

Sourcebook of environmentally-relevant data on industry

Data 1990-1999

.....



EUROPEAN
COMMISSION



THEME 8
Environment
and
energy



A great deal of additional information on the European Union is available on the Internet.
It can be accessed through the Europa server (<http://europa.eu.int>).

Cataloguing data can be found at the end of this publication.

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Introduction

Since ratification of the Treaty on European Union¹, the EU has an obligation to integrate environmental concerns into other policy areas, as a logical step 'towards sustainability'. This obligation was reinforced in 1999 by the Amsterdam Treaty².

As a follow up to this, several formations of the Council, including the Industry Council, were asked to report on the progress of this integration process and to produce appropriate indicators to measure this progress. The Commission was invited to present elements of an 'integration' strategy for industry and to further develop tools and methodologies to assess the impacts of policy proposals on the environment, competitiveness and on employment.

This publication attempts to bring together in one report the most relevant statistical information concerning industry and environment which is currently available at Eurostat, as a basis for the production of integration indicators for industry. Much of the relevant background information has been taken from Eurostat's key publication on industry, the *Panorama of European Business 2000* edition³. The bulk of the data is available in the New Cronos database⁴, and is largely drawn from the Council Regulation on Structural Business Statistics⁵ and the joint Eurostat/OECD questionnaire on the environment.

As a general rule, the concept of industry has, as far as possible, been restricted to purely industrial activities, thus not embracing the whole notion of 'business' or 'entreprise' which includes the Services sector. Indicators based on Eurostat data normally follow a NACE-type approach⁶ and include, where possible, the sectors *Mining & quarrying (c)*, *Manufacturing (d)*, *Electricity, gas & water supply (e)*, and *Construction (f)*. However, lack of data for other branches, and especially for *Construction* which is not systematically included, means that the focus is essentially on Manufacturing industry.

For indicators not based on Eurostat data, a different definition of industry may be applied, depending on the structure of the data source concerned. This is the case namely for the air and climate change indicators which are based on the UNECE and UNFCCC emissions inventories⁶.

The statistical content of the publication is split into 3 main parts, covering the last decade or so (from 1988-90 to 1998-1999), and dealing with:

1. **the Competitiveness of Industry:** a set of 5 general feature indicators aimed at providing a broad overview of the global structure of the EU industry, with comparisons with Japan and the USA.
2. **the Environmental Pressures from Industry:** a wider set of 10 indicators, more specifically orientated towards the EU but including EFTA more systematically⁷, and covering 6 specific issues ranging from climate change to use of resources, air, water and soil pollution, and waste.
3. **the Impacts of & Responses by Industry:** 7 indicators in the field of health and safety and sustainable production in the EU.

A section on 'sound social developments', namely consumer behaviour, prices, etc. was initially planned but this idea had to be abandoned due to the scarcity of data in this area.

¹ Signed on 7 February 1992 at Maastricht, the Netherlands ; entered into force on 1 January 1993.

² Treaty of Amsterdam: signed on 2 October 1997, entered into force on 1 May 1999.

³ *Panorama of European Business 2000* edition, ISBN 92-894-0180-X.

⁴ The New Cronos database contains the official statistics available at Eurostat, classified under 9 themes, each of which is further broken down into domains. For more details, see Annex 1: Databases & Nomenclatures.

⁵ Regulation EC, EURATOM n° 58/97 of 20 December 1996, OJ n° L 14, 17. 1. 97.

⁶ See Annex 1: Nomenclatures & Databases.

⁷ EFTA: Iceland (IS), Norway (NO) and Switzerland (CH); Liechtenstein (LI) is excluded for lack of data (except in the indicator on soil contamination, Part 2, Chapter 6).

One important aspect of this publication is that, as far as possible, the domain in Eurostat's New Cronos database where the data can be found is indicated. When data is taken from databases of other organisations, such as UNECE, the address of the relevant website is also given. This should enable users to update many of the tables as needed. It is hoped that this report will thus prove a useful input to the general debate on the integration of environmental concerns into industrial policy within the EU, as well as to discussions on progress towards a sustainable economy within the EU, in the run up to the World Summit on Sustainable Development in Johannesburg in September 2002.

PART 1: Competitiveness of Industry

- Trade balance
- Market shares
- Value added
- Specialisation
- SMEs

PART 2: Environmental Pressures from Industry

- ❖ **Chapter 1: Climate Change**
 - Emissions of CO₂, CH₄, N₂O, HFCs, PFCs and SF₆
- ❖ **Chapter 2: Use of Energy**
 - Final energy consumption
 - Renewable energy sources
 - Combined Heat & Power (CHP)
- ❖ **Chapter 3: Use of Material Resources**
 - Water use
 - Recovery & recycling of packaging
- ❖ **Chapter 4: Air Pollution**
 - Emissions of SO_x, NO_x, CO, NMVOCs, heavy metals and POPs
- ❖ **Chapter 5: Water Pollution**
 - Generation of N, P, BOD and COD
- ❖ **Chapter 6: Waste & Soil Pollution**
 - Waste generation
 - Soil contamination

PART 3: Impacts & Responses from Industry

- ❖ **Chapter 1: Labour Force & Safety**
 - Occupational accidents and work-related health problems
 - Chemical accidents
- ❖ **Chapter 2: Sustainable Production**
 - Eco-industries
 - Environmental expenditure
 - Environmentally-relevant innovation
 - Eco-Management and Audit Schemes (EMAS)
 - Environmentally-sound products (Eco-labels)

PART 1: COMPETITIVENESS OF INDUSTRY

- Trade balance
- Global market shares
- Value added
- Specialisation
- Small and Medium sized Enterprises (SMEs)

Part 1 provides an economic overview of the industry of EU-15 and, where available, EFTA and other triad countries.

The focus is on Manufacturing industry, both because it provides most of the available data and because of its significance: Manufacturing accounts for 20.6% of total GDP for EU compared to 28% for the USA and 24.7% for Japan. Because of a lack of data and because it is not an export-intensive activity, almost no data has been provided on the Construction industry.

Trade balance

This indicator presents the annual trade balance of industry in Triad countries, calculated as total exports minus total imports, and expressed in million ECU.

Trade balance ⁸ of Triad countries by main industrial activities

million ECU

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Total industry										
EU-15	-7 975	-24 327	-33 734	-52 822	-34 630	18 902	30 485	46 357	65 795	63 579	34 624
B	:	:	:	:	:	:	:	:	:	:	:
DK	-447	-229	757	793	2 650	3 759	2 730	1 532	879	2 098	83
D	70 105	73 613	52 408	18 409	25 257	43 882	52 231	63 525	68 609	77 872	87 462
E	-5 895	-8 335	-9 543	-10 873	-11 290	-12 019	-10 678	-11 657	-13 331	-13 990	-15 620
E	-12 140	-19 122	-19 745	-21 343	-22 032	-11 300	-10 878	-12 386	-12 458	-15 293	-20 020
F	-15 115	-18 267	-20 587	-17 161	-9 522	1 427	3 915	8 634	10 846	14 286	10 803
IRL	1 981	1 969	1 182	1 654	3 747	5 202	5 729	7 505	9 460	11 201	17 412
I	-1 090	-3 776	-2 782	-2 653	-1 110	24 463	25 019	27 856	41 454	34 119	30 642
L	:	:	:	:	:	:	:	:	:	:	:
NL	-2 066	-2 713	-5 987	-9 062	-9 896	5 489	3 007	7 951	8 271	10 500	4 195
A	-3 779	-4 932	-5 389	-6 590	-6 403	-6 117	-7 454	-5 601	-6 245	-4 784	-4 245
P	-4 571	-4 479	-5 320	-6 815	-7 891	-6 237	-6 172	-6 002	-6 785	-8 192	-9 541
FIN	1 175	-584	318	1 508	2 661	5 105	5 831	4 549	8 131	9 460	10 565
S	4 801	3 686	3 252	5 430	5 830	7 253	9 198	13 287	16 009	17 402	17 463
UK	-40 438	-40 760	-29 675	-19 486	-24 140	-20 735	-20 157	-19 314	-18 301	-20 204	-36 508
USA	:	-145 155	-124 516	-97 459	-109 580	-149 980	-183 838	-183 989	-199 380	-233 972	-277 987
JAP	89 062	86 315	66 092	84 307	97 454	120 692	120 824	99 802	67 712	91 972	110 757
TRIAD	79 895	-98 766	-90 881	-65 634	-45 654	-9 283	-30 828	-36 220	-63 275	-75 097	-124 729
IS	-234	-7	-65	-137	-200	-23	73	3	-141	-175	-509
NO	-636	3 006	5 474	6 755	6 824	6 483	6 119	7 013	11 633	11 314	2 579
CH	-3 221	-4 904	-3 566	-2 489	1 159	3 110	3 538	2 694	2 952	2 065	790
of which:											
	Mining & quarrying										
EU-15	-42 438	-55 685	-61 722	-62 814	-57 978	-58 183	-60 047	-56 315	-67 492	-77 704	-61 769
USA	:	-33 064	-35 866	-31 223	-31 187	-36 343	-36 529	-35 239	-43 068	-52 671	-38 780
JAP	-31 082	-37 470	-41 478	-42 539	-39 243	-41 064	-39 866	-40 475	-44 793	-52 437	-38 223
TRIAD	-73 520	-126 222	-139 065	-136 578	-128 410	-135 592	-136 445	-132 028	-155 355	-182 816	-138 772
	Manufacturing										
EU-15	34 616	31 408	27 980	9 938	23 159	76 777	90 192	102 084	132 407	140 667	95 842
USA	:	-111 752	-88 673	-65 887	-77 987	-113 159	-146 527	-148 132	-155 659	-180 547	-238 454
JAP	120 144	123 787	107 570	126 846	136 698	161 758	160 691	140 278	112 507	144 409	148 980
TRIAD	153 568	27 844	48 155	71 237	82 971	126 476	106 057	95 838	91 853	107 851	14 245
	Electricity, gas & water supply										
EU-15	-151	-47	8	54	189	309	341	588	881	618	551
USA	:	-336	22	-347	-404	-476	-780	-616	-654	-752	-752
JAP	:	:	0	:	:	:	0	:	:	:	:
TRIAD	-150	-386	30	-293	-216	-167	-440	-29	227	-134	-201

The table shows a long-term positive trade balance for manufacturing industry in EU-15 and Japan, as opposed to the negative balance for the USA. The result is that industry as a whole in EU-15 and Japan has a positive and, with a few exceptions, a growing trade balance. Among the EU countries Greece, Spain, Austria, Portugal and UK consistently show a negative trade balance for industry. The negative balances registered for France, Italy and the Netherlands in the late 1980s and early 1990s had turned into healthy positive balances by the late 1990s. The negative balance for the USA has become progressively worse throughout the 1990s.

⁸ Source: Eurostat's New Cronos database, theme 4: Industry, domain: sbs plus.

Global market shares

Global market shares are normally calculated as the exports of a country expressed as a percentage of total exports. In the table below, these shares are calculated with reference to OECD and its main markets (the EU, Japan, the USA).

Global market shares are a good indication of the changes which are about to take place in global competitiveness, whereas the domestic shares are based on production which is often distorted by the state of local demand⁹.

Total exports by industry and share of exports by the manufacturing industry¹⁰

million ECU

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total exports											
Industry											
EU-15	314 197	354 233	357 942	368 928	382 435	447 491	503 981	549 402	601 762	689 468	698 811
USA	:	289 557	270 632	301 738	305 348	351 430	380 947	390 330	427 931	537 586	534 191
JAP	223 479	248 859	224 195	252 672	261 235	307 737	332 088	338 164	323 156	370 666	341 764
TRIAD	:	863 433	839 695	909 120	934 429	1 089 693	1 198 017	1 258 563	1 331 233	1 571 496	1 547 669
Manufacturing											
EU-15	306 798	345 817	349 730	361 409	374 643	437 557	492 927	538 304	590 258	677 395	688 782
USA	:	283 119	264 605	295 812	299 934	346 770	376 324	385 093	422 413	531 063	528 375
JAP	223 362	248 730	224 088	252 547	261 110	307 589	331 938	338 003	323 006	370 479	341 626
TRIAD	:	848 450	825 349	895 550	921 097	1 074 951	1 182 191	1 242 068	1 314 061	1 552 713	1 531 686
Share of exports to the OECD market (%)											
Industry											
EU-15	55.1	54.8	55.5	54.0	52.3	48.2	48.7	47.2	48.2	49.7	53.2
USA	:	72.1	72.5	70.2	68.9	67.7	68.2	66.4	66.7	66.6	68.7
JAP	61.6	61.5	60.2	57.3	55.6	53.1	51.9	49.0	48.5	49.9	56.1
TRIAD	:	61.4	62.0	60.1	58.4	55.6	55.6	53.4	54.0	55.3	59.0
Manufacturing											
EU-15	97.8	97.9	97.7	98.1	98.1	97.9	97.9	98.1	98.2	98.7	99.3
USA	:	97.5	97.5	97.8	97.9	98.5	98.6	98.4	98.5	98.6	98.7
JAP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TRIAD	:	98.3	98.2	98.4	98.5	98.6	98.7	98.7	98.7	98.9	99.2
Share of exports by manufacturing industry in each market (%)											
OECD market											
EU-15	16.4	13.2	13.4	12.9	12.4	12.6	12.7	12.6	13.1	13.5	14.1
USA	:	14.1	13.2	13.7	13.0	14.0	13.5	12.6	13.0	14.1	13.9
JAP	13.3	10.6	9.3	9.5	9.2	9.8	9.1	8.2	7.2	7.4	7.3
EU-15 market											
USA	:	8.3	7.8	8.1	7.5	8.0	7.5	7.0	7.1	8.0	8.0
JAP	6.6	5.5	5.1	5.5	5.4	5.4	4.8	4.6	4.0	4.2	4.3
USA market											
EU-15	31.6	28.0	29.4	27.1	24.6	23.1	23.2	23.1	23.7	24.0	26.4
JAP	34.3	31.2	28.3	28.9	25.6	25.2	24.3	22.5	19.8	18.9	18.3
Japanese market											
EU-15	:	27.6	30.3	28.3	25.2	24.1	24.1	24.6	24.4	22.8	25.1
USA	:	40.9	39.8	39.5	36.1	34.1	32.2	31.4	31.0	32.1	36.4

It should be noted that although their trade balance has increased, the global (OECD) market shares of EU, US and Japanese industry (and manufacturing) have decreased as a consequence of the growing impact of dynamic countries in Asia.

⁹ Based on or extracted from Panorama of European business 1999.

¹⁰ Source: Eurostat, New Cronos database, theme 4 Industry, domain sbs plus.

Value added

The figures illustrate the profitability of European and Japanese industries, expressed as gross value added, the value of gross output less the cost of material and other intermediate inputs. No data is available for the USA.

Gross value added of total economy and of industry by branch ^{11 12}

million ECU or EURO (at basic 1995 prices)

	1988	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total economy												
EU-15	:	:	5 777 784	5 849 558	5 829 054	6 000 832	6 147 437	6 250 892	6 409 660	6 602 391	6 771 722	7 008 405
EU-5	1 043 248	1 097 597	2 773 811	2 820 140	2 800 854	2 868 132	2 936 244	2 975 242	3 036 697	3 107 378	3 168 783	:
NO	82 058	85 023	87 865	90 485	92 398	96 783	100 301	104 309	109 082	111 719	113 162	116 046
JAP	3 425 032	3 810 399	3 957 921	4 002 459	3 983 885	4 021 744	4 103 688	4 281 417	4 350 770	:	:	:
Total industry												
EU-15	:	:	1 782 902	1 778 662	1 714 607	1 781 024	1 825 342	1 821 097	1 860 737	1 906 779	1 929 423	2 003 416
EU-5	313 943	329 665	913 061	911 450	868 534	901 090	915 047	901 671	920 311	933 804	932 901	971 094
B	50 640	54 201	53 686	53 043	51 453	53 258	54 747	56 295	59 444	60 248	61 368	63 054
DK	28 592	28 266	28 147	28 222	26 571	28 885	30 627	30 522	32 019	32 618	32 459	34 200
D	:	:	584 134	581 139	548 812	566 651	566 108	551 515	559 949	564 772	558 540	579 959
EL	:	:	:	:	:	:	18 612	19 026	18 779	20 141	20 609	21 550
E	114 639	125 953	128 449	126 023	120 553	122 558	127 618	129 077	134 992	142 341	148 658	155 505
F	262 044	279 118	282 817	285 963	270 335	278 800	289 464	287 563	289 163	301 394	308 302	317 802
IRL	:	:	:	:	:	:	:	:	:	:	:	:
I	215 339	226 080	226 855	228 099	219 261	227 932	237 314	236 231	240 407	243 557	245 148	253 334
L	:	:	:	:	:	:	3 151	3 235	3 391	3 494	3 708	3 917
NL	72 118	77 380	78 715	78 133	77 505	80 618	82 289	83 598	84 279	86 321	88 557	91 725
A	43 166	47 155	48 706	49 083	48 580	50 378	52 528	53 641	55 417	57 672	59 526	62 631
P	19 992	22 077	21 623	21 218	20 609	21 340	22 506	23 888	25 493	26 575	27 162	27 868
FIN	26 847	28 163	25 219	24 907	25 310	27 244	28 470	29 761	32 519	35 185	37 227	40 970
S	45 940	46 618	44 723	42 858	42 481	46 789	50 411	51 030	52 739	55 729	59 125	62 273
UK	228 430	239 033	228 970	227 959	231 708	243 539	247 046	250 889	254 229	256 845	258 797	263 329
IS	:	:	:	:	:	:	:	:	:	:	:	:
NO	24 701	26 315	27 366	28 977	29 455	31 661	33 465	34 920	36 870	36 804	36 523	37 504
JAP	1 260 338	1 436 217	1 506 316	1 496 230	1 469 184	1 463 856	1 499 017	1 575 310	1 581 168	:	:	:
of which:												
Mining & quarrying												
EU-5	5 288	5 482	16 710	16 360	16 612	15 794	16 063	14 803	13 034	12 868	12 930	:
Manufacturing												
EU-5	221 769	232 709	658 916	650 209	612 251	638 094	651 148	637 031	660 836	672 871	676 189	:
Electricity, gas & water supply												
EU-5	24 713	25 815	62 426	62 042	60 997	63 200	65 900	69 897	68 474	69 562	70 496	:
Construction												
EU-15	:	:	361 311	366 518	351 465	359 122	359 168	355 035	350 559	354 079	361 999	368 985
EU-5	62 174	65 659	174 639	182 661	178 666	183 959	181 972	179 926	177 668	176 660	177 171	175 770
NO	4 208	3 984	3 803	3 815	3 541	3 702	3 838	3 861	4 201	4 378	4 141	4 202
JAP	346 372	396 793	411 566	414 847	427 215	426 866	409 159	415 539	388 300	:	:	:

In spite of a 12% increase in absolute terms, the gross value added (GVA) of the EU industry decreased from 30.9% of the GVA of total economy in 1991 to 28.6% in 2000 which represents a 7% decline. During the period 1991-97, the real increase in industry (+4%, 77 835 mio. EURO) was inferior to that of total economy (+11%). Although still behind the EU, the GVA of the Japanese economy increased by 27% during 1988-1997 (10% between 1991-1997), compared with 25% for industry, (5% between 1991-1997, 74 852 mio. EURO).

A sectoral breakdown for GVA is available for only 5 EU Member States ¹². For these 5, the branch with smallest GVA (mining) decreased by 33% between 1991-99, while electricity grew by 13%, manufacturing (the branch with highest GVA) by 3%, and construction (second highest GVA), by 1.4%. In Japan the GVA of the construction sector grew by 23% between 1988 and its peak in 1994, but fell by 9% between 1994-1997.

¹¹ Source: Eurostat's New Cronos database, theme 2: National accounts (breakdowns).

¹² EU-5 = DK, D, I, A, FIN (D included from 1991 onwards, break in series).

Specialisation

This table illustrates the vulnerability of EU industry versus industry in the USA and Japan by comparing the degree of specialisation of their respective manufacturing industries, expressed as shares of the various branches in total value added of manufacturing.

Sectoral shares of value added in manufacturing (1997) ¹³

	EU-15	JAP	USA	Total TRIAD	%
Food products & beverages	10.7	10.9	10.2	10.5	
Tobacco products	0.7	0.3	1.4	1.0	
Textiles	2.8	2.4	2.0	2.3	
Wearing apparel; dressing & dyeing of fur	1.5	1.1	1.6	1.5	
Tanning & dressing of leather	0.8	0.4	0.2	0.5	
Wood, products of wood & cork	1.6	1.7	1.7	1.7	
Pulp, paper & paper products	3.1	2.9	3.8	3.4	
Publishing, printing & reproduction	5.3	5.9	7.2	6.3	
Coke, refined petroleum & nuclear fuel	1.7	1.0	1.7	1.5	
Chemical & chemical products	11.9	10.4	12.3	11.7	
Rubber & plastic products	4.4	4.8	4.0	4.3	
Other non-metallic mineral products	4.4	4.3	2.6	3.6	
Basic metals	4.8	4.9	3.4	4.2	
Fabricated metal products	7.1	7.1	5.4	6.3	
Machinery & equipment n.e.c.	11.0	11.4	8.9	10.2	
Office machinery & computers	1.6	2.5	2.7	2.3	
Electrical machinery & apparatus n.e.c.	5.3	4.7	3.4	4.3	
Radio, TV & communication equipment	3.5	8.1	8.9	7.0	
Medical, precision & optical instruments, watches	2.6	2.0	4.6	3.4	
Motor vehicles, trailers & semi-trailers	9.4	8.7	6.6	7.9	
Other transport equipment	3.0	2.0	4.3	3.4	
Furniture; manufacturing n.e.c.	2.8	2.4	3.0	2.8	

Specialisation patterns of the EU, Japan and the USA show a high degree of similarity at industrial sector level. However, many differences appear when individual branches within each industrial sector are considered, the most competitive branches in 1995 being :

- EU: ceramic tiles & flags, construction materials, leather clothes, recorded media, steam generators, footwear, dressing of leather, textile fibres, railway vehicles, knitted & crocheted articles, insulated wire & cable, articles of fur, cement, lime & plaster, luggage, handbags, etc., motor vehicles
- USA: aircraft & spacecraft, grain mill products, medical equipment, sports goods, electronic components, precision instruments, agro-chemical products, tobacco products, optical instruments, bodies for motor vehicles, weapons & ammunition, made-up textile articles, other mineral products, pulp, paper & paperboard,
- Japan : motorcycles & bicycles, fish & fish products, processing of stone, musical instruments, knitted fabrics, audio-visual apparatus, watches & clocks, other wood & cork products, domestic appliances, parts for motor vehicles, electrical equipment, structural metal products, electronic components, accumulators & batteries, finishing of textiles.

¹³ Source: Eurostat (SBS), WIFO calculations in Panorama of European business, 1999.

Specialisation within the EU manufacturing industry (1996) ¹⁴

Top-5 industries in EU-15 based on manufacturing value added					
B + L	Jewellery & related articles	Other textiles	Made-up textile articles	First processing of iron & steel	Glass & glass products
DK	Games & toys	Fish & fish products	Meat products	Ships & boats	Other transport equipment
D	Electricity distribution, control apparatus	Industrial process control equipment	Motor vehicles	Machine-tools	Electrical equipment
EL	Cement, lime & plaster	Textile fibres	Tanning, dressing of leather	Other wearing apparel	Knitted, crocheted fabrics
E	Fur, articles of fur	Cutting, shaping, stone	Ceramic tiles & flags	Vegetable, animal oils & fats	Cement, lime & plaster
F	Steam generators	Watches & clocks	Wooden containers	Sports goods	Detergents, cleaning & polishing, perfumes
IRL	Recorded media	Jewellery & related articles	Medical equipment	Other chemical products	Office machinery, computers
I	Ceramic tiles & flags	Tanning, dressing of leather	Leather clothes	Motorcycles & bicycles	Luggage, handbags, footwear
NL	TV, radio, recording apparatus	Man-made fibres	Recorded media	Prepared animal feeds	Vegetable, animal oils & fats
A	Knitted, crocheted fabrics	Sports goods	Machine-tools	Made-up textile articles	TV, radio, recording apparatus
P	Articles of wood, cork	Footwear	Knitted, crocheted fabrics	Other wearing apparel	Tanning, dressing of leather
FIN	Pulp, paper, paperboard	Saw-milling, planning, impregnation of wood	Panels & boards of wood	Leather clothes	TV, radio transmitters, telephony
S	Saw-milling, planning, impregnation of wood	Pulp, paper, paperboard	Weapons & ammunition	TV, radio transmitters, telephony	First processing of iron & steel
UK	Agro-chemical products	Aircraft & spacecraft	Grain mill products	Processed fruits & vegetables	Ships & boats

The EU's technological competence and skills are seen in mainstream manufacturing and the research-intensive industries outside the information technologies. It is most competitive in the sectors of machinery, vehicles and chemicals, which together create a trade surplus larger than the overall surplus of the EU.

The above industries are ranked according to their shares in manufacturing value added relative to the total of the EU. In interpreting the patterns, different endowments of natural resources can easily be recognised as the underlying causes of the high share of saw-milling, planning and impregnation of wood, pulp and paper in Sweden and Finland, articles of wood and cork in Portugal, and fish products in Denmark. In addition, the high relative shares of apparel, luggage, handbags and footwear, tanning and articles of fur, and similar products in Portugal, Spain, Italy and Greece indicate comparative advantages with regard to labour costs. On the other hand, specific demand conditions can account for the specialisation in the manufacture of ships and boats in Denmark and the United Kingdom.

Other examples include a high share of food processing and games and toys in Denmark; agro-chemical products, food processing, and aircraft and spacecraft in the United Kingdom; power generation or typical marketing industries, such as sports goods, detergents, cleaning agents and perfumes in France; communication technologies in both Sweden and Finland; consumer electronics in the Netherlands; and various types of electrical and mechanical machinery in Germany. Finally, Ireland is a special case, since its top 5 industries strongly reflect the 'youth' of such products as office machinery and recorded media, the production of which was recently located there through an inflow of foreign direct investment ¹⁵.

¹⁴ Source: Eurostat (SBS), WIFO calculations in Panorama of European business, 1999.

¹⁵ Extracted from or based on Panorama of European business, 1999.

Small and Medium-Sized Enterprises (SMEs)

SMEs are companies with 1-249 employees. In industry and energy, these accounted for 99.2% of enterprises but only for 53.9% of total employment in 1996. In construction, these shares were respectively 99.9% and 88.7%¹⁶.

This table shows the value added of SMEs, broken down by size class, in the main manufacturing branches as a percentage of total value added of that size class.

Share of top-branches in total value added of manufacturing by size class¹⁷

	1-19 persons employed				20-49 persons employed				50-99 persons employed				100-249 persons employed				%
	1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998	
Manufacture of food products, beverages & tobacco (da)																	
B	18.6	18.8	19.3	20.1	14.8	15.4	14.3	14.2	17.8	16.8	15.5	16.7	13.8	11.4	14.5	14.8	
DK	: c	: c	: c	10.6	7.7	9.0	7.8	: c	8.4	8.7	8.9	9.1	14.2	14.4	12.2	: c	
D	:	:	:	:	:	9.4	11.4	10.9	:	9.9	10.6	10.6	:	11.1	11.0	10.6	
E	18	17.5	15.9	16.2	14.3	15.2	14.3	13.6	16.5	16.4	16.5	14.5	15.8	15.6	14.7	14.6	
F	:	25	: c	: c	11.2	12.3	12.6	12.3	12.2	12.9	13.4	12.8	:	13.5	14.2	14.3	
IRL	20.6	18.2	14.9 p	12.7	16.7	18.8	15.7 p	17.6 p	23.2	22.8	14.8 p	: c	27.3	25.3	26.2 p	: c	
I	:	10.6	10.5	:	:	8.1	7.5	:	:	7.3	7.1	:	:	8.9	8.9	:	
L	: c	:	:	:	: c	:	:	:	: c	:	:	:	: c	:	:	:	
NL	14.9	14	13.2	12.9	12.2	11.5	11.4	11.6	12.4	13.9	12.8	12.8	18.7	17.0	17.6	15.7	
A	20.6	:	: c	18	16.8	:	16.5	16.0	11.9	:	11.8	12.3	12.7	:	13.9	13.8	
P	:	10.7	11.7	10.2	:	11.8	8.9	11.3	:	13.5	12.1	11.9	:	14.8	15.2	14.8	
FIN	8	7.6	7.8	: c	11.1	9.5	9.4	9.3	9.7	9.8	7.0	10.8	11.9	9.5	8.8	7.1	
S	:	6.3	6.4	6	:	: c	7.5	7.4	:	7.9	6.4	4.9	:	4.6	6.0	6.2	
UK	:	6.9	4.5	:	6.4	6.5	6.2	:	8.8	8.3	6.9	:	10.4	10.3	9.1	:	
NO	:	13.3	12.4	:	:	20.4	20.0	:	:	17.3	16.7	:	:	17.6	16.7	:	
Manufacture of pulp, paper & paper products; publishing & printing (de)																	
B	13.4	13.6	13.3	14.5	10.0	10.8	10.5	11.2	10.9	11.5	11.0	10.7	12.0	10.7	10.5	10.7	
DK	18.8	18.8	18.8	17.2	13.8	13.0	14.1	13.3	11.1	11.2	11.7	10.8	12.0	10.2	9.2	9.5	
D	:	:	:	:	:	12.6	11.1	11.5	:	9.8	10.1	9.9	:	10.6	10.4	10.2	
E	11.1	11.1	11.8	12.1	10.0	10.2	10.6	9.1	9.9	9.9	9.5	9.6	12.0	11.8	11.8	11.4	
F	:	12.1	12.2	11.9	13.1	11.9	11.9	11.4	11.1	11.2	10.9	10.6	:	10.0	10.1	9.8	
IRL	14.9	14.5	16.3 p	19.8	16.7	18.3	: c	13.1 p	18.6	9.7	9.3 p	13.9 p	12.2	21.3	16.9 p	: c	
I	:	6.6	6.3	:	:	5.8	5.8	:	:	6.2	6.0	:	:	6.8	6.0	:	
L	15.0	:	:	:	13.7	:	:	:	: c	:	:	:	15.7	:	:	:	
NL	17.9	18.6	18.2	17.9	15.4	14.8	14.1	14.4	13.4	13.6	14.2	13.1	12.2	12.8	13.2	12.3	
A	8.3	:	9.4	9.8	10.1	:	9.8	8.6	8.6	:	9.5	9.7	11.0	:	9.9	9.3	
P	:	11.6	12.3	9.8	:	8.4	7.4	9.1	:	8.1	7.8	7.3	:	7.3	6.5	7.0	
FIN	14.5	14.6	14.4	14.7	11.7	10.7	11.2	11.3	12.7	13.2	11.6	13.1	15.5	16.7	17.6	16.2	
S	:	19.9	19.5	19.0	:	11.0	12.0	12.8	:	10.0	10.6	10.2	:	17.8	16.8	17.0	
UK	:	18.5	16.8	:	15.7	16.4	12.8	:	12.9	12.8	11.1	:	13.3	14.4	14.2	:	
NO	:	21.5	20.4	:	:	15.1	14.1	:	:	13.6	14.2	:	:	16.8	16.2	:	
Manufacture of basic metals & fabricated metal products (dj)																	
B	22.0	16.0	16.5	17.1	16.1	17.2	17.0	18.0	14.2	14.8	13.2	14.3	14.0	14.1	13.6	13.6	
DK	17.9	19.1	18.3	20.1	15.1	16.3	17.3	16.8	14.8	13.8	15.2	16.4	11.8	12.0	11.9	12.7	
D	:	:	:	:	:	18.6	18.6	19.0	:	17.8	17.8	18.1	:	15.9	17.2	17.4	
E	18.0	18.6	19.8	19.2	16.6	17.0	16.5	17.3	14.0	13.9	14.8	16.0	10.6	10.0	10.4	10.6	
F	:	18.6	18.6	19.0	21.4	21.2	21.2	21.5	16.8	16.3	16.8	18.3	:	12.6	12.9	13.2	
IRL	14.1	14.1	13.8 p	13.0	7.9	8.9	9.9 p	10.8 p	5.7	6.2	3.9 p	5.7 p	2.5	3.1	3.3 p	4.3 p	
I	:	22.0	23.2	:	:	19.1	19.8	:	:	15.6	16.6	:	:	13.9	14.4	:	
L	18.1	:	:	:	34.7	:	:	:	20.0	:	:	:	19.1	:	:	:	
NL	18.0	18.0	17.4	17.4	18.3	18.9	18.7	19.7	14.5	14.3	15.5	16.6	15.0	14.6	14.6	14.6	
A	13.4	:	13.3	13.8	15.3	:	16.6	18.5	14.1	:	14.7	16.3	15.6	:	14.0	15.4	
P	:	14.7	14.1	16.2	:	10.2	9.1	10.4	:	9.3	9.5	9.1	:	8.6	8.3	9.3	
FIN	21.3	22.8	21.9	22.5	15.7	18.5	19.3	18.0	17.8	18.0	16.5	16.5	11.1	10.5	10.6	9.7	
S	:	23.7	24.0	24.5	:	23.1	22.5	22.7	:	17.9	16.7	18.6	:	14.5	15.1	15.2	
UK	:	18.3	21.1	:	20.3	19.8	19.5	:	16.4	17.0	14.0	:	11.7	11.8	12.2	:	
NO	:	13.9	13.5	:	:	12.0	14.5	:	:	17.6	15.2	:	:	10.6	9.5	:	

¹⁶ Based on 'Enterprises in Europe – Sixth report' (data 1987-97), European Commission/Eurostat 2001.

¹⁷ Source: Eurostat, New Cronos, Theme 4 Industry, domain SBS (annual enterprise statistics broken down by size classes)

Share of top-branches in total value added of manufacturing by size class (continued) ¹⁸

	1-19 persons employed				20-49 persons employed				50-99 persons employed				100-249 persons employed			
	1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998
	Manufacture of machinery & equipment n.e.c. (dk)															
B	4.7	7.7	5.8	5.8	9.3	7.8	7.5	8.4	6.6	7.9	7.9	7.9	6.3	5.5	7.4	7.9
DK	11.6	11.4	11.5	12.3	15.3	15.2	16.4	17.3	17.3	15.9	17.5	16.9	13.6	14.7	15.3	16.0
D	:	:	:	:	:	15.1	15.1	15.5	:	16.4	16.8	16.7	:	17.8	17.2	17.4
E	7.6	8.2	7.9	7.4	8.6	9.2	8.6	9.8	8.6	9.3	9.2	8.7	7.0	6.7	7.1	7.5
F	:	7.6	7.5	7.7	8.4	8.7	8.8	9.3	8.8	10.4	10.1	10.4	:	10.6	10.1	10.9
IRL	8.0	7.9	9.1 p	9.5	7.0	8.7	7.7 p	: c	4.4	3.4	3.4 p	4.0 p	3.3	3.8	3.0 p	3.4 p
I	:	9.5	10.5	:	:	14.3	13.8	:	:	15.6	15.8	:	:	17.3	17.7	:
L	3.2	:	:	:	:	:	:	:	12.8	:	:	:	12.1	:	:	:
NL	10.1	10.6	11.3	11.7	14.7	14.2	13.7	14.3	14.1	14.6	14.2	14.1	12.8	12.1	13.0	13.9
A	7.7	:	8.6	6.9	10.0	:	9.7	9.7	14.3	:	12.1	13.0	12.6	:	15.6	14.9
P	:	6.9	6.5	6.4	:	7.4	8.2	8.2	:	6.4	6.6	5.9	:	5.5	5.3	5.3
FIN	13.7	13.4	13.2	13.2	13.7	14.2	12.5	14.6	16.6	17.2	17.6	15.6	19.2	20.1	19.9	18.9
S	:	12.2	11.9	12.1	:	15.6	14.7	14.9	:	16.7	17.0	16.7	:	14.4	14.4	15.3
UK	:	10.3	10.8	:	12.8	12.9	13.7	:	11.9	12.2	10.9	:	11.3	10.7	11.4	:
NO	:	9.9	11.5	:	:	8.0	8.7	:	:	14.0	12.8	:	:	8.9	10.2	:
	Manufacture of electrical & optical equipment (dl)															
B	4.9	5.7	4.4	4.2	3.6	3.3	4.5	4.9	6.0	6.0	5.4	4.5	3.9	5.0	4.8	5.5
DK	8.8	8.4	8.5	9.0	9.6	9.1	8.5	7.7	10.2	12.5	9.8	10.2	12.8	12.7	14.1	13.3
D	:	:	:	:	:	10.6	11.6	11.2	:	10.4	11.0	11.2	:	10.8	10.4	10.3
E	3.9	4.2	3.8	4.4	4.5	4.9	4.7	4.7	5.7	5.4	5.7	5.6	6.3	7.2	6.8	6.5
F	:	9.3	9.0	9.0	8.4	8.1	8.0	8.2	9.3	9.7	9.7	9.4	:	10.6	10.3	10.4
IRL	7.3	7.9	7.5 p	7.3	7.0	8.6	10.2 p	: c	11.5	12.9	8.0 p	11.0 p	: c	10.8	12.0 p	12.6 p
I	:	7.9	8.1	:	:	8.0	8.6	:	:	8.2	8.3	:	:	8.1	8.8	:
L	6.8	:	:	:	7.8	:	:	:	8.2	:	:	:	0.0	:	:	:
NL	7.3	7.3	7.5	7.0	5.8	5.6	5.9	6.1	6.2	7.0	6.3	5.9	5.6	6.1	5.5	5.0
A	6.3	:	6.3	7.2	5.5	:	5.6	5.5	7.8	:	8.9	9.0	9.7	:	8.9	9.9
P	:	2.8	2.4	2.8	:	2.9	2.4	2.8	:	3.6	3.8	3.2	:	3.4	3.9	5.5
FIN	7.5	8.1	7.8	8.3	8.5	7.9	7.6	6.9	7.9	7.7	8.8	8.0	12.1	11.9	10.2	10.8
S	:	9.0	8.9	9.1	:	8.7	9.1	9.5	:	9.6	9.9	9.5	:	12.4	11.4	11.1
UK	:	10.6	10.0	:	11.0	10.9	11.2	:	12.5	11.9	10.5	:	12.5	12.2	12.9	:
NO	:	6.7	7.4	:	:	7.6	6.2	:	:	4.9	6.5	:	:	7.9	9.2	:

With the available data it is not possible to calculate EU averages and therefore to identify clearly the top branches. However, in the table below, which covers all companies (small and medium-sized, and large), the top branches are those branches which account for at least 10% of total value added of manufacturing.

The same applies for SMEs: basic metals & fabricated metals (dj) seem to have the highest shares, together with pulp, paper & paper products, publishing & printing (de), and both show shares higher than 10% in most cases. Manufacture of food products, beverages & tobacco (da), Manufacture of machinery & equipment n.e.c. (dk) and Manufacture of electrical & optical equipment (dl) appear next.

The other branches are not presented but show following trends: the low value added branches are leather & leather products (dc), wood & wood products (dd) except in some classes in Sweden, rubber & plastic products (dh) and transport equipment (dm) except in Norway; intermediate branches are textile & textile products (db) which reaches shares higher than 20% in Portugal, chemicals, chemical products & man-made fibres (dg) which is above 10% in several countries (B, E, F, IRL, NL, P in the 100-249 size class), and other non-metallic mineral products (di) which only exceeds 10% in E and P. The branches coke, refined petroleum products & nuclear fuel (df), and manufacturing nec (dn) are difficult to estimate due to many gaps, available data showing very low shares for df (from 0.1-3.3%) and shares which only exceed 10% in a few cases for dn.

Share in total value added of manufacturing by branch (1996) – all companies ¹⁹

	dl	da	dm	dj	dg	dk	de	dd-df-dn	db-dc	di	dh
EU-15	12.9	11.9	11.6	11.2	11.2	10.9	8.2	8.0	5.3	4.4	4.4

¹⁸ Source: Eurostat, New Cronos, Theme 3 Industry, domain SBS (annual enterprise statistics broken down by size classes).

¹⁹ Source: Europe in figures – Fifth Edition 2000, Eurostat.

PART 2: ENVIRONMENTAL PRESSURES FROM INDUSTRY

- ❖ **Chapter 1: Climate Change**
 - Emissions of CO₂, CH₄, N₂O, HFCs, PFCs and SF₆
- ❖ **Chapter 2: Use of Energy Resources**
 - Final energy consumption
 - Renewable energy sources
 - Combined Heat & Power (CHP)
- ❖ **Chapter 3: Use of Material Resources**
 - Water use
 - Recovery & recycling of packaging
- ❖ **Chapter 4: Air Pollution**
 - Emissions of SO_x, NO_x and CO, NMVOCs, heavy metals and POPs
- ❖ **Chapter 5: Water Pollution**
 - Generation of N, P, BOD and COD
- ❖ **Chapter 6: Waste & Soil Pollution**
 - Waste generation
 - Soil contamination

Part 2 focuses on the main pressures from industry on the environment for EU-15 and as far as possible for EFTA countries.

The data on emissions are taken from 3 main sources: the data reported annually by the EC and EFTA Member States in the framework of their reporting obligations to the United Nations Framework Convention on Climate Change, the UNECE Convention on Long Range Transboundary Air Pollution, and the bi-annual joint Eurostat/OECD questionnaire on the environment. Only the latter allows a NACE-type approach, as UNFCCC and UNECE are based on other nomenclatures (IPCC and EMEP).

Again, the focus is on manufacturing activity due to data limitations for the other sectors.

CHAPTER 1: CLIMATE CHANGE

Anthropogenic emissions of greenhouse gases (GHG) are widely accepted as the major cause of climate change. This chapter looks at the overall emissions in EU and EFTA countries of the 6 GHGs defined in the Kyoto Protocol²⁰, and at the contribution of industry to these emissions. The 6 gases are CO₂, CH₄, N₂O, HFCs, PFCs and SF₆. Annual emissions figures for each of the 6 gases are weighted according to their global warming potential and summed to give a single figure for emissions, expressed in CO₂ equivalents.

In accordance with article 4 of the Protocol, EU Member States have committed themselves to a combined 8% reduction of their emissions of GHG, relative to 1990 base year levels, to be achieved by 2008-2012. The targets for individual countries are given in the first table below.

EU Member States commitments to reduce emissions in accordance with the Kyoto protocol

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK
Target	-8%	-8%	-21%	-21%	25%	15%	0%	13%	-7%	-28%	-6%	-13%	27%	0%	4%	-13%

Total emissions of Kyoto greenhouse gases^{21 22 23}

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Share (%)	Change 1990-99 (%)
<i>million tonnes of CO₂ equivalents</i>												
EU-15												
CO ₂ (net emiss./removals)	3 126	3 129	3 068	2 989	3 105	3 060	3 127	3 068	3 122	3 070	.	-1.8
CO ₂ (excl. LUCF)	3 325	3 351	3 277	3 208	3 221	3 258	3 333	3 272	3 317	3 271	81.2	-1.6
CH ₄	440	429	418	406	396	394	387	379	370	366	9.1	-16.7
N ₂ O	394	392	383	368	378	379	389	386	362	338	8.4	-14.1
HFC	25.63	24.95	24.96	27.18	32.17	37.26	41.04	46.85	51.39	42.62	1.1	66.3
PFC	13.50	11.85	9.61	8.23	7.52	7.83	7.76	7.41	7.98	8.36	0.2	-38.1
SF ₆	-	-	-	-	-	-	-	-	-	-	-	-
Total (with net CO ₂ emissions/removals)	3 999	3 987	3 903	3 799	3 918	3 879	3 952	3 887	3 914	3 826	.	-4.3
Total (w ithout LUCF)	4 199	4 209	4 112	4 018	4 034	4 077	4 158	4 091	4 108	4 026	100	-4.1
EFTA												
CO ₂ (excl. LUCF)	82	82	82	82	83	84	85	85	87	:	78.7	5.9
CH ₄	12	12	12	12	12	12	12	12	12	:	10.8	-0.9
N ₂ O	9	9	8	8	8	9	8	8	9	:	7.9	-1.4
HFC-PFC-SF ₆	5	5	3	3	2	2	2	3	3	:	2.5	-46.7
Total	108	107	105	105	106	107	108	108	110	:	100	2.0
USA												
Total (w ithout LUCF)	6 049	6 000	6 111	6 232	6 354	6 411	6 616	6 702	6 727	6 726	100	11.2
JAP												
Total (w ithout LUCF)	1 213	1 240	1 260	1 238	1 310	1 322	1 336	1 331	:	:	100	9.7

According to the Sixth Environment Action Programme²⁴, the EU is responsible for around 15% of the world's emissions of GHG, while only representing 5% of its population. However figures show that the EU has managed to reduce its emissions of GHG to below the 1990 levels and forecasts to 2010 suggest a further decrease to the 8% Kyoto target, due to a decrease or stabilisation in emissions of GHG by all economic sectors except transport where emissions of CO₂ are expected to continue to rise by up to 40%.

In EFTA, USA and Japan overall emissions have increased during the period for which data is available.

²⁰ Third Conference of Parties (COP-3) to the UNFCCC (Kyoto, Japan, Dec. 1997).

²¹ Source: EU-15: Annual EC Greenhouse Gas Inventory 1990-1999 (Submission to the Secretariat of the UNFCCC), EEA 2001 ; EFTA, USA and Japan: UNFCCC web site (inventory data as of end of September 2000).

²² EFTA: CO₂, CH₄, N₂O: IS, NO and CH, break in series after 1995 (no data for IS) ; HFC, PFC, SF₆: IS and NO only.

²³ LUCF = Land use change and forestry

²⁴ Environment 2010: Our future, our choice, European Commission 2001.

Emissions of CO₂, CH₄, N₂O, HFC, PFC and SF₆

This table presents emissions of the 6 greenhouse gases (CO₂, CH₄, N₂O, HFC, PFC and SF₆), by industry²⁵ in Europe, as a percentage of total emissions, based on data from the UNFCCC. In this IPCC classification industrial sources correspond to:

- section 1A2 **Energy: Fuel Combustion in Manufacturing Industries & Construction**, and 1B **Energy: Fugitive Emissions from fuels: 1. Solid fuels, 2. Oil & natural gas** ;
- sections 2A-G **Industrial processes: A. Mineral products, B. Chemical industry, C. Metal production, D. Other production, E. Production of halocarbons & SF₆, F. Consumption of halocarbons & SF₆, G. Other.**

Emissions from the generation of electricity are specifically excluded, so as to keep as close as possible to the definition of industry used in other chapters.

Overview of the share of industrial emissions of greenhouse gases in total GHG emissions^{26 27}

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Change 1990-99
%											
EU-15											
CO ₂ (w without LUCF)	24.5	23.3	23.0	22.6	23.5	23.4	22.5	23.5	22.7	22.9	-6.5
CH ₄	2.0	2.0	2.0	1.9	1.8	1.8	1.7	1.7	1.6	1.6	-19.4
N ₂ O	3.1	3.0	2.9	2.8	2.8	2.8	2.8	2.8	2.3	1.7	-45.3
HFC	100	100	100	100	100	100	100	100	100	100	0.0
PFC	100	100	100	100	100	100	100	100	100	100	0.0
SF ₆	100	96	97	97	97	100	100	100	100	100	0.0
Total	25.2	24.2	23.9	23.4	24.1	24.2	23.5	24.3	23.2	22.7	-10.1
EFTA											
CO ₂ (w without LUCF)	25.5	23.7	22.6	23.6	25.0	25.0	24.0	24.0	24.2	:	-5.0
CH ₄	6.0	6.3	7.0	7.3	7.5	7.4	7.4	8.4	7.9	:	31.0
N ₂ O	25.6	23.9	18.3	20.8	21.7	21.2	20.9	19.4	21.2	:	-17.2
HFC-PFC-SF ₆	100	-	-	-	-	-	-	-	100	100	0.0
Total	27.4	21.1	20.0	21.0	22.3	22.3	21.5	21.5	23.7	:	-13.3

The share of industry in total EU-15 emissions of the 6 greenhouse gases has decreased from 25.2% to 22.7% but is still important. The contribution from industry in four Member States increased between 1990-1999: NL (from 30.5 to 31.6%), A (30.9 - 31.2%), FIN (27.5 - 30.4%) and S (24.8 - 26.9%). In EFTA countries, the share of industry in total emissions has decreased or remained stable for all GHG except for CH₄.

For CO₂, the main greenhouse gas, this relative importance of industry is also valid for the world and OECD industries: according to OECD²⁸, 21% of total CO₂ emissions were ascribable to the world industry and almost 10% to industry in the OECD in 1995.

²⁵ using the IPCC classification. See Annex on Databases & Nomenclatures.

²⁶ Source: EU-15: Annual EC Greenhouse Gas Inventory 1990-1999, EEA 2001 ; EFTA: UNFCCC web site ; HFC, PFC, SF₆: UNFCCC web site and IS: Submission to EUROSTAT; NO: Greenhouse Gas Emissions in Norway 1990-2000, Submission 2002 to UNFCCC, Norwegian Pollution Control Authority, 12 April 2002.

²⁷ EFTA: CO₂, CH₄, N₂O: IS, NO and CH, break in series after 1995 (no data for IS) ; HFC, PFC, SF₆: NO only.

²⁸ Source: OECD Environmental Outlook for the Chemicals Industry (2001).

Emissions of greenhouse gases (CO₂, CH₄, N₂O, HFC, PFC and SF₆) by main industrial sectors ²⁹million tonnes of CO₂ equivalents

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	4 199	137	70	1203	107	306	551	53	518	11	216	76	65	77	69	750	2.6	49	53
1995	4 077	150	77	1055	111	337	544	57	525	6	233	77	73	75	73	689	2.7	50	52
1999	4 026	:	73	977	123	380	550	65	541	-	230	78	79	76	71	641	3.1	55	:
of which:																			
Fuel combustion in manufacturing industries & construction																			
1990	649.2	26.3	6.2	198.6	10.3	50.8	77.7	4.0	88.6	5.3	42.0	7.5	8.9	14.8	12.2	96.0	0.2	3.5	5.3
1991	627.0	27.4	6.5	174.7	10.2	52.0	78.8	4.0	85.8	5.5	42.8	6.9	9.2	14.3	12.2	96.8	0.2	3.3	5.4
1992	603.5	25.7	6.6	161.4	9.8	51.1	76.4	3.7	84.5	3.5	42.6	7.0	9.0	14.0	10.8	95.3	0.2	3.2	5.0
1993	580.0	25.4	6.6	149.2	9.5	49.2	71.6	3.7	84.1	3.4	40.0	6.9	8.9	13.7	12.0	93.8	0.3	3.4	4.9
1994	603.0	32.2	6.7	150.8	9.4	53.4	75.0	3.8	85.8	2.4	41.0	6.7	9.4	14.5	13.5	95.3	0.2	4.1	4.9
1995	609.3	31.0	6.2	150.6	10.1	57.5	74.2	3.6	90.9	1.7	43.5	7.6	9.2	14.5	14.0	93.0	0.2	3.7	5.1
1996	598.2	29.6	6.5	146.9	10.9	51.3	75.0	3.6	89.0	-	42.2	8.9	9.6	14.1	13.4	93.9	:	4.2	4.9
1997	616.5	30.7	6.4	148.4	11.1	56.7	76.1	4.1	93.7	-	44.6	9.1	9.5	16.1	13.6	94.0	:	4.3	4.8
1998	597.2	31.1	6.2	144.1	11.3	58.6	77.9	4.0	78.2	-	44.0	9.7	9.7	16.2	13.4	91.1	:	4.5	4.9
1999	590.9	:	6.3	140.4	9.9	56.7	78.1	4.4	81.3	-	43.6	8.7	10.5	16.8	12.7	89.9	:	4.3	:
Fugitive emissions																			
1990	110.7	0.9	0.5	32.8	0.9	4.9	10.8	0.1	8.2	-	4.4	2.2	0.3	3.6	0.3	40.8	0.08	2.3	0.4
1991	106.6	1.0	0.8	30.9	0.9	4.8	11.0	0.1	7.8	-	4.4	2.4	0.2	3.6	0.3	38.4	0.08	1.9	0.4
1992	104.9	1.0	0.8	30.7	1.0	4.9	10.8	0.1	7.7	-	3.8	2.5	0.3	3.6	0.2	37.5	0.08	2.1	0.4
1993	100.3	1.0	0.8	28.3	1.0	5.0	11.2	0.1	7.6	-	3.7	2.4	0.3	3.6	0.3	35.1	0.08	2.3	0.4
1994	94.5	1.1	0.8	25.6	1.0	5.2	11.0	0.1	7.4	-	3.9	2.5	0.3	3.6	0.4	31.6	0.08	2.4	0.4
1995	92.5	0.9	0.7	25.1	1.0	5.4	10.4	0.1	7.1	-	4.6	2.5	0.3	3.6	0.3	30.4	0.08	2.5	0.3
1996	89.5	1.0	0.7	23.4	1.1	5.5	9.5	0.1	7.1	-	4.7	2.8	0.3	3.6	0.3	29.3	:	2.7	0.3
1997	86.5	0.8	0.9	22.6	1.1	6.0	9.1	0.1	7.1	-	4.3	2.7	0.3	3.6	0.3	27.8	:	2.8	0.3
1998	82.9	0.8	0.7	20.4	1.1	6.1	9.0	0.1	7.2	-	4.6	2.9	0.3	3.6	0.3	25.8	:	2.6	0.3
1999	80.6	:	1.2	19.5	1.1	6.4	8.6	0.1	7.1	-	4.6	2.8	0.4	3.6	0.3	24.3	:	3.1	:
Industrial processes																			
1990	299.0	12.8	1.0	58.1	9.7	23.3	54.5	3.0	32.2	1.4	19.3	13.9	4.7	2.8	4.7	57.1	0.4	13.5	3.5
1991	286.9	13.1	1.2	55.2	9.6	22.1	51.3	2.8	32.2	0.4	18.9	13.4	4.7	2.4	5.2	52.9	0.4	7.6	3.1
1992	274.7	12.9	1.3	58.8	9.3	20.6	47.2	2.8	31.9	0.3	17.5	11.9	4.6	2.2	5.3	46.7	0.4	7.1	2.8
1993	261.3	13.2	1.3	57.1	10.1	18.9	42.9	2.7	27.8	0.2	17.8	11.5	4.6	2.1	5.5	44.0	0.5	7.8	2.7
1994	275.6	14.3	1.4	57.7	10.1	23.1	44.8	3.0	26.9	0.6	19.7	12.2	4.4	2.2	5.6	49.5	0.5	8.2	2.8
1995	284.2	15.3	1.4	56.9	11.7	25.9	46.7	2.9	28.8	0.5	20.1	12.9	5.0	2.3	5.9	47.9	0.5	8.4	2.7
1996	288.1	16.4	1.7	56.2	12.5	26.5	45.9	2.8	27.9	-	21.2	12.5	5.0	2.4	6.0	50.9	:	8.7	2.3
1997	290.5	12.4	1.9	53.4	12.7	27.8	47.2	3.1	28.5	-	22.7	13.7	5.5	2.5	5.9	52.6	:	8.5	2.3
1998	273.1	12.6	2.0	41.5	12.3	28.9	40.1	3.1	29.5	-	24.1	13.0	5.4	2.5	5.8	51.7	:	10.9	2.3
1999	241.8	:	2.1	36.5	12.2	32.6	35.1	3.0	31.4	-	24.5	13.0	5.5	2.8	6.0	24.1	:	10.9	:

In absolute terms, total EU-15 emissions have declined by 4.1% (-172.5 mio. t. of CO₂ equiv.) due mainly to a sharp decrease in D and the UK. This should be compared with a 13.8% (-146 mio t. of CO₂ equiv.) decrease in EU-15 industrial emissions, mainly attributable to downward trends in D, F, I and UK. Fugitive emissions have decreased most (-27.2%), followed by emissions from industrial processes (-19.1%) while emissions due to fuel combustion fell by 9%. In EFTA countries, total emissions have increased while industrial emissions have decreased (figures may not systematically include all 6 gases).

The main sources of CO₂ emissions in industry (see below) are fuel combustion and industrial processes, whereas fugitive emissions are mainly responsible for CH₄, and industrial processes in the chemical industry for N₂O. A strong decrease in N₂O emissions occurred in the UK, German and French chemical industries, due to specific measures in the production of adipic acid in these countries ³⁰.

²⁹ Source: see footnote 26.

³⁰ Based on Report from the Commission to the European Parliament and the Council under Council Decision 93/389/EC as amended by Decision 99/296/EC for a monitoring mechanism of Community GHG emissions (COM(2001) 708 final, 30.11.2001).

Share of industrial emissions of CO₂, CH₄ and N₂O in total emissions of each gas ^{31 32}

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	%
EU-15											
CO₂											
Fuel combust. (Manuf./Constr.)	19.20	18.40	18.10	17.78	18.42	18.39	17.66	18.54	17.73	17.78	
Fugitive emissions	0.78	0.71	0.72	0.73	0.81	0.73	0.72	0.72	0.72	0.74	
- Solid fuels	0.20	0.18	0.18	0.18	0.18	0.18	0.16	0.17	0.16	0.18	
- Oil & natural gas	0.58	0.53	0.54	0.56	0.63	0.55	0.56	0.55	0.56	0.56	
Industrial processes	4.48	4.21	4.18	4.11	4.27	4.33	4.16	4.23	4.22	4.35	
- Mineral products	3.25	3.08	3.10	3.03	3.14	3.15	3.00	3.15	3.19	3.29	
- Chemical industry	0.36	0.33	0.31	0.30	0.29	0.31	0.30	0.30	0.30	0.29	
- Metal production	0.76	0.69	0.65	0.68	0.71	0.77	0.72	0.74	0.69	0.73	
- Other production	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
- Prod. of halocarbons & SF ₆	:	:	:	:	:	:	:	:	:	:	
- Cons. of halocarbons & SF ₆	:	:	:	:	:	:	:	:	:	:	
- Other	0.09	0.09	0.09	0.08	0.11	0.09	0.12	0.01	0.01	0.01	
CH₄											
Fuel combust. (Manuf./Constr.)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
Fugitive emissions	1.92	1.92	1.94	1.88	1.72	1.73	1.68	1.66	1.59	1.53	
- Solid fuels	1.15	1.13	1.12	1.04	0.87	0.91	0.83	0.80	0.72	0.66	
- Oil & natural gas	0.77	0.79	0.82	0.84	0.85	0.82	0.85	0.85	0.87	0.87	
Industrial processes	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
- Mineral products	-	-	-	-	-	-	-	-	-	-	
- Chemical industry	-	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	
- Metal production	-	-	-	-	-	-	-	-	-	-	
- Other production	:	:	:	:	:	:	:	:	:	:	
- Prod. of halocarbons & SF ₆	:	:	:	:	:	:	:	:	:	:	
- Cons. of halocarbons & SF ₆	:	:	:	:	:	:	:	:	:	:	
- Other	-	-	-	-	-	-	-	-	-	-	
N₂O											
Fuel combust. (Manuf./Constr.)	0.24	0.24	0.24	0.23	0.23	0.24	0.22	0.23	0.22	0.24	
Fugitive emissions	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-	-	
- Solid fuels	-	-	-	-	-	-	-	-	-	-	
- Oil & natural gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-	-	
Industrial processes	2.80	2.77	2.68	2.54	2.59	2.57	2.58	2.53	2.03	1.42	
- Mineral products	-	-	-	-	-	-	-	-	-	-	
- Chemical industry	2.80	2.77	2.68	2.54	2.59	2.57	2.58	2.53	2.03	1.42	
- Metal production	-	-	-	-	-	-	-	-	-	-	
- Other production	:	:	:	:	:	:	:	:	:	:	
- Prod. of halocarbons & SF ₆	:	:	:	:	:	:	:	:	:	:	
- Cons. of halocarbons & SF ₆	:	:	:	:	:	:	:	:	:	:	
- Other	-	-	-	-	-	-	-	-	-	0.01	
EFTA											
CO₂											
Fuel combust. (Manuf./Constr.)	10.39	10.20	9.58	9.86	10.49	10.16	10.12	10.06	10.32	:	
Fugitive emissions	2.46	1.93	2.01	2.16	2.27	2.37	2.48	2.39	2.32	:	
Industrial processes	12.61	11.59	11.04	11.58	12.27	12.49	11.41	11.51	11.54	:	
CH₄											
Fuel combust. (Manuf./Constr.)	0.11	0.12	0.11	0.11	0.12	0.12	0.13	0.15	0.16	:	
Fugitive emissions	5.69	5.96	6.68	6.94	7.13	7.04	7.07	7.96	7.51	:	
Industrial processes	0.25	0.22	0.21	0.23	0.24	0.23	0.25	0.25	0.25	:	
N₂O											
Fuel combust. (Manuf./Constr.)	0.42	0.43	0.42	0.42	0.46	0.46	0.49	0.50	0.55	:	
Fugitive emissions	0.03	0.02	0.02	0.04	0.04	0.04	0.04	0.04	0.03	:	
Industrial processes	25.11	23.49	17.89	20.30	21.22	20.75	20.34	18.87	20.57	:	

³¹ Source: EU-15: Annual EC Greenhouse Gas Inventory 1990-1999 (Submission to the Secretariat of the UNFCCC), EEA 2001 ; EFTA: UNFCCC web site.

³² EFTA: CO₂: after 1995: IS + NO only, CH₄ (all) and N₂O: combustion: NO + CH only ; N₂O: fugitive emissions: NO only.

Share of industrial emissions of HFC, PFC, and SF₆ in total emissions of each gas³³

%

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EU-15	HFC									
Fuel combust. (Manuf./Constr.)	-	-	-	-	-	-	-	-	-	-
Fugitive emissions	-	-	-	-	-	-	-	-	-	-
- Solid fuels	-	-	-	-	-	-	-	-	-	-
- Oil & natural gas	-	-	-	-	-	-	-	-	-	-
Industrial processes	100	100	100	100	100	100	100	100	100	100
- Mineral products	-	-	-	-	-	-	-	-	-	-
- Chemical industry	9.13	9.38	9.38	8.61	7.27	3.14	-	-	-	-
- Metal production	-	-	-	-	-	-	-	-	-	-
- Other production	-	-	-	-	-	-	-	-	-	-
- Prod. of halocarbons & SF ₆	88.09	87.66	87.01	82.85	81.61	79.98	76.85	70.83	66.12	47.94
- Cons. of halocarbons & SF ₆	1.41	1.54	2.18	7.23	9.18	14.41	21.30	26.83	33.87	52.06
- Other	1.37	1.42	1.44	1.31	1.94	2.47	1.85	2.34	-	-
	PFC									
Fuel combust. (Manuf./Constr.)	-	-	-	-	-	-	-	-	-	-
Fugitive emissions	-	-	-	-	-	-	-	-	-	-
- Solid fuels	-	-	-	-	-	-	-	-	-	-
- Oil & natural gas	-	-	-	-	-	-	-	-	-	-
Industrial processes	100	100	100	100	100	100	100	100	100	100
- Mineral products	-	-	-	-	-	-	-	-	-	-
- Chemical industry	0.52	0.59	0.73	0.85	0.27	-	-	-	-	-
- Metal production	87.26	86.01	83.79	79.90	76.14	73.98	73.39	72.36	74.81	75.01
- Other production	:	:	:	:	:	:	:	:	:	:
- Prod. of halocarbons & SF ₆	4.14	4.04	3.96	3.41	3.03	2.24	2.25	2.36	2.72	1.01
- Cons. of halocarbons & SF ₆	6.34	7.41	9.38	13.36	17.74	20.52	22.27	23.04	22.47	23.98
- Other	1.76	1.95	2.14	2.47	2.82	3.26	2.08	2.25	-	-
	SF₆									
Fuel combust. (Manuf./Constr.)	-	-	-	-	-	-	-	-	-	-
Fugitive emissions	-	-	-	-	-	-	-	-	-	-
- Solid fuels	-	-	-	-	-	-	-	-	-	-
- Oil & natural gas	-	-	-	-	-	-	-	-	-	-
Industrial processes	100	96	97	97	97	100	100	100	100	100
- Mineral products	-	-	-	-	-	-	-	-	-	-
- Chemical industry	-	-	-	-	-	-	-	-	-	-
- Metal production	24.93	23.30	21.40	20.59	20.99	19.83	22.02	19.90	19.03	18.00
- Other production	-	-	-	-	-	-	-	-	-	-
- Prod. of halocarbons & SF ₆	-	-	-	-	-	-	-	-	0.43	-
- Cons. of halocarbons & SF ₆	72.68	70.40	72.55	73.60	73.45	77.55	75.13	77.11	80.54	82.00
- Other	2.39	2.56	2.58	2.60	2.59	2.69	2.79	3.00	-	-
	EFTA (NO)									
	HFC - PFC - SF₆									
Fuel combust. (Manuf./Constr.)	-	-	-	-	-	-	-	-	-	-
Fugitive emissions	-	-	-	-	-	-	-	-	-	-
Industrial processes	100	-	-	-	-	-	-	-	100	100

HFC, PFC and SF₆ emissions are limited to industrial processes. These fluorinated gases have a direct warming effect much higher than that of CO₂³⁴, and are used as substitutes for those ozone depleting substances which are banned by the Montreal Protocol, such as CFCs. HFCs are essentially by-products from the production of HCFC-22, while PFCs are used in processes in the aluminium and electronics industries and SF₆ in electricity distribution (use in switches).

³³ Source: see footnote 26.

³⁴ global warming potential (GWP) of 23 900 for SF₆ (100 years time horizon), compared with 1 for CO₂, 21 for CH₄, 310 for N₂O.

Chapter 2: USE OF ENERGY RESOURCES

This chapter looks at three aspects of the use of energy by industry:

- Final energy consumption,
- Renewable energy sources,
- Combined Heat & Power (CHP).

The use of the planet's resources, whether renewable or not, has increased in parallel with population growth and economic development, thus giving rise to numerous impacts on the environment and human health. Much of the existing Community environmental policy has been established to limit the impacts that arise from this unsustainable use, including measures to improve efficient use of energy, this sector playing an important role in the EU economy³⁵. The promotion of energy efficiency is the objective of the SAVE programme for 1998-2002, as defined in Decision 647/2000/EC of 28 February 2000 (OJ L 079 25.10.2000 p.6).

Energy use can be measured with reference to several variables, the most common of which are gross inland consumption (GIC, the total amount of energy necessary to satisfy internal needs), and final energy consumption (FEC, the energy supplied to final consumer for all energy uses; because it is final consumption, FEC excluded the fuel input to electricity generation and to refineries, but does include the outputs from the refineries and the electricity generated,). Depending on the indicator, this chapter uses both gross inland consumption and final energy consumption, the latter variable providing most of the sectoral information available.

The various energy products included in this chapter are:

SOLID FUELS: COAL & SOLID DERIVATIVES (COAL, PATENT FUELS, COKE, TAR & BENZOL), LIGNITE & DERIVATIVES:

- ❖ Coal & solid derivatives: Coal with a gross calorific value equal to or greater than 23 865 kJ/kg (or 5 700 kcal/kg) on wet sample, free of ash. This also includes middling, slurries and combustible shale. As of 1987 coal figures for Spain include lignite negro ; Patent fuels: Composition fuels manufactured from coal fines by shaping with the addition of a binding agent (pitch) ; Coke-oven coke and gas works coke ; Tar, benzol: Very complex mixtures of variable proportions of aromatic and aliphatic constituents, usually resulting from the distillation of coal, lignite or peat.
- ❖ Lignite & derivatives: Lignite, brown coal coke, brown coal briquettes, peat and peat briquettes.

CRUDE OIL & PETROLEUM PRODUCTS: CRUDE OIL, FEEDSTOCKS, ALL PETROLEUM PRODUCTS:

- ❖ Crude oil: Naturally occurring mineral oil consisting of many types of hydrocarbons, the term petroleum includes gaseous and solid as well as liquid hydrocarbons. Crude oil may include small amounts of non hydrocarbons produced with the liquids.
- ❖ Feedstock: Processed oils destined for further processing (e.g. straight run fuel-oil) excluding blending. With further processing, it will be transformed into one or more components and/or finished products.
- ❖ All petroleum products: Refinery gas, LPG, motor spirit, kerosene & jet fuels, naphtha, gas/diesel oil, residual fuel oil and miscellaneous petroleum products.

GAS: NATURAL GAS, DERIVED GASES:

- ❖ Natural gas: Gas occurring in natural underground deposits, associated or not with oil deposits. Contains essentially methane but also small proportions of other gases. It also covers methane recovered in coal mines.
- ❖ Derived gases: Manufactured gases, comprising gas works gas, coke-oven gas, blast furnace gas and oxygen steel furnace gas.

HEAT: NUCLEAR ENERGY, DERIVED HEAT, RENEWABLE ENERGIES:

- ❖ Nuclear energy: Heat generated in the reactor of a nuclear power plant
- ❖ Derived heat: Heat sold to third parties, i.e. not comprising heat consumed on-site.
- ❖ Renewable energies: Hydro-, wind & solar energy, biomass/wastes, geothermal energy.

ELECTRICAL ENERGY:

- ❖ Includes: electricity generated in conventional thermal and nuclear power plants, in hydro-electric plants as well as electricity generated from wind, geothermal, and other renewable sources of energy.

³⁵ The energy branch represented 4.5% of GDP in 1997 or a value added of 305 billion ECU.

Final energy consumption

This table presents for both EU and EFTA: 1) the level of final energy consumption in industry ; 2) a breakdown of final energy consumption by industrial branch and energy product, expressed in 1 000 tonnes of oil equivalent (toe) or in percentages of industrial energy consumption.

Final energy consumption (total and industry) ^{36 37}

1 000 tonnes of oil equivalent

	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Change 1985-99 (%)
Total final energy consumption												
EU-15	823 857	863 261	883 984	879 900	885 434	880 614	898 937	936 928	931 832	946 446	957 143	16.2
EFTA	17 136	17 275	16 994	16 936	17 451	18 001	18 119	17 313	16 946	17 980	18 499	8.0
of which biomass:												
EU-15	34 531	33 975	35 784	34 767	35 066	34 203	34 647	35 647	39 508	40 544	40 043	16.0
EFTA	792	488	433	424	527	629	592	640	564	916	1 352	70.8
Share of industry in total final energy consumption (%)												
EU-15	32.2	30.8	29.1	28.8	27.9	28.6	28.8	27.9	28.3	27.7	27.6	-2.8
EFTA	41.4	35.1	33.1	32.2	32.4	33.5	33.9	33.5	33.0	35.3	36.5	-11.8
of which biomass:												
EU-15	35.7	36.4	34.7	34.4	36.5	39.7	39.9	38.5	35.9	34.9	34.4	-3.8
EFTA	45.7	:	:	:	:	:	:	:	:	31.3	57.9	26.6
Final energy consumption of industry by country												
B	10 926	11 889	12 247	12 346	11 574	12 183	12 083	11 998	12 972	13 008	13 533	23.9
DK	2 907	2 878	3 005	2 686	2 752	2 927	3 053	3 159	3 131	3 051	2 992	2.9
D	78 859	71 515	64 815	61 221	58 013	58 744	61 951	60 606	58 394	57 643	56 440	-28.4
EL	3 736	3 935	3 753	3 810	3 707	3 737	4 094	4 297	4 339	4 421	4 154	11.2
E	18 836	19 750	20 224	19 432	19 203	19 819	20 396	19 701	21 592	22 459	22 369	18.8
F	38 053	37 045	36 637	36 879	36 303	34 513	37 229	37 341	36 616	37 101	36 448	-4.2
IRL	1 768	1 788	1 803	1 716	1 625	1 732	1 774	1 794	1 836	1 912	1 978	11.9
I	31 537	36 903	36 036	36 039	34 947	35 901	37 134	36 521	37 429	36 641	39 222	24.4
L	1 773	1 719	1 693	1 603	1 645	1 553	1 181	1 151	1 032	864	945	-46.7
NL	13 775	13 188	12 276	12 582	13 256	12 488	12 672	13 188	13 208	13 102	12 803	-7.1
A	5 877	5 766	5 659	5 419	5 405	5 596	5 875	6 029	7 053	6 911	6 297	7.1
P	3 687	3 990	4 077	4 231	4 238	4 433	4 252	4 504	5 057	5 237	5 258	42.6
FIN	8 426	9 225	8 862	8 874	9 644	10 040	10 011	10 216	10 824	11 410	11 984	42.2
S	11 866	11 825	11 618	11 281	11 804	12 312	12 625	12 408	12 648	12 438	11 657	-1.8
UK	32 867	34 591	34 632	35 376	33 192	35 981	34 932	38 380	37 311	35 925	37 628	14.5
IS	372	377	349	353	372	394	397	:	:	:	:	:
NO	6 721	5 686	5 283	5 093	5 278	5 636	5 748	5 804	5 594	6 351	6 753	0.5

In EU-15, total final energy consumption increased by 16% between 1985 and 1999, whereas energy consumption by industry fell by 0.4%. The result is that in 1999 industry accounted for 28% of total final energy consumption, down from 32% in 1985. A similar trend is seen in Iceland and Norway.

EU industry is no longer the main consumer of final energy, this position is now occupied by transport (which rose from 25% of FEC in 1985 to 32% in 1999). There are many different uses for energy in industry, from space heating and lighting, steam-raising in industrial boilers, drying and many specific process applications. There is a shift towards electricity use as many new industrial processes are exclusively powered by electricity. The other fuels compete for more traditional steam-raising, heating and process uses, with natural gas gaining market share at the expense of coal and oil ³⁸ (see table overleaf).

³⁶ Source: New Cronos, theme 8 Environment and Energy, domain Sirene.

³⁷ EU-15 and Member States: includes provisional data for 1998-99 ; EFTA (IS, NO): break in series after 1995 (NO only).

³⁸ Based on 'Panorama of European business 1999'.

Breakdown of final energy consumption of industry^{39 40}

1 000 tonnes of oil equivalent or %

	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Change 1985-99 (%)
EU industry	264 892	266 007	257 337	253 496	247 306	251 957	259 263	261 292	263 441	262 123	263 709	-0.4
EFTA industry	7 093	6 063	5 632	5 446	5 650	6 030	6 145	5 804	5 594	6 351	6 753	-4.8
Breakdown by industrial branch (%)												
EU-15												
Iron & steel industry	23.2	21.1	20.9	20.1	19.9	21.1	20.9	19.9	20.9	20.0	19.0	-18.1
Non-ferrous metals	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.7	3.7	4.1	3.9	4.4
Chemical industry	18.6	19.0	17.9	18.7	18.3	17.9	17.2	16.8	16.2	15.7	15.9	-14.2
Non-metallic mineral products	13.2	13.4	13.5	13.5	13.0	12.8	12.6	12.6	12.3	12.2	13.1	-0.8
Ore extraction	1.3	1.1	1.1	1.0	1.0	0.9	1.0	1.0	0.9	1.0	1.0	-26.4
Food, drink & tobacco	8.2	8.2	8.7	8.9	9.0	8.9	8.9	9.0	8.8	9.0	9.4	15.1
Textile, leather & clothing	3.2	3.3	3.3	3.2	3.3	3.3	3.2	3.1	3.1	3.1	3.1	-4.2
Paper & printing	5.9	6.8	7.0	7.2	7.6	7.9	8.0	8.0	8.3	8.4	11.0	84.6
Engineering & other metal ind.	10.5	10.3	10.7	10.4	10.1	9.6	9.1	9.0	8.7	9.3	9.4	-9.9
Other industries	6.8	7.7	7.7	8.2	8.7	8.7	10.0	11.3	11.2	12.5	13.1	93.3
EFTA												
Iron & steel industry	23.7	23.6	23.0	23.2	19.1	20.9	21.8	20.8	21.0	20.8	19.3	-18.3
Non-ferrous metals	24.0	27.7	27.1	29.3	29.8	28.4	26.9	27.8	29.9	26.2	23.2	-3.3
Chemical industry	12.0	12.6	12.3	12.1	14.4	13.6	14.1	17.5	14.6	14.8	12.7	6.2
Non-metallic mineral products	4.0	4.0	4.0	4.6	5.9	6.0	5.8	6.3	6.4	6.3	5.2	29.9
Ore extraction	2.0	1.9	1.6	1.4	1.5	1.4	1.0	1.4	1.0	0.8	1.1	-45.1
Food, drink & tobacco	6.5	7.5	7.2	8.4	8.4	7.5	7.8	8.0	6.8	6.4	5.7	-11.2
Textile, leather & clothing	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	-25.3
Paper & printing	9.6	11.5	12.1	11.7	12.5	13.4	13.1	14.3	14.2	12.1	19.7	105.8
Engineering & other metal ind.	5.1	4.2	3.9	4.5	4.4	4.3	4.4	4.5	4.4	3.6	3.3	-34.9
Others industries	9.3	6.5	5.3	3.8	4.1	4.0	4.0	4.4	3.7	3.6	7.2	-22.3
Breakdown by group of energy products (%)												
EU-15												
Solid fuels	24.1	20.3	18.7	17.8	16.1	16.0	15.1	13.9	14.3	13.7	13.0	-46.3
Hydrocarbons	21.4	18.6	19.1	19.3	19.3	19.6	19.0	18.1	17.5	16.7	16.3	-23.9
Gas	25.2	29.0	29.7	30.5	31.3	31.0	31.8	33.8	33.0	33.7	34.6	37.4
Nuclear energy	-	-	-	-	-	-	-	-	-	-	-	-
Derived heat	1.3	1.4	1.2	0.9	1.0	1.0	1.2	1.6	1.6	1.5	1.6	30.4
Renewables	4.7	4.6	4.8	4.7	5.2	5.4	5.3	5.3	5.4	5.4	5.2	12.0
Electricity	23.4	26.0	26.5	26.8	27.1	27.0	27.5	27.5	28.2	29.0	29.3	25.3
Other fuels	-	-	-	-	-	-	-	-	-	-	-	-
EFTA												
Solid fuels	13.9	14.2	14.0	14.1	14.6	15.7	16.5	16.5	17.0	16.3	14.6	5.1
Hydrocarbons	21.5	16.7	12.6	10.7	10.7	13.7	12.0	18.7	14.2	12.7	13.2	-38.8
Gas	0.7	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.3	-63.8
Nuclear energy	-	-	-	-	-	-	-	-	-	-	-	-
Derived heat	0.0	0.3	0.3	0.3	0.4	0.5	0.6	0.5	0.4	0.3	0.3	11.5
Renewables	5.1	:	:	:	:	:	:	:	:	4.5	11.6	127.1
Electricity	58.7	68.6	72.9	74.7	74.1	69.9	70.7	70.6	70.4	67.7	61.7	5.1
Other fuels	-	-	-	-	-	-	-	-	-	-	-	-

In EU-15, four industrial branches together accounted for 59% of industrial FEC ; these are iron & steel, chemicals, non-metallic mineral products and paper & printing ; in EFTA, the top branches are iron & steel, non-ferrous metals, chemicals and paper & printing, and these account for 75% of industrial FEC.

Electricity and gas account for 64% of industrial FEC in the EU (increasing by 12% and 37.4% respectively between 1985-99). In EFTA, electricity alone represents almost 62% of industrial FEC (+5.1% between 1985 and 1999). Noteworthy in these countries is that energy produced from renewable energy sources more than doubled over this period.

³⁹ Source: Eurostat (New Cronos database, theme 8 Environment and Energy, domain Sirene).

⁴⁰ EU-15: includes some provisional data for 1998-99. EFTA: refers to IS and NO except for gas, derived heat, renewables (NO only), and for solid fuels after 1995 (NO only) and electricity after 1996 (NO only).

Overview of industrial FEC by branch and by group of energy products in EU-15^{41 42}

1 000 tonnes of oil equivalent

	Solid fuels		Hydrocarbons		Gas		Derived heat		Renewables		Electricity		Branch share (%)	
	1985	1999	1985	1999	1985	1999	1985	1999	1985	1999	1985	1999	1985	1999
Iron & steel industry	29 517	22 816	4 147	3 106	19 197	15 544	190	20	-	0.2	8 530	8 716	:	19.0
Non-ferrous metals	1 651	738	1 364	1 366	1 779	2 354	-	-	-	5.0	5 607	5 541	:	3.8
Chemical industry	7 836	1 779	10 883	4 710	14 971	19 915	892	684	-	116	14 585	14 794	:	15.9
Non-metallic mineral prod.	12 939	5 133	8 871	9 894	8 732	13 353	207	54	-	449	4 313	5 746	:	13.1
Ore extraction	725	133	1 008	996	549	548	-	-	-	-	1 210	884	:	1.0
Food, drink & tobacco	3 103	650	7 749	4 506	5 939	11 488	264	198	-	614	4 533	7 288	:	9.4
Textile, leather & clothing	1 254	82	2 912	1 548	1 663	3 456	117	73	-	60	2 942	2 609	:	3.0
Paper & printing	1 709	1 098	4 355	2 217	3 392	8 877	35	174	-	6 341	6 227	10 181	:	11.0
Engineer. & other metal	3 600	258	6 411	3 330	7 721	9 631	610	566	-	5.3	11 079	9 380	:	8.8
Other industries	1 130	737	8 602	11 285	2 773	6 060	560	1 514	-	4 845	33	4 873	:	11.1
Energy group share (%)	24.0	12.7	21.3	16.3	25.2	34.6	1.1	1.2	:	4.7	22.3	26.5	:	:
Total FEC (industry)	63 945	34 188	56 704	42 969	66 712	91 228	3 320	4 311	12 342	13 764	61 868	77 204	.	.
Total FEC (all sectors)	101 903	40 319	373 839	441 133	161 388	228 201	15 701	21 363	34 713	40 768	136 313	185 313	.	.

Industrial consumption shifted between 1985-1999 towards gas and electricity at the expense of solid fuels and hydrocarbons in almost all branches. Use of solid fuels has been cut by more than 50% though it remains important in the iron & steel industry, while use of hydrocarbons (petroleum products), which is decreasing to a lesser extent, is dominant in the non-metallic mineral products industry and other industries. Natural gas has benefited from the move away from coal and oil, and consumption is up in all sectors.

A large part of the gas consumed in the iron and steel industry is coke oven gas and blast furnace gas, both by-products of the steel-making process: coke oven gas is a by-product of the production of coke, needed to make steel in a conventional blast furnace, and blast furnace gas is a by-product of the use of blast furnaces to produce steel. The decrease in consumption of these gases is thus a reflection of the restructuring of the iron and steel industry and the move to electric arc production processes.

Use of energy produced from renewable sources has increased by 11.5% between 1985 and 1999 (see next indicator) and is most important in paper & printing. Electricity use has increased by 20% overall, with the chemical industry the major consumer.

The 'energy group shares' and 'branch shares' presented in the table refer to the share of each group of energy products or branch in total industrial consumption. These shares may differ slightly from those in the previous table as some data is missing for some branches, namely for renewables and derived heat. The overall total for industry used for the 1999 calculations does not refer to the sum of the sectors (253 337 000 toe) but to the 263 709 000 toe estimated total for industrial FEC in the previous table; for 1985 it is the corresponding value of 264 892 000 toe that has been used for consistency.

⁴¹ Source: Eurostat (New Cronos database, theme 8 Environment and Energy, domain Sirene).

⁴² Includes some provisional data for 1999.

Renewable energy sources

Renewable energy sources (RES) include geothermal heat, hydropower, solar, tide, wave and ocean energy, wind and ambient heat, as well as energy derived from incinerating biomass and industrial and municipal waste.

The EU target is for 12% share of RES in gross inland consumption (GIC) by 2010. The first table shows the current EU situation in relation to this target, as well as the contribution of the different renewable energy sources to the total. The second table looks at the contribution of RES to the final energy consumption of industry, as it is only at this level that figures for industry are available.

Renewable energy production and gross inland consumption (GIC) – 1998 ⁴³

	GIC		RES in % of GIC		Share of each renewable energy source in total RES in 1998 (%)				
	1985	1998	1985	1998	Biomass	Geo-thermal	Hydro-power	Wind	Solar heat
EU-15	1 242 354	1 435 638	5.4	5.9	63.9	3.5	31.0	1.2	0.4

The use of RES in the EU has risen from 65.5 mio. toe in 1985 to 86.2 mio. toe in 1999, that is 6% of GIC, similar to the average for all OECD countries (6.1%). The contribution of RES to total electricity generation has increased by 29%, from 275.5 TWh in 1985 to 355.7 TWh in 1999, with hydropower accounting for 86.6%. Heat production from RES is mainly based on burning of biomass (98.4%) and increased from 36.2 mio. toe in 1985 to 44.3 mio. toe in 1999 (+22.4%), with combustion of wood waste in industry accounting for 18% of RES production in 1998.

The 1997 White Paper on Renewable Energy Sources (COM(97) 599 Final) provides a framework for Member States to develop such sources and sets an indicative target of doubling the share of renewables in GIC from 6% to 12% by 2010. A specific Action Plan – ‘Campaign for Take off’ – has been established to promote the use of renewable energy sources, the key technologies to be promoted for the period 1999-2003 being solar, wind energy, biomass (for use in combined heat and power plants, see related indicator on CHP in this Chapter), biogas and biofuels.

Renewable energies in FEC of industry and share in each EU and EFTA Member State ⁴⁴

	1000 toe or %											Change 1985-99 (%)
	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
EU-15	12 342	12 366	12 426	11 967	12 816	13 573	13 831	13 730	14 199	14 154	13 764	11.5
NO	362	:	:	:	:	:	:	:	:	287	782	116.2
Shares of renewables in FEC of industry (%)												
EU-15	4.7	4.6	4.8	4.7	5.2	5.4	5.3	5.3	5.4	5.4	5.2	12.0
B	1.2	1.0	0.9	0.9	0.5	0.5	0.9	0.7	0.3	0.5	1.1	-7.5
DK	4.9	7.2	7.4	6.6	6.4	6.4	6.6	3.0	3.7	3.8	3.2	-34.8
D	1.2	1.2	1.2	0.7	0.8	0.8	0.8	0.8	0.6	0.7	0.7	-42.8
EL	3.8	4.4	4.7	4.7	4.8	4.7	4.3	4.4	4.8	4.6	5.0	30.8
E	9.2	8.0	8.0	6.4	6.5	6.3	6.1	6.4	5.9	6.2	6.3	-31.9
F	4.0	4.5	4.6	4.7	4.4	5.0	4.7	4.5	5.0	5.0	5.1	26.0
IRL	2.4	3.5	3.5	2.0	2.2	7.0	6.8	4.0	3.7	4.6	4.4	81.9
I	3.1	2.7	2.8	2.8	2.9	2.7	2.6	2.7	2.5	2.6	2.4	-22.3
L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
NL	0.3	0.4	0.5	0.5	0.4	0.5	0.4	0.4	0.5	0.6	0.6	65.6
A	6.9	6.9	7.0	7.3	10.3	13.5	13.5	14.9	12.3	8.0	8.7	26.4
P	16.2	11.1	10.1	14.0	16.8	14.1	12.7	14.2	14.0	10.2	10.3	-36.6
FIN	25.8	22.8	21.9	22.5	25.3	26.0	27.1	27.8	28.0	29.6	28.6	11.0
S	28.4	30.7	33.3	33.2	34.1	33.3	33.4	31.7	33.4	32.6	30.1	6.2
UK	0.4	0.2	0.2	0.7	0.7	1.3	1.4	1.3	1.4	1.4	1.4	295.8
IS	-	-	-	-	-	-	-	-	-	-	-	-
NO	5.4	:	:	:	:	:	:	:	:	4.5	11.6	115.2

⁴³ Source: Measuring progress towards a more sustainable Europe – Proposed indicators for sustainable development, Eurostat 2001.

⁴⁴ Source: New Cronos, theme 8 Environment and Energy, domain Sirene.

Renewable energy sources in final energy consumption of industry by branch ⁴⁵

1 000 tonnes of oil equivalent

	Iron & steel	Non-ferrous met.	Chemic.	Non-metal. min.	Ore extract.	Food	Textile	Paper	Engineer.	Other industries					
										1990	1995	1996	1997	1998	1999
EU-15	0.2	5.0	116.2	449.3		614.0	59.8	6 341.2	5.3	176.8	603.3	593.6	613.0	3 058.1	4 844.9
B										120.2	105.2	88.1	39.2	65.9	144.9
DK				0.5		5.0		0.2	4.2						86.0
D															
EL						165.2	11.1	3.9							28.1
E			13.0	130.0		283.8		506.8							467.4
F						56.4								1 844.3	1 792.5
IRL													67.7	87.3	87.3
I															
L															
NL			0.3			11.5		2.6							58.9
A			50.7			8.8	0.1	431.6	0.6					554.3	57.6
P		5.0	32.1	318.6		81.0	48.5	32.3	0.3						22.0
FIN								2 739.5							691.6
S			19.9			2.0		2 624.1							867.0
UK										56.6	498.1	505.5	506.1	506.1	541.0
IS															
NO				2.5		0.1		605.9							173.6

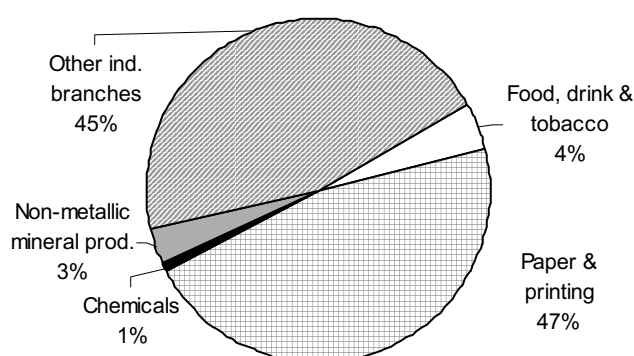
Available figures for RES refer only to biomass/waste, of which the most important are wood and wood waste (12 145 300 toe in 1985 vs. 13 586 700 toe in 1999) and biogas (218 800 toe in 1990 vs. 154 500 toe in 1999). Hydropower, geothermal and wind are mainly used for the generation of electricity and thus are not included, as it is not normally possible to distinguish the provenance of electricity purchased from the grid.

Although their share increased by 23.2% during 1985-98, the use of renewable energy sources remains marginal representing only 5.2% of industry's final energy consumption, and, around 1.5% of total final energy consumption in the whole economy during the period considered.

In general, the major users are the paper industry, where the type of waste products produced are particularly suitable for use as a fuel, and the food industry, where the waste is mainly biomass. Other industries includes the wood working industries, where again the waste is particularly suitable for combustion as a fuel.

Sectoral breakdown of biomass/waste in FEC of industry ⁴⁵

%



With 34% of RES in total final energy consumption, industry is the second main user of RES, after households (64%, at 25 669 ktce in 1999), with only marginal use in agriculture and the other sectors.

⁴⁵ Source: New Cronos, theme 8 Environment and Energy, domain Sirene.

Combined heat & power

This table shows the uptake of combined heat and power (CHP) by branch in European industry.

CHP, or cogeneration, the generation of heat and power in the same plant, generally using a gas turbine with heat recovery, is a technology used to improve energy efficiency⁴⁶. Around 60-70% of energy is estimated to be lost as heat in conventional thermal power plants, while up to 90% of the energy content of fuel can be utilised in CHP plants. By utilising this 'waste' heat for mainly space heating, CHP reduces the need for additional fuel combustion for the generation of heat and avoids the associated environmental impacts, such as CO₂ emissions, air pollution, etc.

EU-15 consumption of different fuels by CHP plants⁴⁷

TJ

	1994	1996	1997	1998	Change (%)	Share (%)	
						1994	1998
Hard coal and lignite	1 078 318	1 014 105	910 080	857 258	-21	30	20
Liquid fuels	543 353	502 487	501 650	456 061	-16	15	10
Natural gas	1 081 724	1 403 550	1 639 660	1 977 403	83	30	45
Renewables	421 320	497 383	550 278	576 561	37	12	13
Others	486 309	492 139	490 794	519 814	7	13	12
Total	3 611 024	3 909 664	4 092 462	4 387 097	21	100	100

CHP is supported by EU policy measures, namely by Council Resolution of 18 December 1997⁴⁸ on a Community strategy to promote combined heat and power and by the 'Carnot' programme (Council Decision 1999/24/EC of 14 December 1998⁴⁹) of technological actions promoting the clean and efficient use of solid fuels (1998 to 2002) which aims inter alia at financing measures to promote the industrial exploitation of clean technologies for energy purposes, for example combined heat and power production.

The target to increase the share of electricity generated by CHP in the EU to 18% in 2010 (compared with 9% in 1994 and 11% in 1998) should lead to considerable energy savings and CO₂ emission cuts.

⁴⁶ See Action Plan to improve energy efficiency in the European Community: COM(2000) 247 of 26.04.2000.

⁴⁷ Source: Combined heat and power production (CHP) in the EU, Eurostat 2001.

⁴⁸ OJ C 004 08.01.1998 p.1.

⁴⁹ OJ L 007, 13/01/1999 p. 28- 30.

CHP as a percentage of thermal electricity generation and total electricity generation ⁵⁰

GWh

	1994			1996			1997			1998		
	CHP elect.	Share in thermal elect. (%)	Share in total elect. (%)	CHP elect.	Share in thermal elect. (%)	Share in total elect.	CHP elect.	Share in thermal elect. (%)	Share in total elect.	CHP elect.	Share in thermal elect. (%)	Share in total elect.
EU-15	204 235	17.6	9.0	226 636	18.3	9.4	244 994	19.8	10.1	270 615	21.0	10.9
B	2 448	8.0	3.4	3 000	9.5	3.9	3 069	10.2	3.9	3 410	9.6	4.1
DK	21 874	56.2	54.5	29 260	55.9	54.6	26 562	62.7	59.9	25 591	66.9	62.3
D	47 752	13.5	9.0	37 817	10.3	6.8	36 834	10.3	6.7	41 770	11.3	7.5
EL	819	2.2	2.0	886	2.3	2.1	968	2.5	2.2	981	2.3	2.1
E	8 537	11.1	5.3	13 390	17.5	7.7	18 567	18.9	9.8	21 916	22.2	11.2
F	8 506	24.5	1.8	9 864	22.0	1.9	10 663	26.2	2.1	12 660	22.7	2.5
IRL	259	1.6	1.5	357	2.0	1.9	457	2.4	2.3	404	2.0	1.9
I	26 477	14.7	11.4	31 383	16.2	12.9	40 164	20.1	16.0	44 856	21.6	17.3
L	:	:	:	:	:	:	120	37.1	9.5	320	87.7	22.5
NL	31 543	41.7	39.5	36 410	45.1	42.7	41 502	49.6	47.9	47 835	55.4	52.6
A	11 721	66.0	21.4	13 539	70.3	24.7	14 025	71.7	24.7	14 268	76.2	24.8
P	3 111	15.1	9.9	2 845	14.5	8.2	2 949	14.1	8.6	3 288	12.8	8.4
FIN	20 312	59.0	30.9	22 536	59.3	32.5	23 051	64.0	33.3	25 128	75.6	35.8
S	9 257	85.0	6.4	10 241	70.9	7.3	9 301	91.4	6.2	9 544	95.5	6.0
UK	11 619	5.0	3.6	15 108	6.1	4.3	16 762	7.0	4.9	18 644	7.4	5.2

Electricity generated by CHP increased by 33% between 1994-98 (from 9% to almost 11%) in EU-15 ; heat generated increased in smaller proportions (+18%), from 17.6% to 21%. CHP generation has increased in all countries except Germany where it decreased in absolute terms, and is used most intensively in Denmark, the Netherlands, Finland, and to a lesser extent, Austria.

Combined heat and power by industrial sector ⁵⁰

GWh or TJ

	Production of electricity		Production of heat	
	(GWh)	(%)	(TJ)	(%)
Mining & agglomeration of solid fuels	743	0.5	9 498	0.6
Extraction of crude oil and natural gas	181	0.1	1 047	0.1
Coke ovens	38	0.0	69	0.0
Refineries	24 393	14.9	226 595	13.2
Iron & steel industry	4 688	2.9	40 404	2.3
Non-ferrous metals	314	0.2	5 035	0.3
Chemical industry	38 803	23.6	417 218	24.2
Non-metallic mineral products	2 705	1.6	15 203	0.9
Extraction	2 825	1.7	32 599	1.9
Food, drink & tobacco	10 211	6.2	122 335	7.1
Textile, clothing & leather	2 605	1.6	16 310	0.9
Paper & printing	35 067	21.3	489 452	28.4
Metal products, machinery, equipment	1 528	0.9	11 570	0.7
Other industries	5 360	3.3	38 788	2.3
Total industry	129 461	78.8	1 426 123	82.9
Total all sectors	164 250	100	1 722 015	100

The five branches chemicals, paper & printing, refineries, food, drink & tobacco and iron & steel, together account for around 90% of electricity (87.5%) and heat (91%) produced by CHP.

The potential for and benefits of CHP depend on the branch concerned. Emission savings arise primarily from combustion of fuel, especially in refineries, paper and non-ferrous metals, which reflects large energy saving potentials in these sectors. Some branches, e.g. non-metallic minerals and the iron & steel industry (high temperature processes) have a low potential for CHP. In other sectors such as waste management (not shown), CHP is expected to reduce emissions of CH₄ (a potent greenhouse gas) and increase emissions of CO₂, NO_x and SO_x (acidifying gases), due to incineration of landfill gas and incineration of waste itself ⁵¹.

⁵⁰ Source: Combined heat and power production (CHP) in the EU, Eurostat 2001.

⁵¹ Based on 'Study on Energy Management and Optimisation in Industry', AEA Technology on behalf of DG ENV, July 2000. This report includes estimates of potential emission and energy savings, namely via CHP, in relevant industrial branches. The methodology used in this report differs from that of the 2001 Eurostat report on CHP but the estimates of CHP production per sector are quite comparable (although fewer sectors covered and reference year 1995-96 in the AEA report vs. 1998 in the Eurostat report).

CHAPTER 3: USE OF MATERIAL RESOURCES

There is a limited amount of detailed data available on the use of material resources. Therefore this chapter is devoted to the use of water and to the re-use of waste:

- Water use,
- Recovery & recycling of packaging.

The world consumption of water increased from a total of 1 300 million m³ in 1950, to 2 600 million m³ in 1972 and 4 200 million m³ in 1997, which illustrates the importance of managing these resources, although partially renewable, in a sustainable way in all economic sectors ; the same sharp upward trend applies to the generation of waste, much of which often represents a loss of valuable resources, which are sometimes scarce and could/should be recovered and recycled to help reduce demand for virgin raw materials. Much of the existing Community environmental policy has been established precisely to limit the environmental and health impacts that arise from the use and overuse of natural resources and are targeted on areas such as energy (see Chapter 2 on Use of Energy Resources), water, soil, waste going to final disposal and hazardous waste generation (see indicators on Waste generation and Soil contamination in Chapter 6)⁵².

⁵² Based on 6EAP.

Water use

This section looks at water abstraction by the EU and EFTA industries, expressed as follows:

- the share of abstraction by manufacturing industry in total fresh renewable water resources,
- the quantity of fresh surface and ground water abstracted⁵³ per year by industrial branches

based on the latest data provided by the Eurostat/OECD joint questionnaire (2000), as reported into the New Cronos database.

An overview of the world industrial consumption of water is presented below as background information.

Industrial water use in the world (1995)⁵⁴

million m³

	Chemicals	Iron & steel	Light industry	Non-ferrous metals	Paper & pulp	Stone, glass, clay	Transport equipment	Other industries	Total
World consumption of water									
All sectors	:	:	:	:	:	:	:	:	428 126
of which Industry	41 576	26 269	5 297	2 170	10 910	696	6 281	5 270	98 469
Share of each group of countries in world industrial total, by branch (%)									
EEA	31.9	27.0	30.0	23.3	23.7	29.6	15.2	33.2	29.6
USA + CA + MEX	44.1	33.2	40.8	44.1	44.2	50.6	39.4	43.7	41.7
JAP + KOR	11.6	20.6	8.6	10.8	10.5	10.1	7.9	11.3	13.5
Other	12.4	19.3	20.6	21.8	21.6	9.8	37.5	11.7	15.2
OECD	95.4	93.5	94.4	93.9	96.8	88.2	95.8	92.0	94.8
Non-OECD	4.6	6.5	5.6	6.2	3.1	11.8	4.2	8.0	5.2
Total branch share	42.2	26.7	5.4	2.2	11.1	0.7	6.4	5.4	100.0

Worldwide, total water use amounted to almost 430 billion m³ in 1995, with industry accounting for 23% of total use, and agriculture and domestic use at 69% and 8%, respectively.

At OECD level, industrial use is surpassed by agriculture, energy and household (domestic sector) withdrawals. Of all industries, the chemical industry was the largest consumer of water in the world in 1995, at 42%, followed by iron & steel (27%) and paper & pulp (11%). Industrial abstractions have declined since 1980, thus reflecting the significant water efficiency improvements that have been realised in the industrial sector in recent years in response to increased water prices (this trend may however also reflect a shift of some of the water-intensive industries to non-OECD countries)⁵⁴.

Share of abstraction by manufacturing industry in total fresh renewable water resources⁵⁵

billion m³

	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
	1998	1996	1995	1997	1997	1997	1994	1998	1998	1996	1998	1998	1998	1995	1998	1998		
Total resources	16.5	6.1	182.0	72.0	111.0	191.0	52.2	175.0	1.6	91.0	84.0	72.9	110.0	179.0	68.3	170.0	393.0	53.3
Industry share (%)	8.5	0.9	3.3	0.0	1.7	2.0	0.5	5.5	0.9	0.8	1.5	0.5	1.4	0.8	1.3	0.0	:	:

The share of industry in total fresh renewable water resources is in general very low, at a maximum of 3.3% (D) except in Belgium and Italy where these shares are still low at 8.5% and 5.5% respectively.

⁵³ Water removed from any source, either permanently or temporarily. Mine water and drainage water are included.

⁵⁴ Source: OECD Environmental Outlook for the Chemicals Industry (2001) and OECD Environmental Outlook (2001).

⁵⁵ Source: Eurostat, New Cronos, theme 8, Milieu.

Total water abstraction versus abstraction by main industrial branches ^{56 57 58}million m³

	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
	B					DK					D				
Total abstraction	:	8 145	7 430	7 604	7 442	:	887	961	932	754	:	43 274	:	:	:
of w hich Mining & quarrying	:	36.9	26.3	32.4	31.3	:	:	:	:	:	:	2 972	:	:	3 041
of w hich Manufacturing	:	1 502	1 468	1 356	1 404	:	80.0	53.0	:	:	:	6 041	:	:	:
- of w hich: food-processing ind.	:	56.7	52.0	48.8	49.1	:	:	:	:	:	:	322	:	:	303
- of w hich: industry-cooling	:	1 113	1 079	918	1 027	:	:	:	:	:	:	:	:	:	:
of w hich Prod. of electricity (cooling)	:	4 716	4 027	4 397	4 244	:	:	:	:	:	:	27 777	:	:	:
of w hich Construction	:	4.1	5.6	3.0	4.8	:	:	:	:	:	:	:	:	:	:
	EL					E					F				
Total abstraction	:	7 732	7 721	8 695	:	:	33 288	:	40 855	:	40 670	:	:	30 341	:
of w hich Mining & quarrying	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
of w hich Manufacturing	:	:	:	110	:	:	1 874	:	1 920	:	3 954	:	:	3 890	:
- of w hich: food-processing ind.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- of w hich: industry-cooling	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
of w hich Prod. of electricity (cooling)	135	132	121	124	:	3 002	:	5 679	:	25 814	:	:	17 211	:	
of w hich Construction	:	:	:	:	:	:	-	:	:	:	:	:	:	:	:
	IRL					I					L				
Total abstraction	1 176	:	:	:	:	:	56 200	:	:	56 200	:	57.0	:	:	60.8
of w hich Mining & quarrying	:	:	:	:	:	:	:	:	:	:	:	:	:	:	-
of w hich Manufacturing	250	:	:	:	:	:	:	:	9 554	:	14.2	:	:	14.0	
- of w hich: food-processing ind.	:	:	:	:	:	:	:	:	:	:	1.3	:	:	1.3	
- of w hich: industry-cooling	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
of w hich Prod. of electricity (cooling)	277	:	:	:	:	:	:	:	10 678	:	:	:	:	-	
of w hich Construction	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	NL					A					P				
Total abstraction	:	:	4 655	:	:	3 312	3 368	3 571	3 561	:	:	:	:	:	11 090
of w hich Mining & quarrying	:	:	6.3	:	:	:	:	:	:	:	:	:	:	:	:
of w hich Manufacturing	:	:	740	:	:	1 343	1 285	1 280	1 286	1 300	:	:	:	:	373
- of w hich: food-processing ind.	:	:	193	:	:	:	:	:	:	:	:	:	:	:	:
- of w hich: industry-cooling	:	:	550	:	:	:	:	:	:	:	:	:	:	:	:
of w hich Prod. of electricity (cooling)	:	:	2 411	:	:	1 242	1 373	1 582	1 571	1 312	:	:	:	:	1 237
of w hich Construction	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	FIN					S					UK				
Total abstraction	2 517	2 586	:	:	2 328	2 961	2 711	:	:	:	11 752	12 118	13 111	13 530	15 256
of w hich Mining & quarrying	25.0	21.0	:	:	21.0	36.0	40.0	:	:	:	81.0	95.5	90.5	108	80.3
of w hich Manufacturing	1 618	1 593	:	:	1 569	1 721	1 440	:	:	:	951	850	1 184	1 045	907
- of w hich: food-processing ind.	:	:	:	:	:	:	18.0	:	:	:	:	:	:	:	:
- of w hich: industry-cooling	:	:	:	:	:	609	:	:	:	:	441	342	597	480	378
of w hich Prod. of electricity (cooling)	375	480	:	:	256	26.0	69.0	:	:	:	260	390	135	148	232
of w hich Construction	:	:	:	:	:	0.0	:	:	:	:	:	:	:	:	:
	IS					NO					CH				
Total abstraction	164	164	161	159	157	:	:	:	:	:	2 595	2 571	2 555	2 557	2 566
of w hich Mining & quarrying	-	-	-	-	-	:	:	:	:	:	:	:	:	:	:
of w hich Manufacturing	10.0	10.0	10.0	10.0	10.0	:	:	:	:	:	:	:	:	:	:
- of w hich: food-processing ind.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- of w hich: industry-cooling	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
of w hich Prod. of electricity (cooling)	-	-	-	-	-	:	-	:	:	:	1 503	1 503	1 503	1 503	1 503
of w hich Construction	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

In spite of a lack of data, the same decline is observable for abstractions by the European and world industries. The production of electricity (cooling) is in general responsible for the biggest industrial withdrawals (except in FIN, S, UK, IS), followed by manufacturing industry.

Water abstraction also concerns marine and brackish water, including desalinated water which is increasingly used in southern countries. The few data which are available for abstraction of this type of water show that in countries like E, IRL, NL, S and UK, industry consumes 100% of this water.

⁵⁶ Source: Eurostat, New Cronos, theme 8, Milieu.

⁵⁷ Sector coverage may differ from one country to another. Data includes estimates, partial and provisional data. F: break in series after 1996 ; L and FIN: 1998: 1999 data; P: 1994: 1990-91 data ; UK: refers to England & Wales.

⁵⁸ Cooling is not an industrial sector but refers to the use of water by the manufacturing and electricity sectors for cooling purposes.

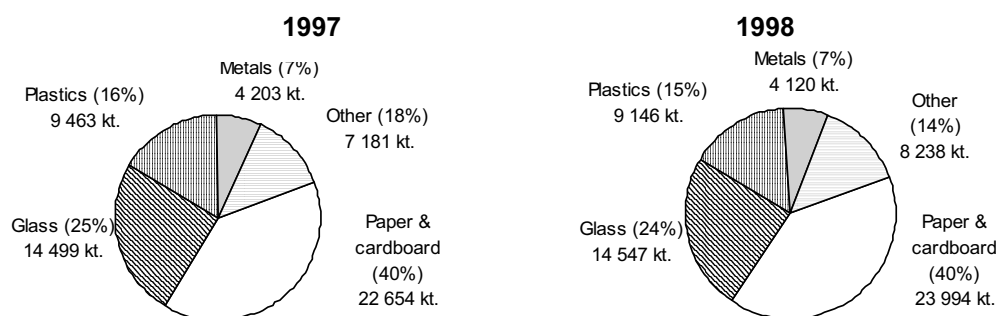
Recovery & recycling of packaging

The indicator is defined as the rate of recovery and recycling of packaging achieved by the EU Member States in 1997-1998 with reference to targets set for 2001 and 2006.

A variety of treatment methods aimed at avoiding landfilling or incineration, are applied to products at the end of their life cycle, e.g. reuse, recycling or recovery. The definitions of these methods are not harmonised among countries. However, reuse is generally defined as the use of products or materials at the end of their life for the original or other purposes without any (important) processing, while recycling requires a true reprocessing including organic recycling but excluding energy recovery. The term 'recovery' is defined by reference to a list of operations (see Council Directive on Waste 75/442/EEC; OJ L 194, 25.7.1975, p. 39).

The amount of packaging placed on the market was estimated to represent a total of 58 000 kilotonnes (kt) in 1997 and 60 000 kt in 1998, with the following breakdown⁵⁹:

Composition of packaging⁶⁰



Packaging waste accounts for about 20% of the weight of municipal waste and 3% of the total waste stream. It is assumed to roughly equal the amount of packaging placed on the market.

As part of waste policy a number of countries tax certain individual products and have set up tax reforms in the 1990s to encourage reuse or recycling. In recent years however, many reuse systems have been replaced by throw-away packaging (particularly plastic bottles and composite packaging), which in turn greatly contributes to the overall generation of packaging waste and is difficult to recycle. Priority is therefore now on recovery and recycling of packaging waste which is generally environmentally superior to incineration, even with energy recovery, and justified from a cost/benefit perspective.

In order to help Member States to manage packaging and packaging waste in a harmonised way, Directive 94/62/EC⁶¹ set targets for recovery and recycling, to be achieved by 30 June 2001. The Directive is currently being amended by a proposal for a Directive (COM(2001) 729 final, 07.12.2001) with revised targets for 30 June 2006 as follows:

⁵⁹ 'Metals': aluminium + steel ; 'Other materials': wood (6 375 kt. in 1997 and at least 7 917 kt. in 1998) + composites + textiles.

⁶⁰ Source: proposal for a Directive (COM(2001) 729 final, 07.12.2001) amending Directive 94/62/EC (OJ L 365, 31.12.1994, p.10-23) on packaging and packaging waste.

⁶¹ Directive 94/62/EC on packaging and packaging waste 20 December 1994, OJ L 365, 31/12/1994, p. 0010 – 0023.

Targets to be attained by Member States by 30 June 2006 vs. 30 June 2001 ⁶²

	Recovery	Recycling	Recycling per packaging material
Targets to be attained by 30 June 2001	Betw een 50-65%	Betw een 25-45%	Minimum of 15%
Targets to be attained by 30 June 2006	Betw een 60-75%	Betw een 55-70%	Glass: 60% Paper & cardboard: 55% Metals (aluminium/steel): 50% Plastics (mechanical/chemical recycling): 20% Other materials (composites/w ood/textiles): not set

The revised targets will put more constraints on Member States especially in the case of recycling. Up to now most of them have managed to reach or exceed the 2001 targets, in spite of differences per Member State and material concerned (see table below).

Recovery and recycling rates of packaging ^{62 63}

	Packaging placed on the market (kt.)		Member State rates of recovery & recycling attained								%	
			Recovery rate		Recycling rate		Recycling rate per packaging material					
							Paper & board	Metals	Glass	Plastics		Composites/ wood/textiles
			1997	1998	1997	1998						
EU-12	57 954	60 045	>48	50	43	44	62	45	52	18	:	
B	1 356	1 426	>62	73	62	64	83	66	66	26	53/39/-	
DK	906	838	84	89	40	50	58	40	75	7	-/0/0	
D	13 731	13 866	66	67	65	65	90	83	86	60	-/81/-	
EL	:	:	:	:	:	:	:	:	:	:	:	
E	5 930	6 350	37	37	33	34	52	22	37	9	-/3/-	
F	11 069	11 641	55	56	40	42	61	45	45	8	-/18/-	
IRL	:	:	:	:	:	:	:	:	:	:	:	
I	9 530	10 584	32	35	29	28	37	7	37	11	-/19/-	
L	76	77	51	56	51	56	49	11	80	9	:	
NL	2 745	2 525	55	62	55	62	70	79	85	14	:	
A	1 269	1 115	66	70	61	65	84	38	80	27	38/17/-	
P	:	:	:	:	:	:	:	:	:	:	:	
FIN	418	424	54	56	42	45	57	16	62	10	:	
S	924	955	69	68	62	61	68	31	84	20	:	
UK	10 000	10 244	26	33	23	28	47	23	23	8	:	

All Member States considered ⁶⁴ have managed to reach the 2001 target of 50-65% set for recovery, except E, I and UK. The targets for recycling per material are differentiated due to differences in costs and benefits of recycling for the various materials. The 15% target for recycling plastic has not been reached in several countries (DK, E, F, I, L, NL, FIN, UK) due to high recycling costs as well as technical constraints. The recycling of the other materials is difficult to estimate (both existing and achievable targets). For this reason why no targets for 2006 have been set.

⁶² Source: proposal for a Directive (COM(2001) 729 final, 07.12.2001) amending Directive 94/62/EC (OJ L 365, 31.12.1994, p.10-23) on packaging and packaging waste.

⁶³ The EU average recovery rate in 1997 is based on the assumption that the recovery rate in B was at least 62% (if this rate was 100% in B, the EU average would only increase from 48% to 49%).

⁶⁴ EL, IRL, P have been granted special conditions: attainment of 25% recovery by 30.06.2001 and the other levels by 30.06.2006.

CHAPTER 4: AIR POLLUTION

This chapter presents the emissions of the main air pollutants, by industry in Europe (EU-15 and EFTA) :

- Emissions of SO_x, NO_x, CO, NMVOCs, heavy metals (lead, cadmium, mercury), and POPs (dioxins).

Acidification, tropospheric (ground-level) ozone and eutrophication are the main environmental problems caused by emissions to the atmosphere of SO_x, NO_x, CO, and NMVOCs. While acidification and eutrophication are mainly environmental issues, tropospheric ozone is a health problem, a major trigger of asthma and of particular concern for children, the elderly and those with weakened immune systems. For their part, heavy metals are poisonous and inhaling or digesting them can have adverse effects on human health (such as digestive problems, damage to the nervous system and even cancer). Their excessive presence in the marine environment can affect marine biota and pose risk to humans via the consumption of seafood. Similar risks are associated with POPs, and the potential disorders caused by even relatively low levels of chronic exposure to POPs are thought to include reproductive and immune effects, developmental anomalies, and cancer.

Total emissions of main air pollutants^{65 66}

1 000 tonnes (POPs: g I-TEQ)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Change 1990-99 (%)
EU-15											
SO ₂	16 362	14 768	13 540	12 346	11 151	10 190	8 843	7 793	7 488	6 734	-58.8
NO ₂	13 284	13 155	12 858	12 227	11 824	11 446	11 209	10 701	10 371	9 936	-25.2
CO	50 104	48 239	46 196	43 905	41 605	40 269	38 691	36 887	35 605	34 065	-32.0
NMVOCs	15 173	14 610	14 211	13 577	13 275	12 854	12 087	11 733	11 336	10 872	-28.3
Heavy Metals	20.65	16.90	13.88	11.91	10.09	8.92	8.34	7.94	7.38	6.56	-68.2
POPs (g I-TEQ)	:	:	:	:	:	:	:	:	:	:	:
EFTA											
SO ₂	80	71	64	62	61	60	:	57	84	:	4.5
NO ₂	332	318	311	314	310	305	:	314	356	:	7.4
CO	1 346	1 249	1 194	1 152	1 118	1 055	:	958	1 062	:	-21.1
NMVOCs	393	377	397	405	416	425	:	419	534	:	35.6
Heavy Metals	0.73	0.63	0.55	0.45	0.32	0.26	0.22	0.19	0.16	0.14	-80.3
POPs (g I-TEQ)	:	:	:	:	:	125	105	105	:	:	-16.0

The almost general downward trend observed in EU and EFTA emissions of these substances in recent years is the result of political measures taken at EU level, such as restrictions on the lead content of petrol, the Large Combustion Plant Directive 94/66/EC (amending Directive 88/609/EEC), Directive 2001/81/EC establishing National Emission Ceilings (NEC) for SO₂, NO_x and VOCs, and at a broader international level under the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Economic Commission for Europe (UNECE) Convention on Long Range Transboundary Air Pollution (CLRTAP) and its various protocols.

Although only figures for EFTA (Norway only) are presented above for POPs, due to many data gaps which make it impossible to calculate EU or EFTA averages, an overall decrease in total releases of POPs has also taken place in the whole EEA (B, D, E, F, L, NL, A, S, UK and NO), except in FIN (+11.6% increase between 1990-98).

⁶⁵ Source: ETC-ACC (EEA), IPCC 2001 CRF submissions & EMEP data submitted for 1999 inventories (14/6/2001), and EMEP.

⁶⁶ POPs: Amounts are expressed in g-I TEQ (International Toxic Equivalent) ; EFTA refers to NO only (IS, NO, CH otherwise) ; 'Change 1990-99' refers to the change between the first and the last year for which data is available.

Emissions of SO_x, NO_x, CO, NMVOCs, heavy metals and POPs

This indicator presents the emissions to the atmosphere of the above substances by European industry, expressed as percentage of total emissions for EU-15 and NO, and as absolute amounts (tonnes or g I-TEQ), for EU-15 and EFTA, and/or the different Member States.

For SO_x, NO_x, CO and NMVOCs, industry covers emissions to air from the following IPCC sources ⁶⁷:

- section 1A2 **Energy: Fuel Combustion in Manufacturing Industries & Construction**, and 1B Energy: *Fugitive Emissions from fuels: 1. Solid fuels, 2. Oil & natural gas* ;
- sections 2A-G **Industrial processes: A. Mineral products, B. Chemical industry, C. Metal production, D. Other production, E. Production of halocarbons & SF₆, F. Consumption of halocarbons & SF₆, G. Other.**

For heavy metals and POPs, the definition of industry ⁶⁸ covers the following SNAP sectors:

- **3. Combustion in manufacturing industry,**
- **4. Production processes.**

Thus Refineries and Waste management within industry are excluded. Solvent use could not be included because no distinction between the various solvents was possible.

Overview : industrial emissions of SO_x, NO_x, CO, NMVOCs, heavy metals, POPs as percentage of total emissions ⁶⁹

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Change 1990-99
%											
EU-15											
SO _x	23.4	21.6	21.8	22.0	22.0	22.5	22.8	24.0	23.3	24.3	4.0
NO _x	12.3	12.1	11.8	11.6	11.9	12.1	11.8	12.0	12.2	12.6	2.6
CO	14.2	13.4	13.5	13.7	15.1	15.8	14.8	16.0	16.0	16.0	12.5
NMVOCs	15.6	15.7	15.9	15.9	16.2	16.4	16.6	16.8	16.5	16.2	4.0
Heavy Metals	:	:	:	:	:	:	:	:	:	:	:
POPs	:	:	:	:	:	:	:	:	:	:	:
EFTA (NO)											
SO _x	70.6	70.4	69.6	71.8	77.7	78.7	78.8	77.7	75.5	76.0	7.6
NO _x	9.3	8.9	8.1	8.8	10.0	9.7	9.2	9.4	9.4	9.1	-2.1
CO	8.1	7.3	7.1	6.9	7.6	8.2	7.3	7.8	8.2	7.8	-4.5
NMVOCs	49.5	52.1	56.0	58.5	59.9	63.1	63.6	64.8	64.2	65.2	31.7
Heavy Metals	:	2.4	2.5	2.2	2.1	2.3	2.7	2.7	2.7	2.4	-1.6
POPs	:	:	:	:	:	:	:	24.8	:	:	:

Emissions of SO_x, NO_x, CO and NMVOCs by EU industry have decreased in line with total emissions (see previous and next tables). In absolute terms, industrial emissions of SO_x decreased in almost the same proportions as total emissions of SO_x (-57% versus -59%); the same is true for NO_x (-23% vs. -25%) and NMVOCs (-25.5% vs. -28.3%) while industrial emissions of CO only decreased by 23.5% vs. 32% for total emissions. In spite of the paucity of data - time series are available only for 4 countries, F, A, FIN, UK - industrial emissions of heavy metals and POPs also seem to have decreased. The large decrease in emissions of heavy metals is due largely to the move to unleaded petrol in Europe. The result is that in spite of declining emissions from industry, industry is now responsible for a much larger share of emissions than in 1990. For POPs, 3 of the 4 countries with time series also show declining industrial emissions; the exception is FIN, where emissions of dioxins are up 22%.

It is more difficult to distinguish trends for EFTA countries due to limited data availability ; however figures for Norway indicate that industry's share of total emissions of SO_x and NMVOCs is rising, while its share of NO_x, and CO emissions is falling slightly and its share of heavy metals emissions is stable. In absolute terms, industrial emissions by the Norwegian industry are decreasing, except in the case of NO_x (3% increase) and, more drastically, in the case of NMVOCs (+53%).

⁶⁷ IPCC classification as used in UNFCCC. See Annex on Databases & Nomenclatures.

⁶⁸ SNAP sources of emissions as used by UNECE/EMEP. See Annex on Databases & Nomenclatures.

⁶⁹ Source: UNFCCC for SO_x, NO_x, CO and NMVOCs ; EMEP (<http://www.emep.int/index.html>) for heavy metals and POPs.

Emissions of SO_x by main industrial sectors⁷⁰

1 000 tonnes

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	16 362	371	183	5 323	506	2 048	1 279	186	1 653	14.7	203	91	360	259	132	3 754	42	53	:
1995	10 190	246	149	1 993	551	1 722	933	161	1 322	8.6	147	56	366	95	93	2 348	26	34	:
1999	6 734	187	56	832	541	1 497	682	157	923	3.8	100	42	375	87	64	1 187	27	29	:
of which:																			
Combustion in manufacturing industries & construction																			
1990	3 023	160.0	21.6	994.0	283.0	333.0	116.0	37.4	321.1	12.6	67.0	25.7	82.6	89.7	22.0	457.7	3.0	6.6	:
1991	2 602	140.0	23.2	644.0	286.0	359.0	114.0	31.4	307.9	12.8	55.3	17.9	72.4	49.5	18.0	471.1	2.0	5.6	:
1992	2 400	146.0	21.7	489.0	281.0	311.0	109.0	32.7	311.0	12.9	53.1	13.0	74.3	33.4	13.0	499.3	3.0	5.2	:
1993	2 179	137.0	20.4	369.0	290.0	272.0	98.0	33.9	275.8	13.1	52.2	11.3	63.8	25.3	15.0	502.6	3.0	4.5	:
1994	1 953	77.0	22.5	272.0	332.0	276.0	70.0	39.6	240.6	10.6	49.2	9.6	73.9	30.1	15.0	435.1	3.0	5.6	:
1995	1 790	88.0	19.1	230.0	337.0	251.0	72.0	32.8	241.3	6.5	48.7	12.2	69.8	22.4	15.0	343.9	2.3	4.4	:
1996	1 553	93.0	11.5	184.0	239.0	248.0	80.0	30.9	212.0	5.7	31.1	11.7	75.9	30.8	15.0	284.5	2.8	5.5	:
1997	1 431	95.0	13.0	180.0	239.0	216.0	76.0	32.4	184.0	3.7	13.7	12.9	74.7	29.2	13.3	248.1	3.2	4.6	:
1998	1 316	88.0	9.9	165.0	239.0	198.0	73.0	30.5	152.0	1.5	18.0	13.8	80.6	26.7	14.3	206.2	2.7	4.6	:
1999	1 221	86.0	8.5	151.0	239.0	179.0	73.0	27.5	141.0	1.8	16.9	8.9	80.6	24.7	27.0	155.6	2.7	4.2	:
Fugitive emissions																			
1990	56.9	-	:	-	-	:	39.0	-	-	-	-	2.0	-	-	-	15.9	15.8	:	:
1991	29.1	-	:	-	-	:	22.0	-	-	-	-	1.3	-	-	-	5.8	15.8	:	:
1992	31.4	-	:	-	-	:	22.0	-	-	-	-	2.0	-	-	-	7.4	15.8	:	:
1993	27.2	2.0	:	-	-	:	18.0	-	-	-	-	2.1	-	-	-	5.1	15.8	:	:
1994	17.5	-	:	-	-	:	10.0	-	-	-	-	1.3	-	-	-	6.2	15.8	:	:
1995	23.5	1.0	:	-	-	:	15.0	-	-	-	-	1.5	-	-	-	6.0	15.8	:	:
1996	22.9	1.0	:	-	-	:	14.0	-	-	-	-	1.2	-	-	-	6.7	15.8	:	:
1997	15.2	-	:	-	-	:	8.7	-	-	-	0.1	0.1	-	-	-	6.3	15.8	:	:
1998	15.0	-	:	-	-	:	8.7	-	-	-	0.1	0.0	-	-	-	6.2	18.4	:	:
1999	15.5	-	:	-	-	:	14.0	-	-	-	0.1	0.1	-	-	-	1.2	18.4	:	:
Industrial processes																			
1990	743.3	52.0	0.3	226.0	15.0	53.0	87.0	-	108.9	0.2	28.0	12.8	22.7	50.3	39.0	48.1	3.0	30.6	:
1991	565.0	34.0	1.4	90.0	15.0	54.0	85.0	-	103.7	0.2	25.3	11.5	17.9	43.6	42.0	41.5	2.0	25.5	:
1992	525.4	23.0	2.4	84.0	14.0	59.0	78.0	-	95.8	0.2	26.7	10.8	20.0	35.9	40.0	35.5	2.0	20.2	:
1993	506.0	11.0	3.4	80.0	14.0	72.0	69.0	-	85.9	0.2	24.7	11.7	32.1	28.6	40.0	33.4	2.0	20.7	:
1994	487.2	39.0	4.5	77.0	14.0	60.0	63.0	-	76.5	0.1	22.8	11.8	26.8	24.1	37.5	30.1	2.0	21.5	:
1995	477.6	21.0	3.2	84.0	16.0	65.0	66.0	-	75.5	0.1	23.2	11.3	27.2	23.0	35.0	27.0	2.7	22.2	:
1996	443.2	17.0	2.7	79.0	16.0	55.0	66.0	-	63.0	0.1	24.0	12.8	26.3	19.9	34.0	27.4	2.9	20.5	:
1997	420.7	18.0	2.0	80.0	17.0	55.0	69.0	-	61.0	0.1	19.0	13.0	27.5	18.4	16.0	24.7	3.1	18.8	:
1998	415.0	16.0	1.4	80.0	18.0	55.0	68.0	-	65.0	0.3	18.7	13.1	28.7	18.1	13.9	18.7	3.5	17.9	:
1999	400.3	16.0	1.4	78.0	18.0	55.0	61.0	-	58.0	0.2	17.6	12.9	28.7	19.1	17.0	17.4	3.5	17.6	:

Around 24% of total emissions of SO_x arise from industrial sources, 75% of which are from combustion in manufacturing industries and construction and 25% from industrial processes.

The country with highest emission levels is Greece (257 kilotonnes), due mainly to the widespread use of lignite, a fuel with high sulphur content, followed by Spain (234 kt), Germany (229 kt) and Italy (199 kt). The 57% decrease in industrial emissions is mainly due to sharp decreases in Germany (-991 kt), the United Kingdom (-348 kt), Italy (-231 kt) and Spain (-152 kt).

⁷⁰ Source: UNFCCC.

Emissions of NO_x by main industrial sectors ⁷¹

1 000 tonnes

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	13 284	339	272	2 705	326	1 156	1 865	118	1 938	23	580	193	317	299	398	2 756	37	219	:
1995	11 446	337	251	1 967	341	1 213	1 699	115	1 768	21	498	170	358	258	361	2 088	42	214	:
1999	9 936	291	210	1 637	382	1 192	1 529	119	1 485	16	424	171	369	247	261	1 603	28	231	:
of which:																			
Combustion in manufacturing industries & construction																			
1990	1 417	79.0	10.7	355.0	20.0	134.0	161.0	10.4	247.6	10.8	81.4	19.3	29.4	21.1	23.0	213.9	0.1	8.1	:
1991	1 387	68.0	11.3	306.0	20.0	144.0	163.0	9.3	279.8	10.9	78.3	16.3	31.2	20.9	23.0	204.8	0.1	8.6	:
1992	1 326	72.0	11.5	270.0	19.0	133.0	151.0	9.3	276.3	11.0	75.2	16.1	31.3	33.1	18.0	199.3	0.1	7.4	:
1993	1 246	72.0	11.4	251.0	19.0	127.0	143.0	9.4	238.2	11.1	69.2	14.4	31.2	32.2	19.0	198.1	0.1	8.8	:
1994	1 234	73.0	11.8	242.0	20.0	143.0	149.0	9.8	198.1	9.7	67.6	13.9	33.9	35.0	19.5	207.9	1.0	10.1	:
1995	1 209	73.0	10.6	238.0	21.0	148.0	139.0	9.5	204.6	8.7	63.6	15.0	33.7	30.7	20.0	193.3	0.6	9.5	:
1996	1 149	73.0	14.1	230.0	23.0	135.0	141.0	9.6	168.0	9.3	54.9	16.6	35.9	34.6	18.0	186.0	0.7	9.4	:
1997	1 125	74.0	18.1	234.0	22.0	135.0	139.0	9.2	156.0	7.4	43.9	17.6	35.0	31.0	12.2	190.2	0.7	9.7	:
1998	1 100	77.0	15.4	221.0	22.0	135.0	139.0	9.3	146.0	6.2	44.8	18.0	38.0	35.3	12.3	180.6	0.7	9.5	:
1999	1 093	75.0	15.2	215.0	22.0	135.0	135.0	9.8	156.0	5.7	43.3	15.2	38.0	34.2	26.0	167.5	0.7	9.3	:
Fugitive emissions																			
1990	1.4	-	:	-	-	:	-	-	-	-	-	-	-	-	-	1.4	:	:	:
1991	0.7	-	:	-	-	:	-	-	-	-	-	-	-	-	-	0.7	:	:	:
1992	0.6	-	:	-	-	:	-	-	-	-	-	-	-	-	-	0.6	:	:	:
1993	2.4	2.0	:	-	-	:	-	-	-	-	-	-	-	-	-	0.4	:	:	:
1994	1.5	1.0	:	-	-	:	-	-	-	-	-	-	-	-	-	0.5	:	:	:
1995	1.5	1.0	:	-	-	:	-	-	-	-	-	-	-	-	-	0.5	:	:	:
1996	1.6	1.0	:	-	-	:	-	-	-	-	-	-	-	-	-	0.6	:	:	:
1997	1.4	0.0	:	-	-	:	-	-	-	-	0.8	-	-	-	-	0.6	:	:	:
1998	5.1	1.0	:	-	-	:	-	-	-	-	3.5	-	-	-	-	0.6	:	:	:
1999	4.6	-	:	-	-	:	-	-	-	-	3.4	-	-	-	-	1.2	:	:	:
Industrial processes																			
1990	216.3	16.0	0.8	31.0	31.0	16.0	28.0	1.0	12.3	0.2	12.5	21.8	4.9	5.0	23.0	12.8	0.0	12.3	:
1991	198.6	11.0	0.8	24.0	31.0	14.0	25.0	1.7	11.4	0.1	11.4	21.8	5.1	6.1	24.0	11.2	0.0	10.1	:
1992	189.0	9.0	0.7	19.0	31.0	13.0	22.0	1.8	10.6	0.1	10.4	21.1	5.2	6.8	28.0	10.4	0.0	9.5	:
1993	173.2	6.0	0.7	15.0	32.0	11.0	18.0	1.0	10.4	0.0	9.4	20.5	4.7	6.9	28.0	9.7	0.0	10.3	:
1994	166.3	5.0	0.6	14.0	31.0	13.0	16.0	0.3	10.1	0.2	7.8	20.3	4.5	7.1	27.5	8.9	0.0	11.3	:
1995	170.7	9.0	0.6	15.0	33.0	12.0	17.0	0.3	10.1	0.2	9.0	19.2	5.3	6.7	27.0	6.3	0.0	11.2	:
1996	176.3	8.0	0.5	13.0	33.0	13.0	18.0	0.3	10.0	0.2	15.9	18.8	5.1	6.4	28.0	6.1	0.3	11.2	:
1997	161.1	8.0	0.6	13.0	34.0	13.0	18.0	0.3	10.0	0.2	13.3	19.2	5.4	6.6	13.0	6.5	0.5	11.3	:
1998	161.1	9.0	0.3	13.0	34.0	13.0	17.0	0.3	12.0	0.8	12.4	19.1	5.4	6.7	12.0	6.1	0.4	11.7	:
1999	157.0	8.0	0.5	12.0	34.0	13.0	16.0	0.3	11.0	0.9	12.0	18.7	5.4	7.2	12.0	6.1	0.4	11.7	:

As in the case of SO_x, industrial emissions of NO_x mainly arise during the combustion of fossil fuels and biomass (87%), and from selected industrial processes (13%), representing 12.6% of total emissions in 1999, versus 12.3% in 1990.

Highest emission levels occur in D (227 kilotonnes), UK (175 kt), I (167 kt), F (151 kt) and E (148 kt); the largest decreases in emission levels took place in D (-159k t or -41%), I (-93 kt or -36%), UK (-53 kt or -23%) and while emissions continued to grow in FIN (+15 kt or +59%), P (+9 kt or +27%), EL (+5 kt or +10%) and DK (+4 kt or +36%). As a whole, emissions decreased by 23% (-380 kilotonnes). Noteworthy are the increased shares of industry in FIN which has almost doubled (from 9% to 17%) and in DK (from 4% to 7.5%). However, fuel (petrol and diesel) consumed for transport remains the major source of these emissions.

⁷¹ Source: UNFCCC.

Emissions of CO by main industrial sectors ⁷²

1 000 tonnes

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	50 104	1 112	704	11 213	1 328	3 899	10 773	401	7 822	176	1 196	1 307	1 114	558	1 347	7 155	28	821	:
1995	40 269	1 032	605	6 668	1 339	3 446	8 862	304	7 755	107	893	1 049	1 201	436	1 081	5 492	26	701	:
1999	34 065	944	541	4 953	1 500	3 661	7 179	285	6 051	50	696	865	1 095	546	939	4 760	40	566	:
of which:																			
Combustion in manufacturing industries & construction																			
1990	3 314	399.0	4.8	828.0	19.0	252.0	789.0	1.6	506.6	97.9	128.0	6.6	28.3	40.8	25.0	187.2	-	6.7	:
1991	3 172	378.0	4.8	741.0	14.0	268.0	754.0	1.6	483.8	123.7	120.0	6.5	26.5	48.4	25.0	176.8	-	6.8	:
1992	3 069	364.0	4.6	692.0	8.0	244.0	717.0	1.6	474.8	149.5	125.0	6.6	31.2	43.7	26.0	181.0	-	6.8	:
1993	3 018	342.0	4.6	647.0	10.0	246.0	668.0	1.5	489.1	175.3	149.0	6.6	30.8	43.2	26.0	178.9	-	7.5	:
1994	3 024	332.0	4.4	702.0	13.0	258.0	742.0	1.6	503.4	76.3	123.0	4.1	31.1	29.7	31.0	172.8	-	7.7	:
1995	2 914	330.0	3.2	698.0	14.0	208.0	714.0	1.5	506.3	46.1	128.0	4.8	27.1	31.3	32.0	170.1	-	7.9	:
1996	2 637	342.0	6.5	649.0	16.0	195.0	684.0	1.5	367.0	42.6	65.3	5.8	26.3	42.9	30.0	163.0	0.1	8.9	:
1997	2 682	323.0	5.0	685.0	16.0	195.0	742.0	1.7	372.0	25.4	40.8	6.1	30.8	63.5	9.6	165.7	0.1	10.0	:
1998	2 600	300.0	7.7	631.0	17.0	195.0	765.0	1.7	372.0	4.0	23.9	5.5	30.3	57.3	33.0	157.0	0.1	9.6	:
1999	2 606	299.0	6.1	616.0	17.0	195.0	739.0	1.9	413.0	2.0	22.5	5.0	30.3	53.3	33.0	172.6	0.1	10.9	:
Fugitive emissions																			
1990	67.3	-	33.3	27.0	-	:	-	-	-	-	-	-	-	-	-	7.1	:	:	:
1991	68.0	-	42.4	23.0	-	:	-	-	-	-	-	-	-	-	-	2.6	:	:	:
1992	59.2	-	40.9	15.0	-	:	-	-	-	-	-	-	-	-	-	3.3	:	:	:
1993	43.3	-	35.1	6.0	-	:	-	-	-	-	-	-	-	-	-	2.3	:	:	:
1994	43.5	-	39.7	1.0	-	:	-	-	-	-	-	-	-	-	-	2.8	:	:	:
1995	46.5	-	43.9	-	-	:	-	-	-	-	-	-	-	-	-	2.7	-	:	:
1996	46.8	-	43.9	-	-	:	-	-	-	-	-	-	-	-	-	3.0	:	:	:
1997	52.7	-	43.9	-	-	:	-	-	-	6.0	-	-	-	-	-	2.8	:	:	:
1998	47.8	-	31.3	-	-	:	-	-	-	13.6	-	-	-	-	-	2.9	:	:	:
1999	37.6	-	23.8	-	-	:	-	-	-	12.8	-	-	-	-	-	1.1	:	:	:
Industrial processes																			
1990	3 739	146.0	:	702.0	24.0	276.0	1 134	-	536.3	17.4	149.0	275.7	30.4	-	6.0	441.7	:	60.0	:
1991	3 234	146.0	:	656.0	24.0	261.0	793	-	514.3	16.5	115.0	246.8	30.7	-	6.0	424.5	:	48.6	:
1992	3 121	152.0	:	606.0	23.0	234.0	745	-	510.4	15.6	98.4	287.5	33.2	-	6.0	409.7	:	46.3	:
1993	2 946	149.0	:	565.0	23.0	260.0	682	-	404.6	14.6	96.5	296.8	34.4	-	6.0	414.3	:	44.2	:
1994	3 201	143.0	:	593.0	20.0	281.0	957	-	298.8	13.7	98.6	310.0	34.2	0.1	20.3	431.1	:	48.4	:
1995	3 402	160.0	:	618.0	22.0	269.0	1 185	-	299.1	9.3	94.3	238.9	31.8	0.1	34.7	439.8	-	49.7	:
1996	3 027	139.0	:	569.0	20.0	260.0	844	-	221.0	8.4	167.0	263.7	30.7	0.1	49.0	455.5	:	40.3	:
1997	3 166	130.0	:	607.0	21.0	260.0	1 012	-	209.0	7.1	140.0	269.0	34.5	0.1	13.1	463.4	:	39.3	:
1998	3 065	120.0	:	579.0	22.0	260.0	963	-	207.0	2.5	140.0	255.0	33.9	0.1	12.9	470.0	:	39.5	:
1999	2 801	119.0	:	558.0	22.0	260.0	834	-	170.0	6.6	131.0	177.8	33.9	0.1	13.0	475.9	:	33.0	:

Industrial emissions of CO mainly arise from industrial processes (51%) and combustion of fossil fuels and biomass (48%).

Between 1990 and 1999, CO emissions in the EU industry as a whole decreased by 1 675 kilo-tonnes (-26%). This was due to a fall in industrial emissions in I (-460 kt or -44%), D (-383 kt, -25%) and F (-350 kt, -18%); while increases took place in S (15 kt, +48%), FIN (13 kt, +31%) and IRL (0.3 kt, +19%). Industry represents a modest proportion of total CO emissions, but this share has more than doubled in S (+119%, from 2.3% of total emissions to 4.9%) and in D (+71% from 13.9% to 23.7%), as opposed to the sharp decrease in L (share down from 65.7% to 17.3%).

This general downtrend in EU industry's emissions of the 3 substances SO_x, NO_x and CO can be explained by constraints set up by legislation (see Chapter introduction). More specifically relevant for industry is the Large Combustion Plant Directive 94/66/EC and Directive 2001/81/EC, which sets up emission ceilings for SO₂, dust ⁷³ and for NO_x.

⁷² Source: UNFCCC.

⁷³ Reductions of dust emissions by dust abatement equipment are known to help reducing particle-bound heavy metal emissions which are targeted by the UNECE CLRTAP Protocol on heavy metals (see part on Releases of heavy metals later in this Chapter).

Emissions of NMVOCs by main industrial sectors ⁷⁴

1 000 tonnes

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	15 173	343	169	3 220	333	1 880	2 459	110	2 192	18.9	502	345	380	209	533	2 479	5.7	302	:
1995	12 854	284	147	2 023	362	1 738	2 056	104	2 367	16.3	365	260	462	185	448	2 037	6.9	369	:
1999	10 872	271	128	1 651	398	1 707	1 785	95	1 672	13.2	281	231	484	168	422	1 566	10.0	351	:
of which:																			
Combustion in manufacturing industries & construction																			
1990	997.7	32.0	7.5	220.0	14.0	53.0	152.0	3.1	116.6	1.6	40.7	5.0	8.5	10.3	18.0	315.4	:	130.1	:
1991	966.8	28.0	6.9	198.0	14.0	54.0	138.0	3.2	126.1	1.5	35.5	5.6	8.9	10.0	16.0	321.0	:	140.7	:
1992	927.6	29.0	6.2	181.0	14.0	57.0	126.0	3.4	123.0	1.5	37.2	5.5	10.1	9.7	13.0	311.0	:	168.5	:
1993	855.1	28.0	6.4	121.0	14.0	56.0	118.0	3.3	125.4	1.4	33.3	5.6	10.4	9.6	11.0	311.7	:	184.3	:
1994	847.2	29.0	6.7	99.0	15.0	58.0	107.0	3.4	127.7	1.8	36.4	5.7	11.9	9.1	5.0	331.6	:	196.3	:
1995	822.1	29.0	6.9	91.0	16.0	59.0	99.0	3.6	127.9	1.4	35.4	4.9	12.2	8.6	5.0	322.2	:	215.5	:
1996	789.8	32.0	6.9	82.0	16.0	59.0	99.0	3.9	97.0	1.5	28.0	4.0	11.9	8.0	5.0	335.6	:	219.9	:
1997	768.2	32.0	6.9	72.0	18.0	59.0	100.0	4.1	83.0	1.5	26.7	3.5	12.6	7.7	5.2	336.0	:	220.4	:
1998	709.1	31.0	5.5	63.0	19.0	59.0	94.0	4.6	73.0	0.7	26.5	3.0	13.5	7.2	5.0	304.1	:	208.6	:
1999	628.2	30.0	5.5	54.0	19.0	59.0	82.0	5.0	62.0	0.8	25.0	2.2	13.5	6.7	5.0	258.5	:	213.9	:
Fugitive emissions																			
1990	77.5	5.0	0.9	12.0	5.0	8.0	9.8	0.3	9.2	0.4	4.5	1.2	9.1	-	6.0	6.1	:	0.7	:
1991	73.6	3.0	0.9	10.0	5.0	8.0	10.0	0.3	8.9	0.7	4.5	1.1	9.4	-	6.0	5.8	:	0.8	:
1992	72.3	4.0	0.9	9.0	4.0	8.0	9.5	0.2	8.7	1.0	5.2	1.1	9.1	-	6.0	5.6	:	0.7	:
1993	71.6	3.0	0.9	8.0	4.0	8.0	9.2	0.2	6.9	1.3	3.6	1.1	8.8	-	11.0	5.6	:	0.8	:
1994	71.6	3.0	0.8	9.0	7.0	8.0	9.9	0.2	9.0	0.3	3.0	0.5	8.9	-	6.0	6.0	:	0.9	:
1995	71.7	3.0	0.6	8.0	7.0	8.0	9.3	0.1	8.3	0.2	6.0	0.5	8.6	-	6.0	6.1	:	0.8	:
1996	74.5	3.0	1.1	8.0	8.0	7.0	9.4	0.2	8.0	0.2	7.6	0.7	9.0	-	6.0	6.3	:	1.0	:
1997	67.2	3.0	0.7	8.0	7.0	7.0	9.5	0.3	8.0	0.2	2.7	0.7	8.5	-	5.1	6.5	:	1.0	:
1998	70.7	3.0	0.8	8.0	8.0	7.0	9.6	0.1	8.0	0.1	3.3	0.7	8.7	-	7.0	6.4	:	1.0	:
1999	84.7	3.0	0.7	8.0	8.0	7.0	9.0	0.1	10.0	0.1	3.1	0.5	8.7	-	20.0	6.6	:	1.1	:
Industrial processes																			
1990	1 286	51.0	3.7	153.0	15.0	167.0	111.0	0.8	102.1	1.2	124.0	20.5	117.9	23.2	67.0	329.0	:	18.6	:
1991	1 249	37.0	3.9	136.0	14.0	180.0	106.0	0.7	103.7	1.0	105.0	22.1	131.6	21.8	66.0	320.6	:	12.3	:
1992	1 254	37.0	4.2	130.0	14.0	172.0	105.0	0.8	102.3	0.9	108.0	23.9	148.9	22.8	65.0	319.5	:	12.0	:
1993	1 232	36.0	4.2	129.0	14.0	176.0	100.0	0.7	97.8	0.7	94.9	25.3	154.5	23.8	65.0	310.3	:	13.4	:
1994	1 230	35.0	6.4	132.0	14.0	178.0	99.0	0.9	93.4	1.1	96.2	23.0	152.4	21.1	75.0	302.9	:	15.1	:
1995	1 213	34.0	5.2	130.0	16.0	165.0	99.0	0.8	94.1	0.9	71.2	23.0	171.6	19.2	75.0	308.1	:	16.3	:
1996	1 144	34.0	5.9	127.0	18.0	156.0	97.0	0.9	78.0	0.8	70.7	23.0	145.6	17.3	75.0	294.8	:	16.4	:
1997	1 138	33.0	5.1	129.0	19.0	156.0	99.0	0.8	78.0	0.8	62.4	23.0	208.8	16.4	32.6	274.1	:	17.3	:
1998	1 089	33.0	5.1	131.0	18.0	156.0	98.0	1.2	76.0	0.6	54.5	23.1	195.6	16.0	29.1	251.7	:	15.1	:
1999	1 047	33.0	5.1	138.0	18.0	156.0	99.0	1.1	71.0	0.7	51.6	23.0	195.6	13.9	29.0	212.2	:	13.7	:

Industrial emissions of NMVOCs are a result of industrial processes (59% of industry emissions), while burning of fossil fuels accounts for 36%, and a further 5% are fugitive emissions. Use of organic solvents, which evaporate easily, also produces NMVOCs, but these are not included in the figures above.

The share of industry in total EU-15 emissions of NMVOCs increased from 15.6 to 16.2% between 1990-99, while absolute industrial amounts decreased by 25.5% (in spite of an increase in EL, P, IS and NO) during the same period. This is less than the pace at which total emissions decreased (-28.3%). Emissions from processes decreased by 18.6% while emissions from combustion decreased by 37%.

Due to a lack of data it is difficult to distinguish trends for EFTA ; however, total emissions are rising in IS and NO (+17% overall), mainly due to increased emissions from combustion in manufacturing industries & construction in NO (+84%).

Emissions of VOC are controlled and limited by legislation, namely Directive 94/63/EC of 20 December 1994 (OJ L 365 31.12.1994 p.24) on the control of VOC emissions resulting from the storage of petrol and distribution from terminals to service stations (fugitive emissions), Directive 1999/13/EC (OJ L 085 29.03.1999 p.1) on the limitation of VOC emissions due to the use of solvents in certain activities and installations, and more recently, Directive 2002/3/EC of 12 February 2002 (OJ L 067 09.03.2002 p.14) relating to ozone in ambient air (VOCs are precursors of tropospheric ozone), which foresees the design of short-term action plans, which may include effective measures in relation to the use of industrial plants or products.

⁷⁴ Source: UNFCCC.

Releases of heavy metals by main industrial sectors - Lead ⁷⁵

tonnes

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	20 211	720	127	2 323	510	2 755	4 335	130	4 300	77	272	202	630	326	540	2 964	12	185	520
1995	8 673	336	42	632	477	949	1 494	107	2 174	30	152	39	498	57	38	1 648	4	20	226
1999	6 354	212	7	542	470	944	868	88	2 174	2	35	34	392	14	38	534	-	6	131
of which:																			
Combustion in manufacturing industry																			
1990	:	:	2.51	558.00	:	:	144.40	:	:	30.00	:	1.52	:	5.79	:	226.41	:	0.40	:
1991	:	:	:	:	:	:	147.00	:	:	:	:	1.22	:	5.35	:	222.10	:	0.50	:
1992	:	:	:	:	:	:	142.20	:	:	:	:	1.26	:	5.24	:	222.49	:	0.50	:
1993	:	:	:	:	:	:	129.50	:	:	:	:	1.09	:	3.41	:	208.57	:	0.60	:
1994	:	:	:	:	:	:	134.00	:	:	25.90	:	1.03	:	3.22	:	194.74	:	0.80	:
1995	:	:	:	264.00	:	:	136.80	:	:	14.60	:	1.14	:	6.28	:	180.98	:	0.70	:
1996	:	115.83	:	:	:	:	136.10	:	:	13.40	5.47	1.36	:	5.92	:	167.43	:	0.80	:
1997	:	142.46	1.75	:	:	:	138.10	:	:	8.20	8.53	1.37	:	5.05	8.60	152.77	:	0.90	:
1998	:	73.76	1.75	:	:	:	145.00	:	:	2.10	4.99	1.36	:	8.93	7.30	125.07	:	0.90	5.20
1999	:	96.20	1.68	:	:	:	136.90	:	:	0.36	3.74	1.20	:	5.72	7.30	110.36	:	0.60	:
Production processes																			
1990	:	:	3.03	162.00	:	:	174.00	:	:	19.00	:	37.02	:	115.18	:	145.06	:	8.00	:
1991	:	:	:	:	:	:	151.50	:	:	:	:	32.58	:	62.29	:	138.82	:	6.80	:
1992	:	:	:	:	:	:	133.50	:	:	:	:	23.15	:	40.33	:	139.26	:	5.60	:
1993	:	:	:	:	:	:	110.70	:	:	:	:	19.34	:	39.71	:	140.39	:	5.30	:
1994	:	:	:	:	:	:	107.20	:	:	17.50	:	16.25	:	45.74	:	142.60	:	5.30	:
1995	:	:	:	81.00	:	:	113.40	:	:	9.80	:	12.87	:	45.55	:	130.17	:	5.00	:
1996	:	:	:	:	:	:	115.80	:	:	8.20	59.60	12.00	:	23.78	:	117.85	:	5.20	:
1997	:	:	0.70	:	:	:	135.20	:	:	4.90	51.80	12.87	:	8.16	1.40	159.53	:	4.80	:
1998	:	:	0.44	:	:	:	138.40	:	:	1.00	33.90	12.86	:	7.92	2.60	135.23	:	5.00	47.00
1999	:	:	0.74	:	:	:	133.20	:	:	0.90	25.40	12.48	:	5.43	2.60	69.29	:	4.10	:

Releases of heavy metals by main industrial sectors - Cadmium ⁷⁵

tonnes

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	174.20	9.90	1.13	31.00	4.50	13.19	15.96	1.60	53.79	0.60	2.38	3.09	3.00	6.34	2.00	25.72	0.17	1.70	4.20
1995	106.21	6.38	0.88	11.00	3.25	14.52	13.72	1.63	29.90	0.40	1.51	1.64	3.20	1.70	0.80	15.68	0.17	1.10	2.50
1999	89.48	3.31	0.71	11.00	3.00	13.54	12.08	1.65	29.90	0.05	1.01	1.50	3.36	0.56	0.80	7.01	0.17	1.10	2.18
of which:																			
Combustion in manufacturing industry																			
1990	:	:	0.33	14.00	:	:	4.00	:	:	0.60	:	0.60	:	0.44	:	5.85	:	:	:
1991	:	:	:	:	:	:	4.20	:	:	:	:	0.42	:	0.50	:	5.73	:	0.20	:
1992	:	:	:	:	:	:	4.00	:	:	:	:	0.43	:	0.34	:	5.78	:	0.20	:
1993	:	:	:	:	:	:	3.80	:	:	:	:	0.33	:	0.20	:	5.65	:	0.20	:
1994	:	:	:	:	:	:	3.80	:	:	0.50	:	0.27	:	0.28	:	5.25	:	0.30	:
1995	:	:	:	5.00	:	:	3.40	:	:	0.30	:	0.30	:	0.32	:	5.02	:	0.30	:
1996	:	2.17	:	:	:	:	3.60	:	:	0.30	0.05	0.35	:	0.31	:	4.65	:	0.30	:
1997	:	3.28	0.24	:	:	:	3.70	:	:	0.20	0.45	0.34	:	0.32	0.20	4.83	:	0.30	:
1998	:	1.87	0.24	:	:	:	3.70	:	:	0.20	0.19	0.38	:	0.50	0.10	3.21	:	0.30	0.80
1999	:	1.92	0.21	:	:	:	3.30	:	:	0.02	0.17	0.29	:	0.24	0.10	3.08	:	0.30	:
Production processes																			
1990	:	:	0.04	8.00	:	:	3.90	:	:	-	:	0.56	:	5.46	:	1.79	:	:	:
1991	:	:	:	:	:	:	3.40	:	:	:	:	0.51	:	2.67	:	1.66	:	1.10	:
1992	:	:	:	:	:	:	3.10	:	:	:	:	0.38	:	2.28	:	1.63	:	1.10	:
1993	:	:	:	:	:	:	2.60	:	:	:	:	0.33	:	2.33	:	1.65	:	1.20	:
1994	:	:	:	:	:	:	2.50	:	:	-	:	0.30	:	1.55	:	1.68	:	0.70	:
1995	:	:	:	4.00	:	:	2.70	:	:	-	:	0.23	:	1.01	:	1.70	:	0.50	:
1996	:	:	:	:	:	:	2.70	:	:	-	1.47	0.21	:	0.79	:	1.69	:	0.60	:
1997	:	:	0.04	:	:	:	3.20	:	:	-	1.12	0.22	:	0.39	0.05	1.67	:	0.60	:
1998	:	:	0.04	:	:	:	3.30	:	:	-	0.79	0.22	:	0.44	0.10	1.54	:	0.60	0.30
1999	:	:	0.01	:	:	:	3.20	:	:	0.01	0.70	0.21	:	0.02	0.10	1.32	:	0.50	:

⁷⁵ Source: EMEP (<http://www.emep.int/index.html>).

Releases of heavy metals by main industrial sectors – Mercury ⁷⁶

tonnes

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Total emissions by all economic sectors																			
1990	263.20	8.90	3.17	113.00	7.10	20.26	43.79	1.60	19.98	0.30	3.00	2.64	5.50	1.10	1.50	31.36	0.05	1.80	6.80
1995	143.11	4.54	2.42	31.00	12.02	19.66	30.92	1.78	13.23	0.10	1.04	1.44	5.18	0.70	0.90	18.18	0.05	1.20	3.30
1999	115.75	3.02	1.98	31.00	13.00	18.04	16.63	1.92	13.23	0.29	0.53	1.19	4.92	0.40	0.90	8.70	0.05	1.20	2.63
of which:																			
Combustion in manufacturing industry																			
1990	:	:	0.17	72.00	:	:	3.50	:	:	0.30	:	0.22	:	0.10	:	3.98	:	:	:
1991	:	:	:	:	:	:	4.00	:	:	:	:	0.17	:	0.12	:	4.04	:	0.30	:
1992	:	:	:	:	:	:	4.00	:	:	:	:	0.17	:	0.13	:	4.23	:	0.20	:
1993	:	:	:	:	:	:	3.60	:	:	:	:	0.15	:	0.13	:	4.19	:	0.20	:
1994	:	:	:	:	:	:	3.90	:	0.20	:	0.14	:	0.13	:	4.00	:	0.30	:	
1995	:	:	:	16.00	:	:	3.60	:	0.10	:	0.15	:	0.13	:	3.94	:	0.30	:	
1996	:	2.18	:	:	:	:	3.90	:	0.10	0.01	0.17	:	0.12	:	3.61	:	0.30	:	
1997	:	0.83	0.14	:	:	:	3.80	:	0.10	-	0.17	:	0.10	0.10	3.60	:	0.30	:	
1998	:	1.02	0.13	:	:	:	3.90	:	-	-	0.18	:	0.14	0.10	3.28	:	0.30	0.20	
1999	:	0.79	0.13	:	:	:	3.50	:	0.01	-	0.15	:	0.06	0.10	1.95	:	0.30	:	
Production processes																			
1990	:	:	0.25	11.00	:	:	4.40	:	-	:	1.22	:	0.40	:	8.46	:	:	:	
1991	:	:	:	:	:	:	3.40	:	:	:	1.07	:	0.37	:	9.22	:	0.70	:	
1992	:	:	:	:	:	:	3.50	:	:	:	0.87	:	0.27	:	7.76	:	0.70	:	
1993	:	:	:	:	:	:	3.30	:	:	:	0.70	:	0.08	:	3.63	:	0.40	:	
1994	:	:	:	:	:	:	3.50	:	-	:	0.54	:	0.09	:	3.94	:	0.40	:	
1995	:	:	:	3.00	:	:	3.30	:	-	:	0.49	:	0.21	:	4.57	:	0.40	:	
1996	:	:	:	:	:	:	3.00	:	-	0.71	0.47	:	0.23	:	2.74	:	0.30	:	
1997	:	:	0.08	:	:	:	2.40	:	-	0.44	0.49	:	0.09	0.10	1.38	:	0.40	:	
1998	:	:	0.06	:	:	:	2.10	:	0.10	0.32	0.42	:	0.13	0.20	1.63	:	0.30	0.90	
1999	:	:	0.05	:	:	:	2.20	:	0.27	0.31	0.33	:	0.09	0.20	1.83	:	0.40	:	

The main anthropogenic source of heavy metals in the atmosphere is industry, including present and former mining activities, foundries, smelters and fuel combustion. Other sources include incineration of waste, leaded petrol, and fuel combustion in other sectors. More specifically, industrial emissions of lead are mostly associated with combustion in manufacturing industry while cadmium emissions are first of all connected with non-ferrous metallurgy (around 40% of emissions) and fuel combustion (around 30%), and mercury emissions mainly reflect the level of coal consumption in different regions. In the case of mercury, a certain level of re-emissions (secondary emissions of man-made pollutants to the atmosphere) occurs, as biochemical processes can release mercury contamination in soils and water in gaseous form. In the EMEP region, as of the early 90-s, the total re-emissions from soils are estimated as not exceeding 52 tonnes per year or about 10% of contemporary direct anthropogenic emissions to air ⁷⁷.

Total EU-15 releases of heavy metals have decreased in huge proportions (as a result namely of the implementation of the UNECE CLRTAP 1998 Protocol on heavy metals which recommends the adoption of measures to reduce heavy metals emitted by certain installations): by almost 70% for lead, 49% for cadmium and 56% for mercury. Releases by industry have also generally decreased, but in many cases, not as fast as for other sources. The share of industry in total heavy metal emissions evolved as follows during the period 1990-99:

- lead: most of the reduction in overall lead emissions is a result of the move away from leaded petrol, so that industry is now the most important source of lead emissions in most countries, up from 4% of total emissions in 1990 to 35% in 1999 in DK, from 31 to 55% in D (1990-95), from 7 to 31% in F, from 19 to 40% in A, from 37 to 80% in FIN, from 13 to 34% in UK and from 5 to 78% in NO ; decrease from 64 to 63% in L ;
- cadmium: increase from 30% of total emissions in 1990 to 63% in 1999 in UK, from 71% to 82% in D (1990-95), from 49 to 54% in F; decrease from 33 to 30% in DK, from 100 to 52% in L, from 38 to 33% in A, from 93 to 46% in FIN ; NO stable at 73% (1995-99).
- mercury: increase from 18 to 34% in F, from 40 to 43% in UK ; decrease from 13 to 9% in DK, from 73 to 61% in D, from 100 to 98% in L, from 55 to 40% in A, from 45 to 37% in FIN ; NO stable at 58%.

Although there is not enough data to calculate EU-15 totals, the figures show that emissions of lead are several orders of magnitude higher than for the other 2 priority heavy metals cadmium and mercury. However, environmental impact is not only linked to release but also to toxicity, which is much higher for mercury than for cadmium and lead.

The figures on the other heavy metals, arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se) and zinc (Zn) are even more scarce than for lead, cadmium and mercury, and therefore not presented here.

⁷⁶ Source: EMEP (<http://www.emep.int/index.html>).

⁷⁷ Based on EMEP (<http://www.emep.int/index.html>).

Emissions of dioxins to air by main industrial branches ⁷⁸

g I-TEQ

	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH	
Total emissions by all economic sectors																			
1990	448	:	1 196	181	:	2 033	:	:	40	618	92	:	35	58-127	1 030	:	:	:	
1995	438	:	309	157	:	1 785	:	:	24	74	61	:	41	:	724	:	125	:	
1998	116	:	:	:	:	1 391	:	:	8	44	54	:	40	:	277	:	:	:	
of which:																			
Combustion in manufacturing industry																			
1990	:	:	712.0	:	:	363.5	:	:	22.0	:	4.0	:	0.8	:	142.5	:	:	:	
1991	:	:	:	:	:	341.0	:	:	:	:	3.8	:	0.8	:	140.6	:	:	:	
1992	:	:	:	:	:	327.6	:	:	:	:	3.7	:	1.0	:	142.6	:	:	:	
1993	:	:	:	:	:	425.9	:	:	:	:	3.5	:	1.1	:	140.7	:	:	:	
1994	:	:	:	:	:	545.1	:	:	19.0	:	3.4	:	1.2	:	139.0	:	:	:	
1995	:	:	236.0	:	:	531.2	:	:	9.0	:	3.7	:	1.2	:	134.2	:	:	:	
1996	:	:	:	:	:	411.0	:	:	9.0	2.3	3.8	:	1.0	:	133.0	:	:	:	
1997	:	:	:	:	:	327.4	:	:	5.0	3.7	3.9	:	1.1	0.5	129.0	:	5.0	:	
1998	:	:	:	:	:	272.3	:	:	3.0	1.1	3.7	:	1.0	0.1	124.1	:	:	:	
1999	:	:	:	:	:	129.9	:	:	:	0.9	3.7	:	1.0	0.1	125.1	:	:	:	
Production processes																			
1990	:	:	35.0	:	:	31.7	:	:	3.0	:	15.3	:	13.1	:	42.3	:	:	:	
1991	:	:	:	:	:	27.6	:	:	:	:	14.3	:	12.5	:	36.9	:	:	:	
1992	:	:	:	:	:	24.4	:	:	:	:	9.2	:	13.4	:	36.8	:	:	:	
1993	:	:	:	:	:	20.1	:	:	:	:	8.3	:	14.8	:	37.5	:	:	:	
1994	:	:	:	:	:	19.1	:	:	3.0	:	8.3	:	15.3	:	37.5	:	:	:	
1995	:	:	9.0	:	:	20.1	:	:	7.0	:	9.0	:	15.4	:	38.4	:	:	:	
1996	:	:	:	:	:	20.5	:	:	7.0	18.8	8.1	:	15.0	:	36.0	:	:	:	
1997	:	:	:	:	:	23.9	:	:	11.0	17.5	8.7	:	14.6	2.3	37.7	:	21.0	:	
1998	:	:	:	:	:	24.1	:	:	5.0	11.0	8.5	:	15.4	2.6	33.6	:	:	:	
1999	:	:	:	:	:	23.3	:	:	:	8.7	6.1	:	16.0	2.6	25.1	:	:	:	

Most POPs are of anthropogenic origin, emissions being associated with industrial processes, product use and applications, waste disposal, leaks and spills, combustion of fuels, and waste incineration. There are many different types of POPs, but the indicator focuses on polychloro-dibenzodioxins (PCDD) and furans, both for reasons of data availability and because these are considered to be most relevant for human exposure via air. Dioxins are mainly produced as unwanted by-products of industrial processes and are also associated with waste disposal (and incineration), leaks and spills, and combustion of fuels. The major emission sources in Europe are of industrial origin, especially iron ore sinter plants and facilities of the non-ferrous metal industry. Incineration of municipal waste and of clinical waste are other important sources. The remaining emissions come mainly from domestic heating facilities particularly wood combustion, accidental fires, and traffic ⁷⁹.

Data are available for a few countries only but show, as for total emissions, an overall downward trend of industrial emissions in all cases, except in the Finnish industry where emissions originating from combustion in the manufacturing industry and production processes have both increased. In Luxembourg and Sweden, emissions due to production processes have increased also but without affecting the global industrial total in these countries. Overall industry's contribution to POP emissions seems to have increased.

On 24th October 2001, the Commission adopted a Communication on a Community Strategy for dioxins, furans and polychlorinated biphenyls (COM(2001)593) with the objective to reduce the presence of dioxins and furans in the environment and of dioxins and PCBs in feed and food so that human intake be reduced to a level inferior to 14 picograms (pg) WHO-TEQ per kg bodyweight per week, (to be compared with the 0.9-3.0 pg I-TEQ per kg body weight per day estimated average total dietary exposure to dioxins for consumers within the EU and the 1-4 pg TEQ/kg body weight per day level of exposure recommended by the World Health Organisation (WHO)) ⁸⁰. More generally, POP emissions are regulated by the UNECE CLRTAP 1998 Protocol on POPs (dioxins, furans, PAHs and HCB).

⁷⁸ Source: EMEP (<http://www.emep.int/index.html>).

⁷⁹ Source: European Dioxin Inventory. The European Dioxin Inventory - Stage II (Dec. 2000) report provides complete data sets on dioxin emissions to air, broken down by countries and sectors but for the year 1995 only. Releases to the other media land and water are estimated in a report titled 'Releases of dioxins and furans to land and water in Europe' which provides estimates for 1994. The main sources for releases to water are chemical and pesticide production, accidental fires and disposal of municipal solid waste to landfill. While not quantified in the report, these are likely to be significantly lower than both releases to land and air.

⁸⁰ Based on 'Compilation of EU Dioxin exposure and health data', UK Department for the Environment, Transport and the Regions (DETR) for DG ENV, Oct. 1999.

CHAPTER 5: WATER POLLUTION

A large part of the water abstracted for industrial and other uses is returned to the environment (rivers, lakes, seas) as waste water with impaired quality. This chapter provides information on the nature and origin of water pollution, with the focus on industrial discharges of nitrogen (N), phosphorus (P) and of other pollutants, particularly organic matter, whose decomposition in water requires oxygen, reducing the dissolved oxygen available in the water for fish and aquatic invertebrates. Discharges of these pollutants are considered together and referred to as BOD and COD.

Data on water use (abstraction) are provided in the corresponding indicator in Chapter 3 on Use of Material Resources, to which this section is related.

Discharges of nitrates and phosphates encourage production of algae and/or other aquatic plants, which can lead to eutrophication of water bodies. This can be aggravated by nitrates and phosphates released during the breakdown/decomposition of organic matter.

Discharges from industry to water bodies take place either directly from the industry itself, or through the public sewer systems. It may undergo different types of treatment, or no treatment at all, depending on the industry concerned and the legislation applied in Member States, but the major part is treated within the industry itself.

Investment by industry in waste water management ⁸¹

million ECU

	B	D	EL	F	NL	A	P	FIN	UK
	1996	1995	1996	1994	1997	1998	1999	1998	1997
Mining & quarrying	0.37	22.02	0.03	3.91	2.80	2.53	1.66	2.61	17.33
Manufacturing	:	:	:	:	:	:	:	:	:
- food products	19.67	124.33	8.59	59.55	22.30	17.21	8.74	10.01	67.89
- textiles & leather products	2.98	13.46	2.36	6.36	2.85	2.85	11.76	0.53	2.89
- wood & wood products	0.94	9.71	0.38	0.39	-	1.34	1.38	1.79	1.44
- pulp, paper & publishing	4.40	46.16	0.17	12.49	6.47	10.55	7.76	48.40	37.56
- coke, refined petroleum	3.13	103.92	0.82	11.31	22.44	-	1.82	5.17	7.22
- chemicals, rubber & plastics	33.16	189.98	3.53	56.03	33.25	10.89	2.81	0.61	309.11
- non-metallic mineral products	2.60	21.53	0.48	3.56	2.17	6.05	5.63	0.38	14.44
- basic metals	11.60	59.48	0.13	7.52	1.81	6.13	1.19	4.80	50.56
- fabricated metal products	34.23	25.75	0.06	5.53	2.53	15.33	4.11	15.04	36.11
- machinery & equipment	2.98	120.89	0.13	17.86	4.52	1.16	0.55	0.02	-
Energy & water	10.88	:	96.29	91.48	0.77	1.59	3.20	0.69	10.11
Total	126.92	737.22	113.00	275.96	101.91	75.62	50.61	90.06	554.67

Manufacturing industry accounts for more than 90% of total investments in waste water management, except in F (65%) and EL (15%) where a significant part of investments are in the 'energy & water industry'. The largest investors within the manufacturing sector are the branches of chemicals, food, coke & refined petroleum, and pulp, paper & publishing. Some exceptions are textiles & leather in P and EL, and fabricated metals in B, A and UK. (see also Part 3, chapter 2: environmental expenditure).

The above investments by industry are principally aimed at waste water treatment and prevention, but also include ground water and soil protection activities for several countries.

Many EU Directives target water quality, the most recent of which is the Water Framework Directive (WFD) ⁸², aimed at phasing out the discharge of certain hazardous substances into Community waters within the timeframe set by the Directive (by 2020 at the latest). The WFD will allow the environmental costs of water to be reflected in the price of water. Full implementation of the Directive is expected to lead to further and important improvements in water quality.

⁸¹ Source: Waste water in European countries, Statistics in Focus (Environment & Energy, Theme 8 – 14/2001), Eurostat 06.07.2001.

⁸² Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy.

Generation of N, P, BOD and COD

This indicator is defined as the total quantity of nitrogen (N), phosphorus (P), biochemical oxygen demand (BOD) and chemical oxygen demand (COD) generated by point sources and by industry and its main components, expressed in thousands of kilograms per day or thousands of kilograms of oxygen (O₂) per day.

It is complemented with data on total waste water generation.

Generation of waste water by point sources and by industry in selected EU Member States⁸³

1 000 m³ per day

	1994	1995	1996	1997	1998	1995	1998	1999	1995	1999	1990	
	B					D		E		L		NL
Total generation (point sources)	:	:	:	:	:	:	22 925	25 330	57.00	:	5 440	
of which Industry	9 126	9 066	7 803	7 973	8 111	:	17 600	18 640	29.00	18.28	1 293	
Mining & quarrying	156	175	159	187	179	3 333	:	:	:	:	-	
Manufacturing	2 697	2 602	2 502	2 081	2 456	17 052	:	:	29.00	18.28	1 226	
- food-processing	147	151	155	157	167	1 082	:	:	:	1.28	:	
- basic metals	1 521	1 436	1 348	960	1 309	2 460	:	:	:	4.00	22.0	
- transport equipment	:	:	:	:	:	38.0	:	:	:	:	-	
- textiles	54.8	52.1	48.1	43.7	43.4	545	:	:	:	:	45.0	
- paper	140	152	150	144	143	1 838	:	:	:	:	45.0	
- chemicals & refineries	661	642	626	600	622	9 693	:	:	:	8.00	245	
Electricity prod. & distri. (cooling)	6 258	6 275	5 131	5 695	5 464	75 219	:	:	:	:	-	
Construction	:	:	:	:	:	:	:	:	:	:	:	
	1994	1995	1996	1997	1998	1999	1995	1997	1998	1999		
	FIN					S		NO				
Total generation (point sources)	:	:	:	:	:	:	:	:	:	:		
of which Industry	2 421	2 595	2 661	2 112	2 181	2 196	5 757	:	:	:		
Mining & quarrying	57.0	51.0	47.0	49.0	57.0	47.0	127	:	:	:		
Manufacturing	2 043	2 030	1 984	1 750	1 803	:	:	1 015	1 160	1 480		
- food-processing	14.00	14.00	13.00	12.00	11.00	11.00	192	8.90	8.70	8.40		
- basic metals	151	138	127	136	146	165	:	573	404	417		
- transport equipment	:	:	:	:	:	:	:	0.01	0.07	0.01		
- textiles	1.00	1.00	1.00	1.00	1.00	1.00	31.0	2.22	2.64	2.59		
- paper	1 469	1 458	1 458	1 407	1 429	1 443	2 419	8.87	4.37	3.80		
- chemicals & refineries	408	419	385	194	216	217	1 407	202	513	827		
Electricity prod. & distri. (cooling)	321	514	630	313	321	312	:	:	:	:		
Construction	:	:	:	:	:	:	:	:	:	:		

Significant improvements have been made over the last 2-3 decades regarding many aspects of water quality, in particular by the industrial sector, but some problems and unsustainable trends still remain, especially in southern Europe, where waste water generation has increased significantly.

Available data shows that industry is responsible for more than 50% of waste water generated from point sources in Spain and Luxembourg, and 24% in the Netherlands. Within industry, the electricity production & distribution sector uses important quantities of water for cooling, which is later discharged as waste water, with little pollution other than raised temperature. Manufacturing industry generates a smaller part of the waste water, but its environmental impacts are much stronger.

⁸³ Source: Eurostat, New Cronos, theme 8, Milieu.

Very few countries are able to provide data on discharges of nitrogen in general and by industry in particular, and among these, only Finland can provide more or less complete time series. The same applies for phosphorus, BOD and COD for which data availability is even scarcer. Moreover, the data often contain estimates, making it even more difficult, if not impossible, to draw trends from the data presented.

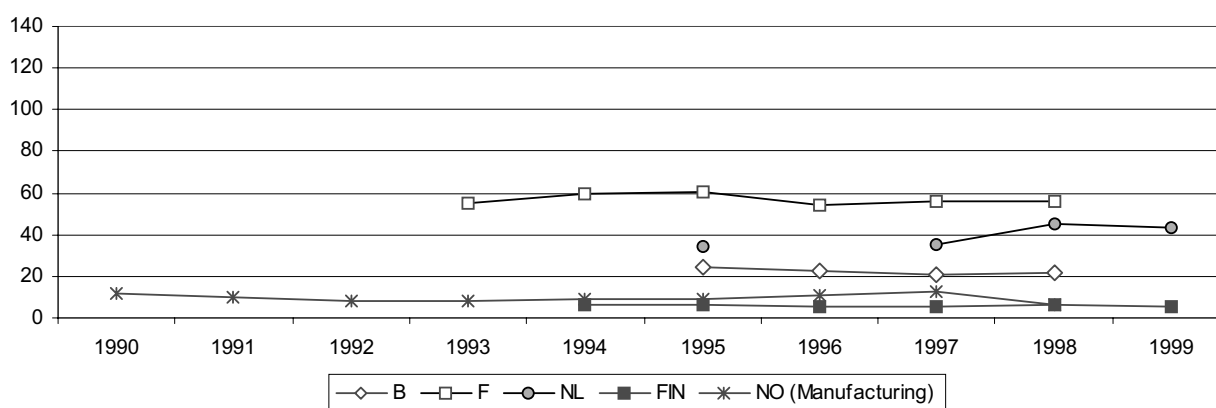
Total and industrial generation of N in selected EU Member States ⁸⁴

1 000 kg per day

	1990	1995	1996	1997	1990	1995	1996	1997	1998	1999
	B				NL					
Total generation (point sources)	:	:	:	:	209	209	:	209	221	220
of which Industry	24.26	22.25	20.85	21.34	40.88	34.05	:	34.83	45.10	43.62
Mining & quarrying	0.05	0.03	0.09	0.06	0.05	0.01	:	0.08	0.06	0.06
Manufacturing	23.97	21.98	20.60	21.01	40.67	33.99	:	34.60	44.88	43.40
- food-processing	6.62	6.01	4.84	4.96	14.87	15.32	:	13.81	22.55	22.04
- basic metals	3.25	2.62	2.16	2.91	4.83	1.65	:	1.40	1.65	1.63
- transport equipment	:	:	:	:	-	-	:	0.01	-	-
- textiles	2.00	2.16	1.63	1.60	0.60	1.52	:	3.21	1.94	1.78
- paper	0.57	0.36	0.72	0.68	0.61	1.59	:	1.60	1.49	1.40
- chemicals & refineries	10.19	9.48	9.89	9.51	19.06	12.38	:	12.41	13.98	13.37
Electricity prod. & distri. (cooling)	0.17	0.23	0.14	0.23	0.11	0.03	:	0.13	0.13	0.13
Construction	:	:	:	:	0.05	0.01	:	0.03	0.03	0.03
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	FIN									
Total generation (point sources)	:	:	:	:	:	:	:	:	:	:
of which Industry	9.82	9.05	7.82	6.39	6.67	6.42	5.33	5.48	5.94	5.62
Mining & quarrying	0.10	0.10	0.06	0.03	0.03	0.02	0.01	0.01	0.04	0.03
Manufacturing	:	:	:	:	:	:	:	:	:	:
- food-processing	0.37	0.36	0.34	0.35	0.35	0.31	0.34	0.26	0.20	0.20
- basic metals	:	:	:	:	:	:	:	:	:	:
- transport equipment	:	:	:	:	:	:	:	:	:	:
- textiles	0.14	0.09	0.11	0.10	0.08	0.06	0.03	0.03	0.05	0.05
- paper	8.41	7.79	6.45	5.38	5.61	5.51	4.47	4.83	5.27	5.10
- chemicals & refineries	0.79	0.70	0.84	0.51	0.58	0.49	0.45	0.35	0.36	0.24
Electricity prod. & distri. (cooling)	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.05
Construction	:	:	:	:	:	:	:	:	:	:

Generation of N by industry – selected Member States ⁸⁴

1 000 kg per day



⁸⁴ Source: Eurostat, New Cronos, theme 8, Milieu.

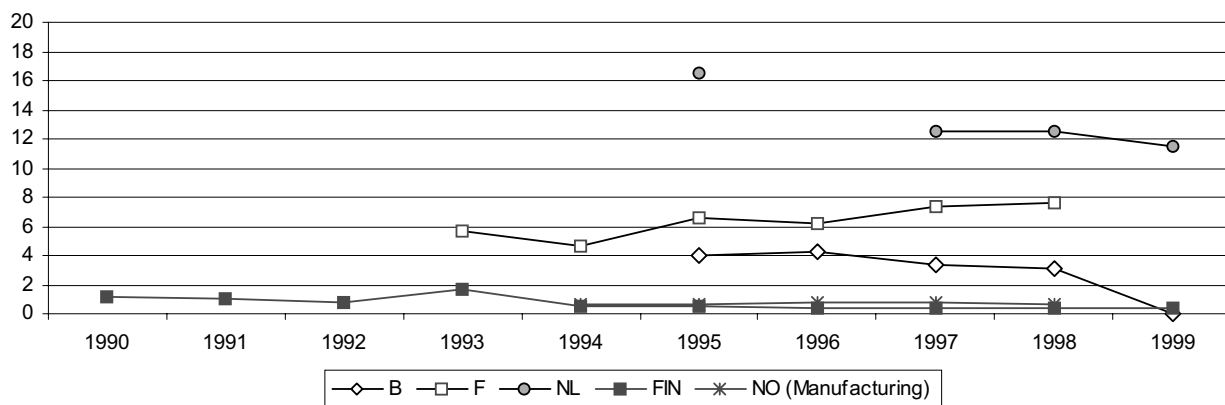
Total and industrial generation of P in selected EU Member States ⁸⁵

1 000 kg per day

	1990	1995	1996	1997	1998	1990	1995	1997	1998	1999
	B					NL				
Total generation (point sources)	:	:	:	:	:	47.87	33.29	29.57	29.75	28.78
of which Industry	:	4.06	4.20	3.32	3.16	31.43	16.58	12.57	12.54	11.48
Mining & quarrying	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	:
Manufacturing	:	4.04	4.18	3.31	3.14	31.42	16.56	12.55	12.53	11.47
- food-processing	:	1.74	1.73	1.55	1.51	2.08	5.20	3.40	3.02	2.98
- basic metals	:	0.05	0.04	0.06	0.04	0.05	0.05	0.08	0.10	0.09
- transport equipment	:	:	:	:	:	-	-	-	-	-
- textiles	:	0.26	0.25	0.23	0.23	0.08	0.22	0.01	0.02	0.02
- paper	:	0.07	0.02	0.07	0.03	0.08	0.12	0.21	0.22	0.21
- chemicals & refineries	:	1.67	1.95	1.17	1.13	28.91	10.32	8.81	9.11	8.11
Electricity prod. & distri. (cooling)	:	0.01	0.01	-	0.01	:	-	-	-	-
Construction	:	:	:	:	:	:	0.01	0.01	-	-
	FIN									
Total generation (point sources)	:	:	:	:	:	:	:	:	:	:
of which Industry	1.21	1.01	0.81	1.63	0.55	0.52	0.42	0.42	0.42	0.40
Mining & quarrying	-	-	-	-	-	-	0.01	-	-	-
Manufacturing	:	:	:	:	:	:	:	:	:	:
- food-processing	0.03	0.03	0.01	1.01	0.01	0.01	0.01	0.01	0.01	0.01
- basic metals	-	-	-	:	:	:	:	:	:	:
- transport equipment	:	:	:	:	:	:	:	:	:	:
- textiles	-	-	-	-	-	-	-	-	-	-
- paper	1.16	0.95	0.78	0.60	0.52	0.49	0.39	0.40	0.40	0.38
- chemicals & refineries	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Electricity prod. & distri. (cooling)	-	0.01	0.01	-	0.01	0.01	-	-	-	-
Construction	:	:	:	:	:	:	:	:	:	:

Generation of P by industry – selected Member States ⁸⁵

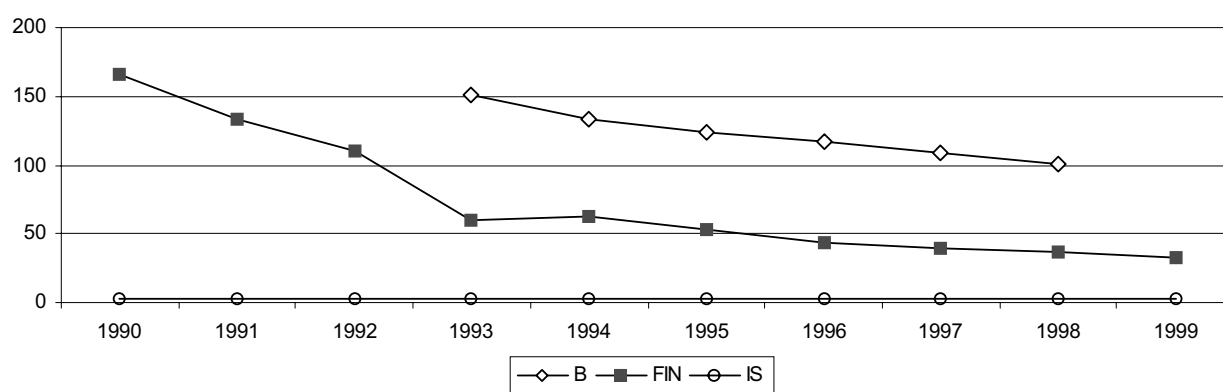
1 000 kg per day



⁸⁵ Source: Eurostat, New Cronos, theme 8, Milieu.

Total and industrial generation of BOD in selected EU Member States ⁸⁶1 000 kg O₂ per day

	1990	1990	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	NL	P										
Total generation (point sources)	1 147	2 315	:	:	:	:	:	:	:	:	:	:
of which Industry	273	1 580	165.82	132.66	110.80	60.47	62.78	52.97	43.09	39.81	36.58	32.78
Mining & quarrying	-	:	0.04	0.04	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01
Manufacturing	259	1 420	:	:	:	:	:	:	:	:	:	:
- food-processing	:	:	0.90	0.28	0.53	0.12	0.17	0.36	0.28	0.37	0.25	0.36
- basic metals	4.70	10.20	:	:	:	:	:	:	:	:	:	:
- transport equipment	0.00	:	:	:	:	:	:	:	:	:	:	:
- textiles	9.40	220	0.23	0.08	0.19	0.23	0.32	0.13	0.10	0.11	0.12	0.15
- paper	9.40	342	159.17	128.05	105.03	55.53	58.32	48.44	39.08	35.68	32.25	28.58
- chemicals & refineries	51.73	112	5.47	4.20	4.93	4.43	3.94	4.00	3.60	3.63	3.95	3.68
Electricity prod. & distri. (cooling)	:	:	:	:	:	:	:	:	:	:	:	:
			0.01	0.01	0.09	0.14	0.01	0.01	0.01	0.01	-	-
Construction	14.11	:	:	:	:	:	:	:	:	:	:	:

Generation of BOD by industry – selected Member States ⁸⁶1 000 kg O₂ per day⁸⁶ Source: Eurostat, New Cronos, theme 8, Milieu.

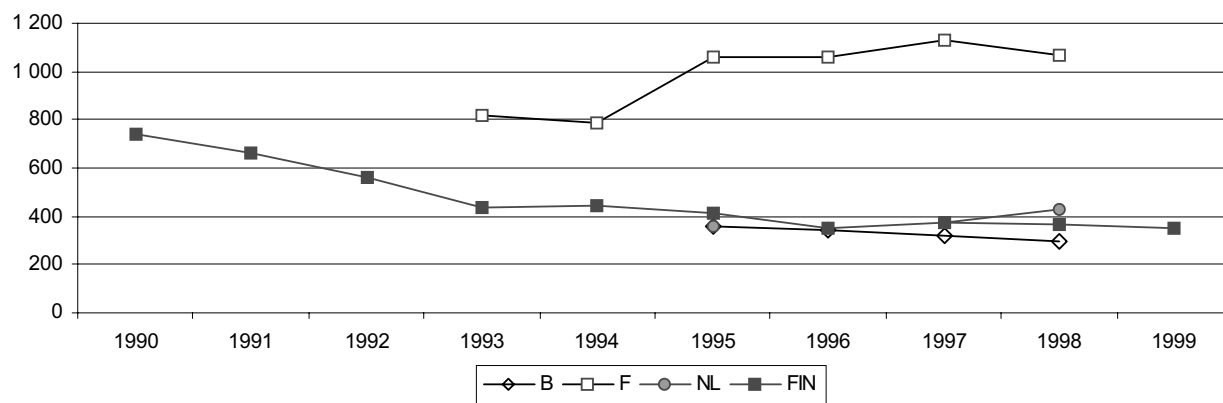
Total and industrial generation of COD in selected EU Member States ⁸⁷

1 000 kg O₂ per day

	1990	1995	1996	1997	1998	1990	1995	1996	1997	1998
	B					NL				
Total generation (point sources)	:	:	:	:	:	:	:	:	:	:
of which Industry	:	359.49	344.24	315.71	296.18	:	356.00	:	374.00	427.00
Mining & quarrying	:	1.43	0.57	64.00	98.00	:	0.02	:	0.30	0.30
Manufacturing	:	356.44	343.00	314.51	294.38	:	355.00	:	373.00	427.00
- food-processing	:	126.96	116.07	101.19	101.13	:	160.00	:	180.00	189.00
- basic metals	:	12.32	11.53	9.75	8.42	:	10.00	:	6.50	6.70
- transport equipment	:	:	:	:	:	:	:	:	:	:
- textiles	:	63.53	58.36	47.88	46.81	:	35.00	:	34.00	43.00
- paper	:	27.80	32.21	27.30	23.88	:	65.00	:	71.00	46.00
- chemicals & refineries	:	111.46	111.07	115.81	102.43	:	66.00	:	58.00	93.00
Electricity prod. & distri. (cooling)	:	0.80	0.54	0.44	0.69	:	0.10	:	0.10	0.13
Construction	:	0.40	:	0.40	0.20	:	:	:	:	:
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	FIN									
Total generation (point sources)	:	:	:	:	:	:	:	:	:	:
of which Industry	741.01	664.94	561.51	437.65	443.49	416.29	348.50	372.75	368.89	347.43
Mining & quarrying	0.17	1.12	0.60	0.04	0.04	0.03	0.78	1.07	1.19	1.28
Manufacturing	:	:	:	:	:	:	:	:	:	:
- food-processing	2.10	1.30	1.38	1.30	1.31	1.36	1.06	0.82	0.74	0.75
- basic metals	0.02	0.03	0.03	0.03	0.06	0.03	0.03	0.02	0.06	0.08
- transport equipment	:	:	:	:	:	:	:	:	:	:
- textiles	0.04	0.15	0.18	0.36	0.34	0.15	0.12	0.09	0.17	0.39
- paper	723.96	650.33	546.29	422.66	428.73	406.18	338.47	363.34	358.64	337.81
- chemicals & refineries	14.59	11.92	12.52	12.54	12.80	8.27	6.74	7.35	7.39	6.69
Electricity prod. & distri. (cooling)	0.13	0.10	0.51	0.71	0.21	0.26	1.30	0.06	0.70	0.42
Construction	:	:	:	:	:	:	:	:	:	:

Generation of COD – selected Member States ⁸⁷

1 000 kg O₂ per day



⁸⁷ Source: Eurostat, New Cronos, theme 8, Milieu.

CHAPTER 6: WASTE & SOIL

This chapter looks at waste generated by industry and at soil pollution:

- Industrial waste generation,
- Contaminated soils.

The quantities of waste produced by society have increased in parallel with population growth and economic development. Industry is one of the main generators of waste, especially hazardous waste. Soil contamination is strongly connected with waste disposal and other industrial activities. The 2 indicators are therefore related.

Waste generation

Although other industrial branches, such as mining & quarrying, energy production, and construction are known to generate considerable quantities of waste, data for these branches is scarce. Therefore this indicator focuses on waste generated by manufacturing industry.

Because of the lack of data, it is not possible to calculate the contribution of industry to total waste generation. Therefore an overview of total waste generation is provided in the short table below which will enable the reader to have an idea of the 'weight' of industrial waste with reference to total waste generated.

Total generation of primary waste ^{88 89}

																	<i>million tonnes</i>
B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
1995	1998	1996	1996	1999	1995	1998	1997	:	1998	1996	1998	:	1998	1999	1999	1998	1999
35	12	391	33	77	136	58	87	:	39	47	22	:	88	378	0.24	6.5	4.6

Primary waste refers to waste generated by the various sectors of economic activity and by households, that is waste from agriculture & forestry, mining & quarrying, manufacturing, energy production, water purification & distribution, construction, other sectors, municipal waste (minus the fraction included in other sectors if any) and only a fraction of sewage and refuse disposal (the rest being secondary waste). Waste generated from waste treatment operations (e.g. by incineration) is considered as secondary waste and therefore excluded from this definition.

The data presented for this indicator include estimates, non-validated data, partial data and are based on different national definitions of sectors or on coverages which may vary from one year to another. Given these limitations the data should be interpreted with care.

⁸⁸ Source: Eurostat, New Cronos, theme 8, Milieu.

⁸⁹ B: estimates from NSI ; EL, E, F, IRL, NL, A, S, UK: Eurostat estimates ; NO: does not include soil, gravel, stone, etc.; includes sewage sludge, but only selected parts of Agricultural and Mining & quarrying wastes.

Primary waste generation by main industrial sectors ⁹⁰

million tonnes

	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	CH
Mining & quarrying																		
1990	:	:	88.84	3.80	:	:	:	:	:	0.39	0.02	:	:	:	107.00	:	9.00	:
1991	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1992	0.72	:	:	3.80	:	:	:	:	:	0.23	:	:	:	:	:	:	7.60	:
1993	:	:	67.81	:	:	:	:	:	:	:	-	:	:	47.00	:	:	4.73	:
1994	0.60	:	:	:	:	:	:	:	:	0.19	:	:	:	:	:	:	:	:
1995	0.62	:	:	3.90	:	:	2.20	:	:	:	:	4.73	:	:	82.00	:	:	:
1996	0.62	:	:	:	:	:	:	:	:	0.34	:	:	:	:	74.00	:	:	:
1997	:	:	:	:	:	:	:	0.35	:	:	:	7.12	28.00	:	:	:	:	:
1998	:	:	:	:	:	:	3.51	:	:	0.33	:	4.69	:	63.82	:	:	:	:
1999	:	:	:	22.76	:	:	:	:	:	:	:	:	29.60	:	118.00	:	:	:
Manufacturing																		
1990	:	:	84.05	:	:	:	:	:	1.44	7.67	12.96	:	:	:	56.00	:	2.00	:
1991	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1992	13.99	:	:	:	:	:	:	:	:	8.05	:	:	15.50	:	:	0.01	:	:
1993	12.57	:	65.12	:	:	105.00	:	:	:	:	12.32	:	:	13.99	:	0.01	3.29	:
1994	12.37	2.31	:	:	:	:	:	:	:	8.21	:	:	:	:	:	0.01	:	:
1995	13.24	2.56	:	:	:	101.00	3.78	22.21	:	:	:	13.32	:	:	56.00	0.01	:	:
1996	:	2.63	:	6.68	:	:	:	:	:	8.89	14.28	:	:	:	56.00	0.01	2.88	:
1997	:	2.74	:	:	:	:	:	22.99	:	:	:	10.99	15.91	:	:	0.01	:	:
1998	:	2.78	:	:	:	:	5.11	:	:	9.78	:	12.80	:	19.78	50.00	0.01	:	:
1999	13.78	:	:	29.24	:	:	:	:	:	:	:	:	:	:	:	0.01	:	:
Energy production																		
1990	:	1.14	31.06	7.68	:	:	:	:	:	1.55	1.15	:	:	:	13.00	-	:	:
1991	:	1.70	:	:	:	:	:	:	:	:	:	:	:	:	:	-	:	:
1992	:	1.40	:	:	:	:	:	:	:	1.27	:	:	1.35	:	:	-	:	:
1993	1.08	1.67	25.31	:	:	:	:	1.33	:	1.27	0.13	:	:	:	:	-	:	:
1994	1.05	1.96	:	:	:	:	:	:	:	1.40	:	:	:	:	:	-	:	:
1995	1.18	1.70	:	:	:	:	0.35	:	:	:	:	0.88	:	:	13.00	-	:	:
1996	1.11	2.33	:	:	:	:	:	:	:	1.40	:	:	:	:	13.00	-	:	:
1997	1.19	1.78	:	9.32	:	:	:	:	:	:	:	0.57	1.27	:	:	-	:	:
1998	1.19	1.47	:	:	:	:	0.45	:	:	1.55	:	0.49	:	:	:	-	:	:
1999	1.29	:	:	:	:	:	:	:	:	:	:	:	:	:	:	-	:	:
Water purification & distribution																		
1990	:	:	:	:	:	:	:	:	:	:	6.62	:	:	:	35.00	:	:	:
1991	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1992	:	:	:	:	:	:	:	:	:	:	:	:	1.70	:	:	:	:	:
1993	0.08	:	:	:	:	:	:	:	:	:	2.27	:	:	:	:	:	:	:
1994	0.07	:	:	:	:	:	:	:	:	0.15	:	:	:	:	:	:	:	:
1995	0.06	:	:	:	:	:	0.06	:	:	:	:	:	:	:	36.00	:	:	:
1996	0.07	:	:	:	:	:	:	:	:	0.07	2.30	:	:	:	35.00	:	:	:
1997	0.08	:	:	:	:	:	:	1.18	:	:	:	:	:	:	:	:	:	:
1998	0.08	:	:	:	:	:	:	:	:	0.10	:	:	:	:	:	:	:	:
1999	0.13	:	:	0.54	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Construction																		
1990	:	:	121.18	:	22.00	:	:	:	:	:	20.95	:	7.00	:	70.00	:	:	3.00
1991	:	:	:	1.72	:	13.70	:	:	:	:	:	:	:	:	:	:	:	:
1992	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1993	:	:	131.65	:	:	:	:	:	:	:	19.95	:	:	:	:	:	3.58	:
1994	:	2.43	:	:	:	:	:	:	:	0.03	:	:	7.00	:	:	:	:	3.00
1995	:	2.56	:	:	:	:	1.32	:	:	:	:	11.00	:	:	70.00	:	:	:
1996	:	3.09	:	1.80	:	:	:	:	:	0.02	25.39	:	:	:	70.00	:	:	3.00
1997	:	3.43	:	:	:	:	:	20.59	:	0.03	:	7.73	35.00	:	:	:	:	:
1998	:	2.96	:	:	:	:	2.70	:	:	:	:	0.06	:	:	:	:	1.54	6.39
1999	:	:	:	:	:	:	:	:	:	:	:	:	:	:	71.00	:	:	:

Industrial waste includes hazardous and non-hazardous waste. A large portion of industrial waste generated is mineral and is used as a substitute for construction materials. This fraction is often classified as a by-product rather than waste. A similar remark can be made for the organic residuals from the food industry (see table next page).

⁹⁰ Source : Eurostat, New Cronos, theme 8, Milieu.

Primary waste generation by manufacturing branch^{91 92}

1 000 tonnes

	Food, beverages, tobacco	Textile & leather	Wood & wood products	Paper & paper prod.	Printing & publishing	Refineries	Chemicals	Rubber & plastics	Non-metal. mineral prod.	Basic metals	Fabricated metal prod., machines	Other manuf. industries
B 1995	1 665	24	58	144	7	68	939	80	123	2 903	175	19
1996	1 718	25	58	136	7	74	932	82	127	2 699	151	21
DK	:	:	:	:	:	:	:	:	:	:	:	:
D	:	:	:	:	:	:	:	:	:	:	:	:
EL 1996	975	219	77	129	:	16	842	8	786	3 570	:	60
E 1999	2 171	240	2 138	1 046	:	147	9 402	:	11 896	:	1 947	252
F 1993	1 503	504	7 596	2 937	:	:	513	644	282	2 104	542	:
1995	1 139	260	6 637	2 769	:	:	545	504	403	2 157	523	:
IRL 1995	899	262	22	182	:	10	330	58	1 550	218	:	250
1998	2 358	171	288	165	:	29	1 533	26	267	120	129	26
I 1997	4 251	944	2 239	:	:	130	2 651	453	4 523	3 885	2 489	1 428
L	:	:	:	:	:	:	:	:	:	:	:	:
NL 1990	3 277	74	305	673	210	87	980	90	663	525	803	73
1992	3 467	69	262	710	233	89	1 137	91	497	538	864	92
1994	4 005	76	278	745	275	79	715	96	511	507	740	182
1996	3 771	75	217	702	292	104	903	121	586	642	705	774
1998	3 915	82	250	798	314	118	917	155	633	1 001	779	800
A 1990	807	157	898	170	1	4	2	8	302	2 770	458	1
1992	432	152	1 350	1 333	:	:	:	501	:	496	:	:
1993	1 202	137	3 505	714	3	6	18	-	4	4 003	19	19
1995	383	161	3 712	1 591	:	:	:	705	:	507	:	:
1996	768	168	3 545	1 238	:	182	:	654	:	:	:	:
P 1995	2 614	:	3 011	:	:	20	160	:	:	:	:	203
1997	:	1 683	2 126	:	:	28	368	30	1 767	:	:	301
1998	1 942	1 235	1 416	429	:	14	91	31	1 674	2 986	2 986	:
FIN 1992	1 400	94	3 300	4 436	53	:	2 550	31	469	2 733	343	73
1997	2 098	18	3 906	5 337	156	:	638	63	1 809	1 188	413	286
S 1993	988	31	6 715	2 626	:	:	246	:	540	2 171	523	145
1998	1 814	36	7 589	3 730	367	18	460	93	583	3 691	1 245	154
UK 1990	:	:	:	:	:	:	:	:	:	6 000	:	:
1995	:	:	:	:	:	:	:	:	:	6 000	:	:
1996	:	:	:	:	:	:	:	:	:	6 000	:	:
IS 1992	10	:	:	:	:	:	:	:	:	:	:	:
1995	10	:	:	:	:	:	:	:	:	:	:	:
1999	10	:	:	:	:	:	:	:	:	:	:	:
NO 1993	594	16	432	1 035	:	:	344	:	134	505	224	3
1996	530	11	625	430	:	12	310	27	100	570	176	82
CH 1996	:	:	:	:	:	:	:	:	:	:	:	:

The amounts of waste generated are closely linked to the process technology used in industry. Waste reduction is better achieved through improved process technologies than by using the rather limited end-of-pipe technologies⁹³.

In general, the amount of industrial waste generated has remained fairly stable in the EU, though significant reductions can be seen in Portugal (construction) and in Germany (mining, and manufacturing), which may be largely attributed to restructuring following German re-unification; on the other hand, a large increase in mining waste is observable in Sweden and in construction waste in Finland.

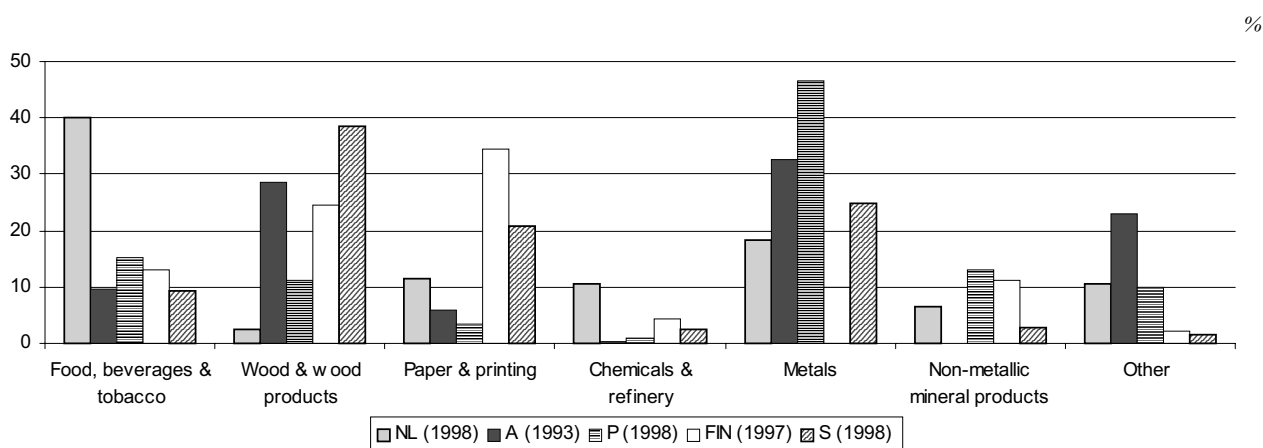
There are big differences among countries due to the different structure of their industry. Intensive waste-generating sectors in NL, A, FIN, S and NO are wood, paper, basic metals and food, beverages & tobacco.

⁹¹ Source : Eurostat, New Cronos, theme 8, Milieu, and various national sources.

⁹² B : Walloon region only. F: only non-hazardous waste from companies with more than 10 employees. Sector coverage may vary from one country to another, e.g. Paper includes Printing in FIN, S, NO, and Textile excludes Wearing of apparel & fur in EL, etc.

⁹³ Based on 'Environmental Pressure Indicators for the EU', second edition 2001, Eurostat, June 2001.

Manufacturing waste generated by main sub-branches in selected Member States ⁹⁴



Primary hazardous waste generation by industrial sectors ^{95 96}

1 000 tonnes or %

	DK				E	IRL	I	NL			P	FIN	S
	1995	1996	1997	1998				1996	1998	1998			
Total primary waste generation	11 466	12 912	12 857	12 233	77 000	58 412	87 500	: 34 943	39 214	22 359	:	:	87 598
of which:													
Primary hazardous waste	179	187	178	187	:	:	3 401	476	495	599	:	:	:
of which:													
Mining	:	:	:	:	208	:	4	16	50	65	6	:	2
Share in total hazard. (%)	:	:	:	:	:	:	0.1	3.4	10.1	10.9	:	:	:
Manufacturing	79	116	104	117	4 071	:	2 166	357	418	497	211	:	801
- food, beverages & tobacco	:	:	:	:	75	2	31	5	5	13	3	4	17
- textile & leather	:	:	:	:	7	1	18	5	12	3	4	:	4
- wood & wood prod.	:	:	:	:	5	1	:	2	3	2	15	2	55
- paper & paper prod.	:	:	:	:	12	1	:	4	4	5	3	36	8
- printing & publishing	:	:	:	:	:	:	216	10	12	13	:	8	74
- refineries	:	:	:	:	60	7	29	51	63	65	6	:	2
- chemicals	:	:	:	:	2 069	208	656	162	180	220	35	147	120
- rubber & plastics	:	:	:	:	:	1	29	6	6	25	1	1	7
- non-metal. mineral prod.	:	:	:	:	1 114	1	12	4	5	6	4	1	13
- basic metals	:	:	:	:	:	5	573	44	49	41	70	154	299
- fabric. metals, machines	:	:	:	:	705	9	530	60	75	75	70	30	185
- other	45	21	28	21	25	:	72	4	4	12	40	1	14
Share in total hazard. (%)	44.1	62.0	58.4	62.6	:	:	63.7	75.0	84.4	83.0	:	:	:
Energy	:	:	:	:	:	1	:	8	4	8	:	:	:
Share in total hazard. (%)	:	:	:	:	:	:	:	1.7	0.8	1.3	:	:	:
Water	:	:	:	:	:	:	48	64	3	2	:	:	:
Share in total hazard. (%)	:	:	:	:	:	:	:	13.4	0.6	0.3	:	:	:
Construction	:	:	:	:	:	:	26	31	20	27	12	1	:
Share in total hazard. (%)	:	:	:	:	:	:	:	6.5	4.0	4.5	:	:	:

The definition of hazardous waste varies from one country to another, depending on national legislation. Therefore the few data which are available should be interpreted with care.

The largest part of hazardous waste generated is ascribable to industry, and in particular manufacturing activities. With so few data available, it is difficult to talk about trends or to draw conclusions, but the chemicals industry, basic metals industry and fabricated metals & machinery industry seem to be the major generators of hazardous manufacturing waste.

The 6EAP has set a target of a 20% reduction in the total amount of waste going to final disposal by 2010 and 50% by 2050 based on the levels of 2000. The same objectives apply for the production of total hazardous waste.

⁹⁴ Source : Eurostat, New Cronos, theme 8, Milieu.

⁹⁵ Source : Eurostat, New Cronos, theme 8, Milieu, and various national sources.

⁹⁶ Sector coverage may vary from one country to another.

Soil contamination

This indicator aims to show the main industrial branches causing local soil contamination in selected EU and EFTA countries or regions. Local contamination is a problem in restricted areas (or sites) around the source, where there is a direct link to the source of contamination.

Diffuse contamination, generally caused by contaminants in air or water transported over wide areas or from agriculture, often far from the source, is excluded. Diffuse contamination includes contamination by heavy metals, acidification, excess nutrients (eutrophication) etc. Both types of degradation may be present within the same problem area or hot-spot⁹⁷.

Contamination is one cause of soil degradation. Contaminated sites are sites where an unacceptable hazard to human health and ecosystems exists. Classification as contaminated is based on the results of risk assessment⁹⁸.

Contaminated sites are mainly the result of industrial activities and waste disposal. Local contamination occurs at waste-disposal sites, gas works, oil refineries, metal-processing (steel) industries, (petro)chemical industries, and other production facilities. The extraction of minerals, metals and construction materials can be another source of pollution, leading to local contamination, destruction of arable land, changes in morphology and consequently erosion and hydrological disruption, and compaction, surface sealing and soil loss. It is estimated that accidental releases of contaminants are responsible for only around 15% of damage, while releases during normal operations are responsible for the remaining 85%.

To tackle the problems of soil contamination, the 5EAP called for the integrated control of pollution from industry, so that reductions in one area, e.g. air pollution, would not lead to increased pollution of other media, such as water or soil. It also called for reductions in waste and better waste management via civil (namely environmental) liability, so that the polluters are held responsible for damage they cause and should pay for remedying this damage. In principle, this covers pollution from industrial accidents as well as from gradual pollution caused by releases of hazardous substances or waste from identifiable industries. The 6EAP recognises that 'little attention has so far been given to soils in terms of data collection and research. Yet the growing concerns on ... soil pollution illustrate the need for a systematic approach to soil protection covering pollution from waste landfill sites, industry and mining', and proposes a 'thematic strategy for soil protection'.

In spite of the poor data availability, potentially or definitively contaminated sites, both abandoned and operating, have been identified and/or their total number estimated in all EU and EFTA Member States, except Greece and Portugal⁹⁹.

⁹⁷ See 'Down to Earth : Soil degradation and sustainable development in Europe - A challenge for the 21st century', EEA/UNEP, 2000.

⁹⁸ Identification of contaminated sites is composed of 2 phases: a screening phase, where sites with a high potential to be contaminated are identified, and a detailed phase, where an investigation and assessment of potentially contaminated sites is carried out, in order to decide whether clean-up measures need to be implemented. See 'Down to Earth : Soil degradation and sustainable development in Europe - A challenge for the 21st century', EEA/UNEP, 2000.

⁹⁹ Extracted from or based on 'Environment in the European Union at the turn of the century', EEA 1999 (and the White Paper on environmental liability, COM(2000) 66 final, adopted 9 February 2000).

Activities responsible for localised soil pollution in selected EU and EFTA Countries ^{100 101}

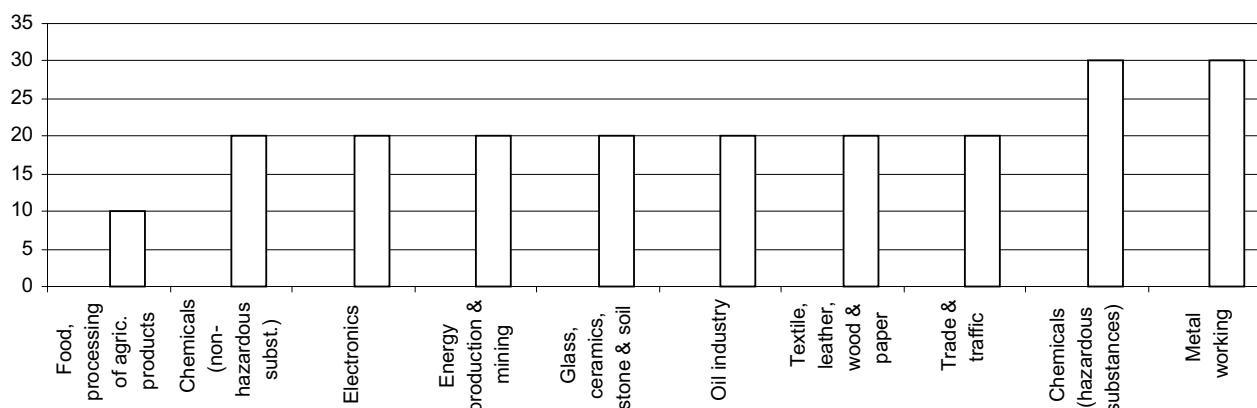
% of total

	Losses during industrial activities	Municipal waste disposal	Industrial waste disposal	Accidents	Others
B (Flanders)	-	39	44	-	17
DK	70	30	-	-	-
D	65	35	-	-	-
NL	30	10	-	15	45
A	47	43	10	-	-
FIN	22	9	2	1	66
S	55	20	20	-	5
LI	20	-	-	80	-

There is no widespread diffuse pollution of Europe's soil ; however, contamination is high in restricted areas ('hot-spots'), namely around industrial facilities. Contaminated sites usually affect, among others, areas with a long tradition of heavy industry. Thus, not surprisingly, the areas where the probability of occurrence of local contamination due to heavy industry is high are located in North-West Europe, from Nord-Pas-de-Calais in France to the Rhein-Ruhr region in Germany, across Belgium and the Netherlands. Other areas include the Saar region in Germany and northern Italy, north of the river Po, from Milano to Padova ¹⁰².

In future, implementation of the legislative and regulatory frameworks in place, and of the future EC environmental liability law which will explicitly include costs for cleaning up of contaminated sites, should result in fewer inputs of contaminants into soil that might give rise to severe contamination ¹⁰³.

Selected industrial branches causing soil contamination from localised sources in selected European regions ¹⁰⁴



score (10= relevant branch for contaminated sites management, 20= very relevant branch, 30= key branch)

The EEA's European Topic Centre on Soil carried out an assessment of the relevance to soil and groundwater contamination of 41 industrial activities (see next table). A score of between 0 and 30 was attributed to each activity in relation to a given pollutant, and an average score taken. The above graph shows this assessment for the 9 test regions (B – Flanders -, DK, D, E, I, NL, A, NO, CH), summarised for the main industrial branches and ranked in their order of importance. Because this is an expert assessment, rather than a measured indicator, different classification systems may be used in various countries, and the assessment may be incomplete in some cases.

¹⁰⁰ Source : EEA-ETC/S (August 1999, updated January 2001).

¹⁰¹ D: 'Industrial activities' also include 'Accidents' and 'Others'; 'Municipal waste disposal' also includes 'Industrial waste disposal' ; D, S: the percentage share refers to the total number of identified, suspected sites ; all figures refer exclusively to abandoned sites (not in operation) ; LI (Liechtenstein): minor accidents are not included.

¹⁰² Extract from 'Down to Earth : Soil degradation and sustainable development in Europe - A challenge for the 21st century', EEA/UNEP, 2000

¹⁰³ Based on 'Environmental signals 2001, EEA, May 2001.

¹⁰⁴ Source: EEA-ETC/S, Proceedings and results of the 2nd Contaminated Sites Workshop held in Dublin, November 1999.

Estimated main industrial branches causing soil contamination from localised sources in selected European regions ¹⁰⁵

score (10= relevant branch for contaminated sites management, 20= very relevant branch, 30= key branch ; -10 = currently not regarded or included)

Industrial sector	Activity	Average score
Chemicals	basic chemicals	26.7
	paint & varnish	26.7
	other chemical & technical products	23.3
	chemical weapons & pest control	22.2
	pharmaceutical industry	21.1
	detergents	20.0
	synthetic fibre, plastic & glue	18.9
	chemical & technical aids	17.8
	rubber	16.7
	Electronics	accumulator & battery
electrical industry		14.4
electronic appliances devices & building components		12.2
Energy production & mining	nuclear power plants	-7.8
	production of gas & coke	23.3
	mining industry	15.6
	power plants	13.3
	exploitation of natural gas & mineral oil	11.1
Food, processing of agricultural products	processing of plant products	8.9
	processing of animal products	7.8
Glass, ceramics, stone & soil	production of building material	16.7
	glass industry	12.2
	ceramic industry	12.2
Metal working	metal forgeries	23.3
	metal production	21.1
	metal processing	18.9
	metal casting	27.8
	metal coating	26.7
Oil industry	fatty acid & wax processing	6.7
	mineral oil refining	23.3
	scrap oil recycling	20.0
Textile, leather, wood & paper	wood industry	22.2
	leather industry	21.1
	textile cleaning	20.0
	textile industry	18.9
	pulp & paper industry	16.7
	printing services & publishers	15.6
	film processing works	14.4
Trade & traffic	storage of liquids & solid substances	25.6
	scrap yards	21.1
	car maintenance	18.9
	transport industry	18.9

The above activities result in releases or emissions to surrounding soil of pollutants such as heavy metals, organic contaminants (PAHs, chlorinated hydrocarbons, PCBs and dioxins pesticides) and artificial radio-nuclides ¹⁰⁶.

¹⁰⁵ Source : EEA-ETC/S (August 1999, updated January 2001). See also 'Down to Earth : Soil degradation and sustainable development in Europe - A challenge for the 21st century', EEA/UNEP, 2000.

¹⁰⁶ Based on 'Down to Earth : Soil degradation and sustainable development in Europe' (see above note).

PART 3: IMPACTS & RESPONSES BY INDUSTRY

❖ **Chapter 1: Health & Safety**

- Occupational accidents & work-related health problems
- Chemical accidents

❖ **Chapter 2: Policy Measures Taken**

- Eco-industry
- Environmental expenditure
- Environmentally-relevant innovation
- Eco-Management and Audit Scheme (EMAS)
- Environmentally-sound products (Eco-labels)

This third Part of the report refers to environmental action within industry itself. Chapter 1 is devoted to health and safety, while Chapter 2 focuses on sustainable production, namely Integrated Product Policy (IPP).

The data provided comes from various sources, including the Eurostat New Cronos database, the JRC Major Accident Reporting System (MARS database) and several sources from the DG ENV web site and refers mainly to EU-15 countries. Again, the focus is principally Manufacturing industry.

CHAPTER 1: HEALTH & SAFETY

This chapter is devoted to health and safety-related aspects in industry in the EU-15 :

- Occupational accidents & work-related health problems,
- Chemical accidents.

Community action in this area has two main aims:

- To improve the working environment, so as to safeguard the health and safety of workers, with some focus on the protection of workers in specific work environments such as construction sites, mineral-extracting industries, or workers exposed to chemical, physical and biological agents such as the vinyl chloride monomer, metallic lead, asbestos, carcinogens and noise ¹⁰⁷, and
- To protect the wider population and the environment from chemical accidents as defined in and regulated by the so-called Seveso II Directive ¹⁰⁸.

¹⁰⁷ See Directive 97/65/EC of 26 November 1997 adapting to technical progress, for the third time, Council Directive 90/679/EEC on the protection of workers from risks related to exposure to biological agents at work, O. J. n° L 335 of 06.12.1997.

¹⁰⁸ Directive 96/82/EC on the control of major-accident hazards, OJ L 10 of 14 January 1997.

Occupational accidents & work-related health problems

This indicator is divided into 2 parts as follows:

- the number of occupational accidents resulting in more than 3 days absence from work; this covers the number of cases where the person is unfit for work for more than 3 days even if these days include Saturdays, Sundays or other days where the person is not usually working, and the number of fatal accidents¹⁰⁹. A so-called 'incidence rate' is also presented which is defined as the number of accidents at work per 100 000 persons in employment - $(\text{number of fatal or non-fatal accidents} / \text{number of employed persons in the studied population}) \times 100\,000$;
- the prevalence rate of work-related health problems, by diagnosis group, which considers the number of most serious work-related health problems occurring (over 1 year, excluding accidents) per 100 000 employees, in the framework of their main job, for the reference week of the Labour Force Survey (LFS, households survey on employment and the labour market), namely during the 2nd or 3rd quarter of 1999 – $(\text{number of health problems suffered over the past 12 months} / \text{number of employees in the reference population}) \times 100\,000$.

The 'accident' concept is based on the ESAW methodology¹⁰⁹ in which an accident at work is defined as 'a discrete occurrence in the course of work which leads to physical or mental harm', which means all the accidents corresponding to all risks the employed person is exposed to in the course of their work. A fatal accident is defined as an accident which leads to the death of a victim within one year of the accident. The figures presented cover both 'normal' and fatal accidents and do not include commuting accidents, although some data are also available for this categories. It is not possible to estimate the full share of industrial accidents as available data only provide details on Manufacturing, Electricity and Construction, that is excluding Mining.

To have a broader view on health and safety at work, a module on 'work-related health problems and accidental injuries', covering 11 EU Member States excluding B, D, F, A and NL (which will be covered as from 2000), but including Hungary, has been inserted in the 1999 Labour Force Survey, as a complementary data source to ESAW and to the 1991 EODS project on occupational diseases¹¹⁰, namely by providing information on the situation of the persons on the labour market, the characteristics of their job, their working conditions or training. The module also provides data on the accidents with less than 4 days' absence from work, and covers a broad new field of information concerning the other work-related health problems. However, only an analysis of work-related problems is presented hereafter as the data on accidental injuries does not provide for so detailed sectoral information.

It is estimated that during the period from 1998 to 1999, around 7.7 million people in work or having been in work in the EU were suffering from health disorders, other than accidental injuries, caused or aggravated by their current employment, representing an estimated 350 million working days lost every year in the EU owing to work-related health problems, in addition to almost 150 million working days lost due to accidents at work (representing 7.4 million accidents of which almost 4.7 million involve absences of more than 3 days from work).

¹⁰⁹ See Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work, OJ L183, 29.06.1989) which gave birth to the ESAW (European Statistics on Accidents at Work) project (1990).

¹¹⁰ The European Occupational Disease Statistics project was launched in 1991 and obtained its first results for the year 1995, showing 57 444 cases of occupational disease, classified into 31 items broken down into 4 categories as follows :12 diseases caused by certain chemical agents, especially heavy metals and other irritative substances ; 8 respiratory diseases such as silicosis, asbestosis, etc., respiratory ailments of an allergic nature or caused by inhalation (e.g. of dust from cobalt) ; 4 infectious diseases transmitted by animals/animal remains, brucellosis, viral hepatitis, tuberculosis ; 7 diseases caused by physical agents such heat radiation, noise, mechanical vibration, pressure, ionising radiation. The 10 most frequent diseases are noise-induced hearing loss (18 419 cases), allergic or irritative skin disease (8 767), respiratory allergy (4 543), silicosis (4 381), asbestosis (3 894), paralysis of nerves due to pressure (3 392), osteoarticular diseases of the hand and wrist due to mechanical vibration (2 539), angioneurotic diseases due to mechanical vibration (2 454), diseases of the periarticular sacs due to pressure (2 305) and mesothelioma (1 446).

Total number of occupational accidents with more than 3 days absence from work¹¹¹

n° of 1 000 cases

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	NO
1998	4 678.6	102.5	73.8	1 488.2	47.5	666.2	661.0	14.7	698.2	9.7	169.1	105.8	169.9	60.7	45.3	366.0	87.9

Occupational accidents with more than 3 days absence from work by industrial branch^{111 112}

unit as specified in the table

	1 000 persons in employm.	Accidents with more than 3 days absence from work							
		Number of accidents				Incidence rate per 100 000 people in employment			
		Accidents		of which Fatalities		Accidents		of which Fatalities	
		1998	1995	1998	1995	1998	1995	1998	1995
Total economy									
EU-15	136 150	4 820 451	4 678 586	6 229	5 476	:	:	:	:
NO	:	74 718	87 898	:	43	:	:	:	:
of which:									
Manufacturing									
EU-15	30 156	1 451 752	1 354 762	1 221	1 101	4 962	4 492	4.2	3.7
NO	:	23 463	26 635	:	11	8 087	8 454	:	:
of which (EU-15):									
Food products; beverages & tobacco	3 410	295 219	274 699	203	188	6 920	6 323	5.2	4.4
Textiles & textile products	2 400	64 471	56 089	49	39	2 765	2 653	2.1	1.8
Leather & leather products	553	11 899	10 862	10	9	2 505	2 292	2.1	1.9
Wood & wood products	900	93 573	89 471	85	75	10 238	10 677	9.5	8.9
Pulp, paper & paper prod.; publish. & print.	2 524	69 951	64 352	63	46	2 795	2 596	2.7	1.9
Coke, refined petroleum prod. & nucl. fuel	178	2 154	1 522	2	5	1 158	875	1.1	2.9
Chemicals, chem. prod. & man-made fibres	2 022	47 109	43 372	58	73	2 431	2 177	3.1	3.7
Rubber & plastic products	1 337	50 410	50 472	29	26	4 233	3 827	2.5	2.0
Other non-metallic mineral products	1 172	75 369	69 083	77	90	6 915	6 269	7.3	8.2
Basic metals & fabricated metal products	4 402	388 864	347 369	336	310	9 022	8 076	7.7	7.2
Machinery & equipment n.e.c	3 224	114 677	115 423	83	73	3 708	3 615	2.5	2.3
Electrical & optical equipment	3 382	95 767	87 886	117	86	2 858	2 631	3.6	2.6
Transport equipment	2 896	77 956	82 024	74	43	2 936	2 883	2.6	1.5
Manufacturing n.e.c	1 757	64 334	62 141	35	38	4 292	3 670	2.6	2.2
Electricity, gas & water supply									
EU-15	1 201	19 964	19 505	55	39	1 545	1 625	4.4	3.2
NO	:	1 585	1 320	:	0	7 079	6 991	:	:
Construction									
EU-15	10 375	867 837	830 873	1 491	1 330	9 080	8 008	14.7	12.8
NO	:	7 895	9 325	:	11	8 148	8 256	:	:

Among all economic branches in EU-15, manufacturing accounted for the highest number of occupational accidents, at 28.2%, in 1998, followed by construction (18.2%). However, when considering the occurrence of accidents per 100 000 persons in employment, construction appears to be the most dangerous activity in terms of incidence in both the total number of accidents and fatal accidents (see above table). Both the number of accidents, whatever their severity, and their incidence rates are however decreasing overall in both total economy and total industry, in spite of increases in a few manufacturing branches, which mainly concern fatalities, and in the electricity, gas & water supply industry.

Contrary to EU countries, in Norway, the number of accidents and the incidence rate of these have increased in all branches, except the electricity, gas & water supply industry.

¹¹¹ Source: New Cronos, theme 3 Population & social conditions, domain Health & safety at work (Accidents at work).

¹¹² Data on people in employment in the table may not fully match employment data presented in Annex.

Work-related health problems with or without absence from work (1998-99)¹¹³*prevalence rate per 100 000 employees*

	EU	DK	EL	E	IRL	I	L	P	FIN	S	UK
Total economy											
Total	5 372	7 765	:	2 162	4 219	4 257	6 786	2 316	23 412	9 326	4 162
Pulmonary disorders	296	229	:	146	:	321	998	178	:	272	137
Musculo-skeletal disorders	2 645	4 750	:	1 136	:	2 002	2 969	607	:	5 321	1 661
Stress, depression, anxiety	1 181	842	:	326	:	652	843	847	3 374	2 052	1 479
Other not elsew here mentioned	1 049	1 930	:	554	:	946	1 973	684	3 887	864	886
Mining & quarrying											
Total	3 790	26 199	2 379	:	2 751	1 397	:	5 981	8 134	11 323	4 072
Pulmonary disorders	672	:	1 131	:	:	881	:	:	:	:	916
Musculo-skeletal disorders	1 988	:	1 248	:	:	:	:	1 014	2 641	1 952	3 155
Stress, depression, anxiety	:	:	:	:	:	:	:	:	:	:	:
Other not elsew here mentioned	645	:	:	:	:	:	:	4 975	2 773	:	:
Manufacturing											
Total	4 627	7 078	:	2 148	3 104	4 035	3 842	2 680	21 688	8 109	3 113
Pulmonary disorders	338	195	:	:	:	371	:	283	:	241	131
Musculo-skeletal disorders	2 456	5 422	:	1 469	:	1 847	1 686	:	:	5 465	1 360
Stress, depression, anxiety	723	277	:	327	:	558	351	1 007	1 979	982	856
Other not elsew here mentioned	926	1 116	:	308	:	939	1 805	924	3 609	733	767
Electricity, gas & water supply											
Total	3 946	8 685	:	2 074	3 808	4 239	6 396	:	18 991	4 519	2 695
Pulmonary disorders	275	:	:	:	:	:	:	:	1 483	:	548
Musculo-skeletal disorders	2 043	2 607	:	866	:	1 873	1 599	:	12 797	4 519	638
Stress, depression, anxiety	928	:	:	664	:	1 708	3 308	:	4 104	:	1 151
Other not elsew here mentioned	556	:	427	546	:	241	1 489	:	607	:	358
Construction											
Total	5 005	9 853	:	2 339	3 712	4 423	6 830	1 745	19 606	8 187	3 137
Pulmonary disorders	286	792	:	430	:	269	217	:	:	120	:
Musculo-skeletal disorders	3 158	5 646	:	1 364	:	3 038	5 796	1 055	:	6 397	1 564
Stress, depression, anxiety	476	:	:	:	:	:	:	495	1 109	948	905
Other not elsew here mentioned	855	3 414	:	545	:	658	817	:	2 584	:	668

In the above table, the figures for EU include all Member States for which data is available plus Hungary, which is not presented for reasons of consistency with the rest of the publication ; the data for D are not presented as they only refer to the number and length of absences from work due to health problems.

There is a very wide variation in the figures for the different countries, with the Nordic countries reporting higher levels of health problems in all areas than the rest of the EU. This is probably a reflection of better reporting rather than of a more dangerous working environment. Therefore caution is advised when comparing countries. In spite of this it can still be said that the most common work-related health problems in the EU are musculo-skeletal disorders, followed by nervous and pulmonary disorders. The construction industry accounts for the highest number of problems, followed closely by manufacturing, then electricity, gas & water supply, and mining & quarrying.

When considering the different groups of problems, the following conclusions can be drawn¹¹⁴:

- Musculo-skeletal problems affect the construction sector most seriously with a prevalence rate of absence from work of 2 weeks or more at 1 292 per 100 000 employees, compared with the average of 817 for all health problems. When all problems are considered (i.e. with or without absence from work), construction is still among the highest at 3 158, though behind health & social work (4 283) but approx. the same as for the transport & communications sector (3 160) (figures not presented here, see related note below).
- Pulmonary disorders mainly concern the extractive industries, with a prevalence rate of 672 compared with an average of 296 ; manufacturing is also above the average and appears in fourth position, at 338, after education (513) and agriculture (375).
- Nervous problems do not affect industry employees overmuch, all industrial sectors being below the average of 1 181. The highest rate is recorded for education at 2 306 cases per 100 000 employees.

¹¹³ Source: New Cronos, Theme 3, Population and Social Conditions, Health and safety at work, Health problems

¹¹⁴ Based on the figures presented in the table and on figures extracted from 'Work-related problems in the EU 1998-99', Statistics in Focus, Population & Social Condition, Theme 3 – 17/2001 (catalogue number: KS-NK-01-017-EN-C).

Chemical accidents

This indicator is defined as the number of reported major accidents in fixed industrial installations, which are due to the use and storage of chemicals.

Major accidents are occurrences such as a major emission (leak), fire or explosion resulting from uncontrolled developments in the course of the operation of an establishment and presenting a serious danger to human health and/or the environment, immediate or delayed, inside or outside the establishment and involving one (or more) dangerous substances such as ammonium nitrate, polychlorodibenzofurans and polychlorodibenzodioxins, etc.

Increasing industrialization has led to the increased use of chemical products and consequently to a number of chemical accidents, some of which are regrettably well-known and have led to the adoption of the so-called Seveso Directive¹¹⁵ which obliges Member States to report major accidents to the Commission via the Major Accident Reporting System (MARS)¹¹⁶, the results of which have been used for this indicator.

The Directive sets out specific criteria for reporting an accident. These include thresholds for spills of dangerous substances or fires and explosions involving these substances, injury to persons or real estate, immediate damage to the environment, long term damage to water, and cross-border damage. More details can be found in the Directive and its annexes.

¹¹⁵ Council Directive 82/501/EEC on the major-accident hazards of certain industrial activities, as amended by Directive 87/216/EEC of 16 March 1987 and by Directive 88/610/EEC of 24 November 1988. Fully replaced on 9 December 1996 by Directive 96/82/EC on the control of major-accident hazards (so-called Seveso II Directive, OJ L 10 of 14 January 1997).

¹¹⁶ developed by the Community Documentation Centre on Industrial Risks (CDCIR) at the Major Accident Hazards Bureau (MAHB, <http://mahbsrv.jrc.it>) established within the Commission's Joint Research Centre (JRC) in Ispra, Italy.

Chemical accidents reported in EU-15 by type of accident^{117 118}*number of reported accidents*

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Release	16	17	21	19	15	21	9	26	27	37	27	235
Water contamination	1	0	0	1	0	0	1	0	1	1	3	8
Fire	6	4	3	5	10	10	8	6	8	9	8	77
Explosion	1	0	4	1	3	3	3	4	4	4	2	29
Other	0	0	0	0	0	0	1	0	0	0	1	2
Total	24	21	28	26	28	34	22	36	40	51	41	351

Number of chemical accidents reported by EU-15 Member States for the period 1994-96^{117 119 120}*number of reported accidents*

	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	Total
Number of accidents	4	1	20	0	4	38	0	5	0	4	0	0	2	1	13	92
Number of sites	85-86	24-21	1 828	52	158	392	20	418-430	4	115-124	158-124	42	69	80-69	303-308	:

Other studies relating to some of the activities excluded from the Seveso Directive (see introduction) have also been carried out by MAHB, namely:

- analysis of safety-related issues concerning the temporary storage of hazardous materials in transportation-related activities (mainly ports and marshalling yards)¹²¹,
- analysis of hazards and accidents involving pipelines transporting dangerous substances¹²²,

the results of which are not presented here. Also excluded are military establishments, waste landfill sites, some activities of the extractive industries, and hazards created by ionising radiation.

Some of these exclusions will disappear in future, as the 6EAP foresees action to prevent industrial accidents, including the extension of Seveso II to cover pipelines and mining, and measures on mining waste.

¹¹⁷ Source: JRC, MARS database

¹¹⁸ Some of the releases have resulted in the other accidents, e.g. fires which are consequences of the initial accident which is the release.

¹¹⁹ Published by the Commission in the second report on the implementation of the Seveso II Directive, OJ C291 of 12.10.1999. The number of sites taken into account may sometimes vary during the period covered, e.g. in B, DK, I, NL, A, S and UK ; for Germany, data does not refer to the number of sites but to the number of installations.

¹²⁰ The sites taken into account by Member States to estimate the number of accidents are those sites considered under the Seveso Directive, and which may vary from one year to another e.g. following creation of new enterprises or closure of others. In Germany the number of sites refers in fact to installations which explains the extremely high figure compared to the other countries.

¹²¹ M. Christou in N. Mitchison & S. Caprioli (Eds.): Chemical Hazards in Ports and Marshalling Yards/Rischi Chimici in Porti e Scali Ferroviari, 242 pp, EUR 17745 EN (1998).

¹²² G. A. Papadakis: 'Gravity scaling and lessons learnt in pipelines accident prevention', European Conference on Leak Prevention of Onshore and Offshore Pipelines, Conference Proceedings, IChem E, London May 1997.

CHAPTER 2: POLICY MEASURES TAKEN

This chapter contains 5 indicators describing various aspects of sustainable production, including Integrated Product Policy (IPP):

- Eco-industries,
- Environmental expenditure,
- Environmentally-relevant innovation,
- Eco-Management and Audit Scheme (EMAS),
- Environmentally-sound products (Eco-labels).

The main focus of Chapter 2 is on Integrated Product Policy, a relatively new approach to environmental issues, which aims at improving the environmental performance of products in the most cost-effective way. It is founded on the consideration of the impacts of products throughout their life-cycle, from the natural resources from which they come, through their use and marketing to their eventual disposal as waste. There is a whole variety of tools – both voluntary and mandatory – that can be used to achieve this objective, including measures such as economic instruments (e.g. reduced VAT rate for 'green' products i.e. 'paying less for cleaner products', or on the contrary, taxes on producers i.e. the 'polluter pays' principle), substance bans, voluntary agreements, environmental labelling (eco-labels) and product design guidelines¹²³.

Worth mentioning is the Communication on Environment and Employment titled 'Building a sustainable Europe' adopted on 18 November 1997 which announces a concrete agenda for building a sustainable Europe: achieving a competitive economy combined with less environmental degradation, improved resource efficiency of energy and raw materials, and higher employment rates. Environmental protection is expected to contribute to job creation via a greater use of renewable energy and through investments in renovation of the housing stock and in public transport, thus improving considerably the quality of life and of the environment, and generating new jobs in urban areas.

¹²³ See Green Paper on Integrated Product Policy COM(2001) 68 final, of 7 February 2001.

Eco-industries

This indicator aims to show the importance of eco-industries in Europe, expressed as turnover, exports, value added and employment in this cross-cutting industry, and broken down by environmental domain for turnover and employment. The indicator is partly based on estimates of the demand for eco-industrial products derived from statistics on environmental expenditure and other sources.

Eco-industries are defined in 'The environmental goods and services industry – Manual for data collection and analysis' (OECD/Eurostat 1999) as 'activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes 3 categories of activities: 1) pollution management, both preventive and remedial (e.g. reducing emissions); 2) cleaner (integrated) technologies and products that continuously improve, reduce or eliminate the environmental impact of general technologies; 3) resource management (such as energy and water use).

Overview of the performance of EU eco-industries (1999)^{124 125}

unit as specified in the table

	Turnover		Value added		Exports of environmental goods	Direct employment	
	Pollution management	Resource management	Pollution management	Resource management		Pollution management	Resource management
	<i>(million EURO)</i>					<i>(n° of full time equivalent jobs)</i>	
EU-15	127 140	56 070	66 000	32 470	6 530	1 454 500	631 200
B	2 400	2 380	1 230	1 460	560	24 100	25 300
DK	5 400	1 220	2 640	740	130	63 800	16 800
D	41 190	15 510	19 900	9 010	2 300	362 000	140 500
EL	1 040	850	560	500	20	23 900	18 500
E	5 530	2 510	2 790	2 160	80	88 300	51 300
F	22 330	15 660	12 660	9 610	840	244 400	157 600
IRL	530	250	260	150	130	7 700	3 500
I	10 700	5 280	5 650	2 180	420	127 200	41 700
L	160	110	70	70	10	1 800	1 300
NL	7 170	2 440	4 060	1 290	330	85 000	24 200
A	8 270	620	4 750	370	190	80 700	5 700
P	920	830	430	480	0.004	29 200	23 200
FIN	1 790	310	920	150	100	21 900	3 300
S	2 610	690	1 350	420	440	25 100	7 900
UK	17 090	7 390	8 720	3 890	980	269 200	110 500

In 1999, eco-industries in the EU were estimated to supply 183 220 million euro of goods and services per year, representing 2.3% of EU GDP, and to employ directly more than 2 million people (1.3% of total employment)¹²⁶. The value added by the eco-industries is estimated to reach a total of 98 billion euro, based on salary costs ; the pollution management group represents two thirds of this total with the following breakdown: waste management 31%, waste water treatment 24%. The value added of resource management relies by far on the water supply industry (58%), followed by recycling of materials (30%) and nature protection (12%).

The EU operates a trade surplus in environmental goods and services, and such exports represent on average 4% of turnover and 0.08% of GDP. The global environmental market has been estimated to be about 550 billion euro with the USA worth 180 billion euro (37% of the total) and Japan 84 billion euro (18%). These markets are expected to grow steadily until 2010, especially in developing and emerging countries such as central and eastern Europe (CEE), south east Asia, China and Latin America.

¹²⁴ Source for data and related comments: Analysis of EU eco-industries, their employment and export potential', ECOTEC 2002 (study carried out for the European Commission) and Report from the Commission – Environmental technology for sustainable development (COM(2002) 122 final, 13.03.2002).

See also the Database on Eco-industries in the EU (<http://europa.eu.int/comm/environment/ecoindu/intro.htm>).

¹²⁵ Figures are rounded so EU-15 totals may not match the sum of individual Member States.

¹²⁶ Total environmental employment is estimated at almost 2.7 million jobs when indirect operating-related jobs are included.

EU eco-industries by environmental domain (1999) – Turnover and employment ^{127 128}
unit as specified in the table

	Pollution management				Resource management			Grand total
	Air pollution control	Waste water treat.	Solid waste management	Other	Water supply	Recycled materials	Nature protection	
	Turnover (million EURO)							
EU-15	14 640	48 190	47 560	16 770	34 360	14 430	7 270	183 220
B	530	700	900	270	1060	1150	150	4 780
DK	1 470	1 090	1 800	1 040	390	350	460	6 620
D	3 670	17 510	15 450	4 560	10890	3700	910	56 700
EL	50	510	420	60	490	200	150	1 890
E	1 010	1 830	2 130	560	1340	160	990	8 040
F	1 507	9 710	8 340	2 773	9010	4450	2180	37 990
IRL	60	240	170	60	140	30	70	780
I	1 460	4 200	3 780	1 260	3680	1360	220	15 980
L	10	70	70	10	60	40	0	270
NL	710	2 060	2 550	1 850	1470	460	490	9 610
A	500	2 670	3 450	1 650	340	140	120	8 890
P	160	450	300	10	540	90	190	1 750
FIN	190	490	770	340	210	70	20	2 100
S	470	930	540	680	180	310	190	3 310
UK	2 760	5 710	6 880	1 740	4500	1860	1010	24 480
Share in total (%)	8.0	26.3	26.0	9.2	18.8	7.9	4.0	100
	Employment (n° of full time equivalent jobs)							
EU-15	111 000	427 600	760 300	155 800	296 900	234 500	99 800	2 085 900
B	3 600	5 200	12 900	2 600	6900	16600	1800	49 600
DK	11 700	11 100	31 200	9 900	4100	6400	6500	80 900
D	17 300	135 500	198 800	10 300	80900	50400	9300	502 500
EL	800	8 800	12 800	1 400	8100	6500	3800	42 200
E	12 600	22 400	45 800	7 500	31800	3700	15800	139 600
F	8 200	75 600	125 200	35 400	64700	68000	24800	401 900
IRL	700	2 700	3 400	900	1500	700	1200	11 100
I	11 700	37 700	61 400	16 600	16000	22800	2900	169 100
L	100	600	1 000	100	400	700	100	3 000
NL	4 800	18 200	42 600	19 400	13000	5000	6200	109 200
A	2 500	18 800	43 500	15 800	2300	1900	1400	86 200
P	3 900	11 900	12 900	400	11400	4300	7500	52 300
FIN	1 500	5 000	11 300	4 200	2100	800	300	25 200
S	3 600	7 700	7 200	6 700	1600	4300	2100	33 200
UK	27 900	66 300	150 100	24 800	52200	42300	16000	379 600
Share in total (%)	5.3	20.5	36.4	7.5	14.2	11.2	4.8	100

In 1999 the turnover relating to pollution management, cleaner technologies and products was 127 140 million euro (equivalent to 1.6% of GDP), employing around 1 million people. Resource management activities accounted for another 650 000 jobs and an additional 56 070 million euro of turnover (0.7% of GDP). The eco-market is dominated by D, F, UK in terms of absolute turnover and employment values. The category 'Others' includes remediation & clean-up (2% of turnover and 1% of employment), noise & vibration (1% of turnover and of employment), monitoring & instrument (2% of turnover, employment not estimated), environmental R & D (1% of turnover and of employment), and public/private environmental administration (3% of turnover and 4% of employment).

The highest percentages of GDP devoted to eco-industries appear in A (4.5%), DK (3.9%), D (2.9%) and F (2.8%). Perhaps more revealing is the per capita analysis which reveals an EU average at 490 euro per capita, with country values ranging from 190-200 in EL and P to 1 100-1 300 in A and DK.

Eco-industry is a response to the environmental impact of economic activity ; it is also expected to create employment¹²⁹. However it should not be seen as a policy objective in itself, as a small 'eco-industry' could be a sign that society was organising production and consumption in a sustainable way and so required less remedial measures to clean up pollution.

¹²⁷ Source for data and related comments: Analysis of the EU eco-industries, their employment and export potential', ECOTEC 2002 (for DG ENV, EC) and Report from the Commission – Environmental technology for sustainable development (COM(2002) 122 final, 13.03.2002). See also the Database on Eco-industries in the EU (<http://europa.eu.int/comm/environment/eecoinus/intro.htm>).

¹²⁸ Figures are rounded so EU-15 totals may not match the sum of individual Member States.

¹²⁹ See Communication on Environment and employment (COM/97/592 of 18/11/97).

Environmental expenditure

This indicator presents the expenditure by industry for the treatment or prevention of pollution or other degradation of the environment such as emissions to air, waste water discharges, waste generation, noise, etc, which result from the production of goods and services.

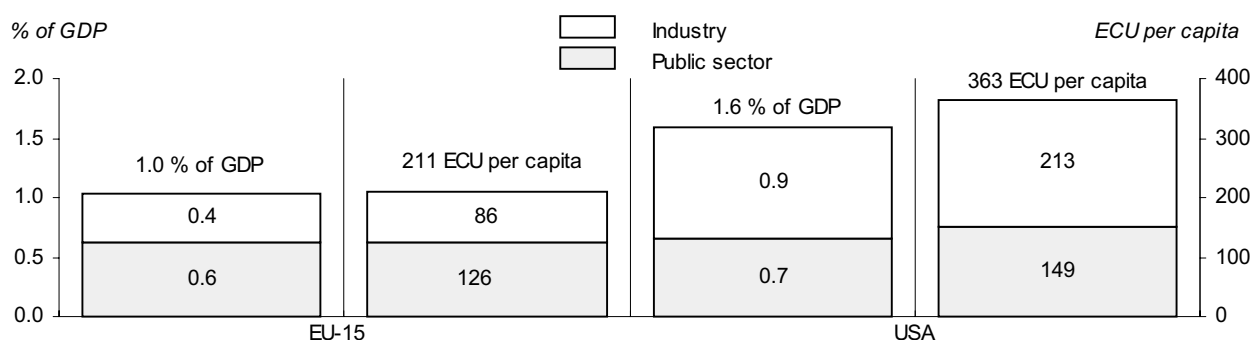
Environmental expenditure is the sum of the following 3 types of expenditure:

- end-of-pipe investments, i.e. specific machinery and equipment used to collect, treat or monitor pollution, e.g. waste containers, filters, sewage treatment plants;
- integrated investments, which are the extra costs of adapting the process design in order to prevent the generation of pollution at source. Examples are modifications to existing equipment, choice of new improved technology, or changes which allow the substitution of raw materials by cleaner inputs, recycled materials or renewables ;
- current expenditure, which includes the payment of employees, cost of material input and the purchase of services .necessary to operate the environmental protection equipment or e.g. related to general environmental management and certification activities.

Total expenditure on environmental protection in the EU (i.e. by the public and industrial sectors) was estimated to be around 80 billion euro in 1998 or 211 euro per capita, around 1% of GDP. The part spent by industry (mining & quarrying, manufacturing, electricity, gas & water supply) was estimated at around 30 billion euro or 0.4% of GDP which is lower than the USA¹³⁰ (0.9% of GDP) but higher than the Japanese¹³¹ (0.1%). Nearly two thirds (63%) of the EU industrial expenditure consists of current expenditure; the remaining third being made up of end-of-pipe investments (23%) and process-integrated investments (14%)¹³².

Total expenditure on environmental protection (latest year available) ¹³²

unit as specified in the graph



Environmental expenditure by industry as a share of GDP has declined sharply in D and A. For D the high levels of expenditure seen between 1992 and 1996 partly reflect increased expenditure to upgrade (often highly polluting) industries in East Germany. Spending has increased significantly in the USA and F, where it represented 0.8% of GDP, the highest in the EU.

¹³⁰ Total business sector including industry, transport and other services (1994).

¹³¹ Investments only (1994).

¹³² Source: Eurostat New Cronos database, theme 8 Milieu.

Environmental protection expenditure by industry and split by branches (mid to late 90s)^{133 134}

million ECU/EURO

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Share of GDP (%)	Per capita expend.
B	:	:	:	:	:	319	361	:	:	:	0.2	36
DK	:	:	:	:	:	:	:	:	:	:	:	:
D	7 592	7 743	8 390	8 981	9 052	9 350	9 222	7 865	:	:	0.4	96
EL	:	:	:	:	:	82	:	:	:	:	0.1	8
E	:	:	:	:	:	:	:	:	:	:	:	:
F	6 089	6 324	6 744	7 596	8 343	8 682	9 221	9 661	9 918	:	0.8	169
IRL	:	:	:	:	:	:	:	:	166	:	0.2	45
I	:	:	:	:	:	:	:	:	:	:	:	:
L	:	:	:	:	:	:	:	:	:	:	:	:
NL	:	:	:	:	:	1 082	:	1 404	:	:	0.4	90
A	:	:	1 137	1 151	1 242	1 062	1 114	1 192	1 081	:	0.6	134
P	:	:	:	:	126	178	219	176	258	331	0.3	33
FIN	:	:	:	:	338	535	577	554	525	:	0.5	102
S	:	711	:	:	:	:	:	958	:	:	0.5	108
UK	:	:	:	:	3 017	:	:	6 175	:	:	0.5	105
IS	:	:	:	:	:	:	:	:	:	:	:	:
NO	:	:	:	:	:	:	:	:	:	:	:	:
CH	:	:	:	1 204	:	:	:	:	:	:	0.6	174
USA	39 101	41 558	43 423	50 234	55 274	:	:	:	:	:	0.9	213
JAP	2 548	:	1 725	3 670	2 966	:	:	:	:	:	0.1	24
Branchwise shares (%)												
	Mining & quarrying	Elect., gas, water	Manufact.	Food, beverages, tobacco	Textiles, leather	Wood	Pulp, paper, printing	Refineries	Chemicals, rubber, plastics	Non-metal. mineral prod.	Basic metals	Other manufact. industries
B	0.1	11.2	88.7	9.7	2.0	0.6	3.5	4.0	22.6	7.4	9.9	29.0
DK	:	:	:	:	:	:	:	:	:	:	:	:
D	2.5	18.3	79.2	:	:	:	:	:	:	:	:	:
EL	6.2	:	93.8	22.1	4.9	0.6	3.9	39.7	3.8	13.8	2.1	2.8
E	:	:	:	:	:	:	:	:	:	:	:	:
F	:	:	:	:	:	:	:	:	:	:	:	:
IRL	:	11.0	92.9	16.3	:	:	:	:	16.6	:	:	:
I	:	:	:	:	:	:	:	:	:	:	:	:
L	:	:	:	:	:	:	:	:	:	:	:	:
NL	10.4	2.6	87.0	6.0	0.5	0.4	2.4	46.6	19.4	2.2	3.3	6.2
A	3.4	3.2	93.3	11.3	2.3	20.7	11.1	0.0	11.0	6.7	5.7	24.5
P	2.4	12.8	84.8	8.7	10.6	3.3	8.6	9.0	7.2	26.3	2.3	8.8
FIN	2.5	2.5	95.0	8.0	0.7	2.8	46.7	3.0	7.2	0.8	8.9	17.0
S	:	19.7	80.3	6.7	:	2.1	28.4	:	5.6	:	4.6	26.3
UK	1.2	5.1	93.7	7.6	0.3	5.7	10.9	1.6	34.7	14.6	10.8	7.5

Environmental protection investments as a percentage of total gross fixed capital formation vary between 2.5% for D and 5.8% for NL. Manufacturing industry accounts for more than 80% of total environmental protection investments made by EU industry. The money spent on environmental protection varies considerably between different industries. The chemical industry alone spent between 10-15% of its total investments on activities related to environmental protection in 1990 and since 1990 devoted between 4-5% of its sales to health, safety and environmental protection. In the USA the share in 1998 was 6% for small and medium sized chemical firms and 4% for large companies, versus 0.4% in Japan in the 1990s¹³⁵. Higher shares, close to 25% of total investment, are to be noted for wood and non-metallic industries in the UK and of more than 12% for refineries in Finland.

¹³³ Source: Eurostat New Cronos database, theme 8 Milieu.

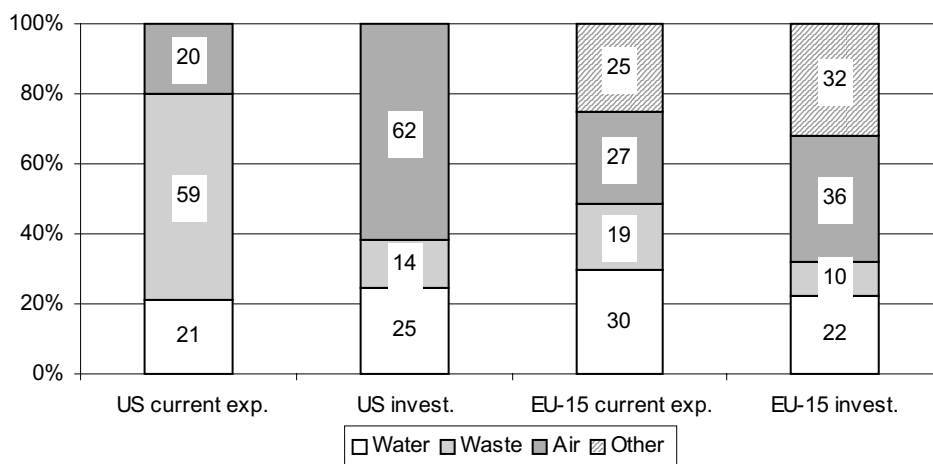
¹³⁴ F, USA, JAP: total business sector ; B, JAP: investments only.

¹³⁵ Source: OECD Environmental Outlook for the Chemicals Industry (2001).

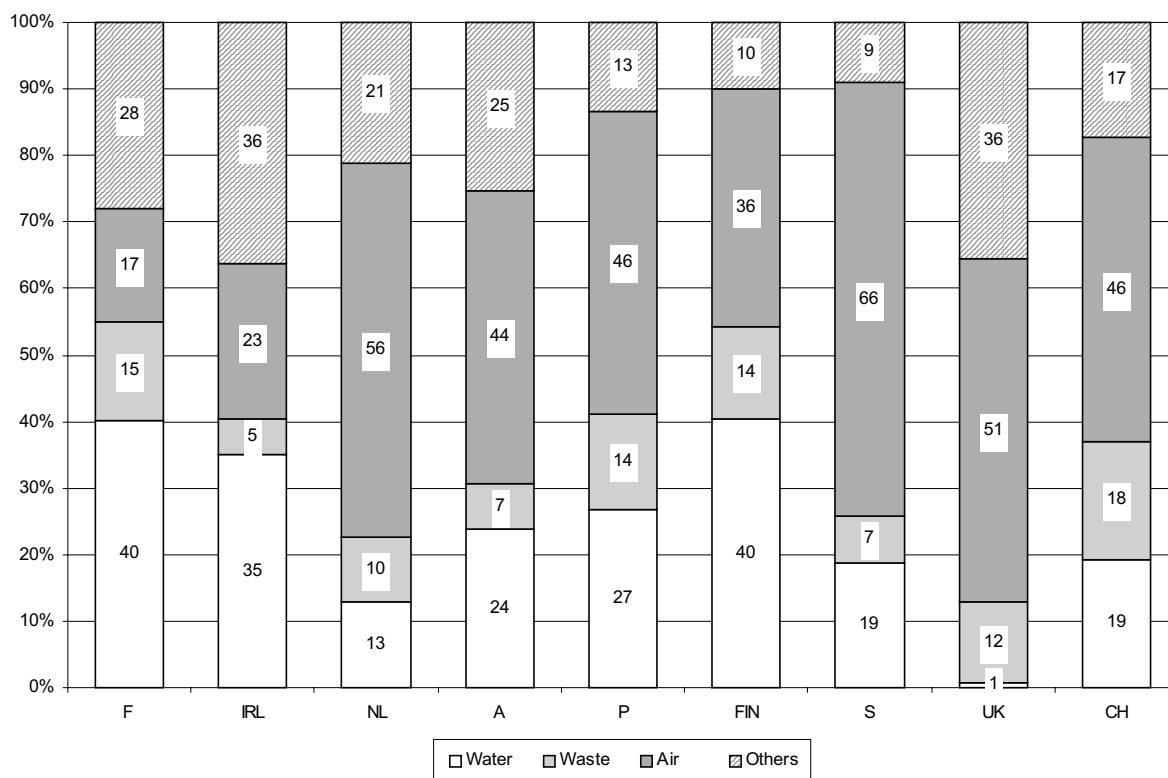
The proportion of total environmental investment spent on pollution prevention (the process-integrated type) varies considerably between countries, from 4% for EL to 60% for B. For mining & quarrying, it is below 30% in all countries except B (60%) and NL (50%). In manufacturing industry is over 50% in S only, though for specific sub-branches the shares are higher. In the electricity sector in NL, B and S, more than 60% of total environmental investment is spent on pollution prevention; in all other countries this does not exceed 40%.

The structure of industry and the importance of different environmental problems within a country affect how much money is spent on different environmental domains. In many countries more than half of the investments are directed towards air pollution. In F, IRL and FIN most investments were directed towards wastewater treatment and prevention. Measures related to waste are less capital-intensive but account for nearly 20% of the current expenditure in the EU.

Environmental protection expenditure by industry, by environmental domain – USA and EU-15¹³⁶



Env. protection investment by industry, by environmental domain – selected EU countries¹³⁶



¹³⁶ Source: Eurostat New Cronos database, theme 8 Milieu.

Environmentally-relevant innovation

This indicator focuses on the purpose of innovation as declared by industry. It is expressed as the percentage of innovating enterprises who state that a given objective was a very important reason behind the introduction of innovation, and is based on the results of the second Community Innovation Survey (CIS2¹³⁷) launched in 1997-98 in all EU (except EL), plus NO, in manufacturing enterprises with 20 employees or more.

Data on the sample surveyed, broken down by company size and branch of activity, are provided as background information.

Sample size of the CIS2 survey (1996)¹³⁸

	<i>n° of firms surveyed</i>															
	EU	B	DK	D	E	F	IRL	I	L	NL	A	P	FIN	S	UK	NO
Total (manuf. + services)	36 581	2 010	527	2 615		7 595	723		308	5 219	1 208	1 816	1 477	1 436	1 787	2 188
of which:																
Manufacturing	25 773	1 164	274	1 706	4 763	4 986	440	5 097	116	2 698	845	800	909	727	1 248	0 1 329
Share of manufacturing (%)	70	58	52	65		66	61		38	52	70	44	62	51	70	61
Manufacturing sector by company size																
Small (20-49)	9 326	325	115	388	1 795	1 694	211	2 613	55	880	158	229	335	206	322	541
Medium (50-249)	10 543	597	85	731	2 191	1 889	184	1 639	43	1 362	439	308	381	213	481	623
Large (250+)	5 904	242	74	587	777	1 403	45	845	18	456	248	263	193	308	445	165
Manufacturing sector by branch																
Food, beverages & tobacco	2 847	152	31	116	453	850	63	370	18	355	85	94	93	61	106	228
Textile & leather	3 188	148	19	102	610	562	46	938		167	79	318	66	34	99	75
Wood, pulp & printing	3 022	118	36	110	605	559	36	475	14	448	116	58	174	140	133	265
Coke & chemicals	1 856	123	14	133	457	361	49	290	7	192	35	29	47	34	85	52
Rubber & other non-metallic	2 736	139	30	245	521	465	56	551	17	268	91	76	82	58	137	88
Basic & fabricated metals	3 752	168	38	262	648	809	54	782	39	395	131	64	98	119	145	169
Machinery & equipment	2 725	91	38	317	302	451	20	644	10	344	104	36	142	113	113	114
Electrical & optical	2 679	85	37	260	451	497	68	473	8	223	92	53	117	84	231	108
Transport equipment	1 472	61	13	81	395	222	18	203	3	169	38	35	48	53	133	143
NEC & recycling	1 496	79	18	80	321	210	30	371		137	74	37	42	31	66	87

The results of the CIS2 survey reveal that 51% of enterprises in the manufacturing sector had made a process or product innovation in the period 1994-1996 (1995-97 for P and NO), among which 44% of small, 59% of medium-sized and over 70% of large enterprises. This represents an increase in all countries, except in B and E, compared with the results of the 1990-92 CIS1 (although this is not fully comparable due to differences in the sampling methods applied).

Innovation is closely linked to research and development (R&D) activities and on average 69% of innovators in manufacturing carry out R&D. Unfortunately data on the objectives of R&D are not available currently.

Another determining factor for innovation is the technological sector to which the enterprise belongs: the industry which devotes the highest share of turnover to innovation is the electrical & optical equipment sector (8.2% of turnover), a high or medium-high technology sector, while the smallest share is in the typically low-technology sectors of food and textile (1.6% of their turnover)¹³⁹.

¹³⁷ The first CIS (CIS1) covered the period 1990-92.

¹³⁸ Source: Eurostat and European Commission (DG Enterprise), CIS2.

¹³⁹ Source (or based on): Enterprises in Europe, Sixth report (data 1987-1997), EC and Eurostat, 2001.

Share of innovating enterprises in the manufacturing sector which rank the specified objective as very important when carrying out innovation (1996)^{140 141}

% (median value across countries)

	EU	Small	Medium	Large
Replace products	23	20	23	32
Improve products	59	58	60	61
Extend range of products	43	44	42	45
New markets or gain share	52	52	52	57
Fulfil regulations or standards	23	25	24	28
Improve production and business	32	31	32	32
Reduce labour cost	40	40	40	43
Reduce material consumption	28	26	28	34
Reduce energy consumption	22	23	22	25
Reduce environmental damage	25	25	21	20

In spite of some degree of variability among countries and across the different industries, the results of the survey show that environmental objectives, whether aimed at reducing material and energy consumption or environmental damage, are still relatively low on the list of objectives within manufacturing industry, the top objectives being to 'improve the product' followed by 'new markets'.

The 3 environmental objectives are considered very important in less than 30% of innovating industries (see table above). Material and energy consumption appear to be more important for low and medium-low technology innovators (57-58% of these companies) than for high-tech innovators¹⁴².

If innovation is closely linked to R&D activities, only around 29% of R&D performers declare that they innovate to reduce their material consumption, compared to 27% of non-R&D performers; for energy consumption, the respective shares are 21% and 25% whereas for environmental damage, they are 22% and 25%.

Ranking of very important environmental objectives behind innovation in manufacturing (1996)¹⁴⁰

1= most important objective, 10= least important objective

	EU	B	DK	D	E	F	I	IRL	L	NL	A	P	FIN	S	UK	NO
Material consumption	6	5	8	6	6	8	9	6	10	9	6	8	7	6	5	6
Energy consumption	10	10	7	7	6	9	8	10	8	10	8	8	10	10	10	10
Environmental damage	7	6	5	7	4	10	7	9	7	8	7	6	9	7	9	8

Share of innovating enterprises and of environmental objectives by manufacturing branch (1996)¹⁴⁰

%

	Food, beverages & tobacco	Textile & leather	Wood, pulp & printing	Coke & chemicals	Rubber & other non-metallic	Basic & fabricated metals	Machinery & equipment	Electrical & optical equipment	Transport equipment	NEC & recycling
	All objectives									
EU innovators by economic activity	50	35	45	70	51	48	68	69	57	48
	Environmental objectives									
Material consumption	24	30	35	23	31	27	24	29	31	27
Energy consumption	33	22	29	20	30	21	18	17	20	15
Environmental damage	25	23	27	41	30	23	22	18	27	22

The ranking per country in the second table above shows that environmental objectives have a high score (which means the objective is of least importance). An analysis per manufacturing branch (see third table above) shows the same weak score for environmental objectives which do not exceed 41% of the surveyed enterprises.

¹⁴⁰ Source: Eurostat (CIS2).

¹⁴¹ The median is the value which occupies the central position in a series of values ranked by size.

¹⁴² Based on 'Statistics on innovation in Europe' – (data 1996-97), EC and Eurostat, 2001.

Eco-Management and Audit Scheme (EMAS)

This indicator presents the number of industrial sites which have implemented EMAS in the EU-15 and Norway, in the sectors of mining & quarrying, manufacturing, electricity, gas & water supply and construction ¹⁴³. Some registrations under NACE 90 (treatment, destruction or disposal of solid or liquid waste) together with registrations under NACE 37 (recycling) are also included.

Apart from the environmental directives and regulations adopted by the EC, a broader range of instruments to tackle ever more diffuse sources of environmental pressures has been introduced; one such instrument is EMAS. The EMAS (voluntary) scheme has been operating since April 1995 and aims to promote continuous improvements in the environmental performance of activities. Participating organisations are committed to evaluating and improving their own environmental performance, complying with all relevant environmental legislation, preventing pollution, and to providing relevant information to the public, via environmental audits, validated by accredited environmental verifiers.

The scheme was originally open to industrial companies only (NACE 10-40), operating in the EU and EFTA, but was revised in 2001 to extend to all economic sectors including local authorities and to integrate ISO 14001 (International European Standard for Environmental Management System) as its environmental management system component ¹⁴⁴. EMAS goes beyond ISO 14001 in a number of ways; namely it requires organisations to undertake an initial environmental review, to actively involve employees in implementing EMAS and to make relevant information available to the public and other parties.

Implementation of EMAS ¹⁴⁵

	31/12/96	31/12/98	31/12/99	31/12/00	31/12/01	31/03/02
	<i>n° of sites or verifiers</i>					
	Number of sites by country					
EU-15	1 231	2 096	2 720	3 358	3 848	3 844
B	2	9	9	11	14	14
DK	15	83	116	152	170	169
D	1 116	1 578	2 007	2 394	2 662	2 620
EL	0	0	1	1	7	8
E	1	18	51	103	165	183
F	7	28	35	31	35	34
IRL	2	6	6	7	8	8
I	0	13	24	42	74	83
L	0	1	1	1	1	1
NL	9	19	25	23	24	25
A	35	141	190	294	362	370
P	0	0	0	1	2	2
FIN	14	17	26	29	36	36
S	15	124	157	199	212	212
UK	15	59	72	70	76	79
NO	38	44	55	59	64	64
	Number of verifiers by country					
EU-15	:	259	277	307	309	309
NO	:	3	6	4	5	5

The figures from 30/09/2001 onwards refer to the implementation of EMAS by all economic sectors. However, in March 2002, industrial companies still represented around 84% of implemented schemes (i.e. 3 457 ¹⁴⁶) broken down as follows: 92.8% in manufacturing, 4.5% in electricity, gas & water supply, 1.9% in mining & quarrying and 0.8% in construction.

Some information on the size of the organisations implementing EMAS may become available in the near future. So far, the size of only 12% of firms is known ¹⁴⁶: 28.2% have 250 employees or more, 57.2% have between 10 and 249 employees, while 14.5% are micro-enterprises (<10 employees).

¹⁴³ Manufacturing may include some Sewage & refuse disposal, sanitation & similar activities (NACE 90) which are normally included with Recycling (NACE 37) .

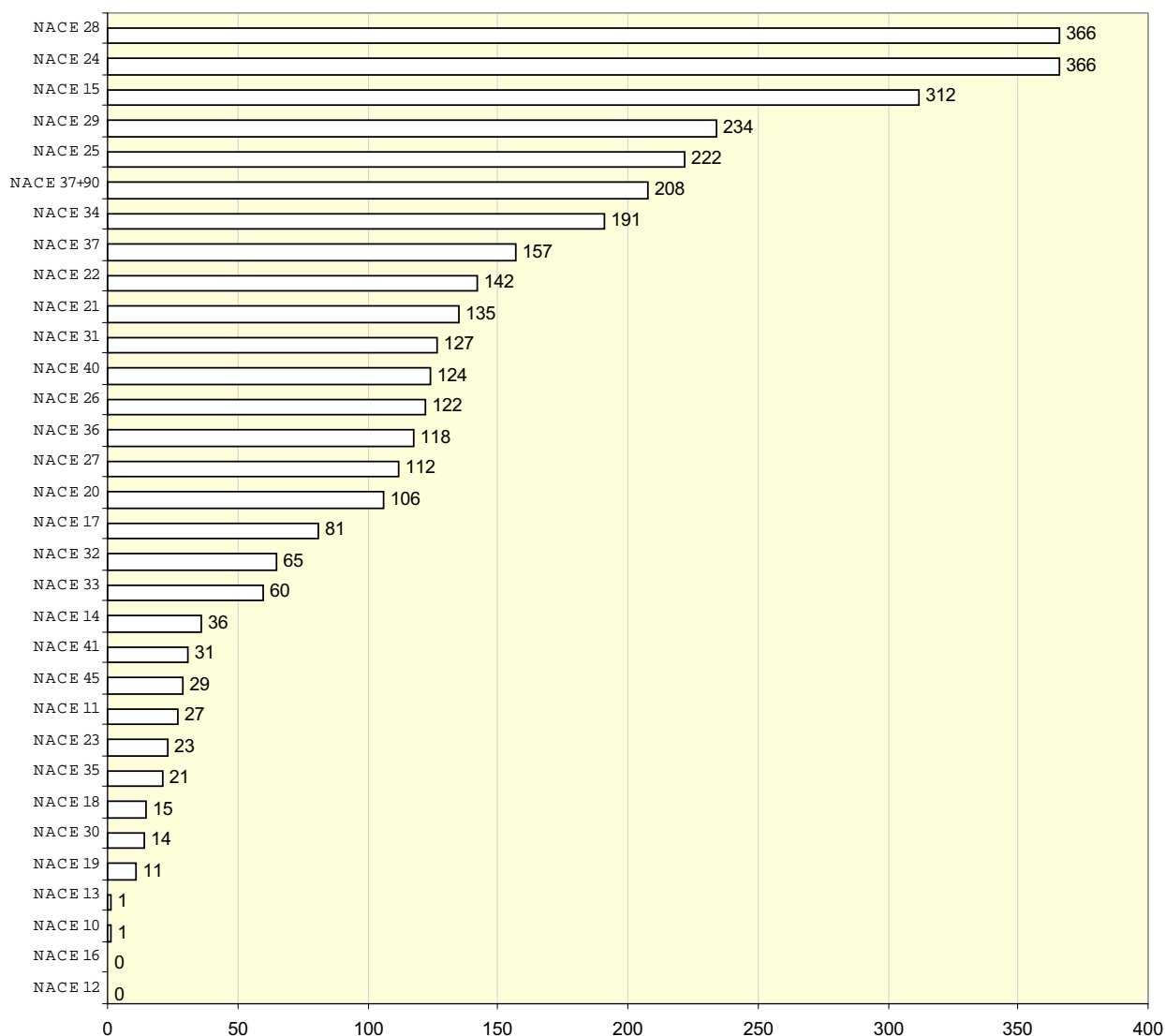
¹⁴⁴ EMAS is applied to sites while ISO 14001 is applied to organisations, therefore the areas and scope covered may be different.

¹⁴⁵ Source: EMAS Helpdesk <http://europa.eu.int/comm/environment/emas/>, emas@cec.eu.int

¹⁴⁶ Because many sites are registered with several NACE codes, the figure to be considered for sectoral calculations is not the effective number of sites (3 844) but 4 130 which represents the total number of schemes.

Implementation of EMAS in EU industry, by branch ¹⁴⁷

n° of registrations



As many sites are registered for several NACE branches, the total of the above figures is not the total number of sites but provides an indication of which industries have implemented the highest number of EMAS, namely fabricated metal products (NACE 28) and chemicals (NACE 24), both with 366 registrations. The non-manufacturing industries, i.e. mining & quarrying, electricity, gas & water supply, and construction, appear essentially at the lower part of the ranking, with the exception of NACE 40 (electricity, gas steam & hot water supply) which appears 12th among the 32 branches considered.

¹⁴⁷ Source: EMAS Helpdesk <http://europa.eu.int/comm/environment/emas/>, emas@cec.eu.int

Environmentally-sound products (Eco-labels)

This indicator is intended to illustrate the importance of environmentally-sound products, expressed as the number of Community Eco-labels ¹⁴⁸ awarded, by product group and manufacturing branch.

The Eco-label may be awarded to products which

1. have the potential to reduce negative environmental impacts, compared with other products in the same product group, thus contributing to the efficient use of energy and natural resources and to an improved level of environmental protection, during the life-cycle of the product, and
2. provide consumers with accurate, non-deceptive and scientifically sound based information on its environmental impacts ¹⁴⁹.

In order to be included in the scheme, a product must fulfil several conditions, namely, it shall represent a significant volume of sales and trade in the internal market and involve a significant environmental impact. The ecological criteria are set so as to allow up to 30% of the products available on the market to qualify for the Eco-label, which means that some of the products already on the shelves will qualify without needing to be modified. Award criteria are constantly revised, e.g. recent changes to the ecological criteria for footwear decree that eco-labelled shoes will no longer have any traces of arsenic, cadmium and lead, 3 priority heavy metals.

Eco-labels cannot be accorded to :

- substances or preparations classified as very toxic, toxic for reproduction, or mutagenic or goods manufactured via processes likely to significantly harm man and/or the environment or which in their normal application could be harmful to the consumer.
- food, drink, pharmaceuticals or medical devices intended only for professional use or to be prescribed or supervised by medical professionals.

The existing European Eco-label award scheme has been in operation since 1993 ¹⁵⁰ and can be used throughout the 15 Member States as well as Norway, Iceland and Liechtenstein.

¹⁴⁸ Council Regulation (EEC) n° 880/92 of 23 March 1992, as amended by Regulation (EC) n° 1980/2000 of 17 July 2000, OJ L 237 of 21.9.2000, on a revised Community Eco-label Award Scheme in which services have been included (tourist accommodation: scheduled adoption: 2002).

¹⁴⁹ Impacts taken into account are the use of resources and energy, emissions to air, water and soil, disposal of waste, effects on ecosystems.

¹⁵⁰ Council Regulation n° 880/92.

Eco-label awards by manufacturing branch and product group (April 1996-March 2002)¹⁵¹

n° of companies licensed

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	IS	NO	Share (%)
Total n° of awards as of March 2002:	103	2	22	2	9	13	20	1	18	0	2	0	3	1	8	2	0	0	100
	Manufacture of textiles																		
Textile	37	1	16	1	1	5	8	0	3	0	0	0	1	0	1	0	0	0	35.9
	Tanning & dressing of leather; manufacture of luggage, handbags, saddlery, harness & footwear																		
Footwear	4	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	3.9
	Manufacture of pulp, paper & paper products																		
Copying paper	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1.9
Tissue paper prod.	8	0	0	1	0	0	1	1	4	0	0	0	0	0	0	1	0	0	7.8
	Manufacture of chemicals & chemical products																		
Indoor paints & varnishes	27	0	2	0	4	5	5	0	1	0	0	0	2	1	7	0	0	0	26.2
Detergents for dishwashers	6	0	1	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	5.8
Hand dishwashing detergents	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1.0
Laundry detergents	3	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2.9
All purpose & sanitary cleaners	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Soil improvers	7	1	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6.8
	Manufacture of rubber & plastics																		
Hard floor coverings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
	Manufacture of machinery & equipment n.e.c																		
Refrigerators	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1.9
Dishwashers	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0
Washing machines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
	Manufacture of office machinery & computers																		
Personal computers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Portable computers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
	Manufacture of electrical machinery & apparatus n.e.c.																		
Light bulbs (single- and double-ended)	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0
	Manufacture of radio, television & communication equipment & apparatus																		
Televisions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
	Manufacture of furniture ; manufacturing n.e.c.																		
Bed mattresses	4	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	3.9

To date, 'licenses' for the use of the eco-label logo have been granted EU-wide, (except in Luxembourg and Austria), with Denmark, France and Italy 'leading the way'. A total of 19 product groups are eligible for the label (see table above), representing about 350 different products, though the table shows that for six of these product groups, no licenses have been granted. One reason is that four new product groups have been introduced since 2001 (hand dishwashing detergents, all-purpose and sanitary facility cleaners, hard floor coverings and televisions). The following groups are scheduled to be added in the near future: vacuum cleaners and furniture (2002), tyres (2003), rubbish bags, converted paper products, batteries for consumer goods. The branch to which most labels have been awarded is the chemical industry (42.7% of all eco-labels awarded notably 26.2% for indoor paints and varnishes), which is also an important branch from an economic point of view and a high or medium-high technology industry. The textile industry, a traditionally low-technology industry, is in second place (35.9%).

The number of applications from manufacturers continues to grow steadily, as does the number of eco-labelled articles put on the European market. A reduced VAT rate for eco-labelled products is currently under discussion, to help 'green' products to reach the target of a 25% annual increase in both the number of products and their value, and to broaden the range of product groups (2 new groups per year).

¹⁵¹ Source: EU Eco-label Helpdesk, <http://europa.eu.int/comm/environment/ecolabel/index.htm>, ecolabel@cec.eu.int

ANNEXES

ANNEX 1: DATABASES & NOMENCLATURES

- **New Cronos** is the database containing all official statistics available at Eurostat, split into 9 themes and broken down into domains. The themes of most importance for this publication are theme 4 and 8:
 - ❖ Theme 1 General Statistics
 - ❖ Theme 2 Economy and Finance
 - ❖ Theme 3 Population and Social Conditions
 - ❖ **Theme 4 Industry, Trade & Services:**
 - compet** Competitiveness Indicators
 - sbs** Structural Business Statistics (Industry, Construction, Trade and Services)
 - sbs plus** Industrial structural business indicators of market share and specialisation in the EU and non-member countries (1988-98)
 - europrom** EUROPROMS : European production and market statistics (provisional version)
 - ebt** European Business Trends - Monthly and Quarterly Short Term Statistics (Industry, Construction, Retail Trade and Other Services)
 - assoc** Trade association database (new)
 - sme** Small and medium sized enterprises
 - steel** Iron and steel
 - ❖ Theme 5 Agriculture and Fisheries
 - ❖ Theme 6 External Trade
 - ❖ Theme 7 Transport
 - ❖ **Theme 8 Environment & Energy:**
 - milieu** Environment statistics: air pollution, water, waste and environmental expenditure, sectoral indicators (transport, agriculture, forestry), and land use, global climate change, wildlife, public opinion and nuclear energy ;
 - sirene** Energy: structural, social and economic data on the energy sector and data on the main energy sources (hydrocarbons, gas and electricity), as well as internal flows and external trade prices of the main energy sources by type of consumer (industrial or domestic).
 - ❖ Theme 9 Science and Technology

NACE nomenclature

• **NACE Rev. 1** is a statistical classification of economic activities in the European Community¹⁵². It serves as a basis for the compilation of statistics on the production, factors of production (labour, raw materials, energy, etc.), fixed capital formation operations of these activities. The use of NACE Rev. 1 was made compulsory by Council Regulation (EEC) n° 3037/90 of 9 October 1990, which was subsequently amended by Commission Regulation (EEC) n° 761/93 of 24 March 1993. It is fully harmonised with the industrial classification of the Member States and the United Nations. The industrial activities covered in NACE Rev. 1 are as follows:

❖ Section C Mining & quarrying

- 10 Mining of coal & lignite; extraction of peat
- 11 Extraction of crude petroleum & natural gas; service activities incidental to oil & gas extraction excluding surveying
- 12 Mining of uranium & thorium ores
- 13 Mining of metal ores
- 14 Other mining & quarrying

❖ Section D Manufacturing

- da 15 Manufacture of food products & beverages
- 16 Manufacture of tobacco products
- db 17 Manufacture of textiles
- 18 Manufacture of wearing apparel; dressing & dyeing of fur
- dc 19 Tanning & dressing of leather; manufacture of luggage, handbags, saddlery, harness & footwear
- dd 20 Manufacture of wood & of products of wood & cork, except furniture; manufacture of articles of straw & plaiting materials
- de 21 Manufacture of pulp, paper & paper products
- 22 Publishing, printing & reproduction of recorded media
- df 23 Manufacture of coke, refined petroleum products & nuclear fuel
- dg 24 Manufacture of chemicals & chemical products
- dh 25 Manufacture of rubber & plastic products
- di 26 Manufacture of other non-metallic mineral products
- dj 27 Manufacture of basic metals
- 28 Manufacture of fabricated metal products, except machinery & equipment
- dk 29 Manufacture of machinery & equipment n.e.c.
- dl 30 Manufacture of office machinery & computers
- 31 Manufacture of electrical machinery & apparatus n.e.c.
- 32 Manufacture of radio, television & communication equipment & apparatus
- 33 Manufacture of medical, precision & optical instruments, watches & clocks
- dm 34 Manufacture of motor vehicles, trailers & semi-trailers
- 35 Manufacture of other transport equipment
- dn 36 Manufacture of furniture; manufacturing n.e.c.
- 37 Recycling
- ❖ **Section E Electricity, gas & water supply**
- 40 Electricity, gas, steam & hot water supply
- 41 Collection, purification & distribution of water
- ❖ **Section F Construction**
- 45 Construction

Among these activities *high technology industry* normally refers to NACE 24, 30, 32, 32 (plus NACE 72 Computer & related activities and NACE 73 Research & development).

¹⁵² Catalogue information: CA-80-93-436-EN-C-EN, 47.00 EUR, Theme: Economy & Finance, Collection: Methods & Nomenclatures.

IPCC classification

The IPCC classification is used to classify sources of greenhouse gas emissions for the UNFCCC inventory (see chapter on Climate Change and indicator on SO_x, NO_x, CO and NMVOCs in the Chapter on Air Pollution).

Tables based on UNFCCC data cover the following IPCC sub-sectors :

- ❖ **1A2 : 1. Energy**
 - A. Fuel Combustion (Sectoral Approach)
 - 2. Manufacturing industries & construction
- ❖ **1B : 1. Energy**
 - B. Fugitive Emissions from fuels
 - 1. Solid fuels
 - 2. Oil & natural gas
- ❖ **2A-G : 2. Industrial processes**
 - A. Mineral products
 - B. Chemical industry
 - C. Metal production
 - D. Other production
 - E. Production of halocarbons & SF₆
 - F. Consumption of Halocarbons & SF₆,
 - G. Other.

Petroleum refining and Fugitive emissions in industry are excluded, as are emissions from the Management of waste & waste waters in industries and Solvent & other product use (no data for the sub-categories 3.B-C, representing industrial solvents, is available).

The full IPCC classification covers the following greenhouse gas source and sink categories (SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES - IPCC TABLE 7A):

1. Energy
 - A. Fuel Combustion
 1. Energy Industries
 2. Manufacturing Industries and Construction
 3. Transport
 4. Other Sectors
 5. Other
 - B. Fugitive Emissions from Fuels
 1. Solid Fuels
 2. Oil and Natural Gas
2. Industrial Processes
 - A. Mineral Products
 - B. Chemical Industry
 - C. Metal Production
 - D. Other Production
 - E. Production of Halocarbons and SF₆
 - F. Consumption of Halocarbons and SF₆
 - G. Other
3. Solvent and Other Product Use
4. Agriculture
 - A. Enteric Fermentation
 - B. Manure Management
 - C. Rice Cultivation
 - D. Agricultural Soils
 - E. Prescribed Burning of Savannas
 - F. Field Burning of Agricultural Residues
 - G. Other
5. Land-Use Change and Forestry
 - A. Changes in Forest & Other Woody Biomass Stocks
 - B. Forest and Grassland Conversion
 - C. Abandonment of Managed Lands
 - D. CO₂ Emissions and Removals from Soil
 - E. Other
6. Waste
 - A. Solid Waste Disposal on Land
 - B. Wastewater Handling
 - C. Waste Incineration
 - D. Other
7. Other

SNAP classification used for UNECE CLRTAP inventory

Tables based on UNECE/EMEP data cover the following SNAP sectors (see indicators on heavy metals and POPs in the chapter on Air Pollution):

- ❖ **3. Combustion in manufacturing industry,**
- ❖ **4. Production processes**

that is excluding Refineries and Waste management within industries (parts of the source categories 1. and 9. respectively). Moreover Solvent use (source category 6.) could not be included because no distinction between the various solvents was possible.

The CORINAIR/UNECE source category split of emissions covers the following:

1. Combustion in energy and transformation industries
2. Non-industrial combustion plants
3. Combustion in manufacturing industry
4. Production processes
5. Extraction and distribution of fossil fuels and geothermal energy
6. Solvent and other product use
7. Road transport
8. Other mobile sources and machinery
9. Waste treatment and disposal
10. Agriculture
11. Other sources and sinks

ANNEX 2: ACRONYMS, ABBREVIATIONS & OTHER SYMBOLS

Statistical symbols

:	data non available
.	not applicable
-	nil
	break in time series (e.g. due to German reunification)

Other symbols

5EAP	EC Fifth Environmental Action Programme (O.J. C 138 of 17.5.93)
6EAP	Environment 2010: Our future, our choice – The sixth EU environment action programme 2001-2010 (ISBN 92-894-0652-6)
A	Austria
As	Arsenic
As-EEQ	Arsenic Ecotoxicology Equivalents
B	Belgium
BAT	Best Available Technology
BOD	Biochemical Oxygen Demand
CAP	Common Agricultural Policy
Cd	Cadmium
CFCs	ChloroFluoroCarbons
CH	Switzerland
CHP	Combined Heat & Power
CLRTAP	UNECE Convention on Long Range Transboundary Air Pollution, signed in Geneva in November 1979 and entered into force on 16 March 1983.
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
COD	Chemical Oxygen Demand
COP	Conference of the Parties to UNFCCC
CORINAIR	CORe Inventories AIR (Corinair90-pan-European & Corinair 94-EU-15+3)
Cr	Chromium
Cu	Copper
D	Germany, including former East Germany (ex-GDR, German Democratic Republic)
DG ENV	European Commission's Directorate-General for Environment, Nuclear Safety and Civil Protection
DK	Denmark
Dobris+3	EEA's 1998 follow-up report to "Europe's Environment: The Dobriš Assessment" (EEA 1995)
E	Spain
EC	European Commission (Brussels, Belgium and Luxembourg, Grand-Duchy of Luxembourg) or European Community
EEA	European Environment Agency (Copenhagen, Denmark)
EEA	European Economic Area (EU-15 plus Iceland and Norway)
EEQ	Ecotoxicity-Equivalent
EFTA	European Free Trade Association (Iceland - IS, Norway - NO, Liechtenstein - LI, Switzerland - CH). In the publication, LI is normally excluded due to a lack of data.
EL	Greece
EMEP	Co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe (UNECE-CLRTAP) http://www.emep.int/ Legal web-site : http://www.unece.org/env/lrtap/emep_h1.htm See also CORINAIR http://reports.eea.eu.int/EMEPCORINAIR/en
EODS	European Occupational Disease Statistics (1991)
ESAW	European Statistics on Accidents at Work (1990)
EU	European Union : Belgium, Denmark, Germany, Spain, Greece, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Austria, Finland, Sweden, the United-Kingdom
EU-12	EU with 12 Member States (B, DK, D, EL, E, F, IRL, I, L, NL, A, P)
EU-15	EU with 15 Member States (EU-12 + FIN, S, UK)
Eurostat	Statistical Office of the European Communities, European Commission, Luxembourg
F	France
FIN	Finland
Gg	Giga grammes (1 000 tonnes)

GHG	Greenhouse Gas(es)
HCB	Hexachlorobenzene
HCFC	HydroChloroFluoroCarbons
HFC	HydroFluoroCarbons
HELCOM	Helsinki Commission (1992) for the protection of the Baltic sea
Hg	Mercury
I	Italy
I-TEQ	International Toxic Equivalent
IPCC	Intergovernmental Panel on Climate Change
IPP	Integrated Product Policy
IPPC	International Pollution Prevention Control
IRL	Ireland (Republic of)
IS	Iceland
JAP	Japan
JRC	Joint Research Centre (European Commission); Ispra, Italy
kg	Kilogramme
km	Kilometre
kgoe	Kilogramme of oil equivalent
kt	Kilotonne
kWh	Kilowatt hour
L	Luxembourg (Grand-Duchy of)
LI	Liechtenstein
LCP	Large Combustion Plants
LPG	Liquefied Petroleum Gas
LUCF	Land-Use Change and Forestry (cf. sinks in CO ₂ emissions)
MAHB	Major-Accident Hazards Bureau at the JRC (http://mahbsrv.jrc.it)
MARS	Major-Accident Reporting System (database by JRC)
mio	Million
N	Nitrogen
N	Norway
NACE Rev. 1	Nomenclature des Activités économiques dans la Communauté Européenne: Statistical Classification (Nomenclature) of Economic Activities in the European Union (ISBN 92-826-9768-6) (see related annex)
Ni	Nickel
NL	(the) Netherlands
NMVOcs	Non-Methane Volatile Organic Compounds
NO _x	Nitrogen Oxides
ODP	Ozone Depletion Potential
oe	Oil Equivalent
OECD	Organisation for Economic Cooperation and Development (Triad countries, including EU-15, USA and Japan, plus the other OECD countries, namely in the current publication: IS, NO, EX-CS/CZ, HU, PL, TR, CA, MX, AU and NZ)
OSPAR	Oslo and Paris Commissions for the protection of the northern Atlantic
P	Phosphorus
P	Portugal
PAH	Polyaromatic hydrocarbons
Pb	Lead
PFC	Perfluorocarbons
POPs	Persistent Organic Pollutants
PRODCOM	Eurostat statistical nomenclature and database on products
S	Sulphur
S	Sweden
Se	Selenium
SF ₆	Sulphur hexafluoride
SME	Small and Medium-sized Enterprise
SNAP	System of Nomenclature for Air Pollution
SO ₂	Sulphur Dioxide
SO _x	Sulphur Oxides
t	Tonne(s) (1 000 kilogrammes)
TEQ	Toxicity-Equivalent
TJ	Terajoules (10 ¹² joules)

toe	Tonne of oil equivalent=107 kcalories Unit of energy used in the international energy industry. 1 toe represents the energy available from burning one tonne (metric ton) of oil; this is considered equivalent to approximately 7.4 barrels of oil, 1270 cubic meters of natural gas, or 1.4 tonnes of coal. 1 toe is equivalent to 41.868 gigajoules (GJ), 39.683 million Btu (MM Btu) or dekatherms, or 11.630 megawatt hours (MWh).
TRIAD	15 Member States of the European Union (EU, see above), USA and Japan
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe (see CLRTAP)
UNFCCC	UN Framework Convention on Climate Change. The text of the Convention was adopted at the United Nations Headquarters in New York on 9 May 1992, open for signature at the Earth Summit (Rio de Janeiro) from 4 to 14 June 1992 and entered into force on 21 March 1994.
USA	United States of America
VOC	Volatile Organic Compounds
WHO	UN World Health Organization
Zn	Zinc

Annex 3: Population of Triad Countries

Population on 1. January of each year ^{153 154}

total number of people

	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
EU-15	354 571 743	358 475 358	363 763 372	365 381 996	366 965 509	368 839 651	370 232 824	371 341 328	372 354 932	373 350 958	374 194 458	375 106 152	376 461 772	:
B	9 855 110	9 857 721	9 947 782	9 986 975	10 021 997	10 068 319	10 100 631	10 130 574	10 143 047	10 170 226	10 192 264	10 213 752	10 239 085	10 263 414
DK	5 122 065	5 111 108	5 135 409	5 146 469	5 162 126	5 180 614	5 196 642	5 215 718	5 251 027	5 275 121	5 294 860	5 313 577	5 330 020	5 349 212
D	78 179 662	77 709 213	79 112 831	79 753 227	80 274 564	80 974 632	81 338 093	81 538 603	81 817 499	82 012 162	82 057 379	82 037 011	82 163 475	:
EL	9 587 543	9 919 500	10 120 892	10 200 104	10 294 472	10 349 200	10 409 605	10 442 863	10 465 059	10 486 595	10 510 965	10 521 669	10 554 404	:
E	37 241 868	38 352 991	38 826 297	38 874 573	38 965 077	39 056 587	39 135 618	39 196 779	39 249 083	39 308 484	39 387 525	9519207.0 e	9733002.0 e	40 121 673
F	53 731 387	55 157 303	56 577 000	56 840 661	57 110 533	57 369 161	57 565 008	57 752 535	57 935 959	58 116 018	58 298 962	58 496 613	58 748 743	59 037 225
IRL	3 392 800	3 544 300	3 506 970	3 520 977	3 547 492	3 569 367	3 583 154	3 597 617	3 620 065	3 652 177	3 693 999	3734901.0 e	776577.0 ep	3826159.0 p
I	56 388 480	56 588 319	56 694 360	56 744 119	56 757 236	56 960 300	57 138 489	57 268 578	57 332 996	57 460 977	57 563 354	57 612 615	57 679 895	7844017.0 e
L	363 450	366 200	379 300	384 400	389 800	395 200	400 900	406 600	412 800	418 300	423 700	429200.0 e	435700.0 e	441300.0 e
NL	14 091 014	14 453 833	14 892 574	15 010 445	15 129 150	15 239 182	15 341 553	15 424 122	15 493 889	15 567 107	15 654 192	15 760 225	15 863 950	15 987 075
A	7 545 539	7 574 364	7 689 529	7 768 944	7 867 796	7 962 003	8 015 027	8 039 865	8 054 802	8 067 812	8 075 425	8 082 819	8 102 557	8 121 345
P	9 713 570	10 008 530	9 919 690	9 877 480	9 864 890	9 869 170	9 892 160	9 912 140	9 920 760	9 934 110	9 957 270	9 979 450	10 178 230	0242874.0 e
FIN	4 771 292	4 893 748	4 974 383	4 998 478	5 029 002	5 054 982	5 077 912	5 098 754	5 116 826	5 132 320	5 147 349	5 159 646	5 171 302	5 181 115
S	8 303 010	8 342 621	8 527 036	8 590 630	8 644 119	8 692 013	8 745 109	8 816 381	8 837 496	8 844 499	8 847 625	8 854 322	8 861 426	8 882 792
UK	56 284 953	56 595 607	57 459 319	57 684 514	57 907 255	58 098 921	58 292 923	58 500 199	58 703 624	58 905 050	59 089 589	59 391 145	59 623 406	:
EFTA	10 635 229	10 869 027	11 189 203	11 285 421	11 405 515	11 499 380	11 588 759	11 665 036	11 731 192	11 775 077	11 817 765	11 876 593	11 954 416	12 023 715
IS	226 948	240 606	253 785	255 866	259 727	262 386	265 064	266 978	267 958	269 874	272 381	275 712	279 049	283 361
LI	25 808	26 680	28 452	29 032	29 386	29 868	30 310	30 629	30 923	31 143	31 320	32 015	32 426	32863.0 e
NO	4 078 900	4 145 845	4 233 116	4 249 830	4 273 634	4 299 167	4 324 815	4 348 410	4 369 957	4 392 714	4 417 599	4 445 329	4 478 497	4 503 436
CH	6 303 573	6 455 896	6 673 850	6 750 693	6 842 768	6 907 959	6 968 570	7 019 019	7 062 354	7 081 346	7 096 465	7 123 537	7 164 444	7 204 055
USA	:	236 938 000	248 143 000	250 660 000	253 589 000	256 537 000	259 159 000	261 687 000	264 162 207	266 490 092	269 106 300	271 626 000	:	:
JAP	117 060 000	121 049 000	123 611 000	124 043 000	124 452 000	124 764 000	125 033 542	125 570 000	125 503 849	124 645 164	126 109 702	126 451 064	:	:
TRIAD	:	716 462 358	735 517 372	740 084 996	745 006 509	750 140 651	754 425 366	758 598 328	762 020 988	764 486 214	769 410 460	773 183 216	:	:

¹⁵³ Source: Eurostat, New Cronos database, theme 3 Population & Social Conditions, domain Demography, collection Population.

¹⁵⁴ Includes some estimated and provisional data.

Annex 4: Gross Domestic Product (GDP) of Triad Countries

Gross domestic product at current market prices ^{155 156}

million EURO

	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
EU-15	:	:	:	5 779 025	6 023 434	6 043 240	6 336 392	6 588 377	6 919 642	7 287 668	7 630 441	8 017 014	8 524 014	8 812 072	9 157 010	9 584 628
B	87 726	109 517	155 311	163 487	174 275	184 466	198 401	211 708	212 653	216 404	224 312	235 538	248 336	256 591	264 740	277 278
DK	49 290	79 067	105 048	108 446	113 694	118 541	128 024	137 793	144 155	149 169	154 069	163 216	173 889	181 435	189 097	198 570
D	:	:	:	1 432 662	1 561 713	1 670 811	1 763 730	1 880 207	1 878 151	1 863 458	1 916 370	1 974 300	2 025 500	2 063 000	2 110 309	2 187 117
EL	35 018	53 642	66 112	73 012	76 964	79 731	84 359	89 889	97 972	107 102	108 978	118 007	122 881	130 436	139 689	150 182
E	159 100	226 288	401 686	443 715	463 263	425 936	425 089	446 881	480 535	495 627	525 436	565 483	608 787	650 193	684 723	724 624
F	491 087	702 165	957 587	987 210	1 040 541	1 089 370	1 139 320	1 188 101	1 224 606	1 241 129	1 297 574	1 350 159	1 404 775	1 455 869	1 499 879	1 563 789
IRL	:	:	37 248	38 648	41 447	42 570	46 148	50 890	57 627	70 609	77 240	89 029	103 470	115 915	125 388	137 890
I	323 237	562 064	867 836	939 612	951 165	849 037	863 368	839 042	971 065	1 029 991	1 068 947	1 108 497	1 164 767	1 216 583	1 262 277	1 324 634
L	:	:	8 698	9 493	10 325	11 603	12 925	13 833	14 314	15 554	16 858	18 449	20 564	21 811	22 953	25 048
NL	128 123	175 386	231 859	244 524	258 503	277 767	293 923	317 324	324 479	332 654	351 648	373 664	401 089	426 850	447 339	473 034
A	57 222	88 644	127 315	136 573	146 955	158 511	168 108	179 840	182 364	181 645	188 646	196 658	204 842	210 701	216 865	225 345
P	:	:	56 253	65 534	75 479	73 635	76 303	82 631	88 310	93 890	100 320	107 741	115 042	122 705	128 543	134 518
FIN	37 757	72 011	107 732	99 829	83 851	73 565	84 369	98 898	100 523	108 072	115 256	120 485	131 229	135 057	138 895	146 166
S	92 717	136 973	187 568	200 132	197 151	164 188	174 216	183 597	206 273	210 815	213 702	227 607	248 479	234 162	244 187	255 314
UK	385 463	602 658	780 695	836 147	828 109	823 509	878 109	867 743	936 614	1 171 548	1 271 085	1 368 181	1 550 364	1 590 763	1 682 126	1 761 074
EFTA	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
IS	:	:	4 977	5 469	5 363	5 199	5 280	5 330	5 717	6 523	7 245	8 093	9 370	8 568	8 804	9 149
LI	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
NO	45 626	83 702	90 923	95 224	97 607	99 128	103 600	112 089	124 026	136 703	131 685	144 091	175 506	183 047	188 809	198 053
CH	77 367	127 824	180 062	188 248	188 344	202 173	220 482	235 052	233 327	225 895	234 267	242 802	259 581	276 060	292 697	305 062
USA	2 007 826	5 520 988	4 557 196	4 830 880	4 867 832	5 672 359	5 930 383	5 657 888	6 153 332	7 335 177	7 833 012	8 696 574	10 689 461	11 397 703	12 110 197	12 752 587
JAP	772 068	1 804 355	2 406 159	2 818 309	2 932 493	3 738 214	4 053 971	4 046 254	3 699 223	3 807 082	3 523 112	4 219 003	5 162 452	4 633 629	4 228 979	4 337 738
TRIAD	:	:	:	13 428 214	13 823 758	15 453 813	16 320 747	16 292 518	16 772 196	18 429 927	18 986 565	20 932 592	24 375 927	24 843 404	25 496 186	26 674 953

¹⁵⁵ Source: Eurostat, New Cronos database, theme 2 Economy and Finance, domain National accounts - Aggregates - Annual data, collection GDP and main aggregates.

¹⁵⁶ Includes some estimated and provisional data. Data for 1999 may not fully match the GDP data as used in the indicator on 'Eco-industry'.

ANNEX 5: EU-15 Employment

Employment – All economic sectors ^{157 158}

full time jobs

	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Total employment by all economic sectors (including army)													
EU-15	:	:	:	:	:	:	153 662	155 169	156 051	157 509	160 188	162 813	165 792	167 851
	Total employment by all economic sectors (excluding army)													
EU-15	:	:	:	:	:	:	129 117	129 688	129 841	130 297	131 875	133 527	135 710	137 708
B	:	2 593	2 664	2 683	2 639	2 605	2 590	2 580	2 575	2 584	2 575	2 566	2 612	3 225
DK	2 099	1 985	2 017	2 012	2 002	1 968	2 035	2 041	2 051	2 058	2 097	2 149	2 169	2 205
D	:	:	:	33 026	32 396	31 701	31 397	31 279	31 052	30 666	30 684	30 834	31 129	30 912
EL	:	3 413	3 564	3 515	3 529	3 577	3 624	3 638	3 614	3 603	3 718	3 683	3 722	3 737
E	11 655	10 875	13 126	13 313	12 961	12 528	12 421	12 555	12 676	13 000	13 484	13 938	14 376	14 734
F	:	19 625	20 096	20 109	19 813	19 329	19 165	19 134	19 115	19 033	19 272	19 659	20 231	20 720
IRL	:	1 024	1 061	1 061	1 062	1 059	1 097	1 137	1 181	1 214	1 273	1 350	1 414	1 455
I	20 100	20 380	21 264	21 661	21 556	21 114	20 713	20 608	20 696	20 702	20 805	20 907	21 178	21 520
L	:	150	175	182	186	189	192	196	202	208	215	224	235	248
NL	:	:	4 578	4 591	4 566	4 517	4 460	4 464	4 517	4 648	4 712	4 767	4 753	4 791
A	:	:	3 348	3 396	3 402	3 380	3 390	3 374	3 354	3 347	3 330	3 343	3 361	3 321
P	:	3 870	4 212	4 312	4 283	4 192	4 163	4 144	4 111	4 121	4 221	4 291	4 385	4 454
FIN	2 114	2 189	2 242	2 101	1 942	1 803	1 779	1 805	1 834	1 903	1 934	1 971	2 003	2 030
S	:	:	3 366	3 286	3 117	2 914	2 886	2 951	2 964	2 963	3 012	3 079	3 211	3 204
UK	:	:	:	:	:	:	19 207	19 785	19 898	20 246	20 544	20 767	20 931	21 154

¹⁵⁷ Source: Eurostat, New Cronos database, theme 3 Population & Social Conditions, domain Employment.

¹⁵⁸ Includes some estimated and provisional data. Data for 1999 may not fully match the employment data as used in the indicator on 'Eco-industry'.

Employment (continued) – Industry ^{159 160}

full time jobs

	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Employment in industry (excluding construction)														
EU-15	:	:	:	:	:	:	30 517	30 365	30 088	29 908	30 168	29 935	29 831	29 810
B	:	782	735	718	699	670	649	641	631	619	616	606	605	646
DK	454	464	437	431	425	416	422	433	434	425	431	429	423	423
D	:	:	:	10 500	9 704	9 013	8 516	8 258	8 003	7 821	7 801	7 694	7 679	7 658
EL	:	717	744	726	712	672	665	668	671	652	666	656	650	652
E	2 938	2 463	2 818	2 789	2 679	2 536	2 473	2 507	2 559	2 660	2 783	2 856	2 941	2 982
F	:	4 675	4 423	4 356	4 208	3 996	3 865	3 858	3 819	3 768	3 761	3 754	3 800	3 849
IRL	:	237	247	247	243	235	247	257	265	279	288	295	299	301
I	6 210	5 504	5 610	5 578	5 408	5 256	5 165	5 146	5 089	5 079	5 166	5 130	5 095	5 077
L	:	37	37	36	36	35	34	34	33	34	34	34	34	36
NL	:	:	1 031	1 029	1 008	967	914	892	892	902	902	896	886	875
A	:	:	768	768	748	718	700	694	681	675	672	663	659	658
P	:	1 036	1 156	1 149	1 100	1 066	1 065	1 028	996	989	997	978	959	967
FIN	597	565	520	476	431	405	407	423	425	438	448	454	461	466
S	:	:	818	763	694	644	640	684	687	691	703	700	714	698
UK	:	:	:	:	:	:	4 757	4 842	4 904	4 876	4 901	4 790	4 626	4 523
Employment in construction														
EU-15	:	:	:	:	:	:	10 696	10 847	10 700	10 749	10 815	11 025	11 284	11 432
B	:	133	154	160	160	166	169	171	164	160	158	162	166	222
DK	174	149	141	135	133	133	139	144	142	144	149	153	161	160
D	:	:	:	2 652	2 771	2 883	3 007	3 056	2 952	2 831	2 725	2 666	2 573	2 394
EL	:	222	240	234	235	248	245	241	240	241	265	260	269	277
E	1 135	832	1 333	1 393	1 307	1 186	1 153	1 218	1 218	1 269	1 355	1 497	1 600	1 677
F	:	1 468	1 606	1 595	1 537	1 444	1 402	1 405	1 377	1 350	1 346	1 376	1 431	1 472
IRL	:	87	79	81	78	80	86	90	97	106	121	139	163	178
I	1 650	1 526	1 454	1 500	1 528	1 488	1 428	1 400	1 387	1 394	1 368	1 402	1 436	1 509
L	:	14	19	21	23	23	23	23	24	24	24	24	25	26
NL	:	:	399	402	396	387	391	395	403	418	427	432	435	452
A	:	:	246	253	262	262	275	285	287	287	280	277	274	261
P	:	366	397	403	396	390	380	391	394	439	471	487	539	529
FIN	173	178	201	173	143	118	105	110	112	127	138	143	151	148
S	:	:	263	259	223	203	189	194	190	185	186	193	198	195
UK	:	:	:	:	:	:	1 704	1 725	1 715	1 773	1 805	1 815	1 862	1 932

¹⁵⁹ Source: Eurostat, New Cronos database, theme 3 Population & Social Conditions, domain Employment.

¹⁶⁰ Includes some estimated and provisional data. Data for 1999 may not fully match the employment data as used in the indicator on 'Eco-industry'.

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