Co-Generation in Small and Medium Paper Mills

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Power generation is envisaged in the modern paper mills to achieve better fuel and product economy. With in-house power generation, the paper mills can have un-interrupted quality power and achieve continuous operation of the paper machine which ultimately results in high output of the machine.

INTRODUCTION

Co-generation is the concept of producing two forms of energy from one fuel. One of the forms of energy must always be heat and the other is electricity. In a power plant, fuel is burnt in a boiler to generate steam at high pressure. This steam is used to drive a stream turbine, which in turn drives an alternator to produce electricity. The exhaust of turbine is taken to the paper machine for process use.

Since co-generation can meet both power and heat needs thus huge saving for the plant and reduction in emissions of pollutants ultimately reduces the fuel consumption.

The potential of power generation from co-generation in India is fairly large as there are number of paper mills which can work on co-generation mode thus saving the power of nation.

CO-GENERATION IN PAPER MILLS

As everyone is aware, almost all large paper mills have gone for own power generation or are in the way to power generation. However, taking into consideration the price hike of fuel and power, we feel every mill has to go for it's own power generation at least in co-generation mode because the co-generation mode is economical installation and power generated in this mode is a bi-product which is considered to be viable at all times.

Example:

- M/s Jai Durga Paper Mills, Ludhiana
- M/s AST Paper Mills, Ludhiana.

TYPICAL ARRANGEMENT FOR A CO-GENERATION PLANT

Steam at high pressure and temperature above saturation conditions is generated and passed through a back pressure turbine and then further used for the paper machine and deaeration. Dump condenser is recommended to take care of excess steam. In case of load variation on turbine, the dump condesnor with it's circulating pump is automatically come into operation in case of back pressure increases just above the set pressure, i.e., 4 Kg/cm^2. This will eliminate the problem of variation of steam and power load. A typical co-generation arrangement is shown in figure 1.

CO-GENERATION WITH DIFFERENT INLET STEAM PRESSURE

Fig. 2 can be referred as basic guide line for different inlet pressures at turbine for a waste paper based mill with 4 kg/cm^2 steam pressure from process.

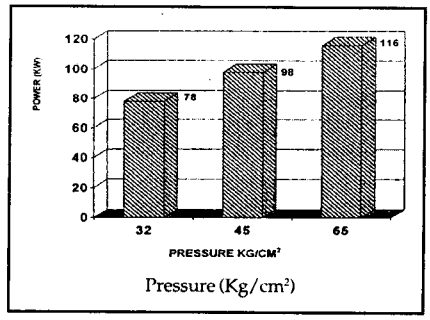

Fig-2: Power Generation in Kw/Ton of Steam at Back Pressure of 4 Kg/cm^2

VIABILITY IN CO-GENERATION

It is imperative to know the viability for additional investment to be done for

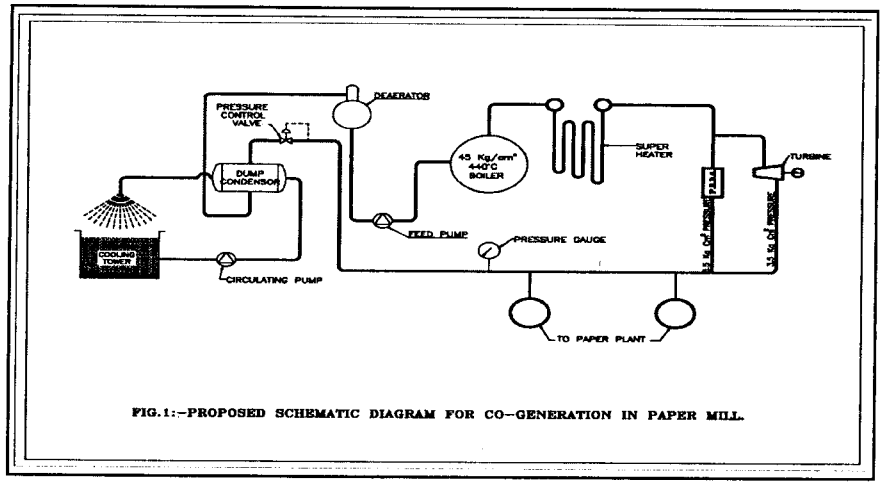

Fig. -1 : Proposed Schematic Diagram for Co-Generation in Paper Mill.

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Table - 3 : Viability of cogeneration in medium & small paper mills

Description	Unit	10.54 Kg/cm²	45 Kg/cm² (440 OC)	65 Kg/cm² (485 OC)
Steam generation	TPH	10	10	10
Fuel		Rice husk	Rice husk	Rice husk
GCV of fuel	Kcal/kg	3200	3200	3200
Fuel consumption	Kg/hr	2340	2610	2680
Additional fuel required at High pressure	Kg/hr	—	270	340
Additional expanses at High pressure (Considering Rice husk @ Rs. 2.00 / kg)	Rs.	—	540	680
Steam available after turbine / Desuperheater at 4.0 Kg/cm² pressure (Saturated)	Kg/hr	—	11000	11000
Steam required in deaerator	Kg/hr	—	1000	1000
Net Steam available for process	Kg/hr	10000	10000	10000
Power generation with 10 TPH steam	KW	—	500	600
Cost of power generation	Rs/KW	—	1.08	1.13
Per unit saving (Considering SEB power at Rs. 4.00/KW)	Rs/KW	—	2.92	2.87
Annual saving (24 Hrs x 330 days)	Rs. in Lacs		115.63	136.40

setting-up of a high pressure boiler with turbine versus normal pressure boiler. Fig. 3 can be referred for assessing the viability on such investment. We can observe that the Co-generation is highly viable in paper mills.

STEPWISE INVESTMENT IN CO-GENERATION

Co-generation is going to be must for all small and medium paper mills in future taking into consideration the increase in fuel price and power shortage. Since co-generation power is bi-product, thus it is always viable.

The co-generation can be done in two stages, i.e., in first stage you buy a Bi-Drum boiler which is convertible to high pressure at later stage. In this process, your cost of boiler will increase in comparison to low pressure boiler but you don't have to invest on foundations, fuel / husk handling system, tank and boiler house at later stage. This proposal is very much viable and has been done by following mills :

Example :

1. Everest Paper Mills Limited, Nepal	15 TPH, 17.5 Kg/cm² convertible to 45 Kg/cm²
2. REI Agro Limited, Bawal	15 TPH, 17.5 Kg/cm² convertible to 45 Kg/cm²
3. Ruchi Soya Ind. Ltd., Indore	15 TPH, 17.5 Kg/cm² convertible to 45 Kg/cm²
4. Ambika Solvex Limited, Nagpur	15 TPH, 17.5 Kg/cm² convertible to 45 Kg/cm²
5. Jindal Solvex Ltd., Kashipur	14 TPH, 17.5 Kg/cm² convertible to 45 Kg/cm²

CONCLUSIONS

You will observe from the above paper that I have tried to give all solutions for a paper mill. Since co-generation is going to be must for the sustainability of the plant in future, either we can go for co-generation in first step as has been done by two paper mills indicated in Para 1 above or it can be done in phases to bifurcate the investment.