

Co-Generation Potential in Sugar Cum Paper Complex

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ABSTRACT

Being an energy intensive sector, Paper Mill consumes considerable quantity of steam, power and water. Low-pressure (say between 3 to 4.5 kg/cm²(g) steam requirement is more than 60% of total steam requirement for a paper mill. Sugar mill also requires low-pressure (say between 1 to 1.5 kg/cm²(g) steam which is about 90% of total steam requirement. This article deals with the potential for installing a centralised Co-generation plant for a paper and sugar complex consisting of Seshasayee Paper and Boards Limited (SPB) and Ponni Sugars (Erode) Limited (Ponni). Two options for Co-generation are presented for the paper cum sugar complex.

INTRODUCTION

Manufacture of paper and sugar requires large quantity of steam at low pressure. They also consume large quantity of power. Hence, if the units manufacturing paper and sugar are located adjacent to each other, there is a good potential to establish a common steam and power system based on Co-Generation concept. This article deals with one such possibility to establish a common steam and power system.

Seshasayee Paper and Boards Limited (SPB) - an outline

SPB was incorporated in the year 1960 with an initial installed capacity of 20,000 t of paper and paperboards per annum. SPB has, over the years, gradually expanded to the present installed capacity level of 1,15,000 tonnes per annum. In view of various expansion and modernisation schemes carried out in different stages, SPB has complex clusters of equipment with five paper machines to produce a wide range of papers viz. printing and writing papers, posters, paper boards, packaging papers, copier paper, coated boards etc. The utilities include the power boilers, turbo-generators, water treatment plant and an effluent treatment system.

Ponni Sugars (Erode) Limited- (Ponni) - An outline

Ponni Sugars & chemicals Limited, a well known sugar mill and a sister company of SPB, was incorporated in the year 1982, with an initial crushing capacity of 1250 t on cane per day. The sugar mill is located adjacent to SPB at Erode. The present crushing capacity is 2500 tcd. Normally sugar mills burn bagasse, in their boilers to meet their steam requirement. However PONNI was designed to burn

a combination of fossil and biofuels, in order to release the entire bagasse generated to SPB, to meet partially the raw material needs of SPB.

Potential for Co-Generation

At present, SPB and PONNI have separate power boilers and Turbo Generator sets to meet their individual requirement of steam and power. In addition PONNI has plans to expand its crushing capacity from the present level of 2500 tcd to 4250 tcd. To meet the additional steam and power demand, New boilers and turbo - generators (TG) sets have to be added. Since both paper and sugar mills need large quantity of steam at low pressures and since SPB and PONNI are located "compound to compound", there seems to be a very good potential to establish a common - Co - Generator facility. However, it shall be kept in mind that while SPB, the paper mill operates almost throughout the year, PONNI the sugar mill operates for about 250 days in a year.

Present Steam and Power Scenario

Seshasayee Paper

SPB's present steam and power requirement and source of generation is as mentioned in Table 1.

Table 1 Steam requirement (in tph)

Steam Required		Steam Source	
Process Steam @ 11 kg/cm ² (g)	40	Ignifluid boiler	37
Process Steam @ 4.5 kg/cm ² (g)	65	AFCBC boiler	49
Condensing steam for power generation	18	Recovery Boiler # 1	16
		Recovery Boiler # 2	21
TOTAL	123	TOTAL	123

About 38% of the total power requirement is met by self generation and the balance power is drawn from the state grid. Table 2.

Table 2 Power required (in MW)

Power Required		Power Source	
Power required	18.00	Steam Turbines	6.83
		Stage Grid	11.17
TOTAL	18.00	TOTAL	18.00

Boilers at SPB

SPB's power block consists of boilers as shown in Table 3.

Table 3 Boiler at SPB

Type	Steam		MCR in tph	Fuel
	Pressure in Kg/cm ² (g)	Temperature in °C		
Spreader Stoker	30	371	25	Coal, Lignite and Bio Fuels
Ignifluid	30	380	40	--- same ---
AFBC	30	390	50	--- same ---
Rec. Boiler # 1	12	185	16	Black Liquor
Rec. Boiler # 2	30	410	23	Black Liquor

Table 4 Turbo generators at SPB

Type	Capacity (MW)
Single extraction (11 kg/cm ² (g) condensing	2.5
Double extraction (11 and 4.5 kg/cm ² (g) condensing	5.0
Back Pressure (4.5 kg/cm ² (g)	3.0

Table 5 Steam requirement in Ponni (in tph)

Steam Required		Steam Source	
Process Steam @ 8 kg/cm ² (g)	6	Spreader stoker	30
Process Steam @ 1 kg/cm ² (g)	47	Ignifluid	23
Steam for power	Nil		
TOTAL	53	TOTAL	53

Table 6 Power requirement in Ponni (in MW)

Steam Required		Steam Source	
Power required	3.80	Steam Turbines	3.80
		State Grid	0.00
TOTAL	3.80	TOTAL	3.80

Turbo Generators at SPB

Power block of SPB consists of turbo - generators as shown in Table 4.

The present steam and power network of SPB is shown in Fig. 1.

Ponni Sugars

Ponni's present steam and power requirement and source of generation is as mentioned in Table 5.

PONNI is self sufficient in power during cane season. During Off- season only PONNI will draw power from state grid Table 6.

Boilers at Ponni

Ponni's power block consists of boilers as shown in Table 7.

Table 7 Boilers at Ponni

Type	Steam		MCR in tph	Fuel
	Pressure in Kg/cm ² (g)	Temperature in °C		
Spreader Stoker	21	340	40	Coal, Lignite and Bio Fuels
Ignifluid	42	410	26	--- same ---

Turbo Generators at Ponni

Power block of PONNI consists of turbo - generators as shown in Table 8.

Table 8 Turbo generators at Ponni

Type	Capacity (MW)
Back Pressure (1 kg/cm ² (g)	1.5
Back Pressure (1 kg/cm ² (g)	3.0

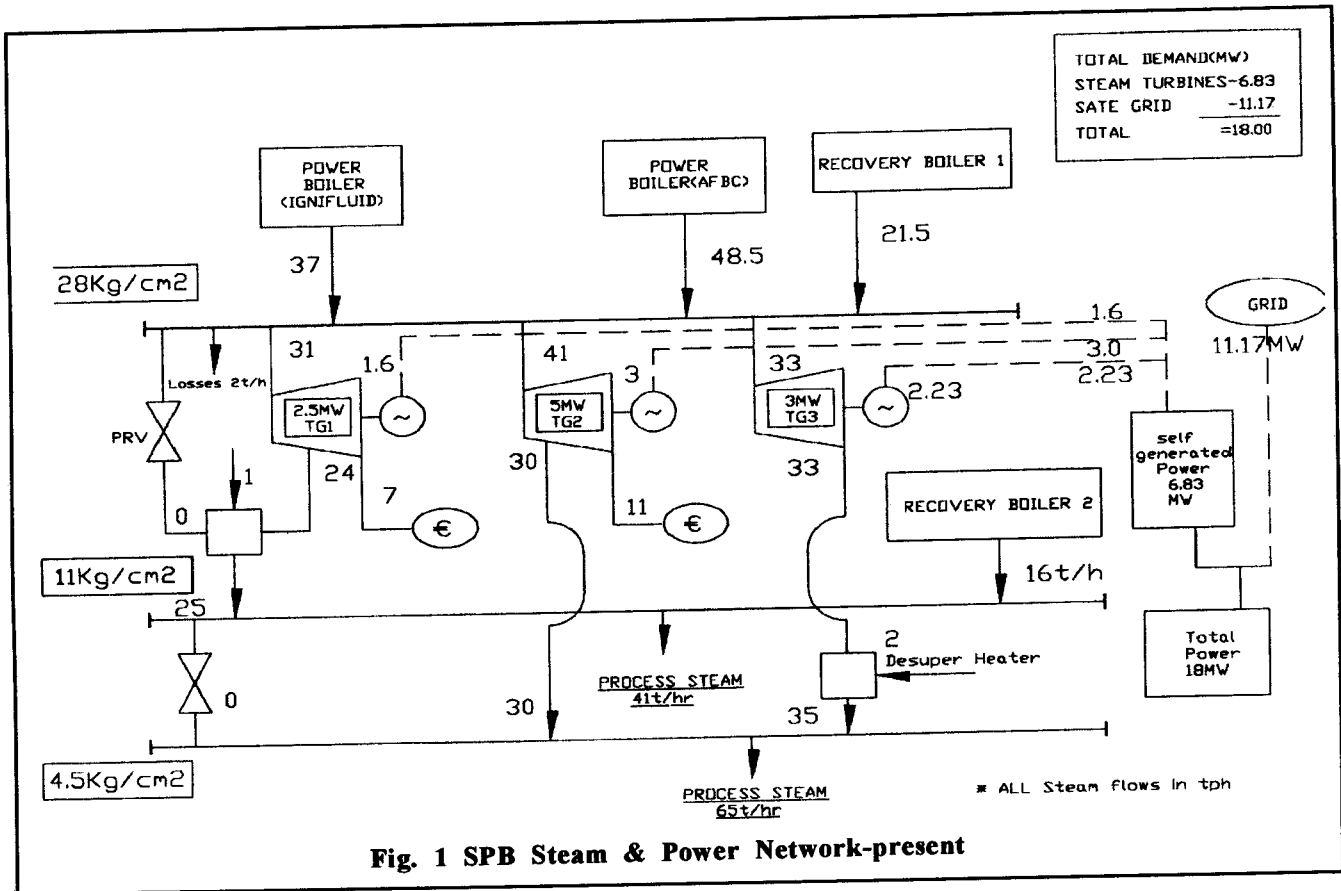


Fig. 1 SPB Steam & Power Network-present

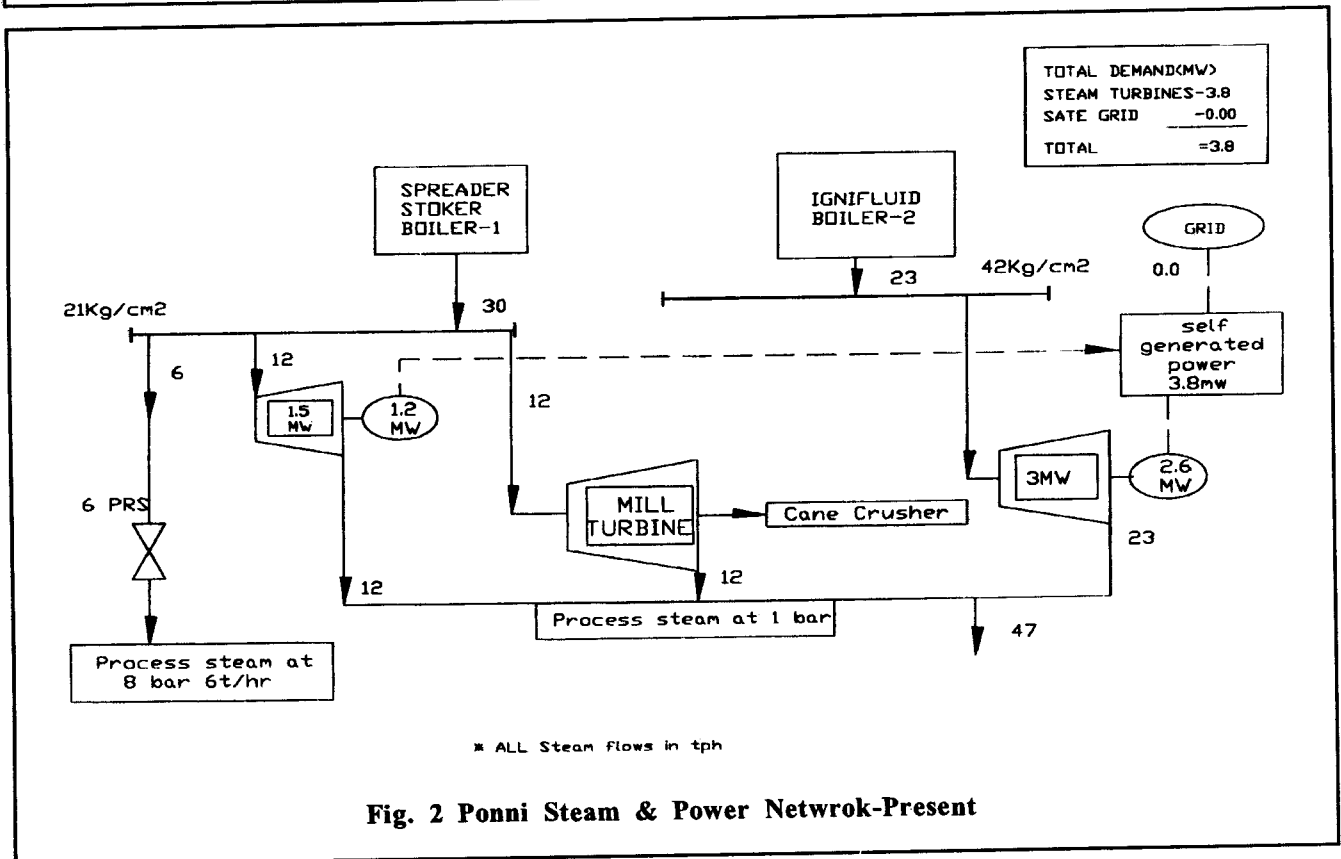


Fig. 2 Ponni Steam & Power Network-Present

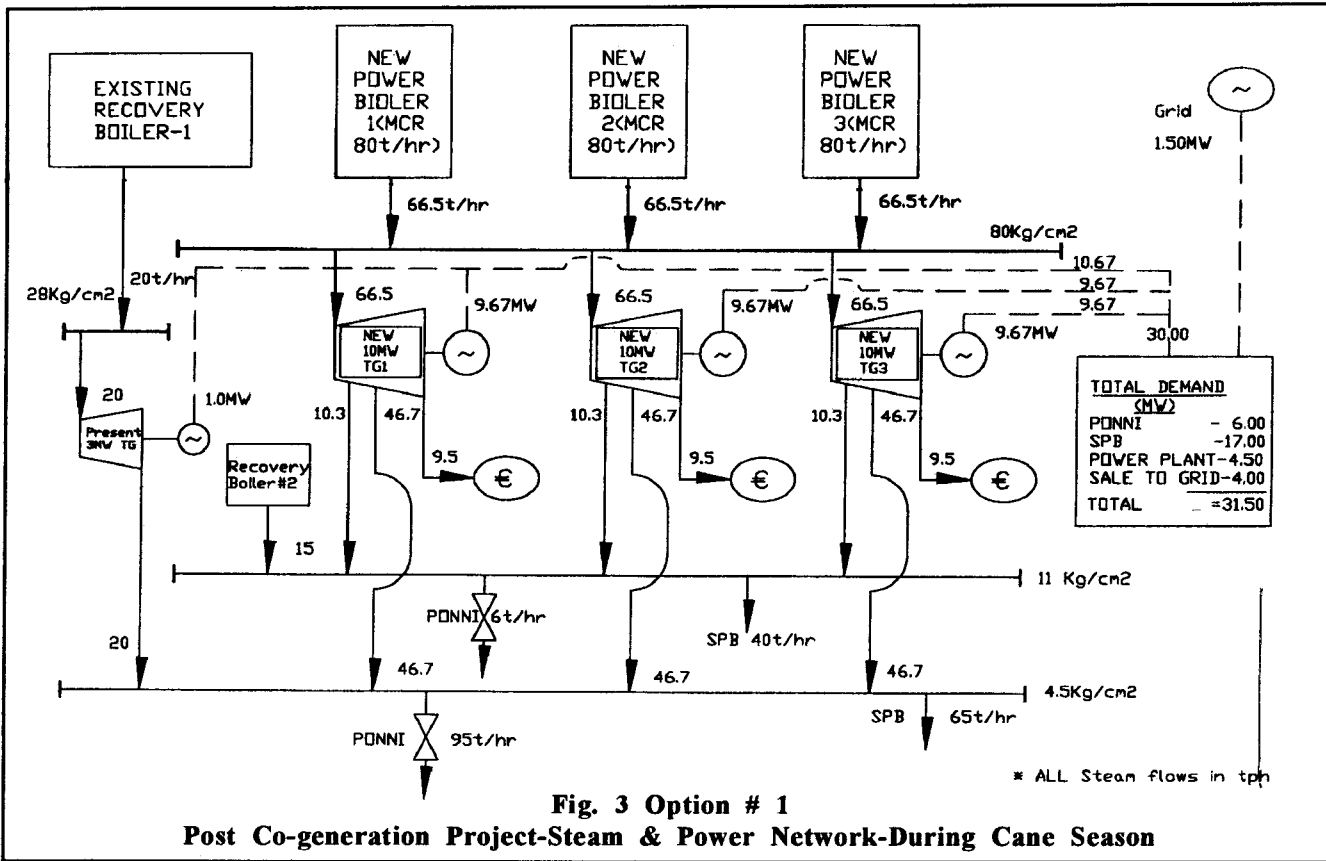


Fig. 3 Option # 1
Post Co-generation Project-Steam & Power Network-During Cane Season

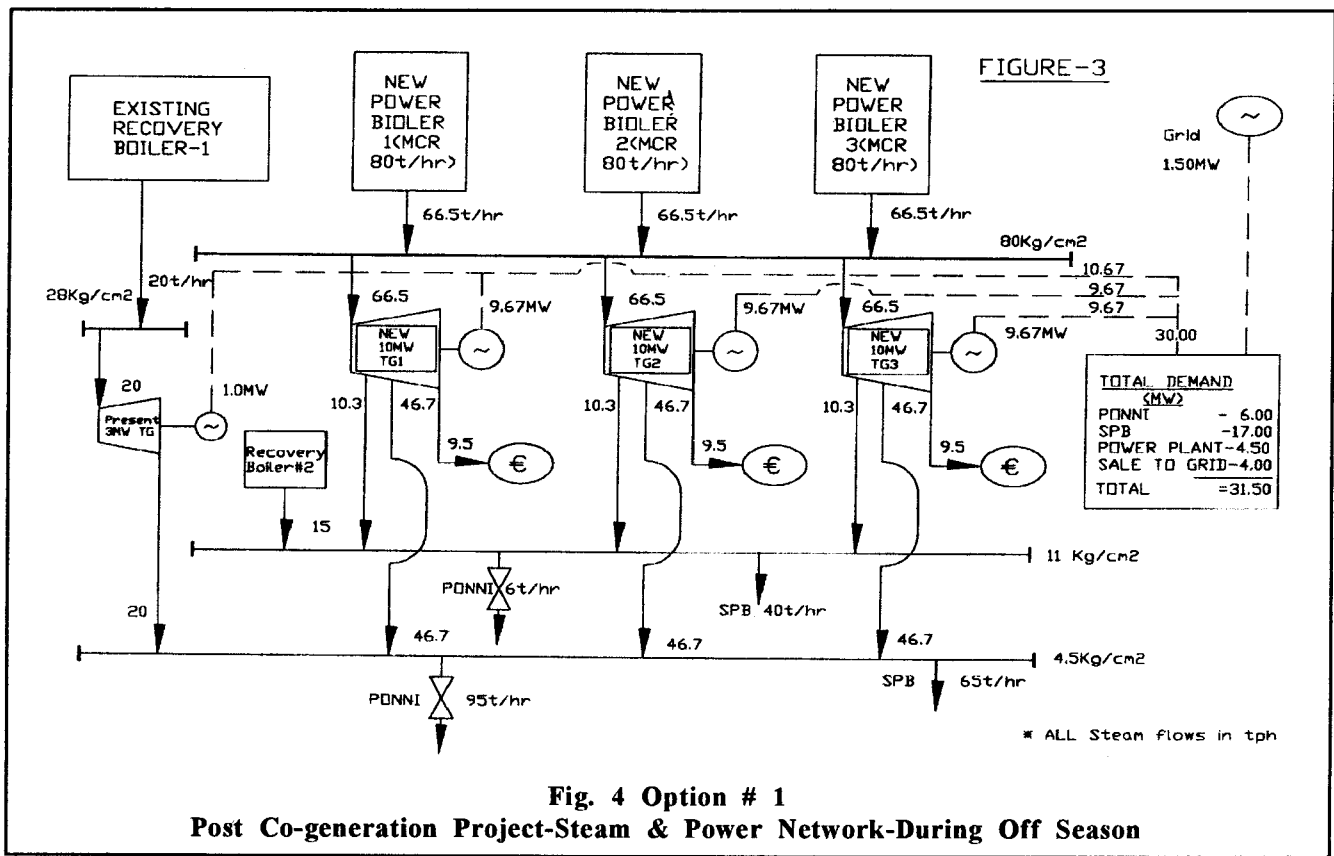
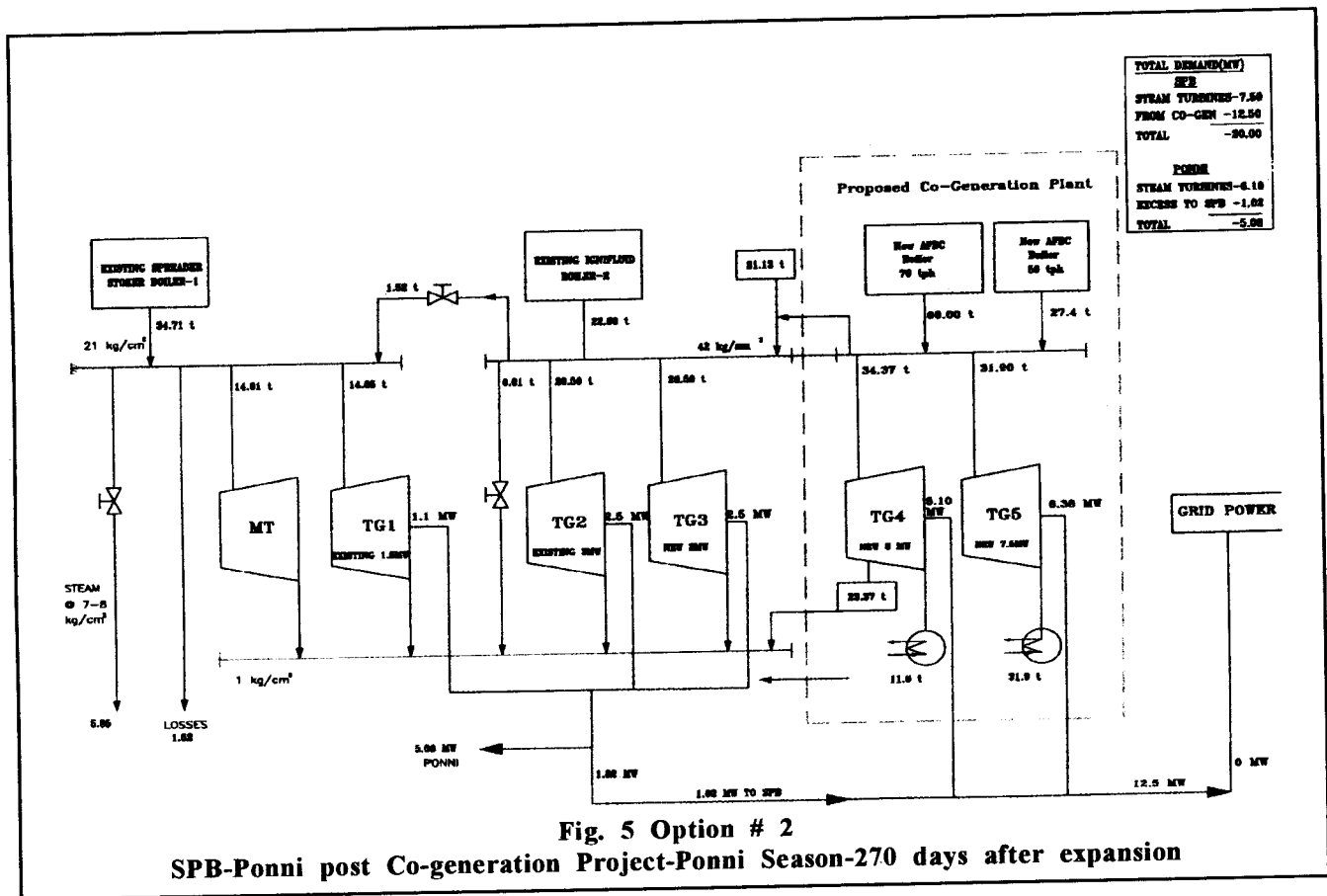


Fig. 4 Option # 1
Post Co-generation Project-Steam & Power Network-During Off Season



The present steam and power network of PONNI is shown in Fig. 2.

Issues for consideration

Paper mill commenced operations during 1962 and the sugar mill was added in 1984. Both paper mill and sugar mill have expanded in stages and hence have many boilers and TG sets of different ratings. Following are the main issues for installing a Co-Generation plant:

- a) Separate operation and maintenance of power block, one at SPB and the other at PONNI.
- b) Separate fuel handling systems, utilities like DM plant, compressor house etc
- c) Dependency on state grid is more. Hence high cost of energy and exposure to grid fluctuations.
- d) Excessive manpower for operation and maintenance
- e) Generation and Distribution losses are high
- f) Present boilers are operating at different and also at low pressures
- g) TG sets are old and hence consuming more specific steam

Objective of new Co-generation project

A Co-Generation plant is under consideration with the following objectives

- 1. Centralised power block with good automation and less manpower
- 2. Overall improvement in efficiency and ease of operation
- 3. Be self sufficient in power and export power to state grid, if available.

Options available for Co-generation

Following are the two options to achieve the objectives Fig. 3-7.

Option# 1: Install a centralised Co-Generation plant with high pressure boilers and Turbo generators with a scope for exportable power to State Grid and dispense with all existing power boilers and TG sets

Option # 2: Install a separate Co-Generation plant to cater only to the need for additional steam and power for the expanded capacity of sugar mill and replacement of State Grid power for paper mill throughout the year.

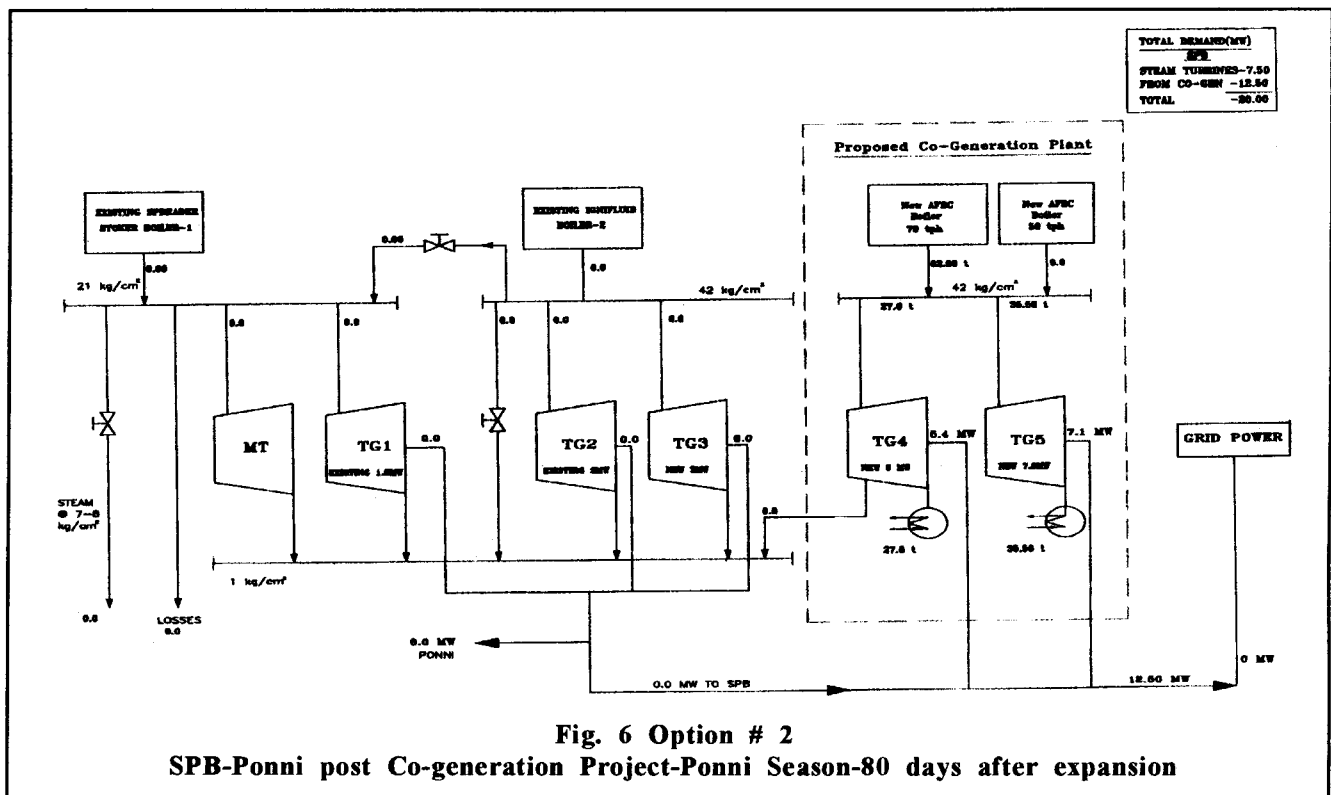


Fig. 6 Option # 2
SPB-Ponni post Co-generation Project-Ponni Season-80 days after expansion

Proposed Co-generation project-Option # 1

The centralised Co-Generation project proposed in this option will have 3 numbers of Fluidised boilers of 80 t/hr capacity each at 84kg/cm² (g) pressure and 500°C and 3 numbers of double extraction cum condensing Turbo Generator sets of 10 MW capacity each with dedicated utilities like Fuel Handling Plant, DM plant, Deaerator, Compressor House etc. with high level of Instrumentation like centralised Distributed Control System (DCS). In this option all the existing power boilers and Turbo-Generators of both SPB and PONNI will be dispensed. The steam and power required for both SPB and PONNI will be supplied from the centralised Co-Generation plant and excess power, if any, can be exported to state power grid. The Co-Generation plant is sized for the present capacity of the paper mill and the proposed expanded capacity of sugar mill.

The steam and power net work during cane season and off - season in this option is shown in Fig # 3.and Fig 4.

The total project cost estimated for this option will be Rs. 1500 million and the savings will be Rs. 360 million per year. The simple-pay back period will be 4.2 years.

Advantages

1. It overcomes all the existing problems mentioned

above in this article.

2. Centralised Co-Gen plant, hence Operation and Maintenance is easy and requires less man power.
3. During cane season as well as during off- Season power can be exported to state grid.
4. Self Sufficient in steam and Power. During Off-season power can be fed to PONNI from this Co-Gen plant, hence dependency on state grid is NIL for both SPB and PONNI
5. No need for additional manpower since existing boilers and turbines will not be used.

Disadvantages

1. High Project Cost.
2. Longer pay back period.

Proposed Co-generation project-Option # 2

The Co-Generation project proposed in this option is sized for the steam and power requirement of expanded portion of sugar mill and the replacement of Grid power for SPB. The new equipment proposed in this option will be over and above the existing facilities, hence all the existing power and steam network system is to be retained. In this option following new equipment will be added.

- A. One number 3 MW back pressure TG

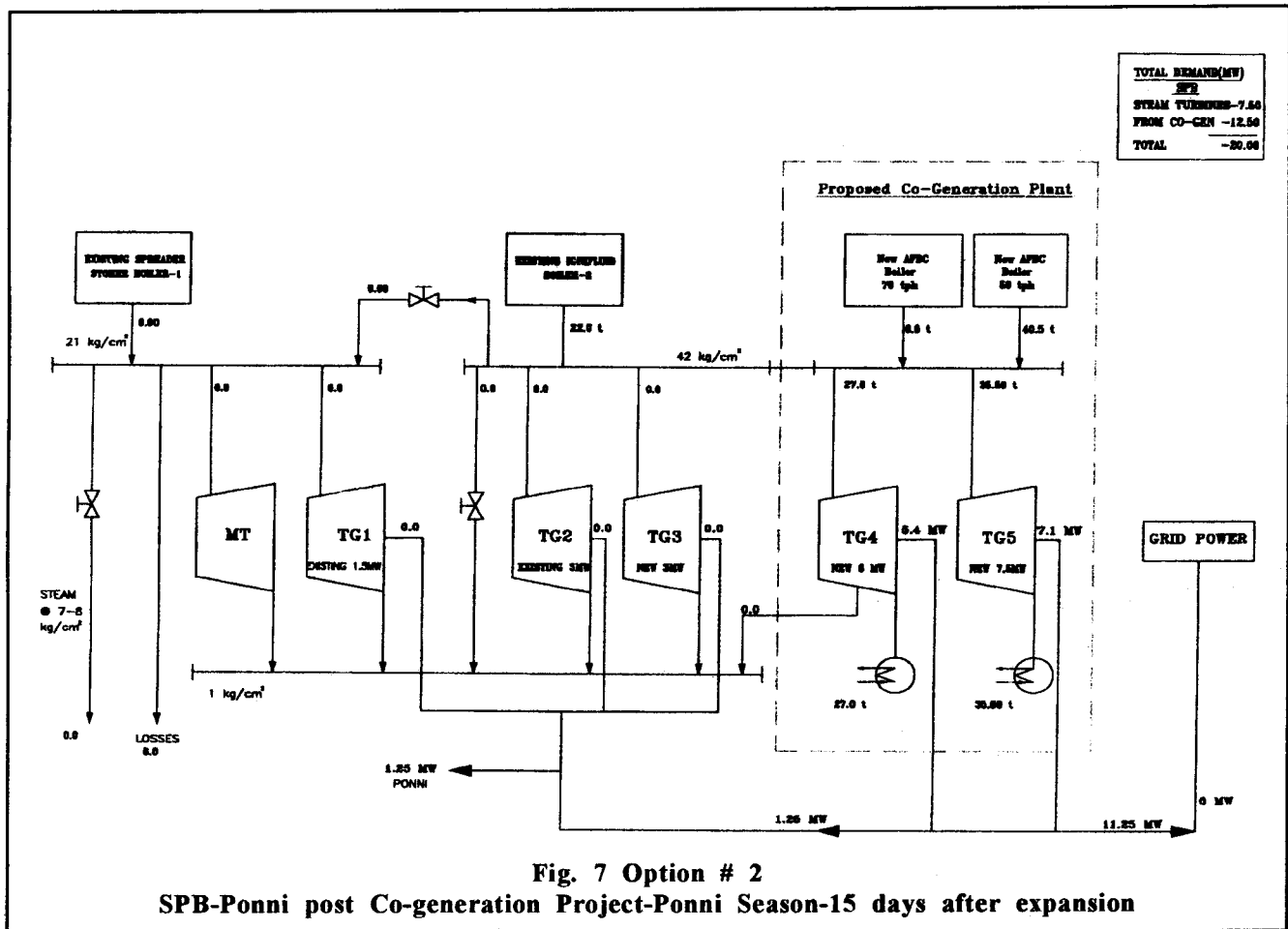


Fig. 7 Option # 2
SPB-Ponni post Co-generation Project-Ponni Season-15 days after expansion

- B. One number 6 MW sigle extraction cum condensing TG
- C. One number 7.5 MW Fully condensing TG.
- D. One number Fluidised bed boiler of 70 tph @ 42 kg/cm²(g) and 410°C.
- E. One number Fluidised bed boiler of 50 tph @ 42 kg/cm²(g) and 410°C.

The total project cost for this option will be Rs. 550 million and the savings will be Rs. 160 million/year. The simple pay back period will be 3.4 years. The steam and power network during cane season and off season in this option is shown in Fig 5, Fig 6 and Fig 7.

Advantages

- 1. Lower Project Cost.
- 2. Shorter Pay back period

Disadvantages

- 1. Steam pressure level is still low at 42 kg/cm²(g) only
- 2. Since the Co-Gen plant is an extension of existing

steam and power network of SPB and PONNI, additional manpower is to be engaged for operation and maintenance

- 3. Power can not be exported to State Grid.
- 4. Specific steam consumption for power generation will be high and as at the present level only.
- 5. Even though state grid power drawal is NIL throughout the year, SPB can not avoid drawal from state grid completely. Minimum contract demand is to be maintained in order to utilise the grid power in case of any problem in the Co-Generation plant.

CONCLUSION

A Paper Cum Sugar Mill Complex is ideal for implementation of Co-Generation project. There seems to be a good potential for installing a centralised steam and power complex with highly automated in efficient high pressure boilers and turbo generator sets.