Co-Generation Using Rice Husk in ABC Paper Punjab

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ABSTRACT

ABC Paper is utilizing Rice Husk for power generation and operating one 1.5 MW steam turbine fed by superheated steam, produced by FBC boiler. The turbine started after few modifications in boiler. Turbine was lying shut for steam and other related problems, now this turbine is giving a net profit of Rs. 108.96 lacs/year. At present the Project for the installation of 2x3 MW TG with 2 Nos. AFBC Boiler, capacity 26 TPH each at 34 kg/cm² is under progress. Net profit of this power plant after commissioning is estimated to be Rs. 350 lacs per annum and also ABC Paper will be self - sufficient in power sector independent of grid power from PSEB.

INTRODUCTION

The present power scenario has put the paper industry in a tough state being it a power intensive industry. Therefore, the paper industry is shifting from grid power to other power sources such as co-generation, thermal, captive power, DG sets etc. Also frequent shutdowns and high cost of grid power is one of the main reasons for the high cost of production. These mills pay a lot of attention in reducing energy consumption for the papermaking. Papermaking is a continuous process and high electrical energy intensive Industry. The uninterrupted quality electricity supply is a pre-requisite. Electrical energy consumption varies from 15-25% of the production cost.

In India, quality of grid power suply is subject to various inconsistencies such as sudden breakdown, high voltage fluctuations and unplanned maintenance by the State Electricity Board, interruption due to cyclones and various other failures resulting in loss of productivity of paper plant. On the top of it, electrical generation and supply is always inadequate, enforcing the paper mill to undergo compulsory 'Peak Hour Load' shedding @ 4-4 hours every day. Instead of sanctioned Load of 7.04 MW, only 4.575 MW is allowed to draw during 4 hrs time ie 6.30 to 10.30 PM. Under this dynamics, it is highly essential that the continuous process industry like Pulp & Paper Mill should instal Captive Power Plant to achieve trouble - free continuous operation as well as the upkeepment of various sophisticated electronic equipments.

EXPERIMENTAL

Indian Scenario

Paper Production and electrical energy consumption in India is shown in Table 1.

Table 1

Break Up of Capacity/ size of Units	(in million tonnes)
Large & Medium Units (above 100 tonnes/day)	2.097
Small Units (below 100 tonnes/day)	2.957
	Total 5.054

The electrical energy requirement (estimated) 6000 million kWh

1.5 MW Captive Power Plant

ABC paper had a 1.5 MW Back Pressure-TG set alongwith a 32 Kg/cm², 26 TPH Rice Husk fired boiler before 1996. This TG was running but with following problems:

1. Poor Quality of DM Water
2. Carry over from the steam drum
3. Leakage of Economiser and superheating coils

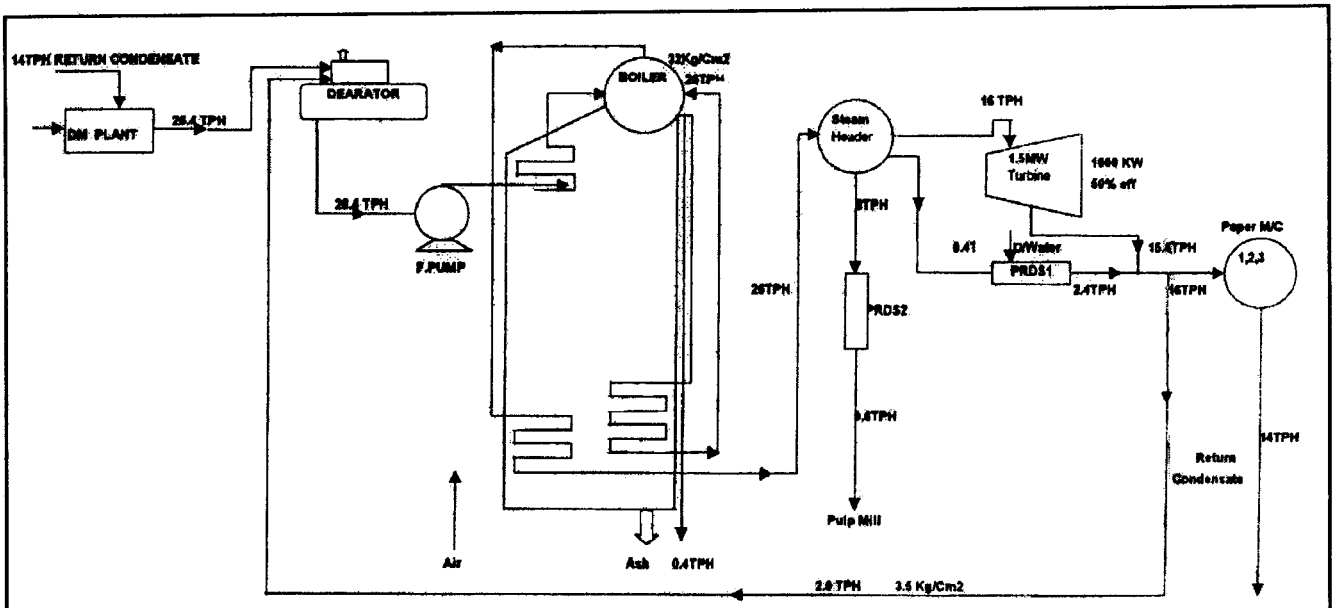

Fig. 1 Flow Diagram of Steam

4. Frequent paper breakages resulting steam venting.

So ultimately the TG was shut down and superheater coils were removed by the end of 1996. But in the year 2000, ABC Paper decided for the revival of the project with certain modifications. For this purpose the services of M/s. DSCL Energy (A division of DCM Shriram Consolidated Ltd., New Delhi) were hired as consultants with a profit sharing scheme.

Table 2 Chronological developments for 1.5 TG

Description	Before 1996	1996-2001 (1.5 MW TG shut)	Oct' 2001
Working Pressure	32 Kg/cm²	25kg/cm²	33.5 kg/cm²
Temperature	400 - 425°C	220°C	400°C
Feed Water Hardness	0.5 - 1 ppm	0.05 ppm	0
Feed Water pH	9.5	8.8 - 9.3	9.5 - 10.2
Condensate pH	7 - 7.2	6.5 - 7.5	7.8 - 8.2
Av. Elect. Load	700 KW	0	1000 KW
Super-heater coil leakage	Too much	-	Nil
Scaling in Turbine	- do -	-	Nil
Scaling in M/C-3 Valve	- do -	Too much	Nil
Economiser Leakage	- do -	Nil	Nil
Instrumentation & Control	Nil, due to which super heated steam temp- 525°C	-	Yes, PRDS
Super heater coil	Yes	Removed	Again put in circuit with modification
Mix Bed	-	-	New M.B. installed for better quality of DM water
SiO_2 & PO_4 testing with spectrophotometer	-	-	Yes, checked & kept under control
Husk/Steam Ratio	3.7	4.5	4.5
Savings- Rs. 108.96 lacs per annum, as detailed below			

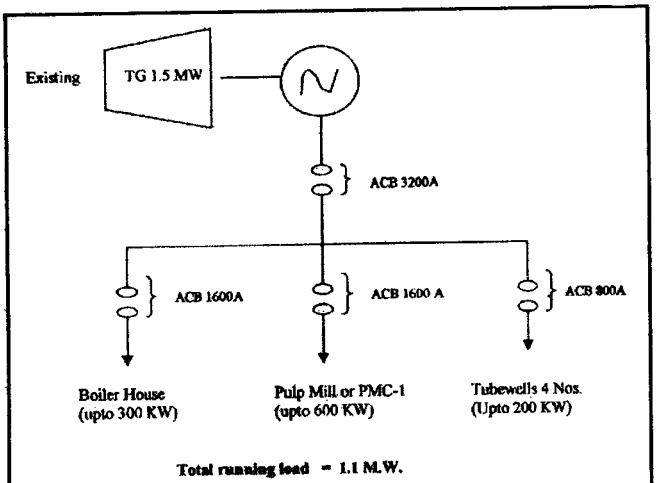

Fig. 2 Electrical distribution system

Following modificatoins were carried out:

i. Quality of DM water was improved by making various modifications in the DM plant. Mixed bed Reactor installed to achieve <0.02 ppm of silica in DM water from <0.5 ppm earlier ie 96% reduction of silica as SiO_2 in steam supplied to steam turbine the details given below.

ii. New superheater coils reinstalled.

iii. Steam drum internals were modified to prevent carry over.

iv. 2 Nos. PRDS (Pressure Reducing and De-superheating Station) were installed with latest instrumentation, which resulted in better control and improved efficiency.

v. And ensured the break-less paper machine operation.

And ultimately in Oct's 2001 this turbine was commissioned successfully with power output of 1000 KW.

Cost of Captive Power Generation

Steam enthalpy at 34 Kg/cm²g, 400°C (Turbine inlet)	= 770 Kcal/kg of steam
Steam enthalpy at 3.5 Kg/cm²g, 250°C (Turbine outlet)	= 707 Kcal/kg
Enthalpy drop in Turbine	= 770-707=Kcal/kg
Steam to Turbine (Metered) as measured in March 2002	= 11500 MT/M
Power generated (Metered - do -	= 405380 kWh
Steam equivalent to enthalpy drop in turbine	= 63x11500/770=941 MT
Cost of STeam- Rs/MT	
GCV of rice husk	= 3400 Kcal/Kg
Average annual rate of rice-husk	= Rs. 1400/- per MT
Boiler efficiency %	= 80
Steam Husk ratio works out to 4.1	
i Fuel Cost 1400/4.1	= Rs. 342/- per tonne

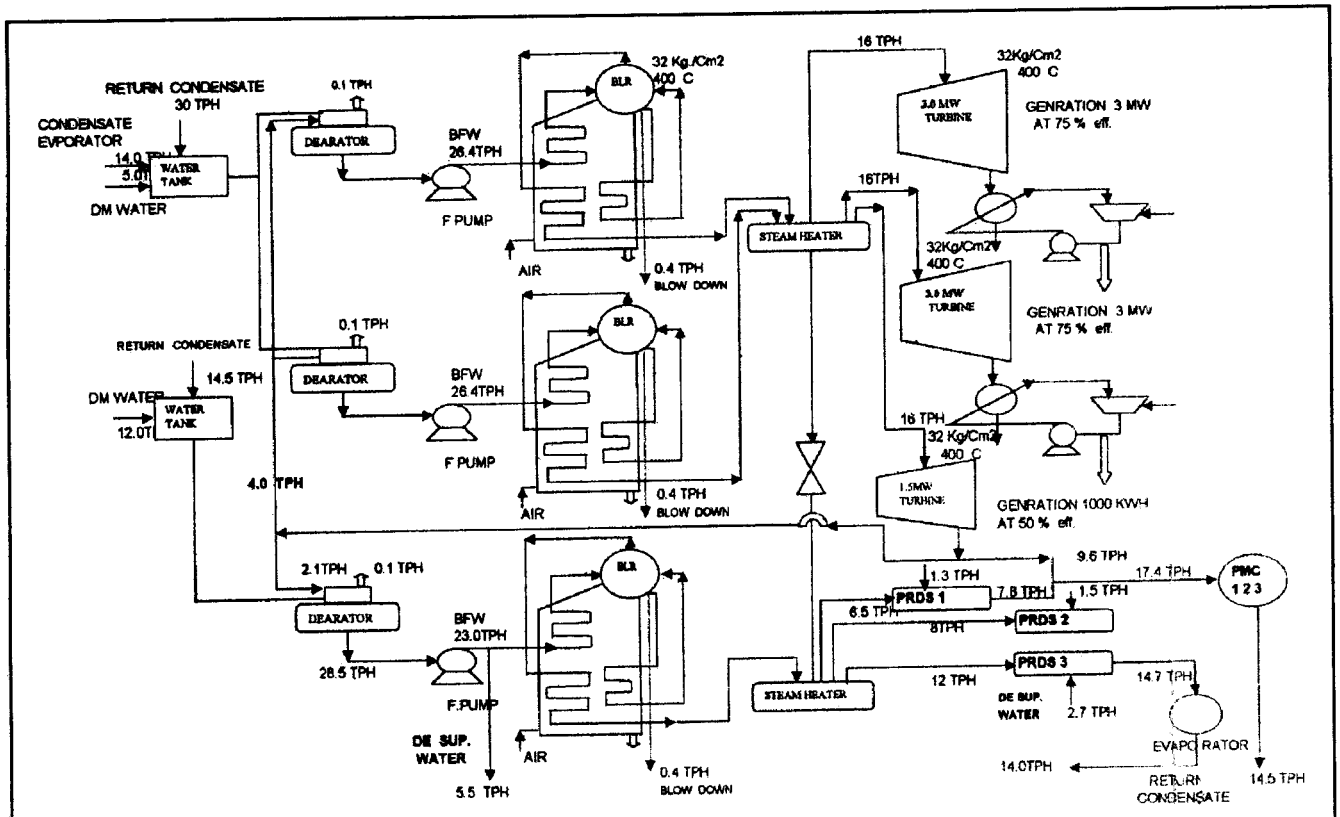

Fig. 3 Proposed Steam Distribution for 2x3 MW Power Plant

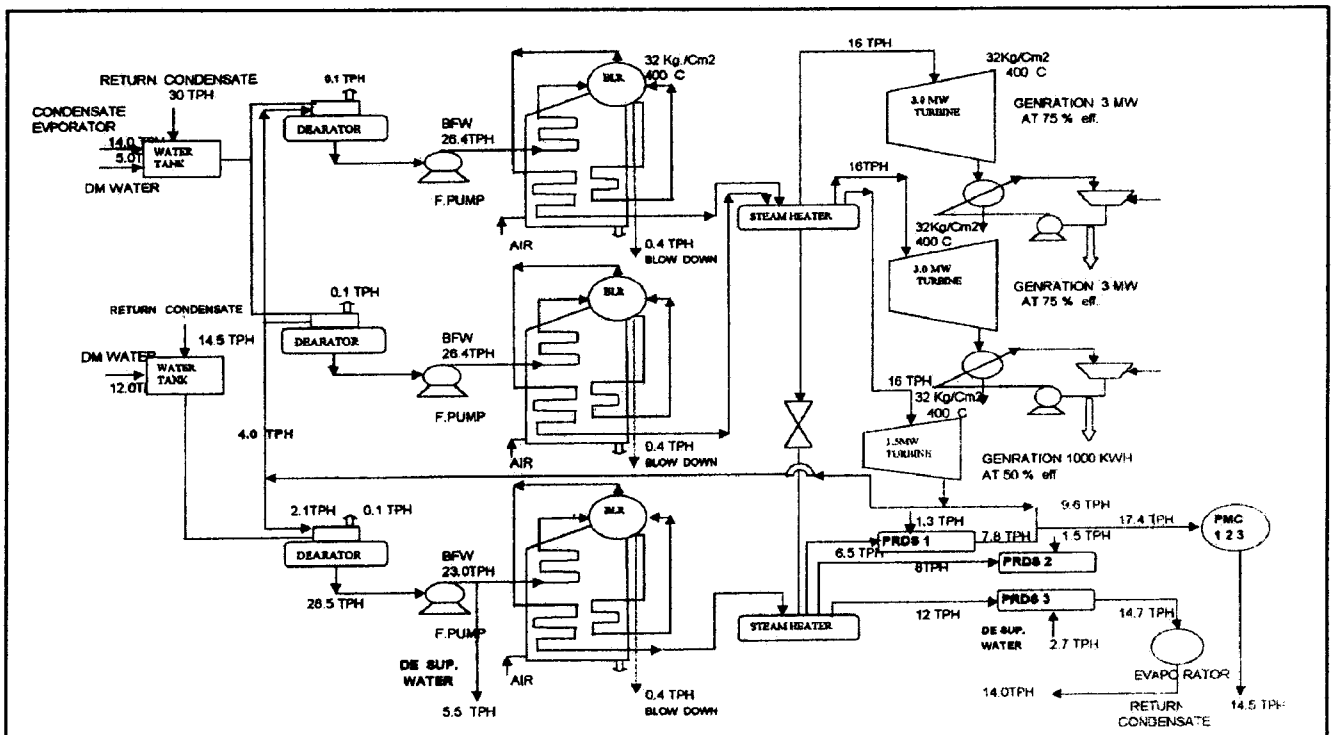

Fig. 4 Proposed Electrical Distribution for 2x3 MW TG

ii Aux. Electrical power cost-10 kWh/T. steam (@ Rs. 3.42 per kWh)	= Rs. 34/- per tonne	
iii Cost of DM/MB water	= Rs. 15/- per tonne	
iv Cost of chemicals (internal treatment)	= Rs. 3/- per tonne	
v Maintenance Cost	= Rs. 6/- per tonne	
vi Operational Cost (Manpower)	= Rs. 10/- per tonne	
vii Daerator steam	= Rs. 27/- per tonne	
Variable Cost	Total = Rs. 437/- per tonne	
Depreciation/Interest Cost	Not considred	
Therefore, steam cost @ Rs. 437/- per MT as per enclosed details) 941x437	= Rs. 4, 11,217/-	
Operation and Maintenance Cost	= Rs. 65,000/-	
Total cost (Rs. 4,11,217+ Rs. 65,000)	= Rs. 4, 76,217/-	
Cost of power generated= 4,76,217/405380	= Rs. 1.18 per Unit	
Cost of PSEB power	= Rs. 3.42 per Unit	
Savings (in March, 2002) Rs. 3.42-Rs.1.18)	= Rs. 2.24x405380 units	
	= Rs. 9.08 lacs per month	
	= Rs. 108.96 lacs/year	

The Schematic Flow diagram of steam and electrical distribution system is explained in (Fig. 1 and 2) respectively, annexed herewith.a
Enthalpy drop in Turbine

RESULTS AND DISCUSSION

Based on this successful achievement, ABC Paper is now going for a 2x3 MW fully condensing turbines with two Nos. of 34 Kgs/cm^2 26 TPH, AFBC boilers based on rice husk. Once again the expert and consultancy services for basic and details engineering, M/s. DSCL have been retained. The proposed and under execution 2x3 MW TG, steam and electrical distribution system is explained in Fig 3 and 4.
The proposed Project 2x3 MW (total 6 MW) in Paper Unit and 1x3 MW in Banaspati Unit, is scheduled to be erected and commissioined by March' 2003.
Total expenditure = 10 Crores
Savings = Rs. 350 lacs p.a. (min)
Pay back = Maximum 2.77 years

CONCLUSION

It may be concluded that by proper investigation and rectification in DM Water Quality, Upgradation of Boiler, improvement in the runnability of Paper Machine and incorporation of Pressure Reducing and Desuperheating System, the trouble free operation of the turbine is ensured and based on that successful results, the Mill is installing 6 MW Power Plant.

ACKNOWLEDGEMENT

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