Energy Economy Measures at Mysore Paper Mills Ltd., Bhadravati – Karnataka

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SUMMARY

Pulp and Paper industry is energy intensive and accounts for about 1.5% of the total energy bill of the entire industrial sector put together in India. The total energy requirement per tonne of finished paper is around 27 mbtu out of which about 21 mbtu is thermal and the balance 6 mbtu is electrical enrgy, The energy cost is around 20% of the sales realisation of paper which is a high proportion of the cost compared to the figure in developed countries having much larer sized paper mills. It is imperative in the present era of energy crisis in the country that paper industry takes all efforts to conserve the scarce energy by adopting suitable measures to reduce energy loss from the system, optimise its use and apply total energy concept. The basic idea in this concept is to try to utilise the energy that is generated to the fullest possible extent.

WATER AND STEAM FOR PAPER MILL :

The normal heat/energy saving devices in the integrated pulp and paper mill are employed in MPM also. These include :

i) total insulation of the steam lines, digestors, evaporator bodies and continuous causticizers;

ii) blow heat recovery system in the digestors;

iii) use of evaporator cooling water with its heat content in the hot water tank in the chemical pulp mill for the counter current brown stock washing and bleached pulp washing;

iv) recovery of all condensate water from the evaporators, paper machines and turbines with make up demineralised water for boiler feed and feeding to desuperheating stations, etc.

Saving in water consumption in the newsprint mill to the tune 100 M^3/T of paper has been brought about by :

i) use of back water to the maximum extent;

ii) use of surface condensate water from evaporator;

iii) control of overflows by providing suitable control devices;

iv) minimisation of gland and valve leakages.

When MPM had only 3 paper machines of 24,000 TPA capacity until 1980, making MG kraft, various grades of writing and printing papers with 4 Nos. batch type stationary digestors, low pressure (8—10 kg/cm^2) coal boilers and a low pressure recovery boiler, the steam from the recovery boiler was just sufficient for the BL evaporators. The steam from the coal fired boilers was used for cooking the raw material and after pressure reduction for the paper machine; there was no power generation. With the expansion of capacity from 24,000 to 30,000 TPA and installation of a newsprint plant for 75,000 tonnes per annum of newsprint, a new chemical pulp mill of 145 TPD capacity and a new chemi-mechanical pulp mill of 200 TPD capacity were Installed. In addition, 3 Nos. of 60 T/hr steam capacity each of high pressure coal fired boilers of 63 kg/cm^2 and 450°C along with a recovery boiler of 30 T/hr steam at the same 63 kg/cm^2 pressure and 450°C were installed. A new B L evaporator of 100 T/hr evaporator capacity along with a suitable causticizing system of 5 times the original capacity were installed. The high pressure steam from the common header could be taken to a battery of two double extraction partial condensing turbo generators each of 12.5 MW or alternatively to two numbers of 100 T/hr and 30 T/hr PRDS stations for obtaining medium pressure 12—13 1g and low pressure 3 5 to 4 kg steam. 24 MW grid supply provides the balance.

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CO-GENERATION :

Process steam at adequate quantity at the digestors at the raw material cooking pressure of 12—13² kg/cm² and at the paper machines and evaporators at pressure of 3.5 – 4 kg/cm² being essential for an integrated pulp and paper mill, cogeneration of power was possible utilising the useful thermal energy from the high pressure steam generated before being used for the process. It is a technically sound proposition for pulp and paper industry because it permits generation of electricity with less fuel consumption when compared to the normal thermal power plants. Besides, this usage is thermodynamically advantageous since heat to power demand of the industry is around 5 which is double that of a minimum economic requirement of 2.5 : 1 for cogeneration. The effectiveness of a cogeneration system is dependent on the extent of heat generation and its final use, that is difference of heat energy in the generated steam and that in the process steam. Higher the difference, more will be the power generation. A typical integrated paper mill uses about 75% of the total steam of low pressure at 3.5—4 kg/cm² and the remaining 25% steam of medium pressure at about 10–12 kg/cm² and thus has a tremendous scope for cogeneration, more effectively compared to many other process industries. The extent of power generation from a cogeneration plant will increase with the increase in pressure and temperature of steam generated and is achieved by expanding it to that of utilisation pressure across a suitable turbine.

This cogeneration concept was taken full advantage of at MPM in its expansion for newsprint and in its implementation of a 2500 TCD sugar mill, fully integrated with it. As against the normal practice of burning the sugar mill bagasse for steam and power for sugar mill, the entire requirement of these utilities is provided by the paper mill—newsprint mill complex, thereby releasing the entire bagasse to the extent of 800 TPD for making paper. Forest raw materials, particularly bamboo, which are depleting are thus replaced to the extent of 25% of the total demand with bagasse.

When only cultural paper mill and newsprint mill run in full swing two power boilers run together with the recovery boiler in series, supplying about 130 T of steam (52 5 T/hr each from power boiler and 25 T/hr from recovery boiler) per hour at its rated pressure and temperature to one of the turbogenerators (the other one will not be in operation). Out of this total steam of 130 tons/hr. 15 tonnes per hour is condensed in the turbine, another 15 tonnes/hr is extracted at 12 kg/cm² pressure to be consumed in digester along with additional 15 tonnes per hour through pressure reducing station.

The remaining 85 tonnes of steam is extracted at 4.5 kg/cm² to meet the low pressure steam demand of both the cultural and newsprint paper mills. The consumption pattern is as follows :

12 kg/cm² M.P. Steam :

15 tonnes per hr through turbine extractions;

15 tonnes per hr through pressure reducing station. Total 30 T/hr to be consumed in pulp mills.

The variation in demand of steam in pulp mill is tackled by condensation of steam in the turbine.

4.5 kg/cm² C.P. Steam :

15 T/hr in evaporation;
8 T/hr in causticizing;
24 T/hr in newsprint machine;
22 T/hr in cultural paper machines;
8 T/hr in generation;
8 T/hr in other areas like CSRMP, etc :

Total 85 tonnes per hour.

The power generation is in the order of 10-11 MW. The total power requirement for the paper mill—newsprint mill complex is about 37 to 38 MW and the balance requiremeet of 27 to 28 MW is taken from the grid, thereby meeting the full steam and power requirement of the mills.

During the power cut period, the second turbogenerator will also be running in full condensing load. During this period, the three power boilers will be running in its partial capacity suppplying 45 tonnes per hour steam each along with recovery boiler supplying 25 tons per hour steam in the battery. 50 T of steam per hour will be condensed in the second turbo generator producing about 5.5 MW of power which is about 30% of the total grid power demand, thereby keeping the mills running.

SUGAR MILL INTEGRATED WITH PAPER MILL :

(i) Power Economy :

There is no boiler or power house in the 2500 TCD Sugar Mill, the entire steam and power being supplied from the paper mill. As such the mill house has thyristor controlled D. C. drives (4 Nos. of 600 HP Motors).

During the period when sugar mill comes into the circuit, the third power boiler and

60 T. Steam/hr and both the turbo-generators are taken into operation, thereby meeting the additional steam demand of 3.5 MW.

The power generated in the two turbines with this set up comes to 21 to 22 MW, the surplus of about 7-8 MW thus generated helping to reduce load on the grid. With the total demand at 40 to 42 MW, the balance requirement of 19 to 20 MW, is taken from the grid. With D.C. drives the power consumed is of the same order as in steam turbina drives; however the system has an advantage of being run even at half capacity with commensurate saving in power whereas this is not possible with steam turbines.

For ccndensing of vapours and for generation of vacuum, rain and shower condensor system, the latest innovation in sugar technology. has been employed as against the conventional multijet and spray condensors; MPM is able to save power to the extent of 110 KW (490 KW as against 600 KW).

ii) Steam Economy :

MPM sugar mill has a vapour cell and quaduple effect evaporator. By incorporating intensive vapour bleeding from evaporator third effect, second effect and first effect for progressive heating of juice and from vapour cell for boiling in vacuum pan, as against steam consumption of 60% on cane in a normal sugar factory, in MPM consumption is reduced to 50% on cane, the saving being effected to the extent of 5.6% in heating of the juices and 4.5% in boiling in vacuum pans.