# The energy synergy in a paper mill

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## IntrOduction :

Energy conservation and co-generation together have synergic effect on the energy scene of a Paper Mill. The energy entensive operations have vast scope of conservation-though curbs on wasteful practices, use of efficient equipment of optimal capacities and introduction of innovative changes to the process elements. Efforts at maximisation of co–generation have further effects on economy in the cost of purchased power and freedom from the vagaries of the Grid Power supply. ITC Bhadrachalam practiced both the concepts thereby minimising the specific energy consumption in their mill.

## Energy Conservation :

The concept of Energy Conservation was built into the culture of ITCBhadrachalam since inception in1979. Simple measures like replacement of higher capacity motors working on low loads, reduction in size and number of pump impellers, improvement in power factor, control of lighting consumption together with process/engineering modifications yielded encouraging results in Energy Saving.

## Co-Generation :

At ITC Bhadrachalam, co-generation meant back pressure generation only since APSEB did not permit of the installation of a condensing turbine initially. The State had surplus power then.

A 5 MW back pressure turbine of BHEL make generated the by- product power reducing steam pressure from 42 ata to 5 ata at the start-up of the Mill in 1979. 2 nos. Spreader stoker coal fired boilers of 27 TPH each together with a Soda-recovery boiler 28 TPH supplied the steam. After an energy conservation study in 1986, it was decided to install a 6o ata, 50 TPH AFBC boiler to meet additional demand for steam, to burn low grade coal effectively and to operate the boiler efficiently. It was also decided to install a 7.5 MW back pressure turbo generator to generate the by product power. While orders for the supply of Boiler and TG were placed simultaneously on ABL and BHEL respectively, commissioning of the boiler lagged the TG by 22 months. During this period, the 7.5 MW TG was operated at the available 42 ata steam to reduce capacity and run in parallel with the 5 MW TG thereby increasing the total by-product power by 20%, Eventually, after the AFBC Boiler was commissioned in November, 1990, the co-generation increased by 50%.

Sparc capacity in Boiler and TGs prompted ITC Bhadrachalam to explore higher usage of LP steam and several measures have been implemented to maximise co-generation.

To make up for the shortfall of power during power cuts/load sheddings by the APSEB, at times generation by venting steam is also resorted to. The vented steam, however, is condensed in an improvised dump condenser to recover the condensate and avoid noise pollution.

## Results :

Recognition of the efforts by IPMA in 1982 for the first time continued unabated, the latest laurels having come from the Department of Power, Ministry of Energy, Government of India in 1991.

Sustained efforts progressively brought down the specific purchased energy consumption year after year to an all time low of 5.7 M K. Cals/Ton of production during the year 1991—92.

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## Case Studies

A few case studies are highlighted below to give a glimpse of the activity at ITC Bhadrachalam in the areas of Energy Conservation and Co-generation.

### Energy Conservation :

CASE 1 : Stopping of one Vacuum Pump without effecting the machine clothing conditioning.

**Status Before Implementation :**

a) Vacuum Pump 11 was operating 3 zone suction boxes. Bleeding of air was practiced to meet operation requirement.

b) Vacuum Pump 9 was connected to both wet press felt boxes and long board felt boxes. The inlet valves of the pump were throttled to maintain required operating parameters. Throttling ranging between 30 to 90%.

**Action Taken :**

After reviewing various operating conditions required, by making certain piping modifications. Vacuum Pump 11 was totally stopped.

**Results :**

Vacuum Pump 11 used to operate for 6000 hours/year and operating load was 80.5 KW.

Units saved = 80 5 × 6000 = 4,83,000/-

Savings Rs = 4,83,000 × 1.71* = Rs. 8.26 Lacs/year

*Unit Cost Rs. 1.71 (APSEB)

CASE 2 : Installation of VFD in place of VFC for Soda Recovery Boiler (SRB) I I D Fan.

**Status Before Implementation :**

SRB I I D. fan was provided with variable speed fluid coupling to vary the fan speed to control furnace draft. The fan motor is 200 KW 1000 rpm.

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|---|---|---|
| Actual running speed of fan | : | 750 RPM |
| Motor load with Fluid coupling | : | 155 KW |

**Action Taken :**

I. D. Fan motor is provided with variable frequency drive and variable speed fluid coupling was eliminated by providing direct coupling.

**Results :**

After installation of VFD

Motor Load : 105 KW

Reduction in load because of the difference in efficiency of variable speed fluid coupling and variable frequency drive.

Energy saved/year : $50 \times 8400$*

= 4,20,000 units

*Running hours of I. D. Fan.

Saving achieved in Rs. = 4,20,000 × 1.71 + = Rs. 7.18 Lacs/year, + unit cost Rs. 1.71 (APSEB)

CASE 3 : Conversion of chain grate fired boiler to AFBC Boiler.

**Status Before Implementation :**

During 1983-84, an old Tri-drum travelling grate fired 20 TPH capacity boiler was purchased and installed to augment steam capacity urgently required to match process requirement, otherwise oil would have been burnt, which is expensive as well as scarce. However with the poor coal quality available the boiler was not in a position to generate more than 50% of its rated capacity. The thermal efficiency of the boiler was of the order of 41%. This situation forced usage of oil fired boiler.

**Action Taken :**

As there was no chance of improving the quality of coal, it was decided to convert the boiler to AFBC system from existing chain grate.

**Results :**

a) The boiler steam generation capacity increased to 22 TPH.

b) The thermal efficiency improved to 75% from 41%,

c) Use of oil fired boiler completely eliminated.

### Co-Generation ;

**CASE I :**

Conversion of MP Steam to LP steam heating for Furnace oil heating.

**Status Before Implementation :**

Furnace oil is used for start/shutdown and load stabilisation in the Soda Recovery Boiler. Furnace oil is actually fired for 4 days/month as average. While firing furnace oil, oil temperature of about 125—130°C

is required, whereas, during the rest of the period oil is heated to maintain 90°C. M. P. Steam was being used to serve the oil heater.

**Action Taken :**

It was decided to use L P Steam instead of M P Steam for oil heating to maintain 90°C, when Furnace Oil is not fired. L P steam piping with valves installed.

**Results ;**

M P Steam consumption before modification: 70 Kg/hr. for 8000 hrs/year

**After Modification :**

L P Steam consumption : 50 Kg/hr. for 7600 hrs/year
M P Steam consumption : 70 Kg/hr. for 400 hrs/year

**Saving ;**

a) Additional units generation by converting M P Steam to L P Steam.
b) Coal saving due to reduction in steam consumption.

CASE 2 :

Use of L P steam instead of MP steam in Maloni Filter.

**Status Before Modification :**

The Maloni filters serve to remove the fibre from the Black Liquor coming from washing street of pulp Mill before going to Evaporator. The filter consists of a rotating drum with wire mesh. The fibre which sticks to the mesh is dislodged with the help of M P Steam. The pressure required to achieve dislodging is less.

**Action Taken :**

M P Steam to filter was stopped and L P steam connecting piping with valves provided.

**Results :**

There was no loss of efficiency of Filters.

| | | |
|---|---|---|
| M P steam consumption | : | 562 Kg/Hr. |
| L P steam consumption (after conversion) | : | 356 Kg/Hr. |

**Savings :**

a) 356 Kg/Hr. steam usage is converted from M P steam to L P Steam giving additional co-generation power.
b) There is a coal saving due to less consumption of L P steam.

CASE : 3

Improvement in Condensate Recovery and Conversion of M P Steam to L P Steam use.

**Status Before Implementation :**

a) M P Steam was being used for Soda Recovery Boiler for Steam Air heater.
b) There was no trap in the condensate line of air preheater, with the result there is an additional consumption of 1.5 TPH of M P steam.
c) The condensate line is connected to Deaerator. The additional consumption of 1.5 TPH did not result in steam wastage, but was resulting in loss of co-generation potential.

**Action Taken :**

a) Installation of Steam Trap in condensate line of steam air preheater.
b) There was no need for any other modification as Deaerator water was already being heated by L P Steam. Line size was checked and found to have adequate capacity to pass additional 1.5 TPH steam.

**Results :**

a) MP Steam consumption before installation of Steam Trap $\rightleftharpoons$ 3.9 TPH
b) MP Steam consumption after installation of Steam Trap = 2.4 TPH

1.5 TPH which was drawn at TG extraction is getting expended to LP stage resulting in additional co-generation.

**Savings :**

The three proposals above have resulted in an additional power generation of 1.5 Lac Units/Year which is equivalent to Rs. 2.57 Lacs (taking purchase unit cost of Rs. 1.71/unit of APSEB).