

Experience in a recent rebuild of a fine paper machine from 30 to 50 TPD using agricultural residue pulp as a chief constituent

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ABSTRACT

The continued growth resulting into capacity expansion would warrant substantial modernisation of existing mills. Modernisation and expansion by re-engineering and utilisation of existing infrastructure and use of as much existing plant and machinery would be one of the economic routes in expansion of capacity. The paper machine is one of the areas, the rebuild of which invariably leads to high productivity and also resulting into per tonne improvement in energy consumption, steam consumption and manpower cost. Until paper machine is grossly underdesigned or has uneconomic imbalances, most of the machines comfortably lend to a suitable rebuild for higher production. The per tonne investment of the rebuild in a medium sized mill would require an investment of Rs 10,000 to Rs. 15,000 as against a fresh investment of Rs. 25,000 to Rs. 30,000, particularly in the case of agricultural residues as fibrous raw material

This paper describes the experience and case history of one such Modification recently executed as Phase-I of the ongoing expansion of the group.

This paper deals with a case history of a rebuilding of paper machine in addition to associated facilities of pulping, stock preparation and offsite facility for optimum productivity and economy.

In most of the cases, the paper machine output is restricted for a certain capacity and production efficiency due to limitation/constraints in some sections of the machine while still having potential of high production subject to elimination of these limitations. These limitations could be wire part, press part or dryer part. At times, this situation is only limited to the approach flow system, vacuum system or the steam and condensate system which are found imbalanced.

Thus the rebuilding of paper machine requires a careful study to identify portions/sections of the total system including paper machine in order to uptodate technology concept to achieve higher output and improve operational parameters resulting into consi-

derable savings in form of energy, water manpower etc.

The experience of various rebuilds indicates that the pay back period of the investment can be anywhere in the range of 2 to 4 years by way of higher sales realisation, lower input cost of utilities, reduced fixed overheads on higher production etc.

There may be exceptions where the investment on rebuilding does not result into economical improvement which may be due to misplanning or proper engineering input and misplaced choice of plant and machinery. A rebuild exercise, therefore, can be considered as technically sensitive and can take substantial time and efforts in stabilising the productivity, thus requiring

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utmost patience on the part of entrepreneur as well as supporting personnel.

Thus, having given a thought to consider the rebuilding of paper machine the following procedure was adopted for achieving the objectives :

- Paper machine capacity was technically audited to work out the speedwise as well as designwise capacity based on raw material being processed and pulp furnish and type of paper being produced.
- With the existing conditions various bottlenecks were identified and listed out for improvement.
- It is thus possible to prepare a balancing scheme on the basis of above mentioned studies.
- Preparation of list of additional equipment required and existing which can be repaired as well as part changing of the existing equipment.
- Study of the improvement in process technology as far as practicable.
- Cost estimation to be prepared for the balancing scheme as well as for improving the process technology.
- The computation of payback period is then done on the projected inputs with regard to utilities as well as other inputs, considering 90% capacity utilisation, while keeping in view the capacity utilisation in excess of 100%.
- The resultant picture helps taking investment decision and an action plan and help preparing implementation schedule.

A CASE STUDY

In northern part of our country, the management of one of the medium scale paper mill alongwith their consultants conceived the idea of rebuilding the paper machine having following parameters :

1. Product : Writing/Printing Paper
2. Substance range : 45 to 80 gm/m²
3. Furnish : — 80% short fibre
— 15% long fibre
— 5% waste paper

4. Deckle : 2850mm at pope
5. operating speed : Maximum 180 m/min.
6. Installed capacity : 30 TPD
7. Achieved capacity : 30 TPD

An assessment of the paper machine revealed that the machine has following capacities :

1. Speedwise : 30 TPD
2. Dryingwise : 45 TPD

Following limitations were also identified which required to be balanced in order to achieve the production of 50 TPD ;

1. Headbox limited to 200m/min speed
2. Approach flow system limited to 30 TPD
3. Vacuum pumps capacity inadequate
4. Press part leaving moisture 63% etc.

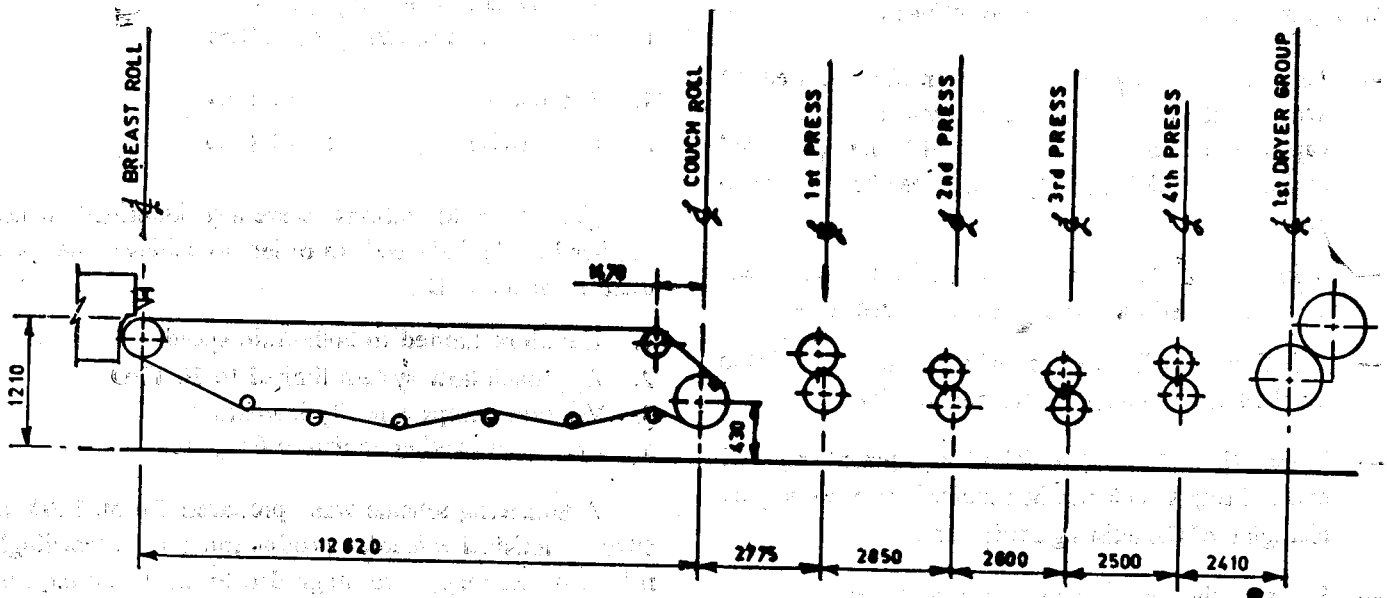
A balancing scheme was prepared for 50 TPD at 50 gsm finished saleable production and accordingly following sections were upgraded to meet the requirement :

1. Approach flow system
2. Wire drainage elements
3. Convert I press to double felted
4. Convert II press to blind drilled high nip load press.
5. Convert III press to inverse blind drilled press.
6. Addition of a group of 40 Nos. drying cylinders
7. Vacuum capacity augmented
8. Steam & Condensate system converted to closed cascading.
9. Calender stack replacement with new stack.
10. Introduction of PV System etc.
11. Dryer bearing changed to roller bearing

The above balancing scheme got sub-divided in two alternatives:

- a. By incorporating close draw by Suction pick-up roll followed by press part.
- b. By incorporating open draw with 3 straight through presses.

The major requirements of rebuilding are detailed through the enclosed 4 Nos. drawings.



CONFIGURATION OF PAPER MACHINE BEFORE REBUILD

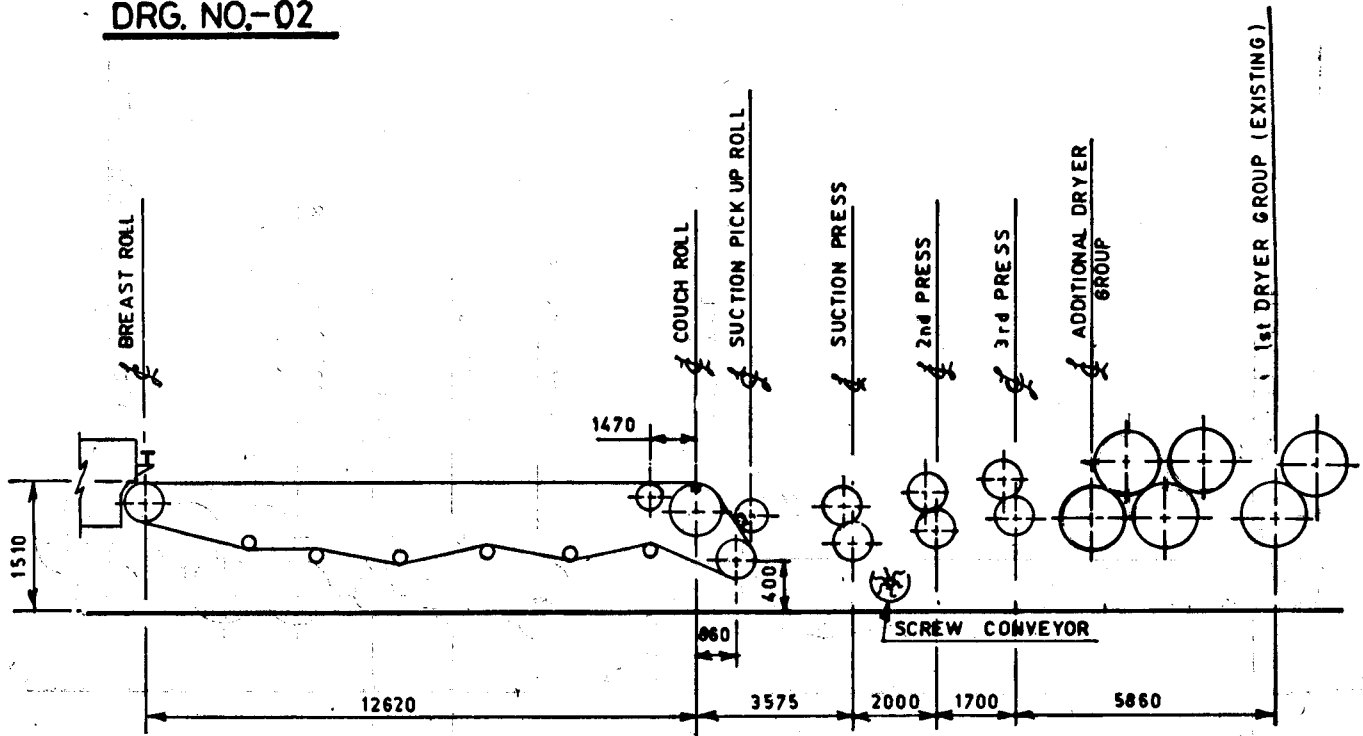
— Drawing No. 1 exhibits the configuration of Paper machine before rebuild. There was a clear space of about 10M between wire and dryer part in which the rebuilding of Press part was conceived.

A detailed cost sheet for both the alternatives was worked out for the investment decision. The estimated cost of alternative—I worked out to Rs. 550 lakhs while alternative—II worked out to Rs. 450 lakhs, which is inclusive of the balancing cost of pulp mill and boiler etc. Out of this cost, the paper machine rebuilding component had been Rs. 310 and 210 lakhs respectively. It was also assessed that the pay back period for alternative—I would be 4 years while for alternative—II would be 3 years on 90% capacity utilisation after the proposed rebuild. The higher pay back period for alternative—I, which is more capital

intensive, is carrying the same efficiency factor as Case II which is distortion as it is expected that Case—I rebuild would operate more trouble free with higher operating efficiency and productivity which would have resulted in lower pay back period.

The return on capital employed for alternative-II worked out to 35% per annum and details are given in the enclosed Annexure titled 'Profitability Statement'.

The investment decision in favour of the Alternative—I was not taken in view of the high investment



CONFIGURATION OF PAPER MACHINE PROPOSED. (ALTERNATIVE -I)

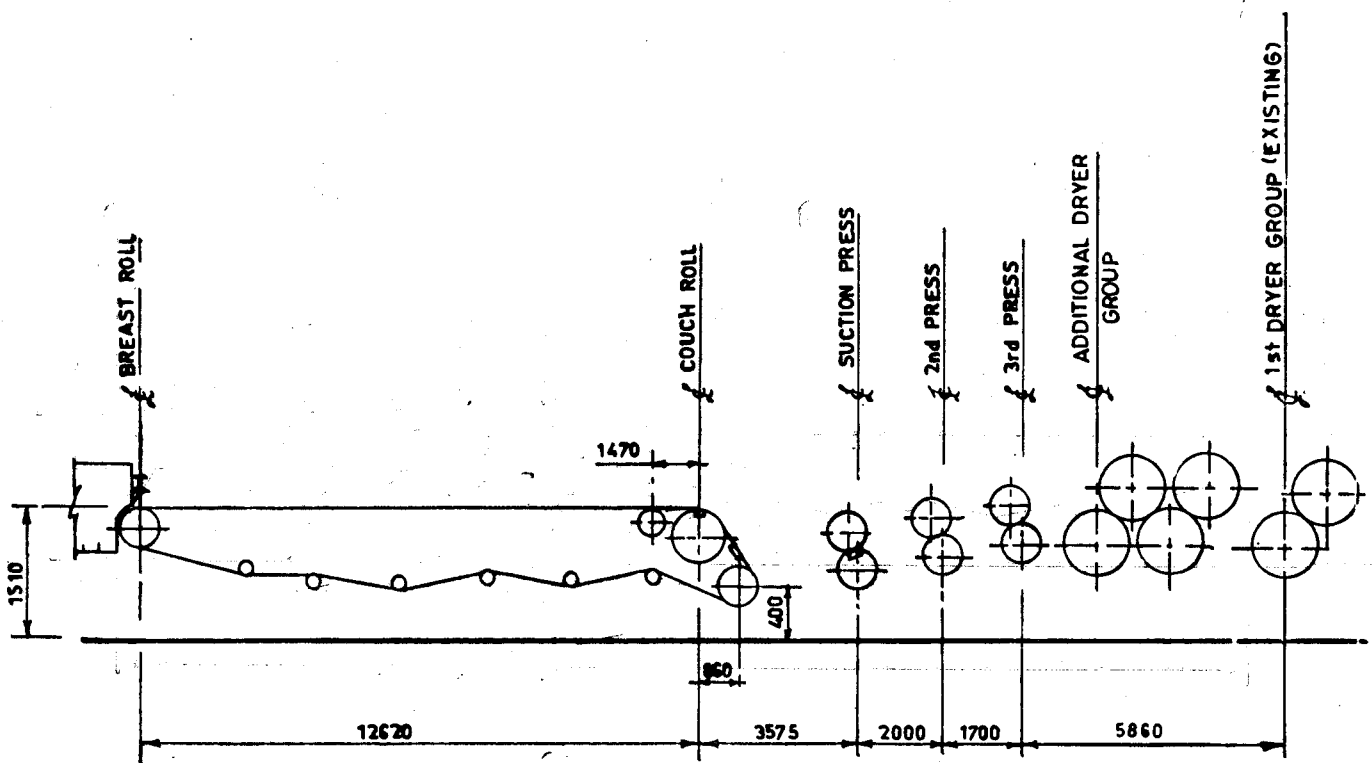
— Drawing No. 2 exhibits the configuration of paper machine proposed (Alternative—I). Suction Pick-up roll and 3 Nos. new presses and a group of 4 Nos. paper dryers are added. It will be interesting to note that a screw conveyor has been considered to install for handling the wet broke (full width) as it was not possible to extend the existing couch pit.

and possible limitations of the machine actually, responding to such a modification. The consultants' foreign counterparts also concurred for this alternative. Finally, alternative—II was selected with an additional provision to incorporate close draw by adding a suction pick-up roll at a later date conveniently, involving a limited investment.

An action plan to implement the project was drawn, which could be implemented five months behind

the schedule for the reasons beyond entrepreneurs' control.

The annual shut of the mill was planned to overlap the required shut of 21 days to implement the rebuild proposal. In spite of the best efforts on the part of all concerned the shut period got extended to 32 days. It will be worth mentioning that apart from paper machine rebuild, the mill also undertook balancing and expansion programme for the pulp mill as well as Boiler House.



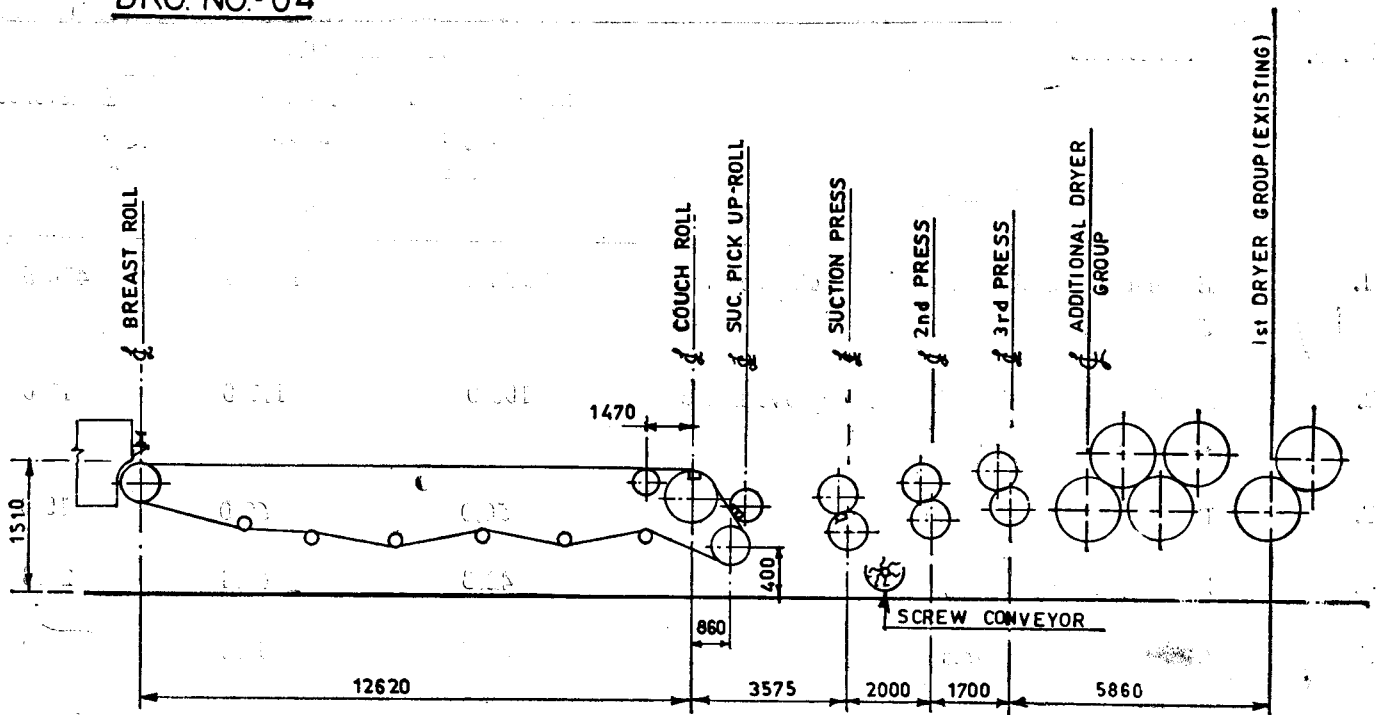
CONFIGURATION OF PAPER MACHINE PROPOSED. ALTERNATIVE-II

— Drawing No 3 exhibits the configuration of paper machine proposed (Alternative—II). This alternative is similar to that of Alternative—I except the suction pick-up roll and screw conveyor are not considered.

The paper machine was started after the rebuild. For a couple of months the machine faced lot of teething troubles resulting into higher stoppage time. There were instances when newly added felt rolls gave way, the setting of new configuration also required a few adjustments and refinements in alignments. As of now, the utilization on enhanced capacity has been achieved to the tune of 75%, but the improved capacity utilisation is expected to achieve in very near future.

The paper machine rebuilding cost reveals that the project had an overrun by 16%.

In a rebuilt like this some amount of constrain is experienced and should be accounted for the manpower to get accustomed of the increased speed and changed configuration and sophistication of the “state of the art” of plant & machinery.



CONFIGURATION OF PAPER MACHINE PROPOSED (ALTERNATIVE-II)

— Drawing No. 4 exhibits the configuration of paper machine proposed Alternative—II to be modified at a later date. Here the suction pick-up roll and screw conveyor shall be added.

To conclude, it may be summed up that India is coming of an age when such modernizations and rebuilds of paper mills in conjunction with indigenous machinery suppliers at best resorting to some back up

assistance of designing and import of critical equipment such as Suction rolls, Kuster rolls, Doctor holders etc. which are so far not manufactured indigeously, could be undertaken successfully.

PROFITABILITY STATEMENT

S. No.	Particulars	Amount (Rs. in lakhs)		
		Before rebuild Capacity : 9900 TPA	After rebuild at 90% cap. utilisation (14850 TPA)	Difference
1.	Estimated cost of Raw material, chemicals & utilities.	984.4	1455.0	470.6
2.	Salaries & wages including factory overheads & admn. overheads	100.0	117.0	17.0
3.	Repairs & Maintenance	50.0	60.0	10.0
4.	Packing & Forwarding	42.3	67.1	24.8
5.	Consumables & Stores	40.5	59.4	18.9
6.	Total cost of Sales	1217.2	1758.5	541.3
7.	Sales realisation (Nett)	1386.0	2175.7	789.7
8.	Gross profit before interest & depreciation	168.8	417.2	248.4
9.	Financial Expenses :			
9.1	Interest on term loan of Rs. 300 lacs @ 15%			45.0
9.2	Interest on working capital loan of Rs. 85 lacs @ 16.5 %			14.0
	Sub total :			59.0
10.	Depreciation @ 7% on rebuild cost			31.5
11.	Profit after interest, but before depreciation			189.4
12.	Profit after interest and depreciation			157.9
13.	Return on capital employed			35%