

Energy management in pulp and paper industry

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ABSTRACT

The economy of paper Mill operations is affected seriously with the increase in the cost of fossile fuels necessitating a need for an efficient energy management. The objectives will be varying but some basic approaches are common to all mills. The industrial energy audit could be the most powerful tool for the paper industry to adopt for defining and pursuing a comprehensive energy management programme.

MPM has been benefitted by adopting this tool and by following a "TASK FORCE" approach. A sample case for "Walk around audit" and "Short audit" has been narrated for the benefit of the participants. The "Maxi Audit" outcome is expected to help MPM in formulating the long term plan of modernisation with the financial assistance forthcoming from Japan.

Back Ground :

Energy Management in a Paper mill is the judicious use of energy to minimize costs and thereby maximise profits. According to Mr. Shipper, energy management is "The strategy of adjusting and optimising energy using systems and procededures so as to reduce energy requirements per unit of output (or well being) while holding constant or reducing total costs of producing the output from these systems". Therefore energy management is not just energy conservation but much more.

Pulp and paper industry is one of the largest consumer of energy. Statistics available reveal that energy cost constitute nearly 20-24% of production cost in India while the advanced countries indicate 12-14%. Therefore much more needs to be done to efficiently manage energy.

Historically, energy prices were low relatively and had a tendency to decline further relative to other prices of inputs in making paper. The oil shocks of 1973 and 1977-78 reversed the trend drastically and an era of higher energy cost commenced. The technology adopted till therefore needed immediate and long term measures for upgradation in order to enhance the competitive position of the industry. The improved energy management would benefit the individual

enterprise by way of reduced operational costs and make a cumulative positive effect on the economy as a whole.

The Concept :

The objectives of each mill might be different and the typical areas of energy management may also vary. The specific energy consumption per ton of paper produced in a small size mill will be different from that in a large mill. The large mill being an integrated one will have an advantage to the extent of 40-60% in captive power generation facility. It will also have 85-90% cooking chemical recovery. The typical areas for energy management programme in a paper mill could be :—

- a) Profit improvement
- b) Energy Conservation
- c) Good energy reporting and monitoring system

The actual program is usually done at the top management level, but it is not essential that the concept should start there. It is ideal to have one person

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reporting well up into the organisational structure of the company to be incharge of the energy management programme. He should therefore be a good candidate highly motivated and having a belief in the programme, to work for its success. But technical talent required for success of such programmes does not normally be with one person. So the backup talent needed can be had from the "Task force" approach. The task force can have the co-ordinator as the leader, with the engineers from other disciplines and a financial expert providing the required base. The committee can have the needed line involvement to generate communication and to encourage participation as well. Such a broad spectrum of interest will help in the unification and the alignment of goals.

With a commitment from the top management of paper industries, the energy management programme has a fighting chance. Secondly the energy management committee should be strong and evident to all involved for a meaningful initiation of the programme. The objectives which are tough, specific and measurable for obvious reasons should be communicated to all levels of hierarchy. Methods of publicity designed to attract and hold employees attention should be adopted. Here the selection of early projects is critical. Guaranteed success with high returns should be the aim then.

Energy accounting through a good monitoring and reporting system is vitally important in addition to the high level of creativity needed for the success of the programme. Systems designed to be evolved towards cost centre metering and reporting is essential. Off standard usages would then need explanations.

Energy Auditing :

The facility to adopt energy auditing as a first step to energy management is available to the paper industry too. For a quick recollection—energy audit is an organised approach for pinpointing energy wastage in a facility and determines how this waste can be eliminated at a reasonable cost and within a reasonable time frame. It is a fact that energy audit though analogous to conventional audit goes one step ahead in helping to formulate an appropriate plan of action to run the mill with minimum specific energy consumption. This approach is emerging as an effective tool to identify, implement and sustain energy conservation programmes in paper industry.

The "Walk through audit" could of course be the first step towards saving energy rupees. Going round the mill with a checklist will do the trick. The low-cost-no-cost ideas" mainly comeout by this type of auditing. This audit is not a one time occurrence. It should be repeated periodically and at different times as well. The changes that can improve operations get revealed in this process. A walk through audit could account for 70% of energy used.

The "Short audit" of the "Mini Audit" could then be taken up with a more fully defined economics. This auditing needs the availability of process and utility schematics, actual monthly energy bills and datas to verify all rate contracts. The short audit team should have medium sized facilities and comprise of members from major disciplines and technologies representing the mill operations. The objective of such an audit effort shall be to account for 85% of facilities of energy supply and demand. The short audit allows study of some of the areas of the energy programme that need strengthening. The audit frequency will have to be once a year for effectiveness. The recommendations could categories the expense items and capital investments. The first category meets the tuning, operational or maintenance expenses and meets the internal revenue service requirements. The retrofits, major modifications and process upgradations go as capital investments. Completion schedules of recommendations need be established by the audit team.

The 'full audit' or the 'Maxi audit' of the entire mill are to be programmed every 3 years to make the energy management programme more meaningful. The objective of this audit will be to define and initiate 95% of the energy plans of the paper mill. It is customary to include outside consultants in the audit team and have maintenance/plant engineering department member. The full audit allows the required time to determine consumption and cost of each energy source, utility, area and the products. It establishes a way to initiate new programmes, by examining all parts of the energy management programme. The detailed engineering calculations are done here. The audit report should aid in setting up and initiate employee involvement plan. The audit report content should have the engineering recommendations, detailed economic analysis on major items and the advise on short,

medium and long range needs for the energy management programme. There should be emphasis on metering individual uses. A detailed plan should be given in the audit report to carry-out capital projects.

The energy audit by and large is the most powerful tool for the paper industry to pursue a comprehensive energy management programme. A careful audit by any of the three types will give the plant engineer a plan with which he can effectively manage the energy system and reduce the energy cost of his plant.

MPM's approach—The case study :

The energy scenario at MPM is complex and in a way unique too. The cultural paper machinery have all been procured and installed before the energy crisis was felt. A sort of obsolescence has also set in there. The newsprint mill, the sugar mill and bagasse pulping plant have been put to use after 1980. Some care and attention has been bestowed at the design stage itself on energy conservation. But the operations commenced at different stages in plants installed after 1980 and it took time for the equipments to stabilize. The need for an integrated approach for energy management was felt only during 1985. A monitoring cell functioned during 1986 doing the preliminary works and the task force approach was adopted from 1987 beginning. A coordinator with engineers drawn from functional departments and belonging to different disciplines commenced energy auditing along with the other problem solving assignments.

The 'Walk through audit' is carried out by this team, perpetually and the 'short audit' too is entrusted to this group. They collect data and all other relevant informations to formulate the programme. The reports are periodically reviewed.

In the early part of 1988, a technical audit of the paper mill was instituted and the 'full audit' of energy was also brought in their scope. The report of the audit team has been used in formulating the schemes involving high expenditure to make the old machinery energy efficient. The expenses of this study has been met partly by KSBPE.

Case Studies from 'Walk through audit' (at MPM) :

a) The wood handling system in MPM has two main streams—one for eucalyptus and the other for

bamboo. The eucalyptus stream has four chipper and the bamboo stream has two. The hardwood is chipped in a fifth chipper and all the seven are driven by 3.3 KV motors. The auxiliaries operate on 440 V 3 pH supply.

The 'Walk through' audit team noticed the continuous running of the euca chippers, for longer duration without load. This continuous running was then attributed to the mismatch between the drive and driven equipment and a large starting time, prevented frequent stops and starts. This situation was needing continuous Motor operation to reduce burnouts. The team with the involvement of plant engineers arranged for the following corrective measures to reduce power consumption in euca and bamboo chipping.

- i) Avoiding idle running of HT motors by introducing fluid coupling to get over the mismatch situation
- ii) Adjusting hydraulic control system in pallaman chippers to avoid dust loss to improve CPM-2 yield

The improvement is quantified below:

	1985-86	1986-87	Difference
Average power consumption/ton of chips produced.	18.49Kwh	15.28Kwh	3.21Kwh
Total production	82285		
Savings in power consumption	264134 Kwh		

At 77 ps per unit electrical energy then prevailing, savings in Rs. is 2,03,383/-

Note : i) The energy meters at the sending end and on the individual motors are calibrated periodically to ensure the required accuracy.

ii) The investment on fluid coupling for 5 motors were payed back in 1 year.

b) The 'Walk through' audit could do much on the steam front too. The audit team had a quick study of the metering system and a dialogue with the plant engineers helped in quantifying consumption accurately with the aid of agreed correction factors. A format which is enclosed is employed for steam accounting every month. This is being monitored regularly and the cause for unaccounted steam crossing a limit would be investigated immediately.

STEAM AUDIT

Date :

GENERATION :

	On Date	To Date	RH	On date	To date	RH
	(T)	(T)	Od/TD Power (Kwh)	(Kwh)	(Kwh)	OD/TD
Steam :						
CF ₁				TG ₁		
CF ₂				TG ₂		
CF ₃						
SRB						
TOTAL :	-----	-----	-----	-----	-----	-----

CONSUMPTION :

	RH		LP		MP		(T)
	On date	To date	On date	To date	On date	To date	
PM - 1							SPRAY WATER : LP thro' TG : _____ LP thro' PRDS : _____ MP thro' PRDS : _____ TG condensate : _____ System condensate : _____ _____ Un Accounted : _____
PM - 2							
PM - 3							
PM - 4							
Sugar							
Evaporators							
Deaerator							
CPM - 1							
CPM - 2							
CSRMP							
Causticizing							
Hypo							
SR Boilers							

On taking corrective steps, the auditing is done once a week for checking the effect of correction.

The benefit during the Jan. 1986 to Dec. 1986 on monitoring MP steam distribution is cited below as an example :

Duration	Steam prodn (T)	Steam Loss(T)	%Loss
Jan '85 to Dec. '85	78847	3817	4.84
Jan '86 to Dec. '86	78490	1725	2.20

Savings in 1986 by bringing down distribution loss

$$= 2092 \times \text{Rs. } 177$$

$$= \text{Rs. } 3,66,768/\text{—per year}$$

(Rs. 177/—was the steam cost for MPM then)

Cases of benefit from short (mini) Audit :

The mechanical pulping plant (CSRMP) is the major load centre of the mill. A 'Short audit' carried out by the energy audit team revealed possibilities of reduction in electrical energy consumption per ton of pulp made.

The pipe line layout for stock transfer and the energy consumption patterns were closely studied by the team. A low cost expenditure in pipeline readjustment in the centricleaner area helped in increasing the yield. The idle running of refiner which have motors of 2500 HP were also eliminated. The refiner plate life was monitored and frequency of plate changing was regulated. The refining was manipulated to work at correct consistency. The interdependency of refining with steam, chemical and electricity was closely studied and optimised. The outcome of the effort was evaluated as narrated below :

Power consumption per BD ton of pulp produced	Apr. 85- Mar. 86	Apr. 86- Mar. 87	Diff.
	2121KWH	1854KWH	267KWH

Weighted avg energy consumption
 Production of Pulp 22260 T

$$\text{Savings in energy by this effort} = 59,43,420 \text{ KWH}$$

$$= 59,43,420 \times 0.77 \text{ ps.}$$

$$= \text{Rs. } 45,76,433/\text{—}$$

Conclusions

The energy future in a paper mill is laden with opportunities. The opportunity to pursue a course of energy decisions can propel the mill ahead and face the tough market competition. The environment and economy can be well saved. Profit improvement options abound, professional enhancement is available for energy managers.

The scenario to be followed and deciding on the approach becomes unique to each mill, specially the large mills. But certain ingredients seems to be essential. They are :

- Appointing an energy audit unit
- To takeup successful and visible projects first
- Establishing a reporting and monitoring system.
- Good energy audits.

It is useful to fix targets for specific energy consumption level for monitoring the efficiency of energy use. The energy audit team can assist in developing energy norms for each plant of the mill. Involvement of trade unions and other interests is crucial for a quick result. Productivity boards, research organisations and industry associations should play a key role in catalysing the energy management programmes of the paper industry.

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