Energy Conservation Efforts at Rohit Pulp and Paper Mills Limited A Case Study

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INTRODUCTION

Although pulp and paper Industry is capital, energy and water intensive one the same occupies position among important industrial sectors, as it is associated with the country's culture, standard and quality of life therein. Continued cost increase of these inputs has caused concern in todays competitive mode of managing paper industry. Therefore, energy management has become equally important as manufacturing of paper. Further, utmost attention is also warranted in the areas of productivity, quality, environment, innovation and cost effectiveness, this is to meet the demand of customer who is positioned better in the open market scinerio having ample choices. Giving full values to all these thoughts Rohit Pulp and Paper Mills Limited (RPPM) who is one of the pioneering paper and board manufacturer believe in keeping pace with the changing needs have been constantly caring for technology upgradation, innovation, and value addition. Energy, water and environment conservation have been receiving equal or better attention of the Management. In fact, RPPM believes that cutting energy costs is a tool emerging out as order of a day for improving corporate bottom line.

Table-1

Description	1997-98	1998-99	1999-2000
Writing & Printing Paper:			
Production (MT/annum)	7765	1145	2954
Specific Steam consumption (MT/MT)	4.49	2.6	2.65
Specific power consumption (kWh/MT)	620.00	771.0	820.0
Specific water consumption (m^3/MT)	131.00	64.0	72.0*
Carton Board:			
Production (MT/annum)	20733.0	21275.0	21567
Specific Steam consumption (MT/MT)	2.19	2.2	12.20
Specific power consumption (kWh/MT)	545.0	525.0	522.0
Water (m^3/MT)	31.0	31.00	25.00
Coated Grades of Paper:			
Production (MT/annum)	3876	2669	3401
Specific Steam consumption (MT/MT)	0.62	0.67	0.58
Specific power Consumption (kWh/MT)	206	203	196

***Partially waste paper was processed.**

RPPM at present possesses licence to produce 33,000 MT per annum paper and board. Manufacturing infracture covers pulp mill to produce straw/bagasse pulp, writing and printing paper machine, carton

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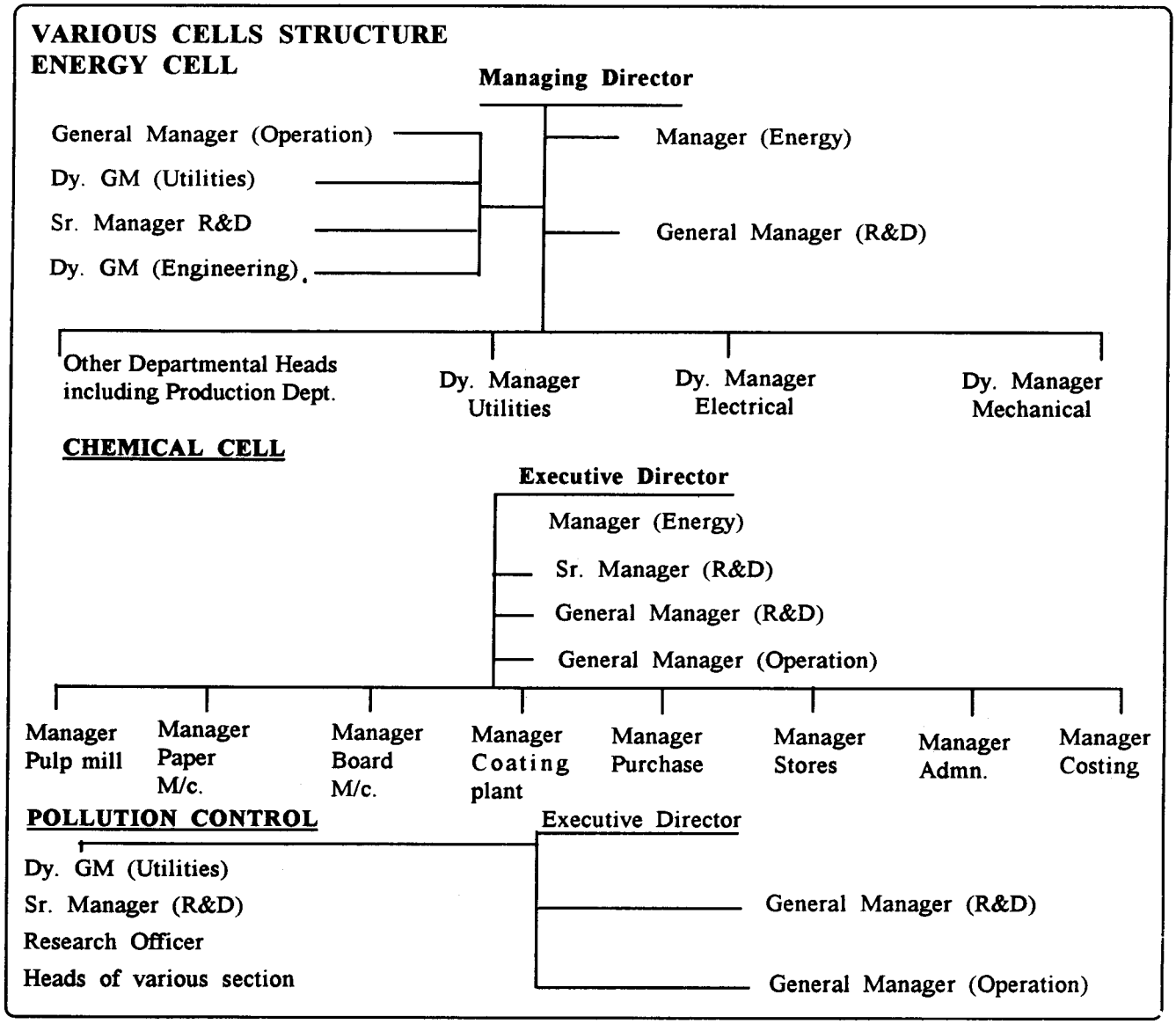
board machine with on-line coating, off-machine coating plant and R&D support. 70% Thermal energy requirement is met by bio-mass fired boiler and remaining 30% by coal fired boiler. Electrical energy is received from GEB and company's own generation through DG. The water supply is from Damanganga Dam.

The last three years production and energy consumption pattern is detailed in Table-1.

Fluctuation in production reported relates to unsteady market condition. As ever RPPM has exerted its best efforts to stand among good energy conscious houses. Attempts are made here to outline some of noteworthy actions taken and implemented.

Efforts on energy conservation at RPPM comprise of,

- Energy cell functioning includes monitoring, innovation, R&D and selection and adoption of valid technology.
- Good energy practices,
- Daily reporting system giving up-to-date information on generation an consumption
- Internal Audit,
- External Audit,
- Involving manpower till gras root level for them to realise the responsibility and have exposure to changing needs,



Attempt to the cause of energy conservation was with a view to ultimately to reduce specific energy cost. RPPM felt it is possible to achieve through possible three routes and they are a) reduce the specific energy demand through technological innovations, b) Generation of energy through cheaper inputs (fuel) and c) optimum productivity through planned working better maintenance and follow targets. At RPPM all these routes are followed. Some of the options exercised are described in the following pages.

THERMAL ENERGY CONSERVATION

Through particle charge analysis: Increased use of recycled fibre in the manufacture of multilayer board has created vide fluctuation in the charge characteristic of stocks used at different layer. Wide difference in the charge of stock apart from interfering in the quality of board, it disturbs the dewatering property of stock resulting in increased demand of steam. It is our experience that the stock performs optimum at nearer to isoelectric zero. Most of the time the stock is negatively charged and vary rarely, it is positive i.e. before any chemical addition is done. Larger chunk of negative charge is neutralised with alum or sulphuric acid and the end point is attained with polymin. If positive charge is to be neutralised, percol-173 is applied. By this correction machine runnability improves upto 3% and the dry contact after the press section increased by 1% helping to reduce the thermal energy requirement and enhanced productivity. At present RPPM has adopted Laboratory Model to monitor and feeling the benefit working to install online charge analyser and control system.

BAGASSE PITH UTILIZATION:

About 20% of bagasse pith generates during dry depithing. Disposal of the same as solid waste was a herculean task. With sustained effort the skill was developed to incinerate 100% pith in a coal fired FBC boiler. The coal firing was optimised by maintaining bed thickness in the range of 230 to 300 mm. At this thickness when bagasse pith was fired overbed the bed temperature was going down below control (400°C) and also positive pressure was forming. Based on continuous trials, 100 mm bed thickness was found ideal for firing 100% pith. Since the quantity of air required to fluidise bed due to lower thickness came down, so there was imbalance in air distribution. Ultimately the air quantity for fluidisation was reduced by 40% from original. However, air supply in the secondary zone was increased, on trial and error basis and the same was optimised. With this, the performance stabilised. It has been possible to generate about 2.5 MT of LP steam per tonnes of pith. The same helped to bring down the steam cost by about 25%.

Conveying of bagasse pith from depither to boiler has been through dense phase pneumatic system and the discharge in the boiler by screw conveyer. The entire system worked well.

STEAM GENERATION THROUGH BAGASSE

Ever increasing conventional fuel cost (Coal) has increased the steam price beyond tollerence. This sow the seed for establishing a new boiler to use bio-mass and mill comnbustible solid wastes to generate cheaper steam and help combustible solid waste disposal. RPPM has installed 12 TPH boiler with the Hybrid Brownian Motion Furnace. Combustion principle is based on embracing the pith from sides and bottom in the medium of gas particles. The pith is agitated in a continuous random movement within the furnace leading to complete combustion. Bagasse with upto 50% moisture burns effectively to give 66% efficiency. The boiler is capable of yielding 12 TPH saturated steam at 21 (kg/cm^2) pressure and the total heating surface area is 1016 M^2. The cost of LP steam appears 40% cheaper than the coal based steam. Stable steam generation using bagasse has been possible. The boiler accepts other combustible wastes of paper mill without any problem. Further there is a proposal to generate power may be small quantity by running 19 (kg/cm^2) steam through mini turbine.

APPLICATION OF STEAM SHOWER:

Objective of installation of steam shower was to improve mainly the CD moisture profile of board However, in addition to quality improvement it has been possible to improve sheet dewatering thereby reducing the specific drying requirement. This facilities improved productivity too. The steam shower works on the principle that when steam is applied to the sheet and the latent energy released in the condensing process heats both the water and the fibre. The added heat reduces the viscosity of the water, lowering the resistance to fluid flow. Improved dewatering in presses is also observed. The net effect is that a warmer and dryer sheet enters the drying section, therefore, it reduces they drying requirement. At RPPM the steam shower has been located before the Ist press. The location of steam shower depends upon the configuration of press section and space availability. However, ideally it may be located after the Ist press

RPPM has been able to improve the productivity by 6% in addition to upgrading the CD moisture profile.This improved productivity and has contributed to the reduction in specific steam as well as power consumption. The unit cosumes about 150 kg steam per hour at 3.5 kg/cm^2.

POWER CONSERVATION EFFORTS:

Installation of Gas IR: Need of coating of paper and board has gained considerable importance as market demand for high quality printing surface has increased. Coating is specialised field involving varied, but selective formulations with respect to end product. The coating colour being complex mixture of organic as well as inorganic constituents response of each to thermal energy, base and application differ. Good base and application of coating colour are related with the paper machine and selectivity of coating head. Assuming both are optimum and then the mode of drying and fixing of coating layer comes into picture. It is fairly well accepted phenomenon that upon the application of coating colour on the base the solid content of coat to be increased to about 76% at the quickest time at which the mobility of components cease. Otherwise there will be incidences like binder migration, pigments coming to surface etc.

To achieve the required results, IR drying has gained considerable importance. In the technical field today we have option to select IR heat source based on electricity or Gas. On understanding the heat transfer efficiency and operating cost and the need of the quality board RPPM have slected Gas IR application. The basic details are as under,

- two rows of ceramic gas IR emitters with independent operation control,
- each row have 13 emitters,
- installed power equivalent 182 kW,
- Maximum consumption 169 kW.
- LPG consumption 13 kg/hr.

On accepting the process need of IR to achieve better quality coated surface, experience indicate Gas IR is more effective heat transfer mode than electricity based source. Operation cost point of view Gas IR is almost 50% cheaper, while not accounting investment cost. In addition to this, since the efficiency of Gas IR is better by atleast 5%, the same can be valued as electrical energy conservation.

Single pass refining: To meet the required °SR of pulp used on the top layer of board single refiner (DDR) was used and where the results were achieved through recirculation of stock. This apart from consuming increased power was giving substandard refined stock due to heterogeneity in defibrillation. This problem was ressolved by the installation of three refiners (TDR) in series, by which required °SR of stock was achieved in one pass. By this apart from obtaining uniform quality stock the power saving to the tune of 10% was achieved. However, some disc pattern matching and metallurgy selection was essential Power consumption details are given in Table-2 below,

VARIABLE SPEED DC CONVERTER THYRISTOR DRIVE FOR OPERATING SUPERCALENDER:

Till recently the Supercalender was driven by 110 kW MG set which was connected to motor of 1850 rpm. At maximum rpm of motor it was possible to operate the supercalender at the rate of 150 mtrs/min. Since this speed was not enough to realise intended productivity and MG set being power inefficient drive, the same was replaced with a new Siemens make Thyristor drive of 125 kW. With the new drive installed it has been possible to operate the supercalender upto 200 mtrs/min at motor rpm of 2160 through field weakening potential free armature voltage transducer. From the Table-3 below one can observe the saving of power at the rate of 300 kWh per day.

Table-2

Description	Power /MT/°SR with single refiner (kWh)	Power /MT/SR with 3 refiner with single pass (kWh)
Soft wood pulp	14	12.5
Bamboo pulp	10	9.5
Hard wood pulp	11	10

Table -3

Description	110 kW MG set at 150 rpm power Consumption	125 kW Thyristor drive at 179 rpm power consumption	Saving kWh
kWh/hr	52.1	37.8	14.3
kWh/Shift	364.7	264.6	100.1
kWh/day	1094.1	793.8	300.3

Note: Shift of 7 hours of operation and 21 hours operation/day. The compitability of drive to operating conditions has beęn quite satisfactory.

AC Variable frequency drives: By now at RPPM number of AC variable frequency drives has been installed at various locations. Power saving with inbuilt operating benefits have been achieved. However, as an example here reference is made to the performance of Former Fan pump operating at 1500 rpm hooked upto suitable ACVFD. The installed power at each fan pump is 20 kW. Before ACVFD hooked-up the power consumption was assessed at 12.5 kWh. When it was hooked up to ACVFD and operating at 1350 to 1400 rpm the power consumption reduced to 8.7 kWh. Therefore, the power saving per day per pump was assessed at 91.2 kWh. Now all 7 pumps are being provided with suitable ACVFD. Apart from power saving installation of ACVFD has provided considerable operating flexibility too. However, one difficulty RPPM facing with ACVFD is its repeated failure and non-availability of quick maintenance service.

Instrumentation: Present pre-requisites for lasting paper making business is to realise productivity, quality and innovation keeping always changing needs at the back of mind. This achievement involves optimum use of raw material, minimum energy consumption and consistent production of high quality paper or board. This is essential to be competitive in the open market system today we are in. The modern trend indicate essentiality of automaion of operation.

RPPM realising the importance of automation, on-machine quality control system (QCS), based on distributed control system (DCS) to manage carton board machine and integrated control system for stock preparation have been installed.

RPPM considering the versatile feature selected TDC 3000 Lippke on-line QCS System. The system is capable of,

- Machine direction control
- CD control
- Coating control
- Production planning and tracking
- Process Management and quality management
- Information reporting etc.

RPPM have installed the system to monitor and control,

- Basis weight through krypton sensors (base and final boards)
- Moisture through micro wave sensor (base and final boards)
- Coat weight (final) detection by gamma difference
- Number of process information and controls
- Production information and grade changes
- Energy consumption, water consumption etc.

As referred earlier in objectives of installation of on-line QCS system, it has been possible to improve the productivity by about 8%, fibre conservation to the extent of 3% and stabilised production with enhanced product quality, specially dimentional stability of board, uniform gsm, stable moisture

content, good printing surface etc. Board mill operators are tuned to the use of QCS system having transparency of parameters. This has helped them to control quality, productivity and care in conservation of fibre and energy. Above all the market has appreciated the quality board manufactured. The overall energy conservation benefits obtained are detailed in Table-1 referred earlier.

Similarly integrated control system installed and operated in the stock preparation has improved the productivity of the system to yield 75 MT/d stock from 55 MT/d. Use of energy, is optimum and no fresh water is used except for startup and gland sealing. Due to optimum operation conditions no good fibre is lost through rejects which has helped to improve the fibre yield. The power consumption reported for the carton board for the year 1999-2000 is shared by machine section and stock preparation in the ratio of 48.52 percents.

CONCLUSION

Business or socio-economic point of view, conservation of energy water and environment need all time attention to meet the prevailing scinerio. Rohit Pulp and Paper Mills Limited experience indicate that the same can be achieved through productivity, quality standards, innovation and R&D inputs. Time spent on these objectives have always yielded one or the other useful results helping the Company to sustain and keep pace with the changing needs in many fronts.