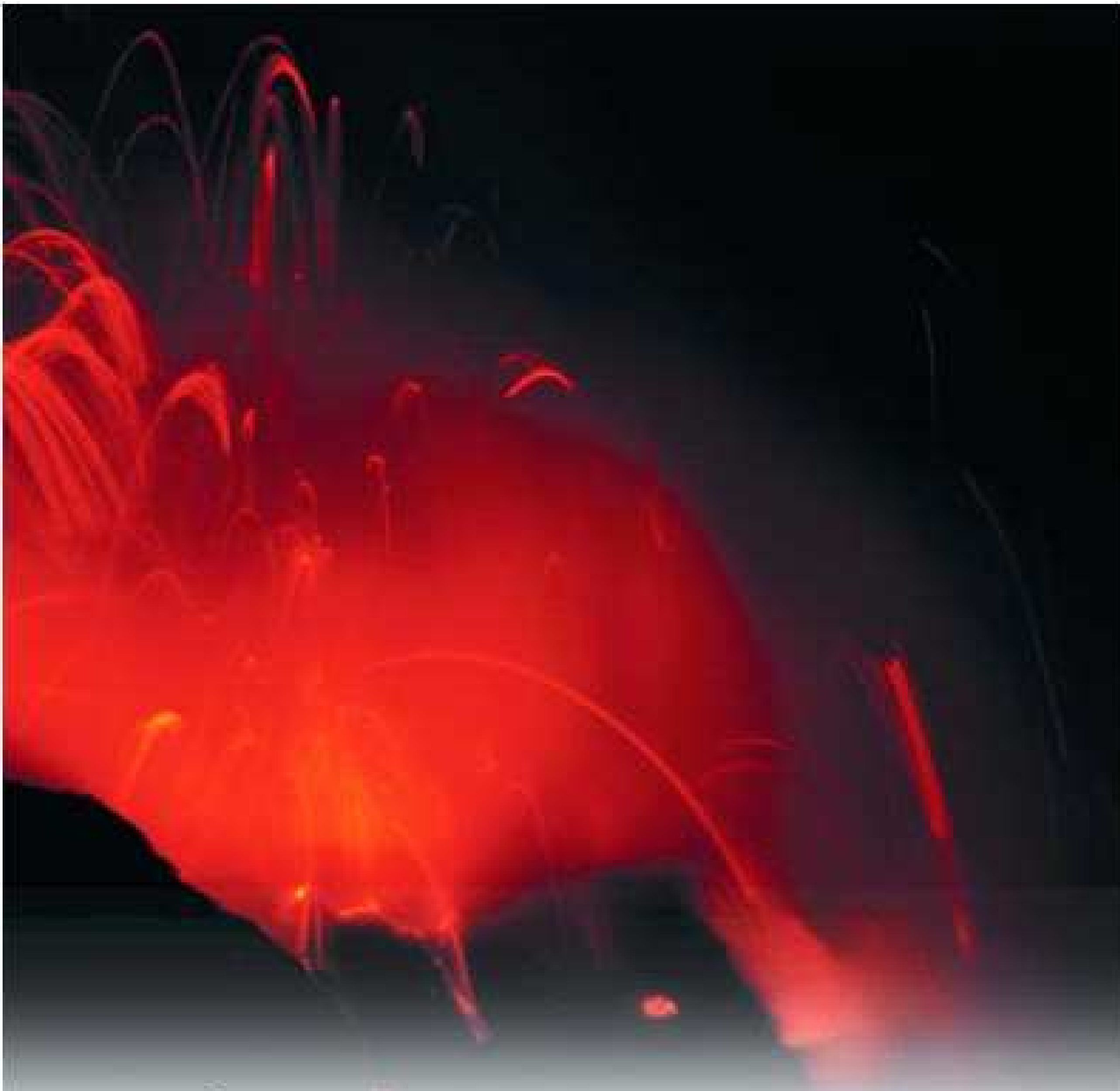

Energy Aspects and Profitability In Nordic Forest Industries´ Annual Reports 1997-2001

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Picture: SCA Environmental Report 2001, pp. 27.

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Executive MBA Program Thesis Work

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Tallinn Technical University

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0 Contents

1	Scope	3
2	Definitions	4
3	Background	6
3.1	Forest industries as part of Finland´s national economy	6
3.2	Forest industries, Kyoto protocol and the Emissions Trading	7
3.3	Forest industries´ energy consumption	8
4	Markets and Industries Covered	10
5	Source Analysis	11
5.1	The role of the annual and environmental report as a part of corporate communication strategy	11
5.2	Accessibility and availability	11
5.3	Readability	12
5.4	Hard facts vs. verbal characterization	12
6	Findings	14
7	Conclusions	15
	References	16
	Attachments	18

1 Scope

The scope of this study is to collect, describe and analyse Nordic forest industries annual and environmental reports to find out if the "energy consciousness" or the quantity and quality of energy aspects in the reports has any correlation to company profitability.

The scope is limited to Nordic and European countries mainly to guarantee the accessibility of the information and enable financial comparison, thanks to relatively similar accounting and reporting guidelines.

To avoid false precision, the "quantity and quality of energy aspects in the reports" data is classified into four classes as well as profitability ranks. This should give adequately clear idea of the possible correlation.

Any detailed analysis on company level energy strategies or technologies or company past or future economic performance is out of scope.

2 Definitions

Energy aspects

Discussion, description or graphic presentation on energy related strategies, technologies and their impact on company economic or environmental performance.

Profitability

Profitability as defined in European accounting and reporting systems.

Forest industry

The forest industry consists of the chemical forest industry and the mechanical forest industry. The chemical forest industry includes the production of chemical and mechanical pulp, as well as the making of paper and paperboard. On the other hand, the mechanical forest industry or wood product industry produces sawn timber, plywood, particle board, fibreboard, and further processed higher value-added wood products (Figure 2.1). There is no standardised or generally accepted paper grade classification system. The classification of paper grades presented below is mainly based on Paulapuro (2000a) [1].

Annual report

Annual report as governmentally regulated performance document on any publicly rated company.

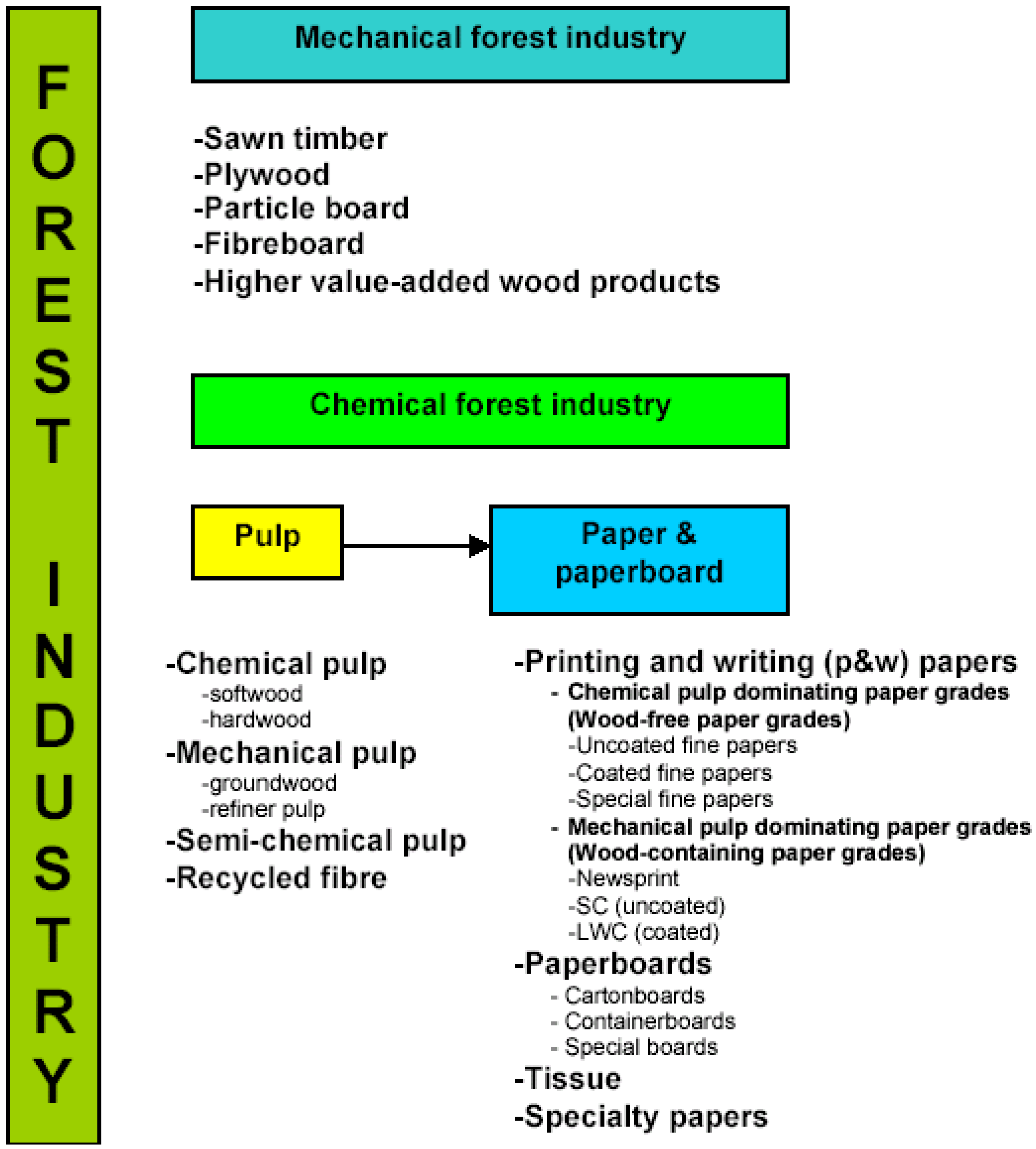


Figure 2.1. Forest industry products [2].

3 Background

3.1 Forest industries as part of Finland´s national economy

Forest industries represent 25% of Finnish export. This would give a strong motivation to analyse the forest industries´ efficiency to use energy as an input to production. However, such an analysis needs vast resources and would be hard to read because of the variety of technologies used, the age distribution of the mill installations and other than technological factors affecting the company profitability.

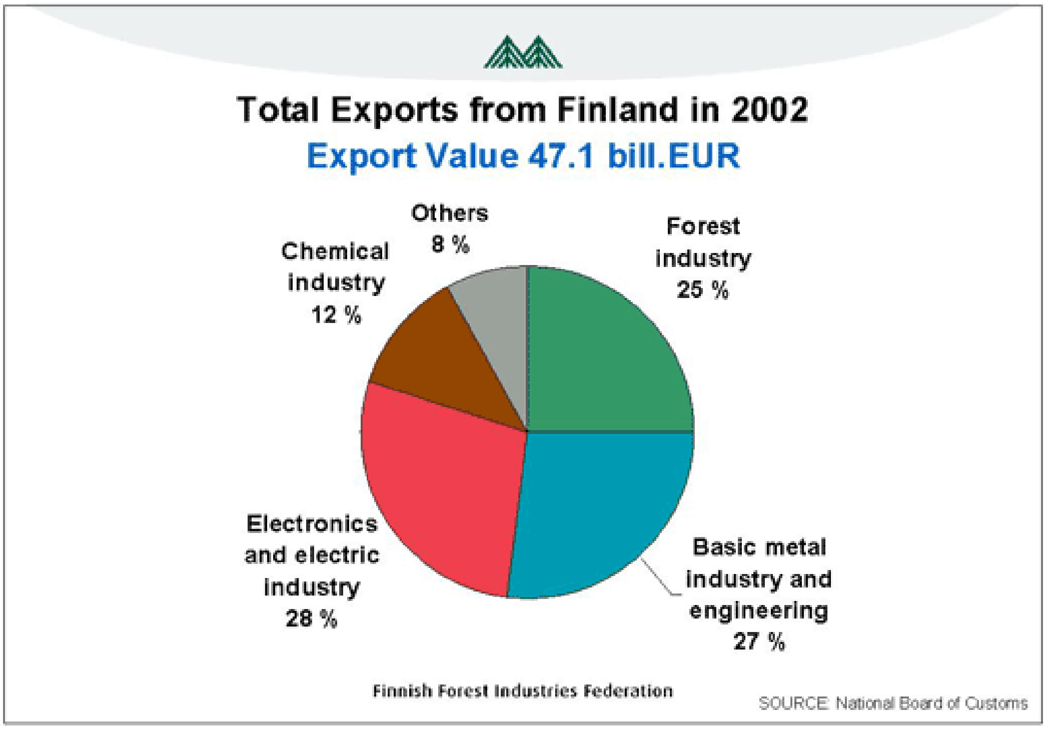


Figure 3.1. Distribution of Finnish exports 2002 [3].

3.2 Forest industries, Kyoto protocol and the Emissions Trading

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (FCCC) in 1997 sets targets for the reduction of greenhouse gas emissions in developed countries and economies in transition. The Kyoto Protocol concerns emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). The protocol shall enter into force after ratification by at least 55 Parties to the Convention whose CO_2 emissions represent at least 55% of the total 1990 carbon dioxide emissions from industrialised countries.

In 2000, Finnish greenhouse gas emissions were 74.0 mill. tonnes in CO_2 equivalent (GWP100). The most important anthropogenic greenhouse gas is carbon dioxide. Total Finnish CO_2 emissions were estimated to be 62.3 mill. tonnes, of which 54.8 mill. Tonnes (88%) were emissions from fossil fuel combustion [4]. In Finland, the forest industry is a major energy consumer. CO_2 emissions from fossil fuel and peat combustion in Finnish pulp and paper mills were, in total, around 5.3 mill. tonnes in 2000, which is equal to the 1990 level. In addition, CO_2 emissions from the production of purchased electricity (including long-term bilateral contracts and purchase from Power Exchange) are assumed to have been 2.6 mill. tonnes [5]. In total, this is around 14% of the CO_2 emissions resulting from total fossil fuel usage in Finland.

Forest industries are considered to be free of CO_2 emissions because forests provide a carbon sink. Only volatile organic compounds (VOC) and sulphur dioxide (SO_2) are emitted (see attachment 1). On the other hand, the future of papermaking in Finland is under discussion, partly because of uncertainty on electricity cost under EU-wide emissions trading [5].

3.3 Forest industries´ energy consumption

The forest industry is on it´s way towards non-fossil or renewable energy usage, as shown in Figure 3.2.

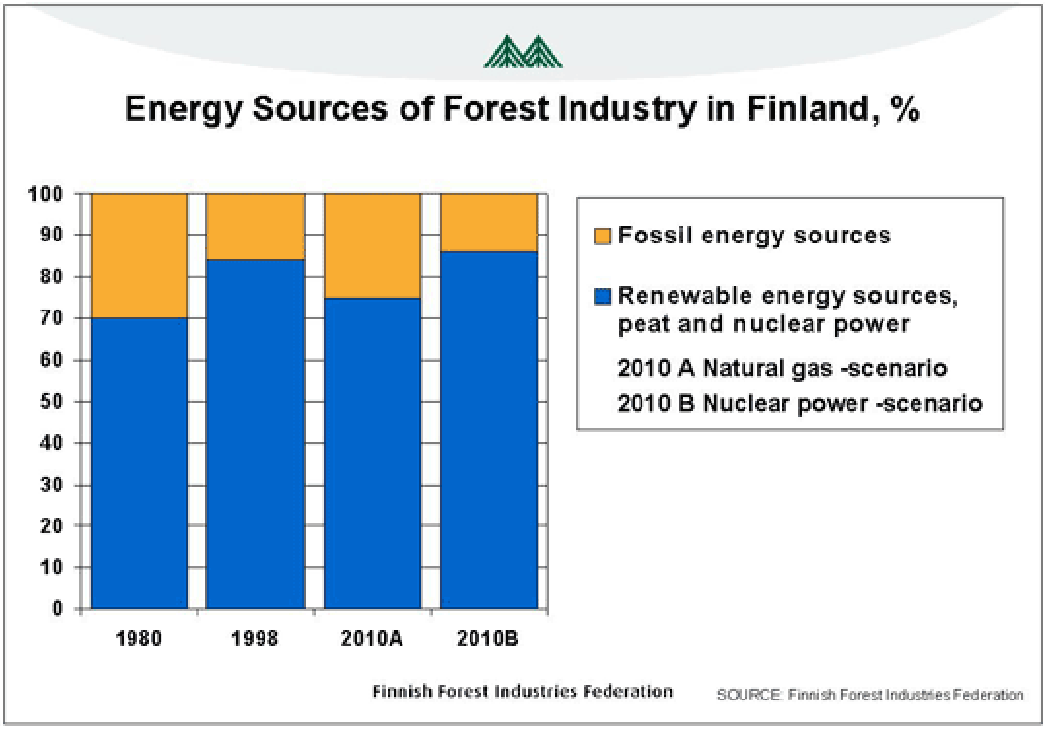
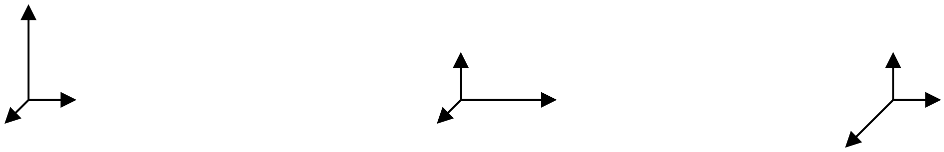


Figure 3.2. Energy sources of forest industry in Finland [3].

The breakdown of forest industry mill fuels is shown on Figure 3.3. It reveals that mills use mostly bioenergy. Also the mill´s own electricity production is increasing (Figure 3.4). This might be the trend in the future as well. Especially the chemical pulping industry has, by respective process selection, the option of emphasizing the "energy dimension" of the "pulping industry space" [6]:

Chemical recovery Energy Fibre



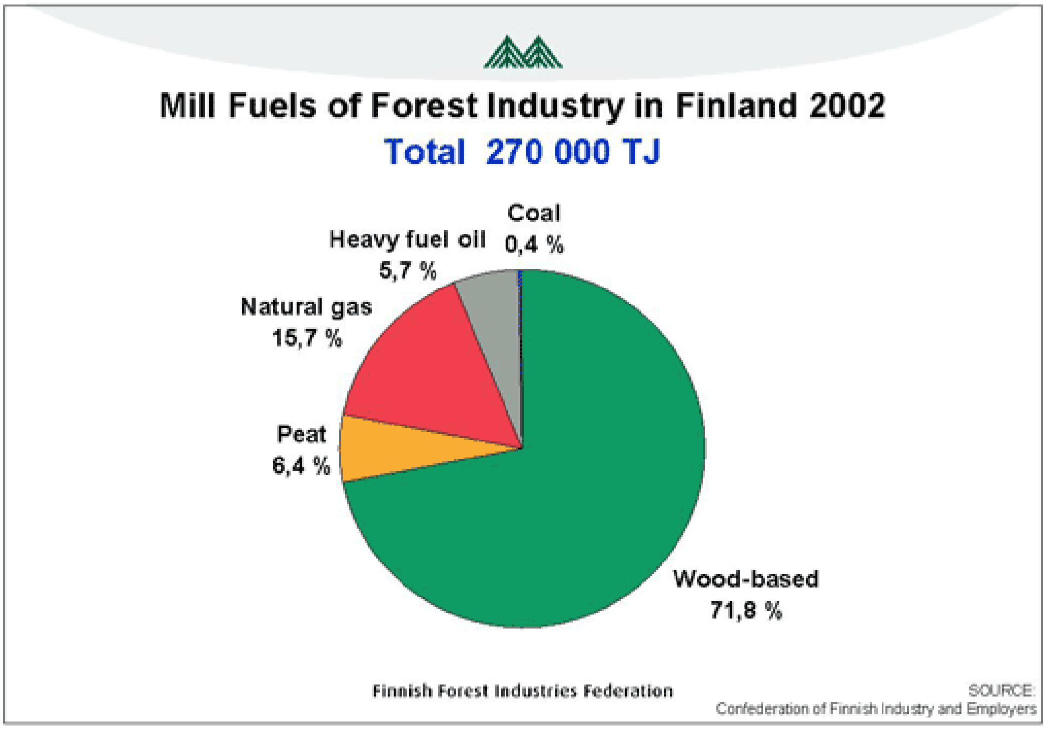


Figure 3.3. The breakdown of forest industry mill fuels in Finland 2002 [3].

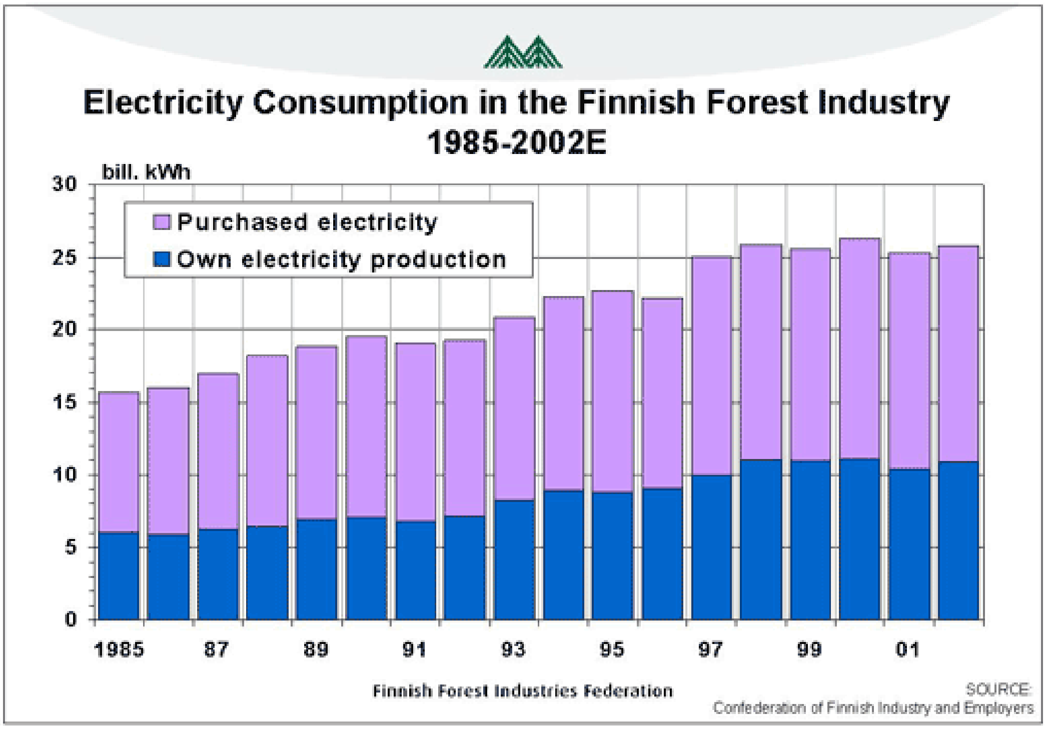


Figure 3.3. Electricity consumption in the Finnish forest industry 1985-2002 [3].

4 Markets and industries covered

The scope of this study is limited to Nordic and European countries mainly to guarantee the accessibility of the information and enable financial comparison, thanks to relatively similar accounting and reporting guidelines.

Many of the companies that submitted the requested reports are operating around Europe and to certain extent in Northern America. The companies are active in the field of forestry, pulpmaking, papermaking, packaging, timber and sawmill products. Pure packaging companies or sawmills were not invited.

5 Source analysis

5.1 The role of the annual and environmental report as a part of corporate communication strategy

The role of the annual report is quite clear. Any public company has to issue an annual report and include the formal financials. The report serves as the main document towards the public and also gives crucial information for investors. Traditionally the annual report focuses on the main investments during the period and omits any details on industrial processes and practises.

However, along with the environmental interest, the energy aspect has become visible also in forest industries´ corporate communications. However, very few companies have used the energy aspect agressively.

5.2 Accessibility and availability

24 invitations for annual and environmental reports were sent out, and 17 companies´ reports were received. Three of the companies denied to submit their reports due to the fact that the company was not public and their policy did not support voluntary information.

The average time to receive the information was two weeks from request. Some companies offered the internet download option.

5.3 Readability

The annual reports resemble each other quite a lot. The main difference with regards to this project was the way the key indicators were presented from past five years. Also the summary tables did not show the Net Profit for the year but either EBIT, EBITDA or Operating Profit.

The structure and contents of the Environmental Report was more versatile, and there were remarkable differences between companies in subjects and the way they are described. Majority of the reports were concentrating around "compulsory" standards and certificates. However, the structure usually was the same through all five years.

5.4 Hard facts vs. verbal characterization

The financial information was considerably easy to find as hard facts. However, the energy related "facts" were mostly limited to energy production and consumption figures by site. The verbal characterization was either non-existing or 1-3 pages, describing the motivation for increased energy consciousness and actions taken.

5.5 Classification method

The companies "energy aspects" ranking was subjective and based on quantity and quality of information. The rank was 0-3 for each reported year, and based on the average rank, the company was classified to either

- none (no information on energy aspects)
- poor (rank < 1)
- fair (1 =< rank < 2) or
- good (2 =< rank).

The companies profitability ranking was based on EBIT (or Operating Profit) averaged over reported years. The company was classified as

- poor (EBIT 0-6 %)
- fair (EBIT 7-10%) or
- good (EBIT over 11%).

The rankings are tabled in Attachment 2.

6 Findings

The companies were organised in a matrix. Energy information was ascending on x-axis and profitability on y-axis.

PROFITABILITY (EBIT) \ ENERGY INFORMATION	NONE	POOR	FAIR	GOOD
GOOD				ASSIDOMÄN BILLERUD HOLMEN METSÄ-BOTNIA SCA STORA ENSO UPM
FAIR	FRANTSCHACH	MUNKSJÖ	ROTTNEROS	M-REAL SÖDRA
POOR	KORSNÄS STROMSDAHL	AHLSTRÖM TREBRUK		

Figure 6.1. Forest industries profitability vs. energy information.

It is obvious from the figure that the companies that operate with good profitability also pay attention on the energy aspects even when reporting to public. However, it should be pointed out that those companies are among the biggest forest industries, and thus one could expect high standard from their reporting.

7 Conclusions

There seems to be positive correlation between the quantity and quality of reported energy aspects and the company profitability. This correlation could be expected since energy is a remarkable input in forest industry, and long time average energy cost has constantly increased after the first oil crisis.

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11. Billerud Annual Reports 2001.
12. Billerud Environmental Reports 2000-2001.
13. Fiskeby Annual Reports 1997-2001.
14. Frantschach Annual Reports 1997-2001.
15. Holmen Annual Reports 1997-2001.

16. Holmen Environmental Reports 1997-2001.

17. Korsnäs Annual Reports 1997-2001.

18. Metsä-Botnia Annual Reports 1998-2001.

19. Metsä-Botnia Environmental Reports 1998-2001.

20. M-Real Annual Reports 1997-2001.

21. M-Real Environmental Reports 1998-2001.

22. Munksjo Annual Reports 1997-2001.

23. Rottneros Annual Reports 1997-2001.

24. SCA Annual Reports 1997-2001.

25. SCA Environmental Reports 1997-2001.

26. Stora Enso Annual Reports 1997-2001.

27. Stora Enso Environmental Reports 1997-2001.

28. Stromsdal Annual Reports 1997-2001.

29. Södra Annual Reports 1997-2001.

30. Trebruk Annual Report 2001.

31. Trebruk Environmental Report 2001.

32. UPM Kymmene Annual Reports 1997-2001.

33. UPM Kymmene Environmental Reports 1997-2001.

34. Energy Aspects Mentioned report version.xls.

Reference 8: Ahlstrom Annual Report 2001, pp. 20.

Health, Safety and Environment

Emissions to the air

Table 4. Emissions into the air are caused by the varying fuels used.

Fuels, % of total	1997	1998	1999	2000	2001
Coal+oil	29.6	25.7	25.4	23.7	20.7
Gas	67.8	71.8	71.9	73.0	72.5
Solid waste	0.7	0.8	0.9	1.2	4.3
Other	1.9	1.8	1.9	1.8	2.6

In the second half of 1990's, coal and heavy oil was substituted by the more environmentally friendly natural gas at several sites, causing reduced emissions especially of NOx and Sulphur.

As an intensive user of energy in the manufacturing processes, the company strongly believes in the need to substitute fossil fuels like oil, coal or natural gas with sustainable ones, e.g. biomass or fuels made from non-recyclable waste materials.

Table 5. The burning of fossil fuels releases greenhouse gases, especially carbon dioxide (CO_2) into the air. The power plants in Osnabrück, Germany, and Kauttua have increased the use of solid waste materials, such as wood, waste papers and other industrial waste materials, as fuels, contributing to the commitment taken by the EU member states to reduce the emissions of CO_2 by 8 percent by 2012 compared with the 1990 level.

In 2001, 29 percent of the fuel used at the Osnabrück plant was derived from waste materials, up from 14.5 percent in 2000, and the company plans to continuously increase this share. Osnabrück's fluidized bed boiler serves as the pilot for new energy concepts. Feasibility studies are underway to use the same concept at plants in Italy and France.

Table 6. The decreased input of both heat and electrical energy are based on the company's continuous efforts to reduce water consumption and consequentially electrical energy and special attention to optimizing the pulp refining process.

Investments in shoe presses at the Turin and Kauttua plants have enabled these reductions as well.

Table 4. **Emissions into the air**

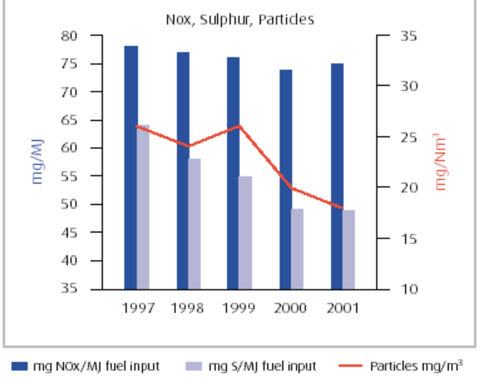


Table 5. **Emissions**

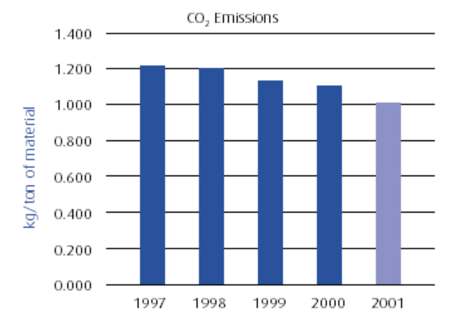
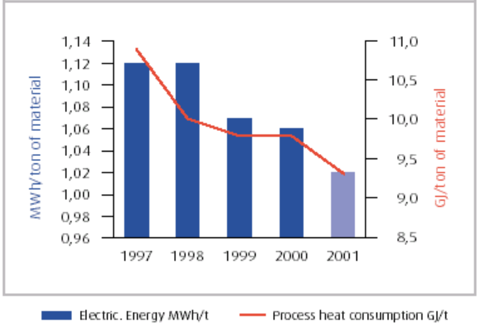


Table 6. **Energy Efficiency**

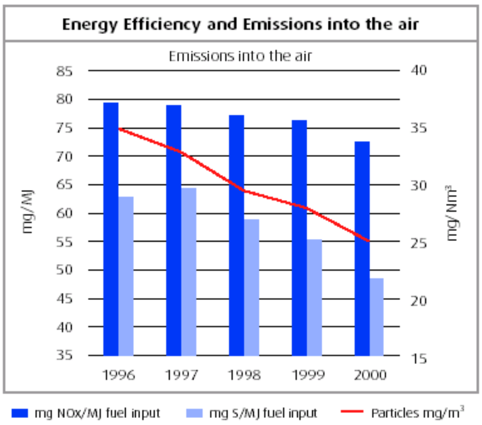


Reference 8: Ahlstrom Annual Report 2000, pp. 24.

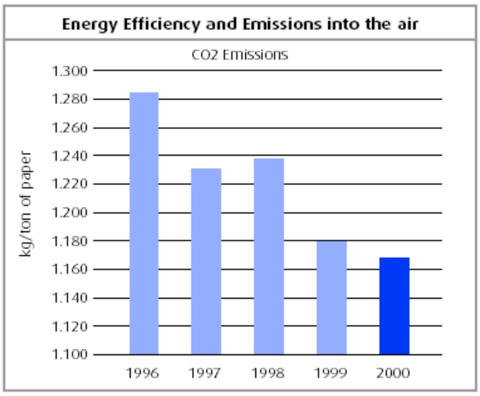
Environment

Emissions into the air

The manufacturing processes in the company's industry require heat energy to dry paper and nonwoven webs or to cure impregnation media. The increased energy efficiency at the mills is mainly due to the improved efficiency of the production lines in terms of downtime, web breaks and broke.

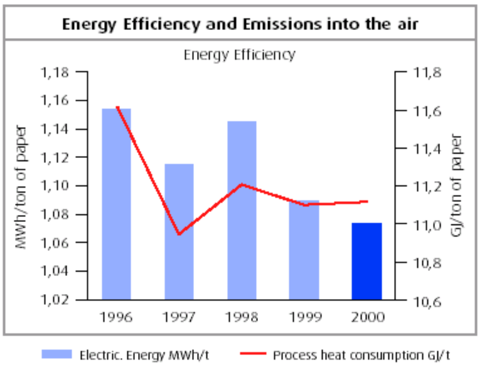


The burning of fossil fuels, mainly coal, oil and natural gas, releases greenhouse gases, especially carbon dioxide (CO2) into the air. Using more natural gas to produce the energy in its mills, Ahlstrom has managed to reduce the CO2 emissions of its power plants by 9 percent within the last five years. The power plants in Osnabrück and Kauttua have increased the use of solid waste materials, such as wood and waste papers, as fuels, thus decreasing the CO2 emissions into the atmosphere.



Figures in the table include CO2 produced by the Ahlstrom electricity suppliers.

The sulfur and nitrogen oxide emissions have been reduced significantly mainly through increased use of natural gas, substituting heavy oil in the Ahlstrom power stations. Investments were made in the mills of Hyun Poong (1997), Mt Holly Springs (1997 and 1999) and La Gère (1999).



Reference 16: Holmen Environmental Report 2001, pp. 15.

ENERGY

Some 60 per cent of the energy required by Holmen's mills comes from renewable fuels, known as biofuels. The raw material that is not processed into products is mainly used as energy in the process, giving a very high degree of resource utilisation.

THERMAL ENERGY

Biofuel comes from the parts of the wood that are not used to produce pulp or sawn timber. At Iggesunds Bruk, a sulphate mill, thermal energy is produced from recovered liquor that contains large quantities of wood substances. Wood residues and sawdust from the nearby Iggesund Sawmill are also used there. The other mills use bark, wood residues, sludge from the effluent treatment process, and sludge from de-inked pulp.

Fossil fuels. Most of the mills use oil as a supplementary fuel to produce steam, although Workington and Peninsular use natural gas. Hallsta, Braviken and Workington also use surplus heat from the pulp production process, which reduces the need for fossil fuels.

ELECTRIC ENERGY

Electricity is generated at the mills as back pressure power by passing high-pressure steam through a turbine that drives an electric generator. This is a very efficient means of producing electric energy for heating. In 2001, internally generated electricity accounted for approximately seven per cent of the total consumption of electric energy at Holmen's mills.

Electric energy from natural gas. At Workington and Peninsular, electric energy is delivered from gas combination plants. These plants are extremely efficient generators of electricity and thermal energy. Peninsular also delivers some of its electricity to the grid.

Hydroelectric power is produced by wholly and part-owned power stations on the Umeälven, Faxälven, Gideälven, Iggesundsån, Ljusnan and Motala Ström rivers in Sweden. Production level in 2001 corresponded to some 30 per cent of the total electric energy consumed by Holmen's mills.

CONSUMPTION OF ENERGY

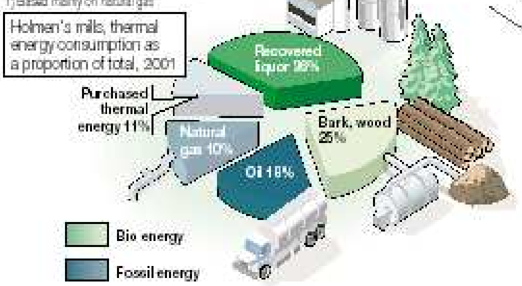
Electric energy is mainly used to run motors such as those used in the production of mechanical pulp. Thermal energy is used for drying paper and paperboard and for heating.

Thermal energy is delivered by Hallsta, Wargön and Iggesunds Bruk to external users. In Hallsta it is delivered to the municipal district heating network.

Thermal energy

TJ	2001	2000
Fossil energy		
Oil	3,240	2,980
Natural gas	1,760	1,310
Purchased thermal energy[1]	2,100	2,000
Bio energy		
Recovered liquors	6,590	7,250
Bark, wood	4,650	5,370
Total	18,340	18,910

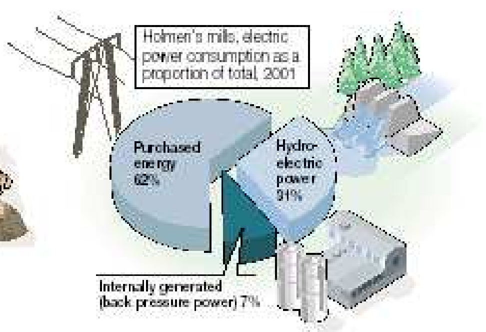
1) Based mainly on natural gas



Electric energy

GWh	2001	2000
Purchased electric energy[2]	2,768	3,072
Hydroelectric power	1,362	1,308
Back pressure power	301	269
Total	4,431	4,649

2) Excluding electricity generated by wholly and part-owned hydroelectric power stations



Reference 16: Holmen Environmental Report 2001, pp. 30.

ENVIRONMENTAL ACTIVITIES IN 2001

HOLMEN KRAFT

POWER SUPPLY

In 2001, 1,362 GWh of electricity were generated by Holmen Kraft's wholly owned or part-owned hydroelectric power stations.

Holmen Kraft's electrical production is environmentally adapted as it uses a renewable raw material – water.

POWER STATIONS

Holmen applies its environmental policy at its wholly owned power stations. At associated stations the largest shareholder's environmental policy is applied.

The power stations and water rights owners hold valid permits for their operations. In the large rivers Holmen Kraft, together with other parties, owns joint companies to handle water rights, fishing, etc.

POWER STATION DAMS

The power industry has drawn up guidelines for dam safety. The dams are classified on the basis of the damage that may be caused by a leak or collapse. All the dams for which Holmen Kraft has responsibility will be risk classified at the beginning of 2002. The guidelines in effect at the facilities that are already classified are followed up regularly.

CURRENT ENVIRONMENTAL ACTIVITIES

Environmental aspects are always taken into consideration when major projects are carried out at the power stations. The current modernisation of the Junsterforsen power station is a good example of Holmen Kraft's approach to environmental issues. The turbines will be fitted with non-lubricated bearings and oil separators will be installed in the spillways. The transformer is being replaced by a new one that requires significantly less oil and be repositioned above ground. Cables containing PCB will be replaced. It is clear from the above that an important goal for the environmental activities is to reduce the risk for emissions of oil into water from the electricity generation process.

The presence of PCB has not been registered in any other power station.

A service company handles the running and supervision of the facilities and takes care of hazardous waste, and this is followed up by Holmen Kraft.

MAINS

Holmen Kraft owns a number of power lines with distribution plants. New permits for these mains operations have been applied for, in accordance with the Environmental Code.

Holmen Kraft and Vattenfall Utveckling are engaged in a joint project relating to the quality of electricity, aimed at grid owners and industry, in order to reduce disturbances and interruptions on power lines.

REPORTING OF INCIDENTS AND COMPLAINTS

The power industry has an industry-wide system of incident reporting in which incidents are registered.

In the Bågede dam the water released fell below the minimum release permitted by the current water rights licence on two occasions in recent years. Measures have been taken and the authorities are investigating the case from 1999. By minimum release is meant the minimum level of water that must be released into old watercourses, for example, to enable fish and aquatic life to survive.

Holmen Kraft. Hydroelectric power is produced by company-owned or part-owned power stations on the Umeälven, Faxälven, Gideälven, Ingesundsån, Ljusnan and Motala Ström rivers.

Production levels in 2001 corresponded to some 30 per cent of the total electric power consumed by Holmen's mills.

POWER STATIONS

PRODUCTION	2001	2000
Electric power, GWh	1,362	1,306
FINANCIAL BACKGROUND, MSEK		
Environmental costs		
internal and external	0.5	–
Net turnover	1,108	1,110
Operating profit	49	39

Reference 16: Holmen Environmental Report 2001, pp. 30.

ALL THE FACTS

HOLMEN PAPER

HALLSTA

Raw materials: Sprucewood, recovered paper

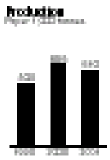
Process: Production of paper based on TMP, groundwood and DIP pulp

Products: Newsprint, improved newsprint, SC paper and book paper

Brand names: HOLMEN NEWS, HOLMEN PLUS, HOLMEN XLNT, SCAMMAG etc.

Environmental investments and costs, MSEK:

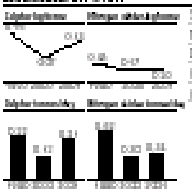
Investments	9.2	(8.4)
of which preventive	1.7	(0)
Internal and external environmental costs[1]	39.0	(60.0)



RAW MATERIAL CONSUMPTION	2001 Total	2001 per tonne of finished product	2000 Total	2000 per tonne of finished product
Wood, m³fub	1,133,700	1.9	1,207,100	1.8
Purchased pulp, tonnes	27,400	0.04	28,300	0.04
Recovered paper, tonnes	94,800	0.15	98,400	0.15
Process water, million m³ and m³	8.0	13	8.8	13
Chemicals, tonnes[2]	32,200	0.05	28,200	0.05
Filler, pigment, tonnes	73,500	0.12	67,100	0.10

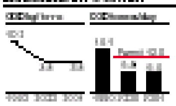
ENERGY CONSUMPTION		2001 Total	2001 per tonne of finished product	2000 Total	2000 per tonne of finished product
Fossil fuels	Oil	1,040 TJ	1.7 GJ	598 TJ	0.9 GJ
Biofuels	Bark, wood	1,075 TJ	1.6 GJ	1,508 TJ	2.2 GJ
Purchased electric power		1,690 GWh	2.67 MWh	1,790 GWh	2.72 MWh
Back pressure power		59 GWh	0.10 MWh	49 GWh	0.07 MWh

EMISSIONS INTO AIR



	2001 Total tonnes	2001 kg/tonne finished product	2000 Total tonnes	2000 kg/tonne finished product
S	79	0.13	42	0.07
NO_x	123	0.20	109	0.17
Dust	56	0.09	25	0.04
CO_2 fossil	80,200	132	45,400	69
CO_2 biogenous	133,800	219	169,100	258

EMISSIONS INTO WATER



	2001 Total tonnes	2001 kg/tonne finished product	2000 Total tonnes	2000 kg/tonne finished product
COD	2,320	3.8	2,490	3.8
BOD	65	0.1	55	0.1
SS	136	0.2	165	0.3
N	29	0.03	34	0.05
P	1.1	0.002	1.4	0.002

WASTE	2001 Total tonnes	2001 kg/tonne finished product	2000 Total tonnes	2000 kg/tonne finished product
Hazardous	364	0.60	332	0.51
Sent to landfill, wet	26,700	44	24,800	38
– estimated as dry waste	16,800	28	16,100	25

OTHER DELIVERIES[3]	2001	2000
Thermal energy, TJ	58	52

1) Excluding capital costs, environmental taxes and charges in 2000. 2) Stated as 100% active substance. 3) For delivery outside the mill.

BRAVIKEN

Raw materials: Sprucewood, recovered paper

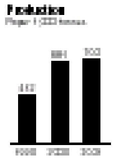
Process: Production of paper based on TMP and DIP pulp

Products: Newsprint, coloured newsprint

Brand names: HOLMEN NEWS, HOLMEN COLOURED NEWS, HOLMEN GUIDE, HOLMEN PLUS etc.

Environmental investments and costs, MSEK:

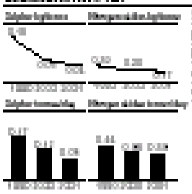
Investments	17.7	(22.2)
of which preventive	2.8	(8.2)
Internal and external environmental costs[1]	30.8	(31.1)



RAW MATERIAL CONSUMPTION	2001 Total	2001 per tonne of finished product	2000 Total	2000 per tonne of finished product
Wood, m³fub	917,000	1.3	989,000	1.4
Purchased pulp, tonnes	17,500	0.03	22,200	0.03
Recovered paper, tonnes	315,000	0.45	278,000	0.41
Process water, million m³ and m³	10.3	15	11.1	16
Chemicals, tonnes[2]	30,600	0.04	29,000	0.04
Filler, pigment, tonnes	15,600	0.02	16,500	0.02

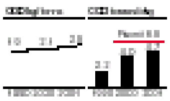
ENERGY CONSUMPTION		2001 Total	2001 per tonne of finished product	2000 Total	2000 per tonne of finished product
Fossil fuels	Oil	448 TJ	0.6 GJ	510 TJ	0.8 GJ
Biofuels	Bark, wood	1,308 TJ	1.9 GJ	1,280 TJ	2.0 GJ
Purchased electric power		1,650 GWh	2.36 MWh	1,650 GWh	2.42 MWh
Back pressure power		11 GWh	0.02 MWh	24 GWh	0.04 MWh

EMISSIONS INTO AIR



	2001 Total tonnes	2001 kg/tonne finished product	2000 Total tonnes	2000 kg/tonne finished product
S	30	0.04	44	0.06
NO_x	120	0.17	133	0.20
Dust	10	0.01	12	0.02
CO_2 fossil	33,900	48	39,400	58
CO_2 biogenous	152,900	218	159,200	234

EMISSIONS INTO WATER



	2001 Total tonnes	2001 kg/tonne finished product	2000 Total tonnes	2000 kg/tonne finished product
COD	1,720	2.5	1,480	2.1
BOD	<30	<0.04	36	0.1
SS	296	0.4	329	0.5
N	77	0.11	76	0.11
P	2.6	0.004	2.9	0.004

WASTE	2001 Total tonnes	2001 kg/tonne finished product	2000 Total tonnes	2000 kg/tonne finished product
Hazardous	220	0.31	270	0.40
Sent to landfill, wet	10,200	15	10,500	15
– estimated as dry waste	8,100	12	8,300	12

1) Excluding capital costs, environmental taxes and charges in 2000.

2) Stated as 100% active substance.

Reference 19: Metsä-Botnia Environmental Report 2001, pp. 14.

Environmental balance sheet

		JOUTSENO	KASKINEN	KEMI Pulp mill	KEMI Kemiart Liners	RAUMA	ÄÄNEKOSKI	TOTAL 2001	TOTAL 2000	CHANGE %
Total production										
Pulp	t/a	334.176	368.523	843.304		469.582	386.858	2.012.062	2.284.776	-12
Board	t/a				289.481			289.481	329.626	-12
Wood consumption										
Total wood consumption	1000 m³/a	1.902	1.704	2.186		2.652	1.921	10.525	11.881	-11
Certified wood	%	61	60	77		67	75	68		
Emissions and discharges										
Effluent										
Effluent flow	1000 m³/a	20.833	18.038	19.016	4.180	10.459	15.213	89.697	86.300	-9
Suspended solids	t/a	289	372	862	186	387	454	2.180	2.690	-19
COD_{Cr}	t/a	8.455	4.610	11.571	836	3.577	6.043	35.094	45.906	-22
BOD_7	t/a	167	131	281	71	314	162	1.016	1.886	-46
Total P	kg/a	10.220	5.891	6.899	1.239	9.236	4.345	38.267	36.013	6
Total N	kg/a	99.035	41.897	134.065	10.990	133.283	99.036	426.654	418.610	3
AOX	t/a	80	18	48			113	274	299	-8
Air										
*Process**										
SO_2	t SO_2/a	377	587	22		433	465	1.884	1.239	52
TRS	t S/a	107	40	55		26	12	240	334	-28
NO_x	t NO_2/a	656	305	801		681	963	3.806	3.969	-4
CO_2 - fossil	1000 t/a	85	28	79		52	57	301	306	-2
- biofuel	1000 t/a	807	998	1.036		922	339	4.197	4.879	-13
Particles	t/a	93	227	29		191	304	843	1.000	-16
*Energy generation***										
SO_2	t SO_2/a		192		276	Bark	Bark	468	476	-2
NO_x	t NO_2/a	38	191		439	sold	sold	668	897	-26
CO_2 - fossil	1000 t/a	26	6		40			72	131	-45
- biofuel	1000 t/a		178		293			471	418	13
Particles	t/a		48		281			329	407	-19
Solid waste										
To the landfill, dry tons	t/a	13.398	3.645	5.549		9.177	8.578	44.342	51.012	-13
Hazardous waste	t/a	49	11	61		116	20	287	139	58
Energy										
Heat production	TJ/a	8.897	7.267	10.034		9.628	6.216	40.872	44.678	-9
Other process fuel (lime kiln etc.)	TJ/a	482	279	570		526	278	2.094		
Biofuel, total	TJ/a	7.465	7.062	9.362		8.467	6.052	38.388	41.221	-7
Share of biofuel	%	91.7	93.6	97.9		87.4	93.2	90	93.7	-4
Power production	GWh	422	348	517		432	241	1.965	2.228	-12
Net share of pulp mill	%	166	116	137		120	96	129	130	-1

*) includes recovery boiler, lime kiln and other process emissions
**) includes auxiliary boilers

Reference 19: Metsä-Botnia Environmental Report 1999, pp. 8.

Energy efficiency is environmental efficiency

Emissions into air have decreased significantly in the forest industry. In the Metsä-Botnia group and in the entire Finnish pulp industry, sulphur dioxide emissions, which cause acidification of the soil and waterways, have become stabilised to a level that has a negligible effect on the environment.

Emissions of acidifying nitrogen oxide constitute the only exception to the falling trend. However, the pulp industry is not a dominant source of nitrogen oxide emissions, which mainly originate from energy production and traffic.

We operate according to the recommendations of Kyoto

Finland is a signatory to the international climate treaty that aims at controlling global warming by limiting greenhouse gas emissions. The Kyoto protocol, which steps up the reduction efforts, defines new area and country specific target emission levels. As part of the Finnish forest industry, we are bound by the Kyoto protocol's emission reduction objectives.

> ***United Nations Framework Convention on Climate Change, Article 2***
>
> *The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.*

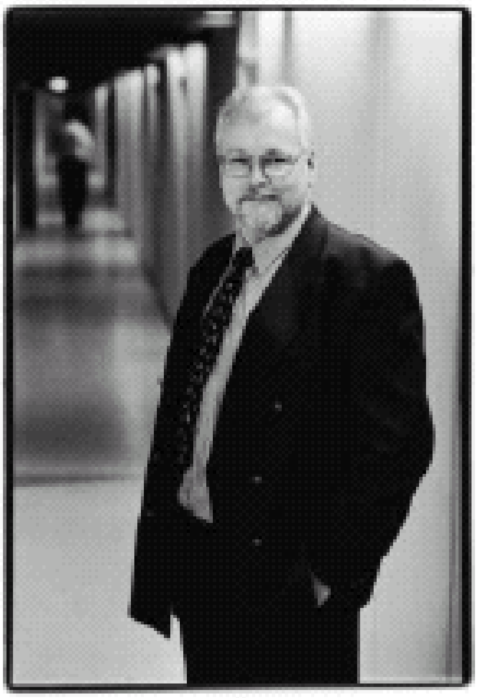
The most important greenhouse gas is carbon dioxide resulting from the burning of fuels. Of other greenhouse gases, methane originates in landfills and nitrous oxide in power station boilers. Metsä-Botnia is entering a joint project which measures greenhouse gas emissions from solid fuel boilers and recovery boilers used in pulp industry. On basis of the project, possible measures will be considered.

The Kyoto protocol singles out three ways of lowering the greenhouse gas emission levels. To begin with, it recommends utilisation of renewable energy sources and bio energy in particular. Over 90 per cent of Metsä-Botnia group's heat production is based on bio fuels.

Secondly, the Kyoto protocol recommends combined production of heat and electricity. This is already the foundation of energy production in Metsä-Botnia group. We produce approximately 40,000 TJ of heat and about 2,000 GWh of electricity per year. About 400 GWh of electricity is sold to the electricity grid. The heat is utilised in our own processes and is sold as back pressure steam or district heat to nearby communities. The energy we sell replaces energy produced out of fossil fuels.

Thirdly, the Kyoto protocol emphasises energy efficiency. All production units of the Metsä-Botnia group participate actively, as part of Metsä-Serla Corporation, in a comprehensive energy survey programme initiated in the beginning of 1999. Our objective which complies with the agreement of energy saving by the Ministry of Trade and Industry and the industry is further to lower our own specific energy consumption and to enhance the efficiency of our energy production. We are also looking for additional ways and means of utilising the surplus heat of the mills in their vicinity.

The most efficient way to diminish the methane emissions from landfills is to limit the volume of organic waste in the dumps. This already is one of the guidelines of our operations. We utilise fibre materials in pulp making as comprehensively as is possible. Bark is used as fuel or sold to be externally utilised. Waste from effluent treatment plants is burned either in bark boilers or in recovery boilers.



Jarno [illegible]

Controlling nitrogen dioxide emissions requires new ideas

According to latest information it is possible to lower the nitrogen dioxide emissions by such means as correct air distribution in the recovery boiler. The decrease may, however, be only cosmetic since reducing nitrogen oxides into nitrogen by changing the air distribution may at the same time significantly increase the amount of nitrous oxide, one of the greenhouse gases, in the flue gases of the recovery boiler. Metsä-Botnia participates in a research project inquiring into the occurrence of nitrous oxides in the recovery boiler's flue gases.

Reference 19: Metsä-Botnia Environmental Report 1999, pp. 9.

Finding the optimum operating model for the recovery boiler requires the simultaneous optimisation of several parameters. A decrease in the volume of nitrogen oxides is not very meaningful if sulphur dioxide and TRS emissions rise as a result. The recovery boiler's basic function of recovering chemicals should not be tampered with. The design of the recovery boiler started up in Metsä-Botnia's Joutseno Pulp mill in 1998 concentrated especially on controlling the nitrogen oxide emissions.

TRS emissions are occasional and smell inconveniences local

The environmental effects of malodorous sulphur compounds are markedly local and linked with production disturbances and stoppages. The inconvenience caused by releases of smell should not be disparaged, however short their duration may be.

There has been a sustained effort in the Metsä-Botnia group to improve the control of emissions due to production disturbances. Special attention has to be paid to the gas mixture's ignition and explosion risk when designing a collection system for malodorous sulphur compounds. Inconveniences cannot be repaired at the cost of safety. We have organised air quality measurements in the mill communities and smell panel surveys to monitor the inconvenience caused by us and the trend of our operations.

Environmental legislation harmonised within the EU

Environmental legislation is being harmonised in EU. A new environment act is under preparation in Finland in compliance with the EU directive on integrated pollution prevention and control. The directive is aimed at harmonising environmental permitting procedures and permit conditions on operators loading the environment. To support the common objectives and uniform application of official regulations, the EU is producing a reference document describing best available techniques (BAT). The technical solutions and reported operation of Metsä-Botnia group and the Finnish pulp industry in general largely constitute the basis of the current pulp industry BAT. With the evaluation of emissions broadening to the EU level, the need to harmonise the methods of measuring and reporting emissions is further accentuated.

Our specific development targets are:

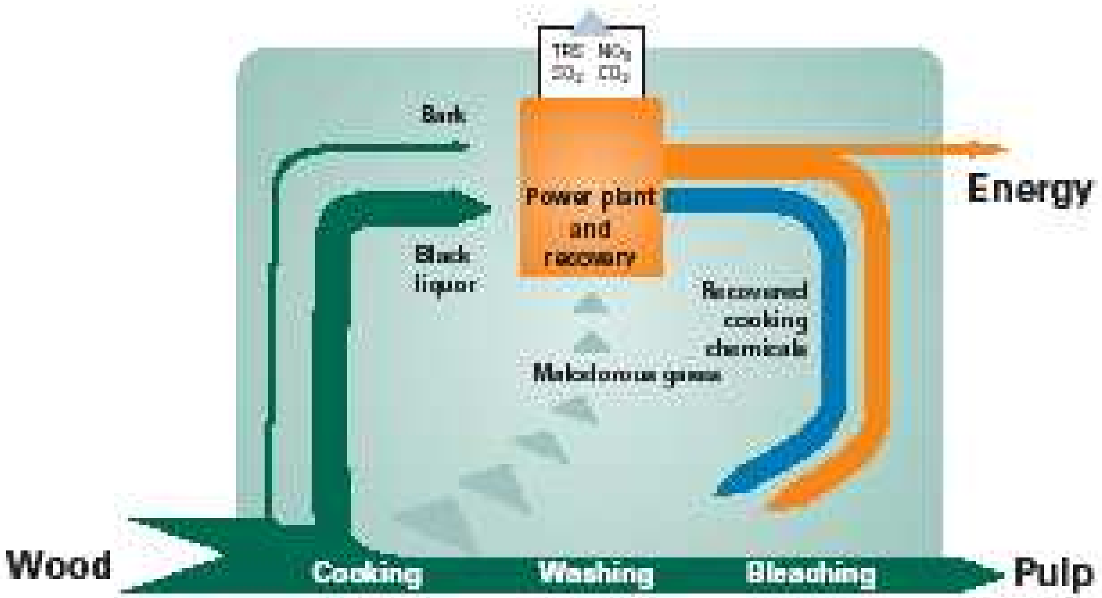
- Reduction of smell inconvenience
- Reduction of specific electricity consumption
- Reduction of nitrogen oxide emissions
- Utilisation of heat with low calorific potential
- Development of monitoring and reporting of emissions

We are committed to continuous improvement

The mills in Metsä-Botnia group are technically modern. We are learning to use ever better the undeniable advantage we have in the sharing of knowledge and experience between our five own mills. We have a lot to learn from each other. Acting together, we can also obtain knowledge from specialists outside the company. Our joint resources make possible the completion of even large development projects. Our good emission trend is the result of determined work. We are committed to continuous improvement and know that improvements will not materialise without work.

Ismo Reilama
Director R & D

Emissions into air



Reference 19: Metsä-Botnia Environmental Report 1999, pp. 18.

The Kyoto protocol: Use the most efficient means

The majority of scientists believe that the atmosphere is warming and that this development is tied in with the increase of the so-called greenhouse gases in the atmosphere. According to **Petri Vasara**, Senior Vice President responsible for environmental strategies and industrial policy at Jaakko Pöyry Consulting Oy, there are other possible explanations for the warming climate, but there are no good grounds to believe that the scientists have got it all wrong. For forest industry, the most important conclusion is that no matter what, international climate politics will have a significant effect on its operating conditions.

According to Vasara, arriving at the emission levels defined in the Kyoto protocol is currently a paradoxically hard challenge for countries and companies who have handled their responsibilities well. However, the situation is unclear, because regulations concerning for example carbon sinks and emissions trade have not yet been finally set.

Interpretation of carbon sinks not necessarily beneficial for Finland

When the annual growth of a forest exceeds natural and logging drain, it functions as a carbon sink: the additional growth binds a part of the carbon released in the use of fossil fuels. However, the Kyoto protocol will recognise only antropogenic changes as true changes in carbon sinks. In practice these changes resulting from human actions consist of increasing the forest area by afforestation.

"By this interpretation, every afforested hectare in countries whose forests have at some point been felled contributes to the growth of the carbon sink. In Finland, the amount of forest area is understandably enough not increasing. Instead, the growing stock per unit area is increased by means of forest management. It's unfair not to take into consideration that this also adds to carbon sinks," Vasara comments.

If the carbon sink is narrowly interpreted, the forest industry's important role in commercial forests' sustainable management is also pushed aside.

Emissions trade cannot be based on hot air

The lion's share of emission reductions can be attained in places where energy is now inefficiently produced with fossil fuels. Savings are most cost-efficient in developing countries. In comparison, energy efficiency in industrialised countries is so high that the marginal cost of reductions is higher. In Finland, the efficiency of energy production is of top quality.

The Kyoto protocol allows emissions trade, which means that if emissions in a country fall below the agreed limit, the country can sell the resulting difference to another country. Vasara reflects that as such, the emissions trade is a healthy idea, but it must be based on real, not notional reductions.

The comparability of emission figures is one of the problems of the Kyoto protocol. For some countries, the proposed emission reductions are more or less cosmetic since the collapse of economy in these countries has already dragged the volume of emissions below the agreed limit. This stands for 'hot air', meaning savings without any concrete measures to reduce emissions. The 'hot air' can then be sold to other countries.

"Such trading is nothing but environmental damage," Vasara states. He is concerned that slowing down the greenhouse effect is turning into a political game.

No need for pontification

In Vasara's view, the greenhouse effect is nothing to moralise about. If the true objective is to diminish the volume of greenhouse gases, resources must be directed where reducing the emissions is both cheapest and most efficient.

"There seems to be those whose fundamental aim is not to improve the state of the environment but rather to change the consumption habits in industrialised countries. If that's the idea, it should be said loud and clear instead of all the talk about the state of the environment."

Petri Vasara
Jaakko Pöyry Consulting Oy

Price of emissions not constant

Vasara is critical of environmental accounting that strives to price environmental impacts so that they can be incorporated into standard management accounting. For some, the leading idea is to evaluate environmental management in a same way than the economic efficiency of a company – by cost-efficiency and productivity criteria based on computations in marks. Converting tonnes of emissions into currency is in Vasara's view doomed to fail since the true price of carbon dioxide emissions is always a function of certain factors – a function of time and place.

"There's no one comprehensive coefficient by which emissions can be converted into price tags without giving thought to where the emissions originate from."

He points out that it is equally impossible to show statistically that there is a cause and effect relationship between sound environmental management and economic success. Rather, the explanation for observed correlations is that a company who takes good care of its business operations handles environmental issues in the same manner.

Reference 19: Metsä-Botnia Environmental Report 1999, pp. 24.

Environmental balance sheet of Metsä-Botnia group 1999

		Joutseno	Kaskinen	Kemi	Äänekoski	Metsä-Rauma	Total 1999
TOTAL PRODUCTION							
Pulp	t/a	381 856	410 111	498 028	451 983	514 818	2 256 796
Board	t/a			290 409			290 409
WOOD CONSUMPTION							
Total wood consumption	1000k-m^3/a	2 223	1 947	2 549	2 169	3 012	11 900
EMISSIONS							
Effluents							
Effluent flow	1000 m^3/a	27 453	21 293	21 860	14 864	8 439	93 909
Suspended solids	t/a	614	371	1 208	497	167	2 857
COD_{Cr}	t/a	14 607	5 557	14 454	7 486	2 354	44 458
BOD_7	t/a	396	185	672	174	139	1 566
Total P	kg/a	12 960	7 107	12 264	5 840	3 723	41 894
Total N	kg/a	85 826	61 452	185 749	62 415	34 268	429 710
AOX	t/a	86	27	62	117		292
INTO AIR							
Process*							
SO_2	t SO_2/a	420	327	69	413	265	1 494
TRS	t S/a	195	65	70	35	29	394
NO_x	t NO_2/a	698	575	944	995	915	4 127
CO_2 -fossil	1000 t/a	66	17	101	90	68	342
-biofossil	1000 t/a	1 021	787	1 183	1 014	1 236	5 241
Particles	t/a	91	370	84	303	304	1 152
Energy development**							
SO_2	t SO_2/a	0	79	309	No own primary boiler	No own primary boiler	388
NO_x	t NO_2/a	57	293	375			725
CO_2 -fossil	1000 t/a	39	1	95			135
-biofossil	1000 t/a	0	202	224			426
Particles	t/a	0	44	246			290
SOLID WASTE							
Landfill waste	t/a	8 543	7 592	9 102	12 420	10 936	48 593
Hazardous waste	t/a	101	22	70	58	9	260
ENERGY							
Heat production	TJ/a	8 164	7 813	10 958	6 713	9 694	43 342
Share of biofuel	%	87	98	88	99	98	93,6
Electricity production	GWh	338	361	544	298	500	2 041
Net share of pulp mill	%	120	117	133	112	127	123,2

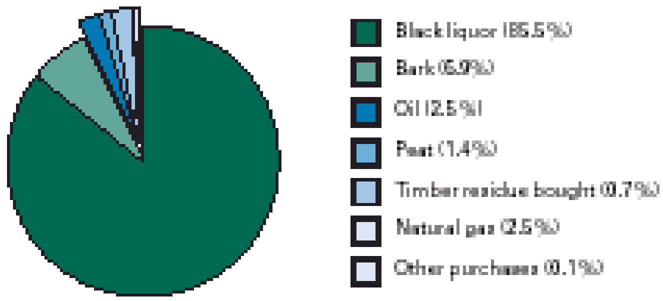
*recovery boiler, lime kiln and other process emissions

** primary boilers

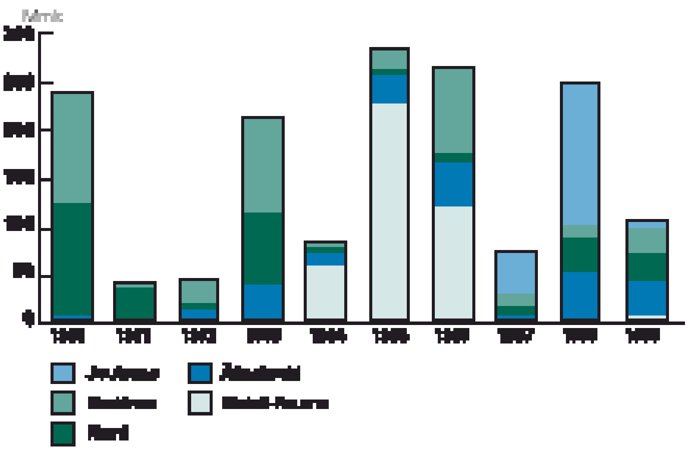
Reference 19: Metsä-Botnia Environmental Report 1999, pp. 25.

Total 1998	Change %
2 157 124	5
293 956	-1
11 301	5
94 181	0
3 121	-8
46 682	-5
1 668	-6
44 051	-5
497 251	-14
366	-20
839	78
758	-48
3 816	8
300	14
4 649	13
1 912	-40
449	-14
660	10
195	-31
487	-12
204	42
64 169	-24
206	26
40 492	7
92,5	1
1 943	5
122,1	1

Fuel distribution 1999



Metsä-Botnia group's environmental investments, 1990-1999



The whole group's environmental investments in 1999 totaled FIM 105,1 million, of which effluents accounted for 53 %, emissions into air 40 % and other investments 7 %. The investments are described in detail in this report's section introducing the group's mills.

Emissions development in 1999

With only a few exceptions, the total volume of emissions decreased by 5 % despite the growth in production.

Emissions into air
- The notable reduction (48 %) in emissions of malodorous sulphur compounds is attributable to the fact that malodorous gas treatment has been intensified in every profit centre. The figures reflect in particular the impact of Joutseno Pulp's new recovery line and improvements made in malodorous gas treatment system of the Kaskinen mill.
- The significant growth in SO_2 emissions (78 %) is attributable to the fact that owing to malfunctions in the actual combustion system in Joutseno Pulp and Kaskinen, a notable portion of malodorous sulphur compounds (TRS) had to be converted into odourless SO_2 in the secondary burner.
- The growth in dust emissions (42 %) in energy production is attributable to the increased total volume of Kemi's dust emissions.
- The reduction in CO_2 emissions in energy production is attributable to the fact that using primary boilers in energy production has diminished and as a result, also emissions have decreased.

Effluents emissions
- Nitrogen emissions decreased (14 %) owing to the stable functioning of activated sludge plants and the fact that nutrients usage became more effective.
- In Äänekoski, enhancing the washing and oxygen bleaching of pulp resulted in significant reduction (20 %) of the total of AOX emissions.

Landfill waste
- The volume of landfill waste diminished somewhat in each mill. The biggest annual reduction was achieved in Joutseno Pulp, where volumes of re-construction waste were produced last year.

Energy production development in 1999

Heat production increased by 7 %. In addition, self-sufficiency in electricity production increased.

Reference 21: M-Real Environmental Report 1999, pp. 18.

Energy

Most of the energy required for the various mill processes is produced by on-site power plants that burn fuels for heat and electricity generation. In addition, electricity is purchased from outside sources.

High energy consumption has been identified as one of the major environmental challenges in the pulp and paper industry. Fortunately, the industry is able to derive a large proportion of the energy it requires from organic residuals left over from its main raw material, wood biomass. This renewable and CO_2 neutral fuel is produced and consumed mainly by the chemical pulp mills.

EMISSIONS IN M-REAL
(per MJ fuel used)
Carbon dioxide: 30(29) g
Nitrogen oxides (as NO_2): 78(79) mg
Sulphur (as SO_2): 65(68) mg

Consumption of electricity in M-real has shown a steady upward trend during the past few years. At the same time, however, the specific use of electricity has been declining. However, the trend reversed in 2001.

In 2001, M-real's total electricity consumption showed a slight decrease, amounting to 7,000 GWh. Total heat consumption was 18,800 GWh.

The business environment in the energy sector is changing rapidly. The Kyoto Protocol and the draft EU directive on carbon dioxide emissions trade, for example, will certainly affect the future but it is still premature to estimate how, as many key issues are still being discussed.

New developments in the energy market

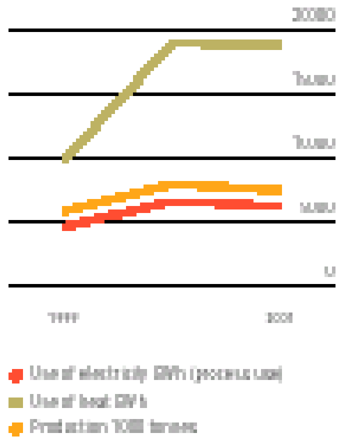
The energy sector has recently seen the development of new markets for green or renewable energy certificates or CO_2 certificates that enable trading in CO_2 emission-free electricity without transferring the electricity itself. The value of these certificates is determined by open market forces.

The green certificate market is aimed at stimulating the overall production of renewable energy by supporting renewable electricity generation at the most efficient and economically-feasible sites. Various projects aiming at promoting international trade in green certificates have been launched.

Emission trading is one of the Kyoto Protocol mechanisms for reducing greenhouse gas emissions. The European Commission has published a draft directive on greenhouse gas emission trading. According to the proposal, each installation will have a permit that indicates its target greenhouse gas emissions and an allocation of greenhouse gas allowances, corresponding to the amount of total emission. This would make the companies part of an emission trading system.

Although some countries have already set up emission trading schemes, it is still voluntary for companies to participate in the CO_2 credit and allowance market. For an energy intensive industry, such as the paper industry, the implementation of a non-voluntary trading system would inevitably result in a significant rise in energy costs. For more information on energy, see p. 28. ■

ENERGY USE AND PRODUCTION
1999–2001



NEW ENERGY ARRANGEMENTS IN PSM
Since May 2000, the heat used at Pont Sainte Maxence mill, France, has been bought from an off-site power plant that burns natural gas. As a result, the mill abandoned the use of heavy fuel oil (1999: 360 GWh and 2000: 135 GWh). Natural gas is a sulphur-free fuel and therefore sulphur emissions from heat production went down to zero (708 tonnes in 2000).

Reference 21: M-Real Environmental Report 1999, pp. 28.

ENERGY

FUELS

Combined heat and power generation supplied 77% (78%) of M-real's energy requirements. Wood-based fuels represented 56 (68%) of all fuels. The reduction from the previous year was the result of a slight change in M-real's production structure, caused by a greater than average fall in production at the chemical pulp mills. Natural gas was the most significant fossil fuel, accounting for 26% (25%) of all fuels. Together, wood-based fuels and natural gas represented 82% of total fuel.

PURCHASED ELECTRICITY

A total of 3,229 (3,265) GWh of electricity was purchased in 2001. Purchased electricity remained the same despite the 9% reduction in production. This means, therefore, that the purchased electricity requirement per tonne of production increased. Only one-third of this increase can be explained by structural changes in production.

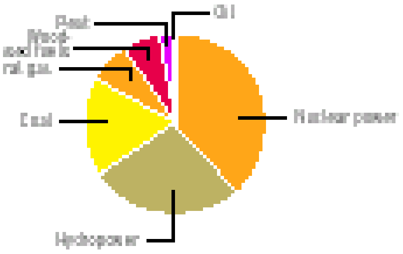
TOTAL ENERGY

Wood-based fuels accounted for 65% (66%) of M-real's total energy usage, which includes the fuel burned by on-site heat and power plants as well as purchased electricity. The most significant fossil fuel was natural gas. The increased use of coal in 2001 was due to the purchase of the Gohrsmühle mill of Zanders.

ENERGY EFFICIENCY

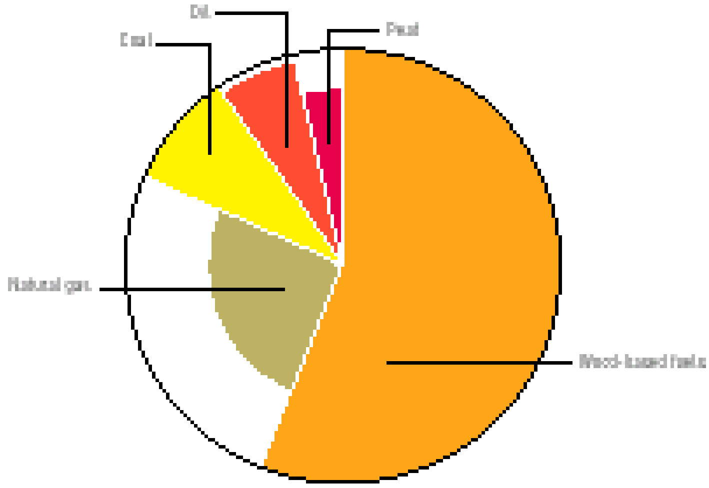
Energy efficiency weakened in comparison with the previous year. Total energy consumption per tonne of production increased by 6%. More than half of this increase (i.e. 2.2%) came from structural changes in company production, which also resulted in more use of fossil fuels and less of wood-based fuels. Technological changes were responsible for a 1.6% increase in total energy consumption and the greater use of purchased electricity. According to the data, a correlation can be found between the decrease in company production and the technology-based increase in energy consumption. ■

PURCHASED ELECTRICITY

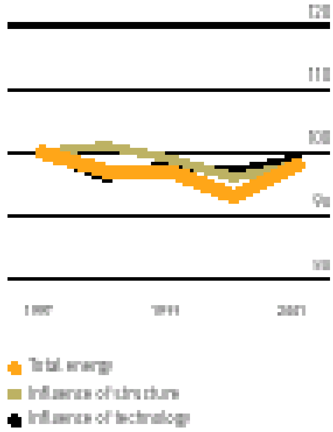


FUELS USED

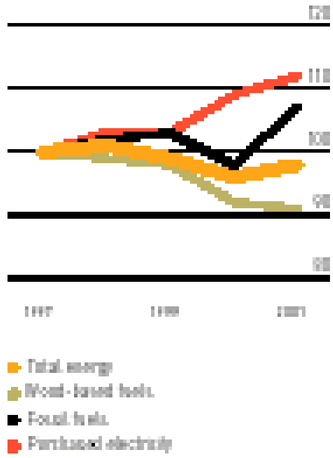
The white areas refer to operations that are not in the ownership of M-real.



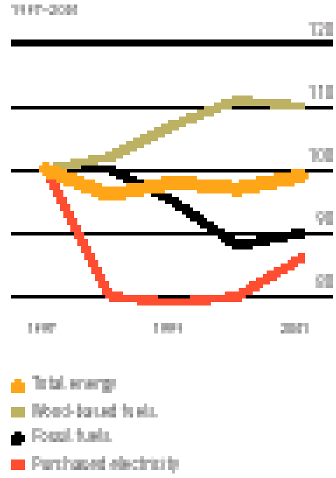
TOTAL ENERGY PER TONNE OF PRODUCTION 1997–2001



THE INFLUENCE OF PRODUCTION STRUCTURE 1997–2001



THE INFLUENCE OF TECHNOLOGY 1997–2001



Reference 21: M-Real Environmental Report 1999, pp. 29.

TOTAL ENERGY CONSUMPTION

	2001 GWh/a	2001 %	2000 %	1999 %	1998 %	1997 %
Wood-based	15,969	45	46	46	49	45
Natural gas	7,616	21	22	24	19	15
Coal	3,705	10	8	9	9	11
Nuclear power	3,096	9	8	10	10	16
Hydropower	2,226	6	6	2	2	2
Oil	1,703	5	6	5	6	7
Peat	1,210	3	3	5	6	6
Total	35,499					

ENERGY CONSUMPTION PER TONNE OF PRODUCTION

	2001 MWh/t	STRUCTURAL CHANGE 2000–2001, %	TECHNOLOGICAL CHANGE 2000–2001, %
Total energy	4.9	2.2	1.6
Use of wood-based fuels	2.1	–2.0	–0.9
Use of fossil fuels	1.7	8.6	2.5
Purchased electricity	0.6	2.2	5.8

NON-COMPLIANCE AND LIABILITIES

NON-COMPLIANCE

Permit levels for wastewater loads were exceeded at M-real Kangas, Sittingbourne and Tako Board as well as at Zanders Gohrsmühle. In all cases, emissions returned to normal levels and action has been taken to prevent disturbances from reoccurring. Permit levels for air emissions were exceeded at M-real Alizay and Hallein. Permit levels for noise were exceeded at Pont Sainte Maxence and Zanders Reflex. ■

M-REAL LIABILITIES

at industrial sites

LOCATION, MUNICIPALITY	CAUSE OF CONTAMINATION	ACTION TAKEN	ACTION STILL NEEDED
Closed-down plants			
Ylä-Savo sawmill, Iisalmi	chlorinated phenols and residual dioxin	composted, soil stored temporarily on landfill site	clean up dioxins
Kolho sawmill, Vilppula	chlorinated phenols and residual dioxin	inspected, soil stored temporarily on sawmill site	clean up chlorinated phenols and dioxins
Böle sawmill, Teuva	chlorinated phenols and residual dioxin	composting completed, soil stored on mill site	clean up dioxins
Vääksy sawmill, Asikkala	chlorinated phenols and residual dioxin	partly composted, soil temporarily stored on sawmill site	clean up dioxins, clean up remaining contaminated soil in conjunction with building work
Toras sawmill, Jyväskylä	dioxins	composted, part of the soil stored on site	dioxin inspection, further clean-up if required
Decommissioned landfill sites			
Laila landfill site, Vilppula	mixed waste	inspected and landfilled	follow-up in progress
Leased industrial sites			
Kolho impregnation plant, Vilppula	creosote, salt impregnating agent	inspected and partially cleaned	prevention of runoff into waterways, clean-up to be continued
Kyrö sawmill, Karinainen	chlorinated phenols and residual dioxin	composted, soil taken to landfill	possible impurities in sawmill area to be inspected and taken into account in conjunction with building work
Metsä-Saimaa sawmill, Lappeenranta	chlorinated phenols and residual dioxin	inspected	to be dealt with in conjunction with building work

The table sets out responsibilities that still belong to M-real after the company closed down operations on the sites.

Reference 25: SCA Environmental Report 2001, pp. 26.

Fire

SCA believes that incineration with energy recovery should be considered as a prime option in the disposal of non-recoverable materials, on a par with re-use and recycling provided that all due pollution prevention measures are taken. Recovered wood fiber should not be classified as 'waste'. The real 'waste' from the production of fresh-fiber paper (tree bark, sawdust or wood chips) is very different from the waste which results from the production of recycled paper (mostly plastic shreds and some fiber), but both have a very high energy potential and should be taken into consideration as bio-fuel or Renewable Energy Sources (RES).

The Incineration Directive aims at preventing emissions to air and the potential damaging results to human health. A consequence is that it reduces the amount of waste burnt, and obliges society to recycle or re-use as many materials as possible. If burnt, waste should have a useful end product through energy recovery, for example through systems for domestic heating in local communities, or for producing steam or energy for industrial processes.

SCA's packaging paper (containerboard) mills represent almost 39% of the total amount of waste sent to landfill in the SCA Group. Special efforts are being made to drastically reduce the amount of waste sent to landfill. SCA's recycled paper mill at Aschaffenburg (Germany) has an integrated incineration plant

26

Reference 25: SCA Environmental Report 2001, pp. 27.

which burns the pre-manufacturing rejects. The Djursland recycled paper mill in Denmark sends its rejects to a cement production unit where they are incinerated for energy recovery and use of the ashes in the product.

In order to reduce its use of, and dependence on, fossil fuels, SCA has invested massively in bio-fuel technologies. The company has made links with energy production specialists in Europe. New bio-fuelled energy production units are being developed at Munksund, Östrand and Edet in Sweden.

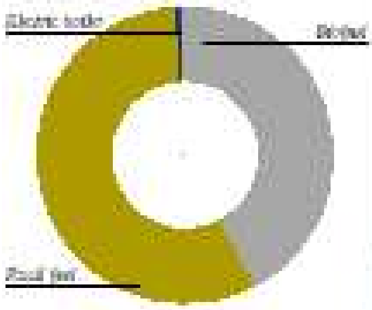
Munksund - a project started in 2001 - is a joint venture between the SCA Packaging containerboard (Kraftliner) paper mill and the energy provider Vattenfall. It also covers the steam requirements of the neighboring SCA Forest Products sawmill. Bark and wood waste from logs entering the mills, as well as sawdust form the combustible bio-fuel base for the two mills. To date, the 450 MSEK (or 48.73 M€) project is one of the largest projects of its type, with a capacity of 98 MW of heat (steam) and 25 MW of electricity.

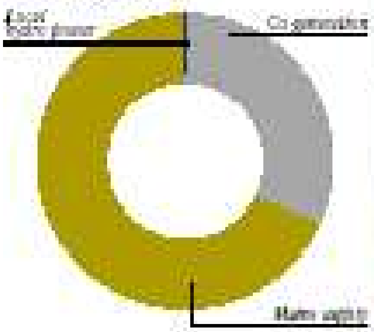
The steam produced is used by the packaging paper mill in the pulp process and to dry paper. At the sawmill, the steam is mainly used in the 37 drying kilns, where timber is dried for periods between one and 17 days. With its consumption of 20 tons of steam per hour, the sawmill uses about 10 percent of the total production of steam. The 25 MW of electricity produced cover more than half the needs of the paper mill, which consumes 40 MW per year. The use of bio-fuel bypasses the need for fossil fuels, and does not contribute to the 'greenhouse effect'.

In the Edet tissue mill project in Sweden, partly developed in 2001, the bio-fuel used is different. Sludge, produced over a period of 15 years, has been stocked in a valley close to the Edet mill. The sludge is now to be burnt to produce energy, alongside the sludge produced by the mill today. It is estimated that the quantity of sludge which will enter the energy recovery process will last for many years to come.

A similar technique will be used at Östrand where an old landfill containing fiber sediments, deposited over a period of 30 years, will be exploited. The sludge will be burnt with bark and wood residuals from the present wood yard in the newly-rebuilt fluidized-bed boiler. The mixed fuel will liberate a large quantity of energy.

Such projects enable the units concerned to cover a large proportion of their energy consumption and in some instances to be self-sufficient. As a policy, and as





The new Munksund power plant

Reference 25: SCA Environmental Report 2001, pp. 28.

Interv

Bo Häger
Manager, Energy and Environment
Munksund
Sweden

"The bio-fuel solution launched here at Munksund in November 2001 combines the best in environmental and economic benefits. Not only is it much more economical for the company to burn our own wood residue than to have to buy fossil fuel, it's also environmentally-sound as the burning is clean and does not produce greenhouse gases. We will use 200,000 m³ of bark every year. Today such factors are more important than ever. Bio-fuel energy production enables both the SCA paper mill and sawmill to be self-sufficient in steam – and we need a lot of steam in the drying process – but is not limited to bark or sawdust. In 2001, after a trial period with bark and sawdust, we also started using rejects from the recovered paper and board entering production at the paper mill. These rejects mainly contain plastic shreds and fiber. Their energy contribution is nearly as good as wood, which means that we will be able to burn all our 37,000 tons of residue at high temperature with energy recovery.

"At other locations, the situation is slightly different. For our colleagues at the Hygiene paper mill at Edet, the raw material will be the sludge stocked for decades in a little valley close to the mill. The old sludge has the right humidity. It will be excavated and burnt for another couple of decades, making sure we have used all our materials to the best of our capabilities.

"These solutions make practical use of a manufacturing by-product, the energy produced makes the mills self-sufficient, and they can provide heat or energy to the community living close-by. In developing our projects, we always position ourselves ahead of the requirements of the different EU directives concerned. This is environmental engineering at its best."

line with the Landfill Directive, SCA also encourages authorities to use incineration with energy recovery for the post-consumer waste associated with disposable hygiene products.

In addition to such large energy projects, SCA has decided to commit to an overall goal to reduce energy consumption at its highest-consuming sites, either in relation to production or to the functional value of the product. ESAVE - a program designed to achieve energy savings utilizing the combined knowledge base of SCA and external experts from energy providers - will be introduced at SCA's high-consumption sites. Under ESAVE, a preliminary assessment of needs and an evaluation of possible energy saving methods are made. Projects offering significant energy savings are identified and categorized. When final decisions are made, SCA or the energy utility makes the necessary investments and takes responsibility for implementation.

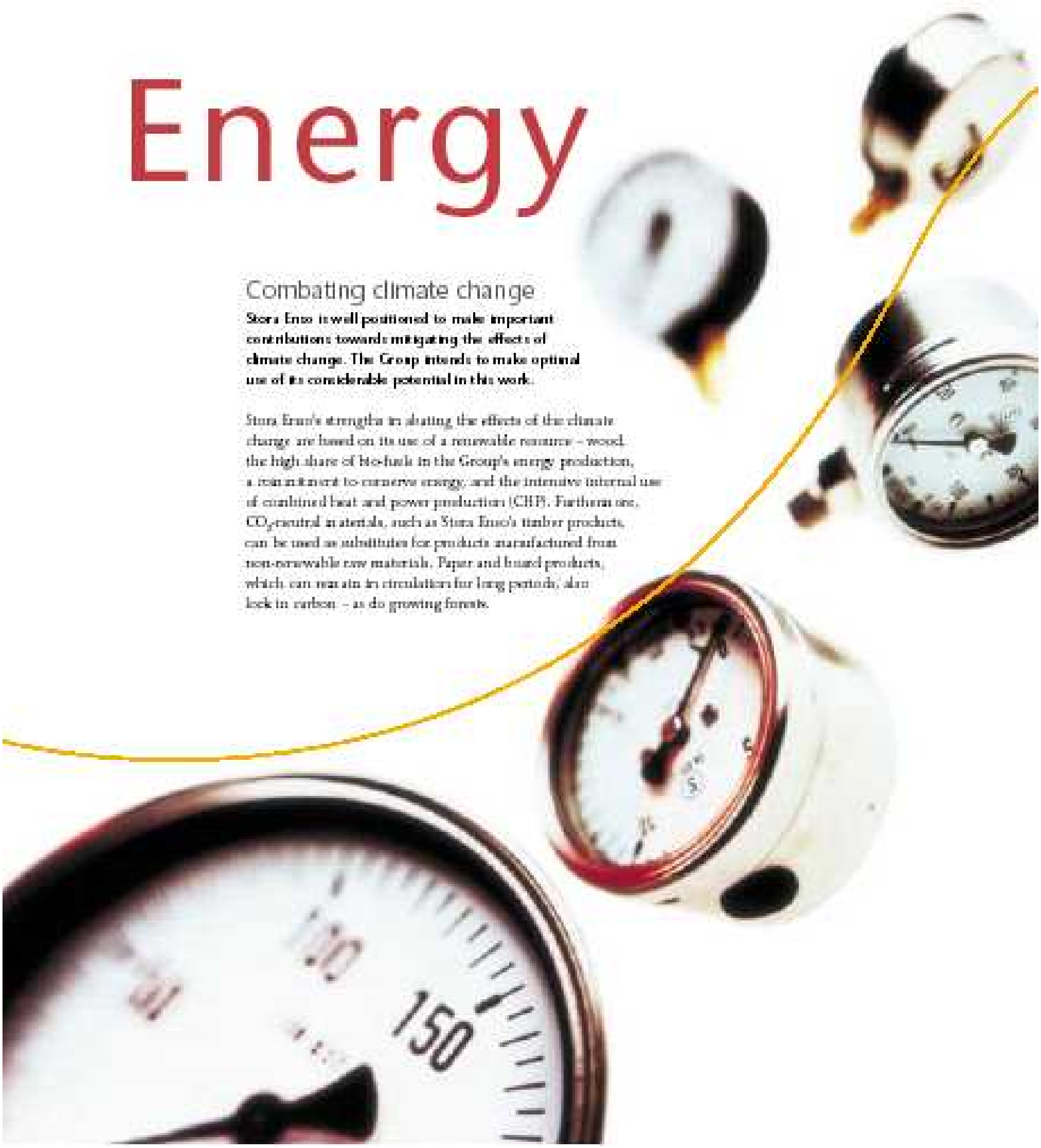
Timber and bark: two useful products from SCA forests

Reference 25: SCA Environmental Report 2001, pp. 39.

Mill name		Munksund		Obbola		New Hythe		De Hoop		Aschaffenburg	
Country		Sweden		Sweden		United Kingdom		The Netherlands		Germany	
Grades *)		kl, wtl		kl, fl		tl, fl		fl, tl		[illegible]	
Year		2001	2000	2001	2000	2001	2000	2001	2000	2001	2000
Production	ktonnes	382	323	376	372	217	231	299	335	274	274
Energy											
Electricity											
Internal hydro power	GWh_e										
Co-generation	GWh_e	41	55	10	14	124	24	119	139	127	129
Grid supply	GWh_e	273	269	312	316		97	3	5		
TOTAL	GWh_e	314	324	321	330	124	121	122	145	127	129
Fuels											
Biofuel	TJ_{fuel}	3 771	3 836	3 830	3 642					254	270
Fossil fuel	TJ_{fuel}	510	325	740	609	1 888	1 467	2 308	2 768	2 095	2 129
Electric boiler	TJ_{fuel}	99	394	-	-	-	-	-	-	-	-
TOTAL	TJ_{fuel}	4 380	4 595	4 571	4 251	1 888	1 467	2 303	2 769	2 348	2 399
of which co-gen	TJ_{fuel}	172	230	41	68	749	181	716	837	840	784
Discharges											
To air											
NO_x as NO_2	tonnes	368	333	306	328	93	61	75	93	361	372
SO_2	tonnes	76	183	271	285	1	1	-	-	6	6
Dust	tonnes	531	715	157	157	-	-	-	-	0	1
CO_2 fossil	ktonnes	40	25	58	48	106	82	134	155	117	119
CO_2 biogenic	ktonnes	362	368	360	350	-	-	-	-	24	26
To water											
COD	tonnes	5 216	5 420	2 118	1 576	637	373	382	317	160	161
BOD	tonnes	2 446	2 790	582	371	121	34	14	15	6	4
Suspended solids	tonnes	890	1 010	903	602	82	78	-	-	6	3
AOX	tonnes	1	1	2	2	-	-	-	-	0	0
P	tonnes	6.5	7.2	22.0	15.6	5.0	3.3	-	-	2.1	1.9
N	tonnes	22.6	21.6	117.4	117.0	2.2	1.7	7.1	6.8	10.8	11.8
Effluent water	Mm^3	11.6	12.1	5.6	10.2	1.6	1.7	1.6	1.5	1.3	1.4
Solid waste											
Landfill	tonnes	25 243	25 600	24 010	21 579	47 273	59 862	3 606	33 855	-	3 795
Recovery	tonnes	113		1 043	895	100	100	29 041	5 007	5 427	1 729
Hazardous	tonnes	68	51	75	70	5	7	10	10	19	60

*) kl = kraftliner
wtl = white top liner
tl = testliner
fl = fluting

Reference 25: Stora Enso Environmental Report 2001, pp. 18.



Energy

Combating climate change

Stora Enso is well positioned to make important contributions towards mitigating the effects of climate change. The Group intends to make optimal use of its considerable potential in this work.

Stora Enso's strengths in abating the effects of the climate change are based on its use of a renewable resource – wood, the high share of bio-fuels in the Group's energy production, a recommitment to conserve energy, and the intensive internal use of combined heat and power production (CHP). Furthermore, CO_2-neutral materials, such as Stora Enso's timber products, can be used as substitutes for products manufactured from non-renewable raw materials. Paper and board products, which can remain in circulation for long periods, also lock in carbon – as do growing forests.

Reference 25: Stora Enso Environmental Report 2001, pp. 19.

Using bio-fuels efficiently

It is most likely that the Kyoto process will greatly affect Stora Enso's operations. This underlines the importance of the Group's Climate Change Policy, which will form the framework for focused actions.

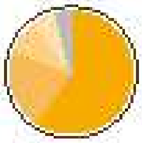
Bio-fuels are considered to be CO_2-neutral in the Kyoto process. At many Stora Enso mills, bio-fuels account for high proportions of total energy consumption; notably at the integrated Varkaus Mill (82%), and Skutskär Pulp Mill (94%). Bio-fuels accounted for 60% of the Group's total annual fuel consumption for energy processes in 2001 – a reduction from the previous year (64%). One reason for this is the use of fossil fuels for intermittent energy production due to production curtailments.

Internal energy flows, especially from chemical pulp mills, can be exploited most efficiently where a sawmill, pulp mill and paper mill are located together. Bark and other bio-fuels from sawmills can also be directly utilised in power plants. The energy-efficiency of this type of integration means that less energy is needed to produce a tonne of paper or board.

The new production line at Langerbrugge Mill will include a 51-MW thermal output bio-fuel power plant that will use fibrous sludge from an integrated de-inking plant and from the waste water treatment plant to generate heat and power, reducing the consumption of fossil fuels. The new line will start up in June 2003.

Total consumption of fuel in Stora Enso's production in 2001, TJ

Bio-fuels	60%
Gas	21%
Coal	9%
Oil	6%
Peat	4%
Total 206 300 TJ	



Bio-fuels account for some 60% of the Stora Enso Group's total annual fuel consumption of 206 300 TJ, with natural gas amounting to about 21%, and the rest divided between peat, oil and coal.
CHP production covers 52% of the Group's total electricity consumption of 22.5 TWh.

www.storaenso.com/2001

Reference 25: Stora Enso Environmental Report 2001, pp. 20.

Electricity procurement and consumption in the Group in 2001, TWh

	Finland	Sweden	Europe (excl. Finland and Sweden)	North America	Asia	Total
Group resources[1]						
CHP (Combined heat and power)	3.7	1.0	1.6	0.9	0.03	7.2
Hydropower	0.4	0	0	0.2	0	0.6
Nuclear power	1.2	0	0	0	0	1.2
Other sources	0.6	0	0	0	0	0.6
Subtotal	5.9	1.0	1.6	1.2	0.03	9.7
External purchasing	2.0	4.8	3.5	3.5	0.08	13.8
Total procurement	7.9	5.8	5.1	4.6	0.11	23.5
Stora Enso mill consumption	7.5	5.8	4.5	4.6	0.1	22.5
External sales	0.4	0.025	0.6	0	0	1.0

[1] Group resources = resources owned directly or indirectly by Stora Enso

Converting residuals into energy

At Varkaus Mill, the consumption of fossil fuels is being greatly reduced now that the gasification of polyethylene from recovered liquid packaging board has commenced. The new gasification plant will generate 900 TJ energy per year, and allow the recovery of aluminium as well as fibre. Preliminary measurements indicate that atmospheric emissions will be low. This process, developed in Varkaus, is the only one of its kind anywhere in the world. The operation concerned, Ecogas, is owned by Corenso, and was set up in 2001.

Heat and power – combined strength

Stora Enso already has a good record in combined heat and power generation (CHP), but there is potential for still more schemes. The challenge is to identify the most cost-efficient and eco-efficient projects, and to assess where co-operation with external partners is feasible.

CHP production with an energy-efficiency of 85% reduces emissions, as well as the demand for electricity from the grid. For instance, CHP accounts for 73% of the energy consumed at Norrsundet Pulp Mill, 63% at the integrated Veitsiluoto Mill, and 59% at Sachsen Mill, which produces newspaper. A modern non-integrated chemical pulp mill such as Enocell produces from its own fuels 53% more electricity than it uses in pulp production.

Several Stora Enso mills provide energy for local district heating schemes. The 25 000 residents of the town of Varkaus are kept warm throughout the year mainly thanks to secondary heat from Stora Enso's Varkaus Mill. The towns and villages of Heinola, Kotka, Nymölla and Skutskär are also heated through similar schemes.

Reference 25: Stora Enso Environmental Report 2001, pp. 21.

Audits show improvements in energy conservation

Stora Enso will further strengthen energy-efficiency auditing procedures throughout the Group. All the European mills have gone through at least one auditing round. Auditing has also begun in the United States, and the first round will be completed in 2002.

By the end of 2001, a total of 117 mills and machines had been audited. The results of these audits have indicated where energy-saving potential still exists, and confirmed the importance of training, systematic reporting, and the sharing of best practices. Many important technical developments were reviewed in 2001.

At Reisholz Mill, a shoe press was installed in Paper Machine 2, leading to a 30% decrease in steam consumption (from 3.5 GJ/tonne to 2.3 GJ/tonne in 2001); since with less moisture remaining in the paper after the pressing phase, less energy is needed in the drying phase.

At Veitsiluoto Mill, process water is now heated with secondary heat from the bleaching plant. This improvement has led to annual energy savings of 380 TJ.

At Hylte Mill, annual NO_x emissions were reduced by more than 11 tonnes, through improvements in the oil and natural gas burners of Boiler 2 that eliminate excess air.

> Policy
> Stora Enso intends to exploit the Group's considerable potential to mitigate climate change through joint efforts with other businesses and sectors.