IPPTA

Silver Jubilee International Seminar & Workshop
Appropriate Technologies For Pulp & Paper Manufacture
In Developing Countries.

New Delhi - 1989

ENERGY CONSERVATON EFFORTS AT PUDUMJEE PULP & PAPER MILLS LTD., PUNE

H. H. Madhani and L. K. Dwivedi
Pudumjee Pulp & Paper Mills Ltd.,
Thergaon, Chinchwad,
Pune 411 033

We manufacture various speciality Papers and our present production level is around the rated capacity of our plant.

By the early eighties, consciousness began to dawn upon us that energy would play a major roll in our costs in the future. This became apparent when we projected increasing energy costs based on available data, besides the fact that our energy inputs are higher than normal due to the wide spectrum of Speciality Papers as also the fact that we are probably the only Mill in the country working our Boilers on Furnance Oil/LSHS. These factors led us to start looking at our plant for efficient utilisation of energy. A small consumption and see the possibilities of conservation/reduction of energy.

The first step was basically to monitor the actual consumption for individual machines in each section and then arrive at a total power consumption for the entire plant. This study was conducted over several months and was a valuable tool thereafter to start our conservation programme. On an analysis of this data it was found that 5% of the total installed equipment accounted for 75% of the total electrical energy in the

plant and therefore the obvious choice was to look at this 5% and establish some form of control to reduce energy consumption. The initial study also indicated that there was a wide variation in energy consumption due to the following factors :

a) Variation in input of raw material.
b) Variations due to change in quality of stock preparation as also finished products.
c) Variations due to efficiency of different process lines and different equipments.
d) Variation due to Operator efficiences.

The team then sat down with the different Department-heads to evaluate the reasoning for the variations and also to find explanations as to how at certain times for the same product and the same furnish energy consumptions were better than at other times. It was also made very clear to the Department-heads that there was no question of vicitimisation in case for past operations but the idea was basically to improve our future energy consumption figures.

Once the optimum consumption levels were identified by the team in cosultation with the Department-heads, these figures were given to the Operating staff to match in their day to day functioning. Problem encountered in this area were also identified. For instance periodic maintenance and plant replacement of spare parts affected energy consumption and therefore in critical areas such as the Disc Refiners maintenance and replacement of discs was given high priority. Similarly it was found that operating staff at times had no means of monitoring power and energy consumption. Hence low level instrumentation was introduced for this purpose.

The energy consumption was then colated and evaluated shift-wise daily, weekly and monthly and variation from the norms were highlighted and discussed openly at meetings between the conservation team as well as departmental-heads and relevant supervisory staff. The fact that energy conservation had very top level management support eased the work of the energy conservation team and co-operation was easily obtained. Besides this such meetings highlighted the fact that modifications in the process line could improve energy reduction. Such suggestions were seriously taken up and also implemented. For instance, we completely modified our stock Preparation system to facilitate easy operation of the process as also bring about control whereby we could save energy. Inefficient stock pumps wherever identified were also replaced with more efficient ones.

Some of the various measures taken by us to conserve energy are briefly summarised below :

1) Pulp Mill

a. Digester loading time was brought down from 75 mnts. to 45 mnts. by changing loading pattern and improving the maintenance of blower pipe-line and wet washing sections.

b. Cooking time was brought down from 90mnts to 65 mnts by changing the steaming procedure and periodic running of the Mechano Chemical pulpers.

c. Washing pattern of raw material was changed so that the plant operated at its rated capacity and staggered operations were stopped.

d. Two vacuum pumps which were operating on the Brown Stock Washers were evaluated and it was found that one pump could be stopped without seriously affecting the washing quality.

e. High efficiency pumps were installed for thick stock pumping to Paper Machines.

f. For hot water requirements in the Pulp Mill a steam heat exchanger had been in use for the last several years. It was decided to replace this heat exchanger by a plate heat exchanger and to extract heat from the hot black liquor available in the plant to raise water temperature to meet requirements of washing.

The cost of the heat exchanger was approximately Rs. 2.5 lacs but the pay back was within three months.

g. Steam flow meters for the pulpers were located in the Boiler House to monitor steam consumption in the Pulp Mill. These were shifted with some pipe-line modifications to the digester house and it was found that our steam consumption in the Paper Machiner reduced by almost 15% just by this modification.

The abovementioned measures alongwith several others eventually brought about a reduction of 50% in thermal energy and 42% in electrical energy consumption of the Pulp Mill leading to exceptionally high savings and cost effectiveness.

2) Stock Preparation:

a. As mentioned earlier, a study of specific consumption for refining of stock was undertaken and a wide variation in energy consumption was minimised by use of correct type and quality of discs, switching off refiners during no load operations, introduction of consistency and flow metering to help all related equipment to run at rated capacity

and by introduction of Microprocessor based controls for controlling process parameters along with sequential logic to switch off equipment when not in use. It was found that only by stopping the relevant pumps and agitators when refiners were not in operation, we achieved a savings of approximately 9600 Kwh per month. The over all savings in the Stock Preparation area were in the region of approximately 1,90,000 Kwh per month.

b. It was found that broke pulper and hydra pulpers in the plant run idle very often for several hours when not required. Similarly they were often not loaded uniformally to meet the end requirements. Controlling of just these two variables brought about a savings of approximately 4100 Kwh/month.

c. Very often the vacuum plant of a Paper Mill is designed taking into account various requirements at the design stage and they continue to run as per origional designed parameters irrespective of changed crcumstances.

On one of our machines the connected load of the vaccum plant was 825 Kw but it was observed that for around 80% of the total working huors we needed only 625 Kw of Vacuum load. This led us to experiment and eventually stop one vacuum pump when not required and with this elimination we were able to achieve a savings of approximately 97,000 Kwh/month.

3) Super Calenders

On the super calenders it was found tha there were large variations in energy consumption due to idle running time, running the machine with increased speeds and unnecessary downtime during roll changes. With just control being exercised in these areas the electrical energy savings were in the region of approximately 1,25,000 Kwh/month.

4) Boiler House

We have three oil fired water tube type boilers, which are used alternatively to generate steam upto 12-14 tonnes/hr at 180-200 psi pressure. This steam is used to meet the heating requirement of various departments.

We introduced microprocessor based control strategy asociated with varible speed drives and with discretion of automatic monitoring and control of the following to improve the boiler operation :

- Pressure control
- Combustion control

Pressure Control :

Load variation of 6 to 18 tonnes/hr were observed in our process operations and it was very difficult to control the pressure by simple conventional method with fixed speed AC drive. We replaced AC drives for oil pump and FD Fans with DC variable speed drives with computing speed control strategy to match the load at the instant. The control scheme uses the steam pressure as the master control signal to control fuel flow. Thus whenever pressure of the boiler is less than the set pressure, the controller automatically increases fuel flow. Steam flow has been used as feed forward signal to check fuel demand.

Combustion control :

This control was computed relating to air fuel mix ratio constant at various load conditions by observing the status of combustion by CO2 analysis of flue gas which ultimately takes care of variations in air/fuel ratio, due to variations in oil quality, temperature and other related parameters.

In addition to the above we are controlling oil temperature, flue gas temperature, drum level, draft, etc.

Following is the outcom of the above operational system :
Table...

	Before	**After**
Pressure variation	50-60 psi	5-10 of set point.
CO2 ratio %	8-10	12-13
Evaporation ratio	13.350	13.620
Efficiency	76	78
Electrical load Kw	55	35
Saving in fuel	—	137 MT/annum
Saving in Kwh	—	14745 Kwh/month

In addition to the above mentioned savings, we have other benefits such as constant steam pressure for process which improves quality of paper, less wear and tear of stem rotory joints which prevent undue maintenance cost, leakage of steam joints which takes place due to variations of steam pressure, etc.

5) Economiser :

As already described in previous paras, we have three water tube type boilers, controlled by microprocessor based controller for getting their rated output constant pressure. Previously, we used to utilize all condensate water comping from different plants after mixing with soft water in the boilers. Later on we introduced 'Economiser' to heat the feed water before it goes to the boilers and after commissioning of the economiser the following results have been achieved :

- Demand for feed water	10-15 TPH
- Temperature of feed water inlet	80°C
- Temperature of feed water outlet	120°C
- Temperature of economiser flue gas inlet	270°C
- Evaporation ratio before installation of economiser	13.260
- Evaporation ratio after installation of economiser	14.7
- Efficiency of boiler before installing economiser	78
- Efficiency ratio after installation of economiser	83

6) We have successfully commissioned our Biogas Plant which treats our black liquor by Anaerobic means and produces methane as a by product. The plant is already generating approximately 7000 m^3/day of biogas leading to a savings of apporoximately 3.3 tonnes per day of fuel oil. Simulataneously due to this treatment of our wasterwater we have been able to shut down a major portion of our aerobic treatment plant thereby saving 1,00,000 Kwh per month of energy required for aeration.

7) We have recently installed a Sulzer Turbo blower on one ot our Paper Machine and the exhaust from this blower is used in the pocket ventillation system of our Paper Machine. This has reduced our steam consumption on the Paper Machine between 25 to 30 tonnes per day of steam.

8) Miscellaneous :

a. Replacement of variable speed drives–

We installed Thyristor Converter variable speed drives on the following equipment :

- Paper Machines line shaft
- Super Calenders
- Rewinder
- Slitter Rewinders

By replacement of these drives the total energy saving per month was 60,000 Kwh.

b. Wherever possible tubelight fittings were replaced with SON Lamps. The total savings per month due to this replacement is approximately 3,000 Kwh.

c. Provision of natural lighting on roof structure so as to switch off artificial lighting during day time. Total energy saving per month 600 Kwh approximately.

d. Insulation of ducting, piping, boiler furnace, etc. Total savings due to improvement in heat efficiency 80 tonnes of steam per month.

From the above mentioned figures you will see that substantial savings of energy are possible provided one can motivate a dedicated team for this work and there is good top management support in such a programme even if investments are necessary.