Energy management Vis-a-vis Energy conservation in paper industry A report from TNPL energy management cell

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The paper disseminates how TNPL work-up darted to nation's need of the hour and established a net of energy saving methods in all possible lines and fields to manage the energy crunch with marginal investments Eventhough the Mill is new, by rationalisation and suitable modifications in Process Systems, energy conservation results are observed to be encouraging.

Introduction :

Energy has always been the key for mankind's greatest goals/achievements and to the dream of a better world. The all round industrial development warrants more energy in different form. As the standard of living improves demands on energy increases and also consumption of energy is an indication of well being (our per capita energy consumption is 3.8% of that of developed nations).

While we spend 48% of our export earnings towards import of oil, we produce only 50% of what other developed nations produce with one unit of energy. Another disturbing factor is the wastage of energy because of ignorance/negligence. Hence for immediate benefits, conservation of energy through scientific energy management becomes the primary requisite of our nation and so in Indian Industrial arena, the talk of the town is :Energy Management'.

While our energy scenerio is very much alarming, the energy cost alone is about 15 to 20% of the production cost in the paper industry. It is a fact that uncontrolled consumption of energy also can jeopardise any industry apart f om other factors. Hence any amount of reduction in the energy bills will be a boon to the paper industry as the cost of fuel and power is escalating day by day. As the energy resources are fast depleting any form of energy conservation is the necessity of the hour for existence and for the benefit of the future generation as well. This need continuous and collective effort.

Energy Audit

TNPL conceived the idea of energy saving from its inception and went for Energy Audit from 1986 when the plant completed its erection and production was more or less stabilised.

To start with we collected actual consumption details of steam, power, water, coal, fuel, oil, pith etc. department wise on daily basis, summarised and synthesised through computer. These informations are reviewed every month and targets fixed forclose monitoring. Areawise energy conservation cell has been formed selecting engineers from different departments to study/implement energy conservation schemes and to monitor energy consumption. The specific consumptions are verified with the average values of previous twelve months and steps taken to reduce further. Also the steering committee members were rotated for obtaining fresh ideas/views/points & involvement.

Motivation

To create awarness among the employees, in house

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energy conservation training seminars are being conducted monthly or bi-monthly. Over a period of 15 months about 11 programmes were organised covering about 220 employees of all levels. Further, engineers were sent outside for attending seminars on energy conservation and management and they visited some of the nearby industries also to get acquaintance with latest energy conservation techniques employed by them. Also for the benefit of two wheeler users and employees' families, programmes in conservation of petrol and LPG were arranged in association with petroleum Conservation & Research Association and Indian Oil Corporation.

A system of cash incentive to workable suggestions from the shop floor personnel had been introduced. Illustrated boards are displayed in number of places.

Power Boilers:

Our Boilers are basically multifuel fired fluidised bed type capable of burning coal, leco, raw lignite, furnace oil and Bagasse pith. The combustion efficiency was observed to be about 94% and pith and lignite are burnt along with other fuels. In some occasions when leco & lignite are burnt in 3:2 ratio, unburnt fuel in the ash over the grate was found to be negligible. For higher efficiency always the boilers were run at higher MCR and the boiler efficiency is being monitored by shiftwise analysis of fuel, ash and by monitoring excess oxygen in flue gas continuously. The unburnt losses were between 3 & 6 % in the ash, the majority is contributed by the grit siftings under the grate, the size of which is less than 3mm. This is more in case of leco fines firing and to some extent in case of raw lignite & leco loose. To recover this, a small modification was carried out in the ash collector to collect these grits and the same is taken to coal yard for recycling. Raw lignite is used to the maximum extent of 40% by weight to bring down the cost of steam.

On an average around 60,000 tons of Bagasse pith is fired in an year. The pith with 50% moisture is directly taken into the furnace along with leco products. The quantity of pith fired during sugarcane season is between 250 & 300 tons per day. On few occasions high quantity of pith enter the furnace and causes fluidisation disturbance/failure.

It was observed that the temperature of the furnace bed starts droping just prior to the fluidisation failure. At such occasions pith firing has, to be & topped In order to overcome this problem we intend to install bed temperature monitor and the signal is to be hooked up to the boiler controls to optimise pith firiing. We are also con emplating to go in for micro processor controls for efficient combustion of fuel, maximising of pith firing and reduction in stack losses.

ELECTRICAL POWER :

Motors (See annexure 1&2)

It is general practice to select oversized motors considering future requirement, minimum breakdowns, standardisation and less inventory. It is worthwhile to make a study on such motors which work with low efficiency and low power factor leading to loss of energy. To start with load currents of all the motors were monitored and recorded throughout the day and over a certain period. Abnormalities and trippings were corelated to process variation. During this initial phase of study, the data collected over 6 months were analysed and it was noticed that quite a number of motors of pumps, agitators and other equipments were underloaded. About 30 numbers of such motors were shuffled for the optimum requirements without any capital expenditure and about 14 more motors were connected in star. Energy savings expected is about 5,00,000 KWH/per annum.

High capacity motors installed for Blowers, crushers and Agitators, wherein high starting torque was required eventhough the running load requirement was comparatively lower, were changed with optimum size motors, provided with fluid couplings to overcome the initial starting torque. The equipments that can be operated on demand basis are also being provided with fluid couplings.

The pay back period on the investment of the fluid couplings from the expected energy savings worked out to be 2 to 6 months. On this account the energy savings expected annually is more than 2,00,000 KWHrs. Possibility of using electronic soft start cum energy saver is under study

Annexure—1

Underloaded Motors Changed (Higher Capacity) & Energy Conserved Without Modifications

Sl. No.	Details of Equipment	Conservation expected annually KWH	Remarks
	PAPER MACHINE :		
1	Pocket ventilation fans A & B	40,000	Capacity reduced to 45 KW from 55 KW
2	Couch pit agitators 3 Nos.	16,000	Capacity reduced to 22 KW from 30 KW
3	Recovered fibre chest agitator.	6,000	—do—
4	Belbaie Exhaust fan	40,000	Motor changed to 30KW from 55 KW
5	Low pressure knock off shower pump.	64,000	Motor changed to 110 KW from 150 KW
	PULP MILL :		
6	Hard wood-Screened tower and washed tower agitators 2 Nos.	27,000	Capacity reduced to 37KW from 45 KW
7	Caustic wa her supply pump.	7,000	Motor changed to 37KW from 45KW
8	Rechipper	15,000	Motor changed to 37 KW from 55 KW
9	Hard wood-screended tower dilution pump.	5,500	Motor changed to 45 KW from 55 KW.
10	Brown stock washer dilution pump.	14,500	Motor changed to 75 KW from 90 KW
11	Secondary cleaners supply pump.	14,500	Motor changed to 75 KW from 90 KW
12	Mechanical Bagasse— Coarse fraction and latency chest agitators.	16,000	Motor changed to 37 KW from 45 KW.
	BOILER HOUSE :		
13	Desupur heat pumps—2 Nos.	28,000	Capacity reduced to 90 KW from 110 KW.

Annexure—2

Energy Conservation Due To Reduction In Capacity Of Motors With Modifications

Sl. No.	Details of Equipment	Energy conservation expected annually KWH	Remarks
1	Paper Machine—UTM Pulper Expected to run about 10 to 12 Hours daily instead of continuous running.	1,00,000	Fluid coupling provided and motor changed to 90 KW from 110 KW and operating "ON DEMAND BASIS".
2	Paper Machine—Winder Trim Blower.	19,000	Fluid coupling provided Motor capacity reduced to 37 KW from 55 KW and operated on demand basis.
3	Boilers—Secondary coal crusher.	25,000	Motor capacity reduced to 55 KW from 90 KW and fluid coupling provided.
4	Paper Machine—4th dryer cyclinders 33 & 34 Operation in parallel with cylinders 31 & 32 respectively.	8000 to 12000 tons of steam. 5,00,000 M^3 of water.	Steam demand was met with flash steam from Separators 4 & 5.
5	Paper Machine—Recovered Fibre chest pump.	60,000 units	Motor speed and capacity reduced to give required flow (30 KW/1500 rpm to 15 KW/1000 rpm).
6	Paper Machine—Sweetner addition pump of Disc Saveall.	60,000	Motor capicity reduced to 11 KW from 30 KW by trimming the impeller.
7	Paper Machine Warm water transfer pump to felt water chest.	15,000	Warm water chest height increased and overflow utilised for the felt water chest.
8	Paper Machine—Couch pit pump (315).	50,000	Motor capacity and speed reduced (from 75 KW/ 1500 rpm to 37 KW/1000 rpm) by altering delivery line.
9	Total number of Motors shuffled for optimum capicities and number of motors connected in star. (30+14).	5,00,000	

Lighting :

We are using lot of high efficient high pressure sodium and mercury vapour lamps. Incandascent fittings are being replaced with fluorascent tube light fittings including Colony area. Further, introducing time switches for tower lights and reducing number of fittings/ wattage of the fittings, we conserve about 5,000 units monthly. Expected conservation is 60,000 units annually. Also, changing of luminaries ballasts in a phased manner with electronic chokes is under progress.

Power Factor and Co-Generation :

Low Power factor restricts capacity utilisation of transformers and increases cable and transformer losses. Group controlled capacitors are provided in motor control centres to maintain a power factor of 0.85 to 0 9 at distribution transformers end. 11 KV capacitors are provided at the Substation for further back up and a power factor of 0.9 to 0.98 is maintained. There are two turbo generators of 8 MW (back pressure) and 18 MW (Extraction/Condensing) capacities. They are operated in parallel with TNEB grid supply which is an added advantage for power factor correction besides efficient co-generation.

STEAM :

Paper Machine : (See annexure 3)

The drying cylinders are divided into 4 main groups and arranged in cascade for best utilisa ion of steam. The fourth group dryer cylinders are again subdivided to 3 groups and the flash steam from two groups are fed to the first two cylinders. During our study, it was found that the flash steam from two groups are in excess even after meeting the requirement of first two cylinders. The excess steam was diverted to another set of two cylinders which were drawing steam from main header. Due to this modification, savings expected:

Steam	:	12,000 tonnes annually
Mill water	:	3,00,000 M^3 ,,
Electrical Energy	:	40,000 KWH ,,

There is also another proposal to divert the condensate from some of the cylinders of the I - group going directly to the condenser, through additional steam separator for higher efficiency (steam savings expected about 1000 tons annually).

Pulp Mill

Chemical bagasse screened pulp thickener : Steam doctors use l for cleaning wire have been replaced with hot water showers thereby conserving steam of 6 tonnes/hour.

Evaporator & Recausticizer :

Replacing of vacuum building up steam ejectors with vacuum pumps is under progress (steam savings expected about more than 1000 tons annually).

Steam Lires :

Replacement of thermodynamic steam traps with more efficient bucket type is under progress.

CONDENSATE AND WATER :

Considerable savings expected by suitable changes/ modifications carried out/underway are summarised below :

Boilers :

All the condensate from steam traps of MP & LP headers which were drained are collected and 75 M^3/ day at 90°C is conserved.

Blow down cooling water and blow down water are recycled for quenching of clinker.

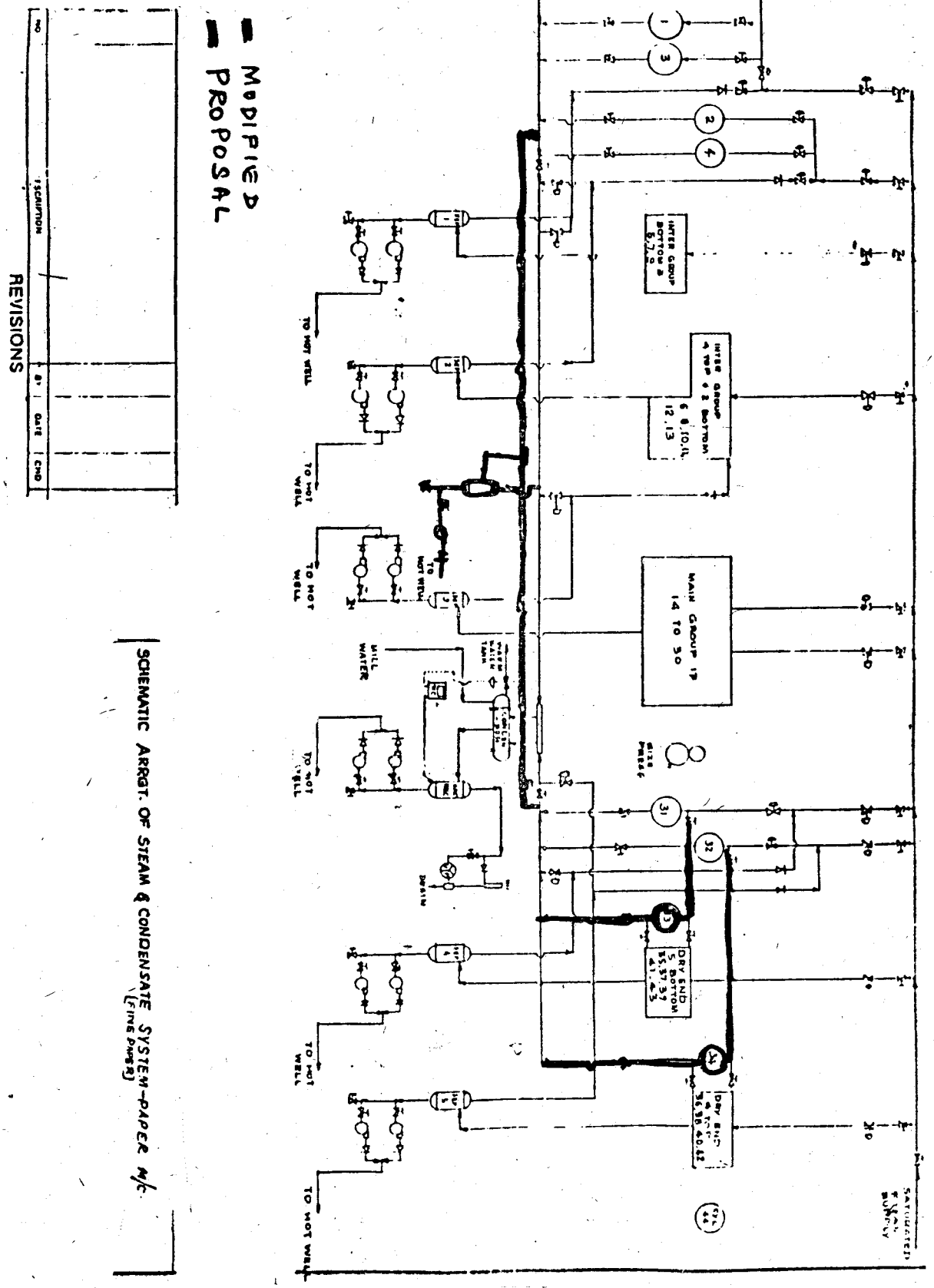
On line conductivity meter had been installed and chemicals concentration was controlled by varying the chemical dosage (Trisodium Phosphate) and the blow down had come down to 1% from 3%. Using of multi component Polyamine for Boiler feed water treatment to reduce further blow down is underway.

Pulp Mill :

Back water from paper machine was tried in final washers and washed tower stock dilution. Due to clogging of wire and foaming problem usage was stopped. However, it is used for foam killing & floor cleaning purposes and is being tried for screened tower stock dilution.

In Hardwood and Mechanical bagasse line, the hot water of hot blow heat recovery accumulator tank is directly used for washing.

Annexure - 3


MODIFIED PROPOSAL
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CHD
SCHEMATIC ARRGT. OF STEAM & CONDENSATE SYSTEM-PAPER M/C
(FINE PAPER)
TO HOT WELL
MILL WATER
MAIN GROUP 19
14 TO 30
DRY END
5 BOTTOM
31, 32, 33
41, 42
DRY END
34, 35, 36, 40, 42

Trial usage of chlorine filtrate excess water for screened tower stock dilution to conserve about 60M³/hr has increased foaming problem. Further trials are underway.

Recausticizer :

Mud filter vacuum pump water has been diverted to bagasse piling up make up (savings : 20M³/Hr).

Excess hot water is connected to hot water tank of Pulp Mill and utilised for brown stock washers (savings: 20M³/Hr).

Heat exchanger has been provided to conserve chilled water in Hypo preparation.

Paper Machine :

Deculator vacuum pump sealant water: Plate heat exchanger had been provided to conserve chilled water.

OTHER IMPROVEMENTS :

Various conservation measures undertaken/proposed to be taken up are listed below :

Puld Mill :

Hardwood-caustic tower and hypo tower feed screw conveyors were replaced with belt conveyors.

Mechanical pulping refiners' feed screws were removed and belt conveyors were extended.

Chemical bagasse-caustic tower & hypo tower feed screw conveyors were replaced with belt conveyors to avoid frequent jamming, overloading and tripping of the drives. Both drive motors were changed to 11KW from 18.5 KW and savings expected is about 30,000 KWH annually.

Bagasse washing—Raw bagasse dewatering press screws life had been increased to 6 months and the motor load had been reduced considerably by providing wear bars in the perforated shells and so arresting spinning of bagasse. Also the screw life increased marginally by using L & T hard facing electrodes.

Brown Stock Washers :

Provision of variable speed AC drives in place of eddy current drives is under progress for better energy management.

Chipper House :

Hardwood feeding chain conveyor was replaced with belt conveyor for least maintenance and energy conservation.

Depither :

Bagasse distribution paddle conveyor was replaced with belt conveyor and motor changed to 11KW from 30 KW.

Pumps :

Since pumps consume major share of electrical power, indepth study was carried out. During our study, it was found that some of the pumps were underutilised and such pumps' impellers were trimmed or the motor speed was reduced to meet the required head and flow. In one typical case, the smaller of the two pumps from the same chest was removed and the delivery line was connected to the bigger pump since this alone could meet the demands of both the pumps. In Paper machine area, in yet another case, the water transfer pump from warm water tank to felt water tank was eliminated by interlinking the tanks.

Due to these modifications annual energy savings expected is about 3,00,000 KWH. The modifications were carried out with ease since we had limited frame size motors and pumps which have more flexibility for interchanging.

Almost all the pumps are of back pull out type with direct coupling leading to energy conservation.

Stuffiing boxes with conventional gland packing which are offering more friction, causing considerable energy loss are being provided with Machinical seals.

Welding Machine :

Energy savers are being provided to isolate them from supply during non-arcing periods.

Workshop :

Gas cutting of MS—

Introducing of air plasma cutting equipment is underway.

Paper Machine :

Winder-slitters—usage of variable frequency A.C. drive, replacing air turbines—to be implemented.

Conclusion :

All the above schemes had yielded considerable savings. The cummulative effect is seen by reviewing the consumptions between October 1986 and September 1989. The consumption of electrical power and steam per tonne of printing and writing paper had reduced by 4.4% and 9 3% respectively for the last 18 months. The overall water consumption had come down by 11.3% for the same period. The total energy (steam + electricity) consumption per tonne of Newsprint had reduced by 5%.

Our conservation during the year 1988 :

Power	:	7.5 lakh units
Steam	:	20,000 tonnes

However, what we have seen "as results", out of Energy Conservation Schemes is just the tip of the iceberg and we hope to achieve much more in future It may be noted that Energy Conservation projects lead to better "Energy Management" with least investment and early returns and it is yet another way of increasing profit of the Company. The encouragement and cooperation rendered by our collegues and the gesture of TNPL Management for publication of this article are gratefully acknowledged.