Development of Energy Consumption Norms & Implementation of Energy Conservation Act in Pulp & Paper Industry

A.G.Kulkarni*, B.P.Thapliyal*, R.M.Mathur*, K.K.Chakarvarti**

In fragmented & complex pulp & paper sector, development of energy consumption norms under Energy Conservation Act 2001, has raised various concerns about fixing up of norms & targets for mills with diversified process and operations and therefore it has delayed implementation of the Act in the sector. After initiating various activities for development of norms during last two & half years, still the activities are under progress to finalize methodology for setting up the norms & implement Energy Conservation Act. Major steps taken up in this direction are highlighted in the present article to answer many doubts and concerns.

INTRODUCTION

Energy is one of the major inputs for economic development of any country and assumes critical importance in view of ever increasing energy needs. Escalating energy demands with rise in industrial activities, have imposed serious threat of energy security on account of depleting primary energy resources and sizable import bills. With the objective of bridging the gap between energy demand and supply, reducing environmental emissions through energy saving and to effectively overcome the energy import barriers, Government of India has enacted the Energy Conservation Act 2001. The Act provides the much needed legal framework and institutional arrangement for embarking an energy efficiency drive. Under the provisions of the Act, Bureau of Energy Efficiency has been established for implementation of policy programme and co-ordination of implementation of energy conservation activities.

Pulp & Paper industry is one of the fifteen energy intensive industries/ establishments specified as designated consumers of energy under the Energy Conservation Act 2001. One of the main provisions of the Act is to establish and prescribe energy consumption norms for designated consumers. Accordingly Bureau of Energy Efficiency (BEE) in order to evaluate energy consumption levels and to establish & notify energy consumption norms for the pulp & paper sector, sponsored a study to Central Pulp & Paper Research Institute (CPPRI), Saharanpur. Since Pulp & Paper industry in India is a conglomerate of old and new plants, their energy consumption varies widely depending on large number of factors such as diversified technology, variety of raw materials, fuel characteristics and production of different products. In view of these, a comprehensive study was taken-up by Central Pulp & Paper Research Institute to propose suitable norms for different types of mills taking into account these factors. Based on the information submitted by mills, draft norms have been proposed for review and evaluation by BEE.

Central Pulp & Paper Research Institute, Saharanpur

**Central Pulp & Paper Research Institute, Saharanpur.*

***Bureau of Energy Efficiency, New Delhi*

Setting up of the norms for pulp & paper sector

As per the draft notification, any pulp and paper mill or establishment having annual energy consumption equal to or more than 30,000 metric tonne of oil equivalent (MTOE) per year, have been notified as designated consumer for the purpose of the EC Act 2001. For all the mills falling under the preview of the Act, energy consumption levels will be evaluated and norms for specific energy consumption notified by BEE. Furthermore, for the purpose of declaring any other energy intensive industry or establishment, the limit of annual energy consumption in terms of MTOE shall be reviewed every three year.

The process of setting up the Specific Energy Consumption Norms, for pulp & paper sector was started in Jan 2004 by CPPRI. In this study relevant information from mills was collected documented and analyzed for setting up the norms for the industries. Following major activities have been completed based on the analysis of information received from the mills.

a. Categorization of the Pulp & Paper sector into various groups.

b. Design of the data collection format for collection of plant data.

c. Design of the annual reporting format for submission of energy consumption by the pulp & paper mills under the EC Act.

d. Collection and compilation of data from pulp & paper mills.

e. Analysis of data for proposing energy consumption norms for mills grouped under three broad categories of pulp & paper mills.

CPPRI contacted about 300 pulp & paper mills and submitted the annual reporting formats for generating a data base of energy consumption pattern of the mills. Out of more than 300 mills, contacted for submission of information, only 52 mills responded and submitted data for evaluation. Subsequently, based on energy consumption data for year 2002-03 from these mills, draft norms were proposed based on the best practicing mills consumption in January 2005, considering the major products manufactured in different ratio from different raw materials. Method for calculating the norms for mills based on their raw material & products was suggested and presented during the 2nd task force meeting for energy conservation under IPEC program on 18 Feb. 2005 at New Delhi. Industry was requested to submit their comments and feedback about the norms proposed for their mills, so that necessary amendments can be made. In response, the industry, stating that the norms are very strict and cannot be met easily, proposed to have individual norms for all mills based on their raw materials, products, process layout, level of technology and vintage of the plant.

The proposal to derive norms for individual mills was considered and mills were requested to submit data for 3 years to arrive at realistic norms. Analysis of data submitted by mills was carried out to propose norms specific to an individual mill considering 2002-03 as base year and evaluating the norms by taking the weighted average of energy consumption for 3 years i.e., 2002-03, 2003-04 & 2004-05. Two types of norms were proposed specific to individual mills.

1. The norms for the purchased energy (in GJ/t) highlighting the energy inputs specific to a mill.
2. Norms for energy consumed in its processes in the form of steam (t/t of paper) & electricity (kWh/t of paper).

Based on the data received from the mills for 3 years, an analysis was made to arrive at the consumption norms for the mills. The proposed energy consumption norms for various mills falling under E.C. Act and classified/ grouped under different categories as shwon in Fig. 1 were presented during 3rd Task Force Meeting on Energy Conservation under Indian Programme for Energy Conservation (IIPEC) & National campaign on energy conservation on 31 January, 2006 at New Delhi.

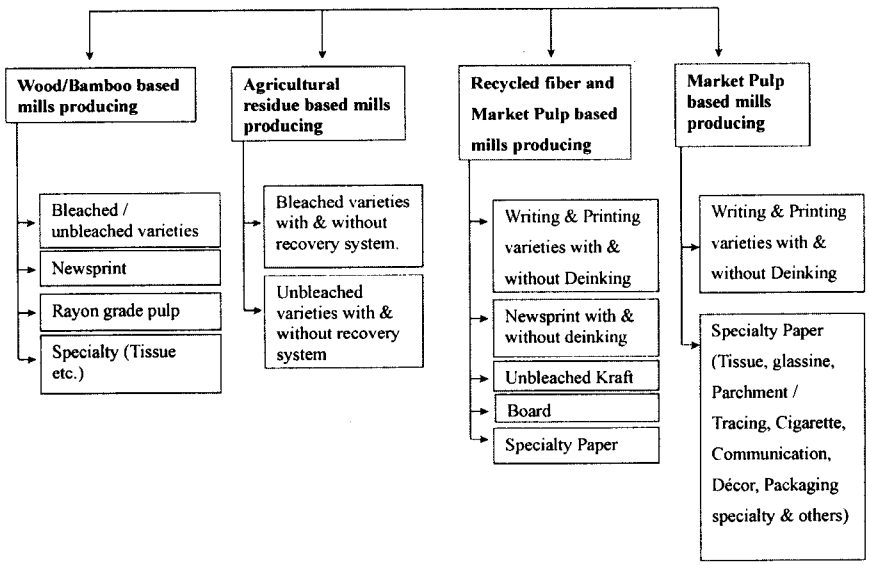

Fig. 1 : Broad Classification of pulp & paper mills covered under EC Act

The norms proposed by CPPRI were based on analysis of data provided by the mills. Till 31 Jan'06, only 25 mills out of 50 mills had submitted data for 3 years. A large number of agro & RCF based mills did not respond positively and no data was submitted for analysis by these mills. Since in absence of data, it was difficult to propose norms on the basis of weighted average energy conservation for these mills , therefore for mills, which have submitted data for one year only, norms based on one year energy consumption were presented. The list of all mills falling under EC Act, and their energy inputs and consumption of steam & electricity in paper manufacturing are presented in Table -1 (a,b,c) and 2 (a,b,c) for mills using different types of raw materials. The steam & electrical energy consumption by the mills in various processes has been split into two parts. First part (within battery limit) incldng the major pulping & papermaking operation is quite similar for mills within a group and can be compared with one another. The processes within battery limit include raw material preparation, pulping, bleaching, stock preparation, paper machine, chemical recovery , boiler house, water system, ETP etc. the other part (outside battery limit) includes auxiliaries such as turbine, water intake, effluent dischrge, chemical plants (chlorealkali etc.) , residential colony etc.

In case of mills which have not submitted any information, BEE would initiate appropriate action in exercise of the powers conferred under the Act. A high powered technical committee represented by senior officials/ executives from ministry, institutions, pulp and paper mills and industry associations, constituted for evaluation of energy consumption norms has been empowered to submit its recommendations on the proposed norms for existing mills and new coming up green field projects.

Based on the appraisal of the specific energy consumption data of mills undertaken by CPPRI showing fairly large performance difference with

Table 1 (a) : Mill Specific Norms for Energy Inputs (GJ/t) for Wood Based Mills

Name of Mill	Purchased energy, GJ/t		Internal Fuel	Total
	Fuel	Grid	GJ/t	GJ/t
Mill 1	37.9	0.3	**20.1**	58.3
Mill 2	51.3	0.5	**21.5**	73.4
Mill 3	45.5	0.3	**18.9**	64.6
Mill 4	26.4	0.1	**21.9**	48.4
Mill 5	24.6	0.6	**23.3**	48.5
Mill 6	22.5	0.2	**9.1**	31.8
Mill 7	23.3	0.3	**13.3**	37.0
Mill 8	18.1	0.5	**9.9**	28.5
Mill 9	30.3	1.2	**0.9**	32.3
Mill 10	58.8	0.3	**19.6**	78.7
Mill 11	40.4	0.0	**15.7**	56.1
Mill 12	56.3	1.5	**0.1**	57.8
Mill 13	25.1	3.7	**3.1**	32.0
Mill 14	27.7	0.5	**20.1**	48.3
Mill 15	17.8	3.1	**13.6**	34.6
Mill 16	15.3	0.5	**34.2**	50.0
Mill 17	9.8	0.0	**34.2**	44.0
Mill 18	41.8	1.2	**15.2**	58.2
Mill 19	46.5	0.3	**18.9**	65.7
Mill 20	46.3	0.2	**23.3**	69.7

Note: The data for all the wood / bamboo based mills are weighted average figures of 3 years (2002-03,2003-04,2004-05)

Table – 1 (b) : Mill Specific Energy Inputs for Agro Based Mills

	Purchased energy, GJ/t		Internal Fuel	Total
	Fuel	Grid	GJ/t	Total
Mill 1*	22.3	3.2	0.0	25.5
Mill 2*	43.1	1.4	0.0	44.5
Mill 3	33.4	0.0	1.8	35.2
Mill 4	14.4	4.3	0.0	18.7
Mill 5	12.1	3.9	1.2	17.3
Mill 6	15.8	0.9	0.0	16.7
Mill 7	39.0	0.0	1.1	40.0
Mill 8	13.3	1.6	0.0	14.9
Mill 9	13.7	2.6	0.0	16.3
Mill 10	25.2	5.7	0.0	30.8
Mill 11	22.0	0.1	0.1	22.2
Mill 12	25.2	1.3	0.2	26.7
Mill 13	20.9	2.9	0.0	23.8
Mill 14	12.1	6.2	0.0	18.3

Note: only the mills marked as "*" have submitted data for 3 years (2002-03,2003-04,2004-05) and their data is the weighted average of 3 years. All other mills have not submitted data for three years.

respect to energy consumption, BEE has proposed that

- CPPRI in cooperation with the association of paper mills will provide a list of all mills falling under the provision of the Energy Conservation Act. This final list will be provided to BEE for their information and necessary action.
- CPPRI team, as accredited energy auditor of the Bureau of Energy Efficiency will visit listed plants to discuss and finalize the self declared specific energy consumption for the financial year 2004-05 and 2005-06.
- CPPRI and mill owners will jointly fill out the forms developed by CPPRI to report the specific energy consumption, the product mix as well as the plant configuration as the first baseline assessment for both financial years 2004-05 and 2005-06.
- The Bureau of Energy Efficiency will encode and analyse collected data and provide the results to all participating mills for the benefit of all.
- The mills will be colored coded on two scales (i) with respect to specific energy consumption for the product mix, as well as based on (ii) efforts to reduce specific energy consumption.
- The Bureau after due consultation with mill owners will set reasonable annual improvement standards in a technically and financially viable manner under the provision of the Energy Conservation Act, 2001 (52 of 2001).

Accordingly CPPRI has contacted all the paper mills associations to review the list of mills falling under E.C.Act. Mills are being visited to finalize their self- declared specific energy consumption for financial year 2004-05 and 2005- 06. Till date 11 mills have been visited and energy consumption data has been collected to assess the first base line for these mills. The data collection will be completed by August / September 2006 and subsequently the analysis results may be encoded for all the mills. Based on the energy consumption data of the paper sector the implementation of E.C. Act may be

Table – 1 (c) Mill Specific Energy Inputs for RCF/Market Pulp Based Mills

Recycled Fiber Based Mills

	Energy Input, GJ/t		
	Fuel	**Grid**	**Total**
Mill 1	21.9	0.5	22.4
Mill 2	36.8	0.2	37.0
Mill 3	26.8	0.3	27.1
Mill 4	11.7	2.7	14.3
Mill 5	10.9	0.6	11.5
Mill 6#	50.2	0.0	50.2
Mill 7	10.5	3.6	14.1
Mill 8	12.1	3.2	15.3
Mill 9	7.0	1.7	8.7
Mill 10	3.0	1.3	4.3
Mill 11	28.3	5.1	33.4
Mill 12	26.7	0.1	26.8
Mill 13	13.4	1.6	15.0
Mill 14	13.6	2.1	15.8

Market Pulp Based Mills

	Energy Input GJ/t		
	Fuel	**Grid**	**Total**
Mill 15*	72.4	1.2	73.6
Mill 16*	27.3	0.0	27.3

Note: only the mills marked as "*" have submitted data for 3 years (2002-03,2003-04,2004-05) And their data is the weighted average of 3 years and the mill marked as "#" have submitted data for 2 years (2002-03,2003-04). All other mills have not submitted data for three years.

Table – 2 (a)

Steam & electricity Comsumption (Within & Outside Battery Limit) for Wood Based Mills

	Battery Limit					
	With In		Outside		Total	
	Electrical	Steam	Electrical	Steam	Electrical	Steam
	kWh/t	t/t	kWh/t	t/t	kWh/t	t/t
Mill 1	1404	10.6	363	6.4	1766	17.0
Mill 2	1552	10.9	585	4.1	2136	15.0
Mill 3	1451	9.8	546	6.3	1996	16.1
Mill 4	1243	8.5	92	3.0	1335	11.4
Mill 5	1200	8.5	76	2.0	1276	10.5
Mill 6	965	5.7	70	1.7	1035	7.4
Mill 7	1142	8.0	81	0.6	1223	8.6
Mill 8	1137	6.7	107	1.4	1244	8.0
Mill 9	1418	9.7	180	0.0	1598	9.7
Mill 10	1650	13.1	479	0.4	2030	13.5
Mill 11	1388	7.1	142	0.0	1530	7.1
Mill 12	2126	6.8	80	5.3	2206	12.1
Mill 13	1834	5.3	93	2.3	1927	7.6
Mill 14	1249	10.9	106	0.0	1355	10.9
Mill 15	1277	6.8	91	1.4	1367	8.2
Mill 16	994	12.4	155	1.3	1149	13.6
Mill 17	807	9.3	44	0.0	851	9.3
Mill 18	1666	11.5	199	3.4	1865	14.9
Mill 19	1432	9.9	337	6.2	1769	16.1
Mill 20	1501	7.1	211	0.0	1712	7.1

Note: The data for all the wood / bamboo based mills are weighted average figures of 3 years (2002-03,2003-04,2004-05)

effected in a systematic manner as briefed below:

Implementation of Energy Conservation Act

A very simple eleven step approach for implementation of EC Act (given below) has been proposed by BEE for designated consumers to comply with the provisions of the EC Act.

Step 1: Each plant self declares their specific energy consumption with respect to the product mix based on kWh electricity and kCal of fuel consumption. (Recommendation of BEE)

Step 2: Specific energy consumption compiled by BEE and sector analyzed. (Recommendation of BEE)

Step 3: The company may review their data online and update online as they wish. However the website would keep track of all updates. (Recommendation of BEE)

Step 4: As soon as sufficient data base is available (50% of all firms in a sector), a comparison and color coding of firms will be done to establish the performance bandwidth of the sector with respect to specific energy consumption. Since apples are compared with oranges, there is a certain bias in the color rating of gold, silver and tin, with newer plants being favored. (Recommendation of BEE)

Step 5: To take out some bias there is a second color rating in a scale of 1 to 10 which judges the efforts of a firm to reduce energy consumption according to the provisions of the law. (mandatory)

Step 6: Based on the provisions of the Act the firm hires an accredited energy auditor and conducts an energy audit. (mandatory)

Step 7: The self declared energy consumption data and plant configuration is validated by this audit and if necessary adjusted and reported online. (mandatory)

Step 8: Furthermore the firm designates or assigns a certified energy manager in charge of implementing the firms

Table – 2 (b) : Steam & electricity consumption (within & outside battery limits) for agro based mills

	Battery Limit					
	With In		Outside		Total	
	Electrical	Steam	Electrical	Steam	Electrical	Steam
	kWh/t	t/t	kWh/t	t/t	kWh/t	t/t
Mill 1	1206	7.7	60	0.0	1266	7.7
Mill 2	1128	8.9	14	0.0	1141	8.9
Mill 3	1334	17.1	73	0.0	1407	17.1
Mill 4	1207	0.0	0	0.0	1207	0.0
Mill 5	1133	4.4	13	0.3	1146	4.7
Mill 6	1114	9.9	42	0.0	1156	9.9
Mill 7	898	11.2	0	0.0	898	11.2
Mill 8	506	8.7	17	0.0	523	8.7
Mill 9	651	4.2	0	0.0	651	4.2
Mill 10	1582	6.6	0	0.0	1582	6.6
Mill 11	908	3.6	53	0.0	961	3.6
Mill 12	925	6.5	53	0.0	979	6.5
Mill 13	1252	3.8	20	0.0	1272	3.8
Mill 14	1603	3.9	62	0.0	1665	3.9

Note: only the mills marked as "*" have submitted data for 3 years (2002-03,2003-04,2004-05) And their data is the weighted average of 3 years. All other mills have not submitted data for three years.

Table – 2 (c) : Steam & Electricity Consumption (within & outside battery limit) for RCF/Market Pulp Based Mills

Recycled Fiber Based Mills

	Battery Limit					
	With In		Outside		Total	
	Electrical	Steam	Electrical	Steam	Electrical	Steam
	kWh/t	t/t	kWh/t	t/t	kWh/t	t/t
Mill 1	915	0.0	0	0.0	915	0.0
Mill 2	950	4.4	78	4.8	1029	9.3
Mill 3	1060	8.6	71	2.9	1131	11.5
Mill 4	817	4.6	17	0.0	834	4.6
Mill 5	450	5.2	0	0.0	450	5.2
Mill 6	1669	4.6	369	0.0	2037	4.6
Mill 7	1293	5.0	22	0.0	1315	5.0
Mill 8	1126	7.7	9	0.0	1135	7.7
Mill 9	427	2.0	43	0.0	470	2.0
Mill 10	356	1.8	2	0.0	359	1.8
Mill 11	1418	6.3	0	0.0	1418	6.3
Mill 12	1687	4.8	90	0.0	1777	4.8
Mill 13	591	2.3	0	0.0	591	2.3
Mill 14	629	2.7	6	0.0	636	2.7

Market Pulp Based Mills

	Battery Limit					
	With In		Outside		Total	
	Electrical	Steam	Electrical	Steam	Electrical	Steam
	kWh/t	t/t	kWh/t	t/t	kWh/t	t/t
Mill 15	2417	26.8	410	0.0	2827	26.8
Mill 16	1807	3.9	83	0.0	1890	3.9

Note: only the mills marked as "*" have submitted data for 3 years (2002-03,2003-04,2004-05) And their data is the weighted average of 3 years and the mill marked as "#" have submitted data for 2 years (2002-03,2003-04). All other mills have not submitted data for three years.

energy conservation policy and energy conservation measures. (mandatory)

Step 9: The firm selects technically sound and financially attractive looking recommendations from the energy audit report and prepares a detailed project report/financial grade paper of selected measures.

Step 10: The firm prepares a three year business plan to implement the selected recommendations within the financial means to the firm.

Step 11: The energy manager of the firm reports on an annual basis progress on implementation as well as verified energy conservation and cost reduction. (mandatory)

CONCLUSIONS

Development of energy consumption norms, color coding & implementation of Energy Conservation Act in pulp & paper sector would serve as a guideline and provide momentum for achieving energy efficiency. The enthusiasm shown by the entire wood /bamboo based mills, their association (IPMA) and a few leading agro & RCF/market pulp based mills, has reflected industry's concern and the vibrancy of energy conservation drive in pulp & paper sector for achieving higher energy efficiency.

We hope that the voluntary action initiated by the mills for implementation of Energy Conservation Act and achieving energy targets in future under the provisions of the Act would make Indian pulp & paper mills energy efficient not only among other industrial sectors in country, but also at par with mills in developed countries. It is also proposed that mills which have not submitted data may contact BEE/ CPPRI and submit the necessary information for avoiding any untoward situation specified under the Energy Conservation Act.