by setting up mills for the production of 'Pulp' only at location where raw material and water are available and

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Installation of Mini Paper Plant A Solution For present Day paper Shortage

The solution of present day 'Paper—Shortage' is to set up a large number of Mini Paper Plants 10 to 30 T.P.D. based upon agricultural residues. The Project cost and production cost per Tonne of B.D. Pulp can be lowered if the pulping technique of Cold Soda, Semichemical Pulping and Mechano-chemical pulping are employed. Setting up of 'Giant Pulp Mills' or Mother pulp Mills in Public sector can help us boosting up the production both at Mini Paper plants as well as in big paper projects. Consultant and planning Engineers can play active role for successful implementation of Mini paper projects by providing expert guidance to the entrepreneur.

organizing the productions of paper near centres of distribution. Though small units do offer vast opportunites and growing potential to the middle class entrepreneur, the smaller the size, more are the responsibilities on the man who starts it. He will have to control organization from both economic and technical aspects to make the unit a real success. He can in this case overcome all the difficulties but a number of problems crop up when a man completely new to the line starts the venture. In this case 'consultant & planning Engineers' play an important role in implementation of the project.

Targets of paper Production to be Achieved

At present there are 59 mills with a total capacity of nearly nine hundred thousand tonnes. Increasing the production by at least 60,000 Tonnes in the next 4/5 years is absolutely necessary to avoid the so called paper famine in the country. Plant equipment worth nearly 3,500 million rupees shall be required for this purpose. We know that paper Industry is a capital incentive industry. We also know diversification period for new paper industry is very long. We have therefore to start planning new paper project right now.

Long term development for the Paper Industry involves huge sumsof money in the installation of new plants and expanding the existing production capacity, Government wants small entrepreneurs should come up in large number. However, it is to be seen what technological factors and equipments will be introduced in the new mills to bring out the efficient use of raw materials resources and capital to generate the national wealth.

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The estimated Paper demands by 1989 are listed below :

		ESTIMATED DEMAND '000 Tonnes				
		19 7 8-79	1983-84	1988 -89		
1,	Paper & Paper Boards : Cultural Papers*	······································				
•	Printing Writing	495 250	680 340	900 450		
		745	1,020	1,350		
-	Industrial Papers Kraft Others Paper Boards	250 100 235	350 150 340	530 220 500		
		585	840	1,250		
Tot	al paper & Paper Boards.	1,330	1,860	2,600		
2.	Newsprint	350	500	700		
3.	Straw & Mill Boards	70	80	90		

*Demand Projections include provision for export.

Keeping the above in view, the Development Council for pulp, paper & Allied Industries has recommended the following targets to be achieved in the Fifth plan both in respect of capacity & production.

('000 Tonnes)

	P	aper & p	aper Stra	Straw & Mill	
		Boards	Newsprint	Boards	
		·			
i.	Anticipated demand 1978-79	1330	350	70	
2. 3.	Production level to be achieved Total Capacity needed for achieved	1330	350	70	
	ving the production at (2) above	e 1500	400	120	

under the prevailing conditions when the money position is tight and there is ceiling on the expansion of big entrepreneurs, small mills should come up with low project cost ranging from 1 crore to 4 crores making papers from 5 to 30 Tonnes per day. These mills should be based upon non conventional raw materials e. g grasses, jute sticks, bagasse, rice straw, wheat straw, old Hemp Ropes and gunny cuttings, etc. locally available. New Technological concepts must be applied to modify the old process and then alone we shall be able to get the best out of existing installa-

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tion This is also neccessary to keep pace with other paper producing countries for export, though only in a small way today.

Small scale concept and its practical application

The main problem is its application. Much has been said in favour or against the economics of the small scale paper units particularly in the days when control was introduced on prices. Industry, since then has learnt enough about working in a controlled economy. Units were forced to work in a condition of rising costs while selling prices were more or less fixed.

Planning commission after careful examination of feasibility of small units recommended the setting up of small paper units, spread all over the country based mainly on locally available raw materials, e.g. straw, bagasse, jute sticks,old Hemp ropes, rags and waste paper etc. In pursuance of this policy quite a number of licenses were sanctioned by the Licensing Commitee. Unfortunately, however many of them started with wild hopes and ambitions with a sad lack of knowledge and technical know-how, resulting in a very high mortality rate. A large percentage of the schemes could not see the light of the day and those that survived found it rather difficult to withstand the rigours of infancy. The units that have survived have now to consolidate and grow.

The proposed targets for the Fifth Five Year plan are as under :---Paper &

Board tonne	s=1.5 mil	lion	tonnes.
News-print	=0.4 mil	lion	tonnes.
Mill Board	=0.12 ,	,	»»
TOTAL	= 2.02 mi	llion	tonnes.

Numerous Letters of Intent have been issused for this purpose and as per Government records, total capacity of nearly 1.37 million tonnes is already licensed or covered by Letter of Intent pending implementation. How much of this licensed capacity shall actually materialise ? This is yet to be seen.

It can be safely stated that our technical people do not lack inven tiveness. Those who have associated with the pulp and paper industry for the last 25 years or more have seen many radical changes. They have seen the industry progressively changing from a mode of operation which was largely a rule of thumb to one which is highly specialized and operated on Scientific Principles. Our technicians have risen well to the occasions and are in no way inferior to their counter parts in western world. They now know, besides 'Bamboo', use of hard wood, and agriculture fibres e. g. straws, bagasse, to their advantage both in small scale and big units. They have been successful in manufacturing qualities of paper, which hitherto were not made in India and had to be imported.

We will have to select judiciously the raw materials to stand in the

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market in competition with better paper manufactured from virgin materials. The small units have to analyse their cost data and find out items where they can save to compensate against the cost of raw materials.

All variable cost like raw materials, stores, power and fuel would be slightly higher than in the case of bigger units. Hence fixed cost is the main item where small units will have to exercise and effect economic control. Minimum Block investment and minimum working capital and minimum labour cost per Tonne should be the three guiding factors. Efficient running and avoidance of leakage at various stages will be very essential.

Economics of Installation of mini Paper plants

For erecting big size integrated paper mills, capacity approximately 100 Tonnes per day would have a project cost of about 30 to 35 crores these days. Are such projects economically viable? Such high capital cost shall mean that nearly Rs. 1,700/- per ton of paper production shall be the charges to cover depreciation and interest alone on such huge The capital cost investment. decreases gradually with still higher production capacity and the economic size for a fairly big mill ranges now from 200 T.P.D. upwards for which the choice of location becomes more and more limited. The concept of adoption of appropriate technology will therefore favour smaller units to be distributed over wide areas, the process and products being chosen according to the quality

of raw materials. It is not necessary that a bigger unit will result in a better profitability. Smaller units are often preferable in the country like ours. Under the conditions existing in this country a small board mill based on waste paper and cerial straws needs capital investment of the order Rs. 4 lakhs per tonne of daily production capacity. The capital cost increases with sophistication and increases in out put. For an integrated pulp and paper mill, the capital investment would range from Rs. 5 lakhs to 10 lakhs per tonne of daily production for small units making 5 to 30 Tonnes per day. In comparison, the Big mills making 100 Tonnes per day the capital cost needed would be Rs. 30 to 40 lakhs per tonne of daily production. The Machinery-makers' in India are charging exorbitant prices for paper plant. A 20 T. P. D 'Kraft Paper' project based upon non conventional bagasse, straw & grass etc. cost of Indegenous machinerynew is Rs. 1.3 lakhs approx. We can not have economically viable projects when capital costs are so high. We can not afford to increase the selling prices of paper for our masses to such an abnormal extent of Rs. 5,000/- per-ton that a sheet of paper becomes a costly item of luxury rather than a basic necessity in their daily lives. While erecting mini plant it is necessary that pulping technology should be such that it gives high yield from the raw materials used, product-mix should fetch good price in the market and equipment cost should not be high.

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Installation of mini paper plant-A present Day Necessity.

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1. It is estimated that a hundred tonne or more per day integrated pulp & paper mill shall cost about Rs. 20 to 30 crores to install which for an ordinary entrepreneur is very difficult to invest since the money market is very tight in these days. Moreover, such big projects due to such a high capital cost would not be economically viable. Also the delivery schedule would be long as well as it will have higher construction period. On the other hand, mini paper plants as they have got no sophisticated machinery complete plants (including stock preparation and paper machine are available from indigenous machinery manufacturers and they can be installed in a shorter period ranging from 22 to 24 months. Mini plants can give production much earlier than the big paper mills.

2. The big paper mills situated in our country are facing difficulty with regard to procurement of raw materials particularly bamboos, hard wood, and soft woods to meet their daily requirement. They have to bear extra transport charges for bringing the raw material to the site. This enhances the cost of production per tonne of paper produced. Whereas the mini paper plants would be situated at the places where the agriculture produce e.g. rice, wheat, jute, sugarcane are available in abundance due to 'green-revolution' in our country. Sufficient quantities of surplus agricultural residues e.g. cereal

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straws, bagasse, jute sticks would be available for pulping in mini paper plants. The transport charges would be much less than in the case of big paper mills.

3. The mini plants would be using 60 to 70 percent agricultural fibres (straw, bagasses etc.) and the rest long fibred pulps from rags, gunny cuttings, hemp ropes, textile mill waste etc. All these agricultural fibres have got open 'Physical Structure' and relatively lower lignin content per cent than bamboo or woods. So all these fibres are easily penetrable by cooking chemicals caustic soda etc. and bleaching chemical c. g. Calcium Hypochlorite etc. So all these fibres particularly straw, it has been experimentally observed can be cooked only with as low as 5 to 6 per cent alkali content on B. D. weight of the raw material bleached with 5 to 6 per cent available chlorine on B.D. weight of pulp. So in case of mini paper plants cost of chemical consumption pertonne bone dry raw material would be less than bamboo and hardwoods or soft woods etc. to be used in the big paper mills. The present indigenous technology being used for pulping these agricultural raw materials pulps of low strength and hydrated which is difficult to run on the machines. Extensive experiments performed with the pulping of all the agricultural fibres including grasses [sabai and khar (sacharum Munja) at the research laboratories at Ballarpur paper and Straw Board Mills (Shree Gopal Division Yamuna nagar) have revealed that present technology can be improved upon by adjusting the parameters specially the solid liquor ratio during cooking and maintenance of proper PH values and washing during the bleaching action. On the other hand, these fibres are very well suited for high yield pulping techniques with minimum chemical consumption e. g. cold soda process, semi-chemical pulping and mechano-chemical pulping. The pulps obtained by this procedures is free pulp, good in strength and runs well on the paper machine. It has been seen that 50 per cent such pulps from agricultural residues can be admixed with long fibred pulps e.g. yarn waste hemp rope, jute waste, soft wood (coniferous) pulps to obtain all the varieties of paper ranging from Kraft to high class writing and printing papers. The papers manufactured at mini paper plants would be comparatively better in quality and lower in production cost than the same papers manufactured on the big paper plants i. e. more than 100 T P.D. paper plants.

4. Experiments on cold soda pulping of these agricultural fibres have proved that cold pulp having 60 to 70 percent bleached yield (brightness 65 to 68%) is obtainable with less of equipment and chemical cost. This pulp when admixed with 20 percent long fibred chemical pulp is very much suitable for manufacture of newsprint as this pulp is free and runs well on the high speed machine. However, pilot plant experiments are necessary to establish the working conditions for manufacture of newsprint in

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mini paper plants 20-30 T. P. D. 5. After erection of mini paper plants in different regions of our country where the availability of agricultural residues is in abundance, the production in these mini paper plants can be boosted up by establishing giant pulp mills in different regions of India. Highest priority should be given for erecting 'Mother pulp mills or 7 Giant pulp Mills in public sector in each region of India. One lakh tonnes of bone dry pulp per year asit may give us 4 lakh tonnes of paper annually with secondary fibres from agricultural residues e.g. rice straw, jute stick, bagasse etc. Newsprint industry will also progress rapidly if chemical pulp is available from the market at cheap price. So the erection of Mother pulp Mills is the immediate need. The suitable places for erection of Mother Pulp Mills can be suggested as under

a) North Eastern Rgeion

In this region about 2.5 million tonnes of bamboo is available (as per survey report by shree S. M. Mahalaha, Chief Executive Officer, Pre-investment survey of forest Resources, Govt of India New Delhi). So, in this region comprising of Assam, Tripura and NEFA States, one lakh tonnes per year bamboo pulp can be obtainable. Suitable location can be Assam.

b) North Himalayan Region

In this region, Himachal Pradesh is very rich in coniferous wood forest (fir and spruce).

Table-1

Composition and Fibre Dimension of some Typical Vegetable Raw Materials.

$\frac{7}{76}$ $\frac{7}{6}$ $\frac{3}{2}$ $\frac{3}{2}$ $\frac{3}{2}$ Fruit Fibre Cotton (Cosipium hirsutum) 2 $22-97$ 18 20 Bast fiber Hemp (Cannabis satiwa) - 5 6 73 22 30 Jute (Corchorus capsularis & C. olitarius) - 12 18 57 2.0 22 Softwood Temperate coniferous woods. 1.0 $26-30$ $10-15$ $40-45$ $ -$ Indian softwoods. 1.0 $28-30$ $9-15$ $39-46$ $2.7-3.6$ $27-52$ Hardwoods Tempe- Me decidorous woods 1.0 $18-25$ $20-25$ $38-49$ $ -$ Indian hardwoods. $0.4-1.8$ $21-28$ $11-20$ $35-45$ $0.7-1.8$ $9-44$ Grass, Bamboo & Reeds Sabai grass (Eucaliopsis binata) 6 22 24 36 2.1 9 Eota reeds (Ochlandra- travancorica) 2.6 27 20 40 4 $-$ Bamboo. $2-4$ $20-32$ $15-26$ $30-40$ $1.4-3.8$ $9-22$ Agricultural residue Sugarcane bagasse. (Saccharun sponta- nium) $2-6$ $18-21$ $28-30$ $32-41$ 1.4 18 Jute stick (C. capsu- laris, C, otilarim & Hibiscus safdarifa $1-2$ $18-21$ $19-25$ $36-39$ $0.6-1.0$ $29-43$ Rice Straw (O		Ash	Proximate Analysis Ash Lignin Hemi Cellu-			Av Dim - length	Average Dimension length Dia-	
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Hibiscus safdarifa 1-2 18-21 19-25 36-39 0.6-1.0 29-43 Rice Straw (Oryza sativa) 15-18 12 24 32 1.1 16 Wheat Straw (Triticum sativa) 7-11 16-18 27-32 31-36 1.1 12	Jute stick (C. capsu- laris, C. otilarim &	•			an a	····		
Rice Straw (Oryza sativa) 15-18 12 24 32 1.1 16 Wheat Straw (Triticum sativa) 7-11 16-18 27-32 31-36 1.1 12	Hibiscus safdarifa	1–2	18-21	19–25	36-39	0.6–1.0	29-43	
Wheat Straw (Triticum sativa) 7-11 16-18 27-32 31-36 1.1 12	Rice Straw (Oryza sativa)	15-18	12	24	··· 32	1.1	16	
	Wheat Straw (Triticum sativa)	7-11	16–18	27-32	31-36	1.1	12	

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In Himachal 4.5 lakh tonnes of coniferous wood with a computed annual increment of 4.6 Tonnes of fir and spruce per year. A Mother pulp mill at a suitable place in Himachal Pradesh would be most appropriate to get long fibred coniferous wood pulp for mini plants. Similarly Jammu & Kashmir is also well suited for establishing Mother pulp Mill as pine wood approximately 5.97 lakh tonnes is available annually.

Project Brief for 10 T.P.D. Kraft & Allied Mini Paper Project based upon Agricultural Residues Total Effective Production-3,000 Tonnes (Annual)

Product-mix

a)	Kraft Pa	per	1,800
		Tonne	s/annum.
b)	Packing a	& Wrapping	
	paper		600
c)	Poster &	Tonne Allied pap Tonne	s/annum. er 600 s/annum.

Raw Material Used

Straw Pulp	. 55%
Gunny cuttings/Hemp	
rope	35%
Waste paper	10%

Construction period

SI. N	o. Particulars	.1	2	3	4
1,	Chemical used as NaOH%	5.0	6.0	8.0	10.0
2.	Bath Ratio	1:5.0	1:5.0	1:5.0	1:5.0
3.	Cooking temperature °C	140	140	140	140
4.	Cooking time Hrs. (it includes 30 Mts. for raising the temp. to 140°C.)	2.5	2.5	2.5	2.5
5.	Yield	%65.2	62.0	59.0	54.5
6.	K. No.	34,3	30.8	24.0	17.0
7.	Strength Properties evaluated at 40° SR.		e e		e titi N
	I. Burst factor	101	100	/1.4	10.8
	II. Breaking Length Mtrs.	2550	2110	2760	2750
	III. Tear factor	37	32	37	31
•	IV. Double Folds Nos.	2	3	2	2
8.	Bleaching				
	I. Hypo added %	_	8.0	12.0	8.0
	II. Retention time Hrs.	·	1.5	1.5	1.5
	III. Brightness %	<u> </u>	35.0	56 0	60.0
	IV. Burst factor			· · ·	13.6
	V. Breaking length Mtrs.	· ·	. .		2750
	VI. Tear factor	<u> </u>			31
	VII. Double folds	· ·	_ :		2

Table-II

Table-III Characteristics of 'Pulps' from Hard Wood by Cold Soda and other Processes

Time span for project completion 24 Month Water' Water Requirement— 99 m ³ /hr.		Soda and other Processes					
		Process	Kraft	Nssc	Cold Soda	Ground Wood	
		1. Yield %	45	65-85	85-90	90	
		2. Brightness %	65	75	75	70	
Power		3. Opacity	75	80	80	94	
Demos en en est		4. Tear	90	75	65	10	
Power consumption		5. Burst	60	25	20	5	
per tonne of finished product	2110 KWH.	6. Power requirem per ton of Pulps (H.P.)	ent s 15–25	3060	5 0–60	70	

 $\sim 1/2$

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Steam

Steam requirement-7 Tonnes per tonne of paper produced. Man-power Total — 142

Capital Cost	Rs.
1. Land, site prepara-	
tion, boundary roa-	
- ds, sewers, etc.	7,13,000
2. Factory Building	5,85,000
3. Ancillary Buildings	· · ·
and Civil works	6,82,200
4. Plant & Machinery	41,92,000
5. Initial spares	50,000
6. Vehicles etc.	50,000
7. Electrics	7,00,000
8. Services and utilitie	s 8,50,000
9. Office equipment,	
furniture etc.	40,000
10. Contingency and	
escalation	7,86,000
11. Engg. and consul-	
tancy charges	4,46,800
12. Mortgage expenses	1,94,000
13. Pre-operative and	
start-up expenses	3,46,000
14. Preliminary and	
capital issue expense	es 2,59,000
15. Interest during	
construction period	5,27,000
16. Margin Money	E 86 000
for working capital	
Total	1.10.00.000

Role	of	Cons	sultants	s For	Inst	lla-
tion	of	Mini	Paper	Proje	ect 🐰	

The consultant can provide an entrepreneur complete expertise from 'Preparation of Feasibility Report to commissioning of the plant for manufacture of all qualities of paper and Board in the production range from 5 T.P.D. to 30 T. P. D. based upon agricultural fibres e. g. straw, Bagasse, jute and Hemp waste. He helps the client in every way to get loans from financial Institutions and getting assistance from state Industrial Devt. Corporation with regard to power, water supply and effluent disposal.

CONCLUSIONS

(1) Mini paper plants should be established in all the places of our country where the Agricultural Fibres, are available in sufficient quantities to run the proposed paper project.

(2) By improving the present day pulping technique and utilizing high yield pulping-methods e. g. cold soda, semi chemical and Mechano chemical process higher yield and better runability on the machine is attainable of the pulps from Agricultural fibers.

(3) The erection of 'Mother pulp Mills' can boost up production both at the mini paper plants as well as in Big paper plants which

would ultimately help us a great deal in removing the present day paper shortage.

(4) For successful Implementation of the Mini paper projects the help of experienced and qualified consultants and planning engineers, should be taken.

Acknowledgement

The author wishes to express his gratitude to Mr. A. N. Naik, Director ATKINS DAS PRIVA-TE LIMITED, planning Engineering & Management Consultants Calcutta for allowing me to publish this article.

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