POCKETBOOK

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Energy and environment indicators

Data 1985-2000

8

THEME 8
Environment and energy

A great deal of additional information on the European Union is available on the Internet.
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Introduction

In 1999 the EU Energy Council agreed on a list of energy and energy-related indicators to be produced and released annually. This pocketbook presents these indicators. For most indicators the most recent data presented is for 1999 though 2000 data is presented if it was available in November 2001 (the date when the data was extracted). This is the third edition of the Energy Indicators Pocketbook and in general the indicators list has been kept stable in comparison to the previous editions.

Energy and energy-related indicators are also useful for measuring progress in other areas. The European Union Strategy for Sustainable Development contains an environmental dimension. The addition of this dimension was agreed by the Gothenburg European Council meeting and met the goals set at the spring 2000 Special European Council meeting in Lisbon. The annual Synthesis Report, released by the European Commission in spring 2002, contains a number of environmental indicators relevant to this strategy.

At the beginning of the 21st century the European Union faces a transition to a new energy system. The structure of this new system is not yet known as it depends upon the market structures and technological developments of the coming years and decades. Whatever form the energy system takes it needs to:

assure the security of energy supply;

be carried out according to the competitive spirit of the Single Energy Market, supporting dynamic economic growth, employment and welfare;

seek to minimise its environmental impacts.

The indicators presented in this pocketbook have been selected to enable the measurement of these policy goals. Long-term time series on energy supply, transformation, consumption, related

emissions and prices allow progress towards the goals to be analysed.

The pocketbook contains ten chapters of indicators covering energy supply, final energy consumption, the structure of the energy industry, renewable energy sources, energy efficiency, energy prices and energy emissions. In the majority of cases the indicators present aggregated data calculated on the basis of the total for the 15 EU Member States. A limited number of national data and data on accession countries is also presented. The main data source for the indicators are the harmonised EU Energy Statistics, although other official Eurostat data sources have also been used. Data on emissions have been provided by the European Environment Agency.

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1 Overview Indicators

Indicator 1.1 Energy Dependency

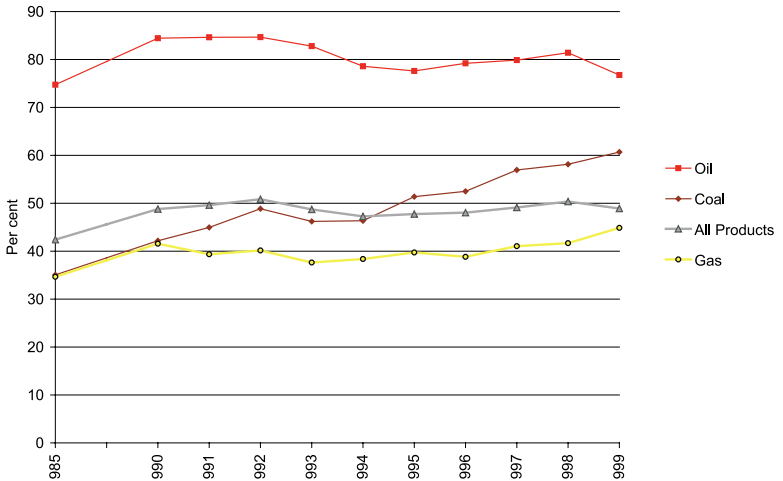


Table 1.1 Energy Dependency

Per cent (%)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Oil	74.7	84.4	84.6	84.7	82.8	78.6	77.6	79.2	79.9	81.4	76.8
Coal	35.1	42.2	45.0	48.9	46.2	46.4	51.4	52.5	57.0	58.1	60.7
Gas	34.7	41.6	39.4	40.2	37.6	38.4	39.7	38.8	41.0	41.7	44.9
All Products	42.4	48.8	49.6	50.8	48.7	47.3	47.8	48.0	49.1	50.4	48.9

Data Source: Eurostat, Energy Statistics

Note: *Energy Dependency measures the extent to which a country relies on imports to meet its energy needs. The method used to calculate this indicator has been changed from last year's edition. Energy Dependency is now calculated as the ratio of net imports of an energy product to the gross inland consumption of that product.*

Import dependency increased considerably over the period 1985 to 1990, from slightly over 40% to close to 50%. During the period 1990 to 1999 the share of energy imported remained at around 50%, with only small variations and weak peaks in 1992 and 1998 coinciding with peaks in the demand for oil products.

The EU remains most dependent on imported oil, although the share of imported oil decreased slightly over the period from 1990 to 1999.

Dependency on imported coal has shown the largest increase in percentage terms. This occurred despite a reduction in total coal consumption within the EU, and largely reflects the price advantages of imported coal over European -produced coal and the gradual reduction of state aid for coal.

The extent to which the EU is dependant on imported gas has remained at the same level of close to 40% over the period 1990 to 1998 though it has increased recently due to a large increase in demand.

Indicator 1.2 Index of Energy Intensity

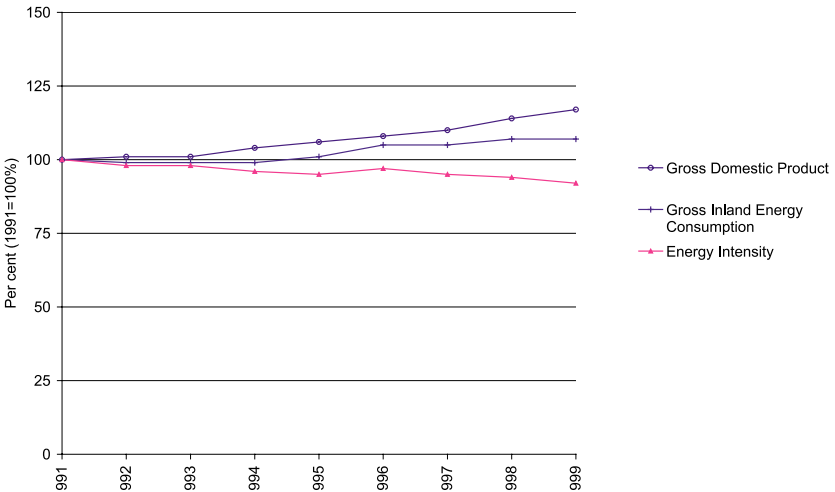


Table 1.2 Index of Energy Intensity

Per cent (1991 = 100%)	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Gross Domestic Product	100	101	101	104	106	108	110	114	117
Gross Inland Energy Consumption	100	99	99	99	101	105	105	107	107
Energy Intensity	100	98	98	96	95	97	95	94	92
Energy Intensity (kgoe/1 000 ECU /euro)	217	212	213	208	207	211	206	204	199

Data Source: Eurostat, Energy Statistics, National Accounts

***Definition**: Energy intensity is calculated by dividing the gross inland consumption of energy by the gross domestic product (GDP).*

Energy intensity is a measure of how much energy is used to produce a unit of economic output. The decoupling of increasing economic activity from increasing energy consumption is often quoted as a goal for sustainable development.

The reduction in energy intensity has been particularly pronounced since 1996. Both gross inland consumption and gross domestic product have increased over this period, but gross domestic product increased more rapidly than gross inland energy consumption. In 1999 GDP was 17% higher than its 1990 level, while gross inland consumption had increased by only 7% over the same period. As a result, energy intensity in the EU has fallen steadily over the last decade, exhibiting an 8% drop between 1991 and 1999.

From 1998 to 1999 gross inland energy consumption did not increase, while GDP rose by three percentage points. It follows that the consistent reduction in energy intensity observed since 1996 has been maintained.

Indicator 1.3 Price of Brent Crude Oil

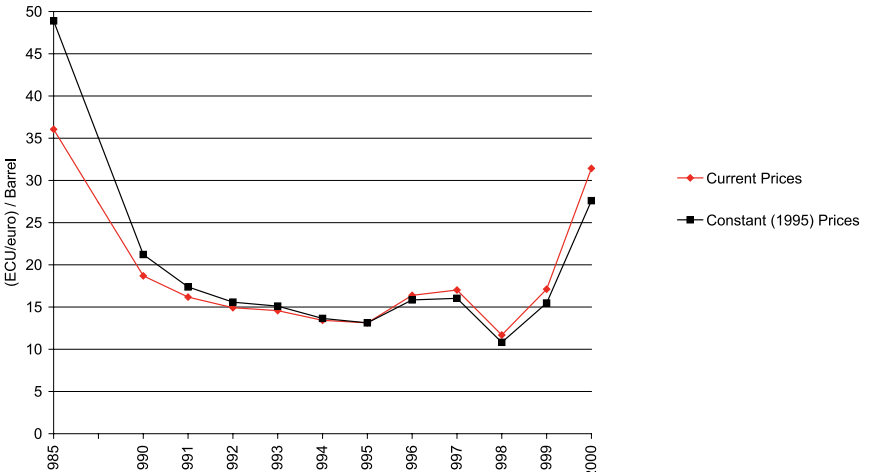


Table 1.3 Price of Brent Crude Oil

(ECU/euro) / Barrel ((ECU/□) /bl)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Current Prices	36.1	18.7	16.2	14.9	14.6	13.4	13.1	16.4	17.0	11.7	17.1	31.4
Constant (1995) Prices	48.9	21.2	17.4	15.6	15.1	13.7	13.1	15.9	16.0	10.8	15.5	27.6

Data Source: Platt's European Marketscan, BP Statistical Review

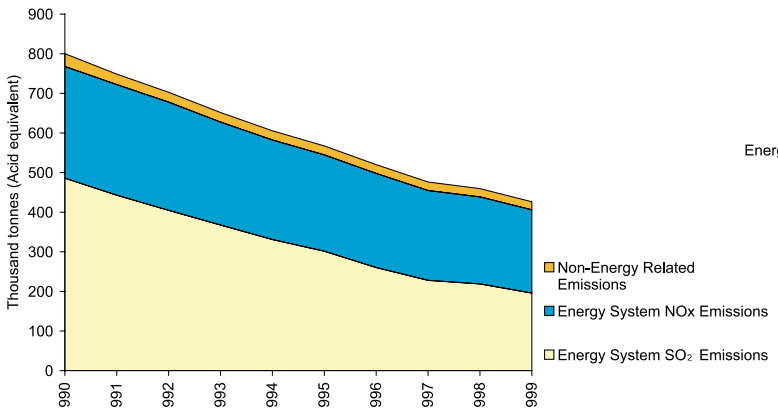
Note: *The price of Brent crude oil is used as a yardstick for world crude oil prices. One barrel contains 158.99 litres.*

The average price of crude oil remained low over the period from 1990 to 1999, particularly in comparison to the price in 1985. Much of the fall in price took place between 1985 and 1986 as a result of OPEC countries introducing netback pricing, through which the price of crude oil was negotiated on the basis of the expected value of the products refined from it. This forced oil producers to compete more actively for market share.

In 1990 the price of crude oil rose in response to concerns over security of supply relating to the Gulf War. The price subsequently fell by 29.9% (in current prices) over the next five years. Tensions in the Gulf led to prices rising again in 1996 and 1997. The dip in prices in 1998 has been attributed largely to the decrease in demand associated with the Asian economic crisis.

The OPEC decision to reduce oil production caused prices to start to rise again in 1999. In 2000 the upward movement in oil prices continued as demand increased, through a combination of economic upturn and a cold winter in the United States.

Indicator 1.4 Contribution of Energy System to Total Emissions of Acidifying Gases (SO_2 and NO_x)



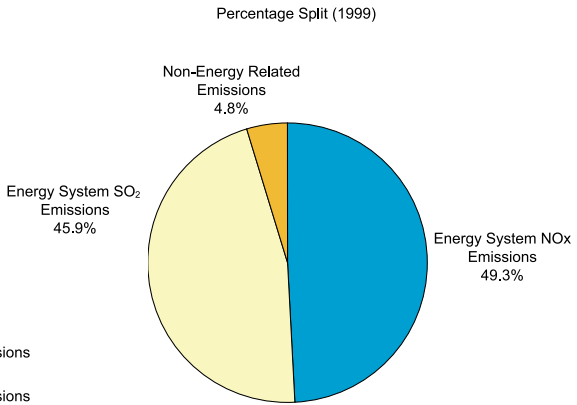


Table 1.4 Contribution of Energy System to Total Emissions of Acidifying Gases (SO_2 and NO_x)

Thousand tonnes acid equivalent (kt acid eq.)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Energy System NO_x Emissions	282	279	273	260	251	243	237	227	220	210	49.3%
Energy System SO_2 Emissions	486	443	405	368	331	301	260	228	219	196	45.9%
Non-Energy-Related Emissions	32	26	25	24	23	23	22	21	21	20	4.8%
Total Emissions of Acidifying Gases	800	748	703	652	606	567	520	476	459	426	100.0%

Data Source: European Environment Agency

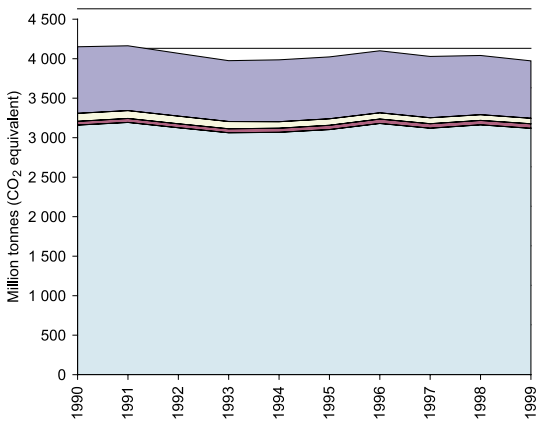
Note: *The term "Energy System" refers to the sum of energy transformation and final energy consumption. The units used adjust the tonnes of emissions by their relative potential acid (hydrogen ion) production.*

Emissions of acidifying gases are partly responsible for acid rain, for increased concentration of photo-oxidants in the atmosphere and for the occurrence of smog in winter. In 1999, emissions from the energy system accounted for 95.2% of the total emissions of acidifying gases. However, emissions caused by the energy system reduced by 47.1% between 1990 and 1999, while emissions from non-energy sources fell by 37.5%.

Emissions of sulphur dioxide (SO_2) from the energy system fell by 59.7% between 1990 and 1999. This can be attributed to a combination of the installation of flue gas desulphurisation (FGD) equipment at power stations, the use of solid and liquid fuels with a lower sulphur content, the move from solid fuels to other fuels such as natural gas containing less sulphur, and improvements in electrical generation efficiency.

NO_x emissions from the energy system fell by 25.5% over the period shown. The transport sector is the largest source of these emissions and the introduction of catalytic converters is largely responsible for this reduction, achieved despite an increase in transport energy use. Fuel switching, improved efficiency and low NO_x burners have also contributed to a reduction in emissions from industrial and electricity generation plants.

Indicator 1.5 Contribution of the Energy System to Total Emissions of Greenhouse Gases



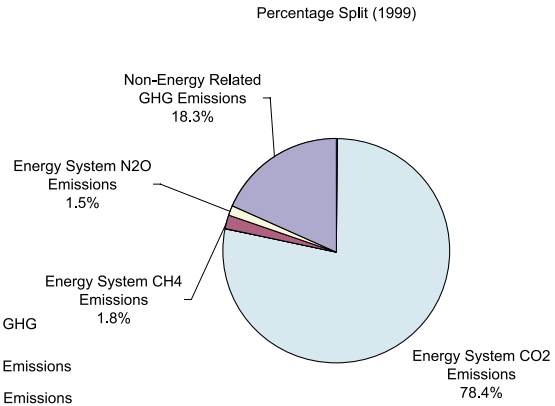


Table 1.5 Contribution of the Energy System to Total Emissions of Greenhouse Gases

Million tonnes of CO_2 equivalent (Mt CO_2 eq.)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Energy System CO_2 Emissions	3 160	3 193	3 126	3 062	3 068	3 103	3 180	3 120	3 163	3 118	78.4%
Energy System CH_4 Emissions	101	100	97	92	82	82	80	76	73	70	1.8%
Energy System N_2O Emissions	48	50	50	50	52	55	56	57	56	58	1.5%
Non-Energy-Related GHG Emissions	843	821	795	770	783	783	785	776	749	726	18.3%
Total GHG Emissions	4 151	4 164	4 068	3 975	3 985	4 023	4 100	4 029	4 041	3 972	100.0%

Data Source: European Environment Agency

***Note:** The term "Energy System" refers to the sum of energy transformation and final energy consumption. Greenhouse gas emissions are widely acknowledged to give rise to climate change. Only the three most significant greenhouse gases, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are considered here. National and EU data produced on the basis of the UNFCCC reporting requirements may differ from the data shown here.*

Total emissions of the three greenhouse gases carbon dioxide, methane and nitrous oxide across the EU fell by 4.3% over the period 1990 to 1999. The EU target (under the Kyoto Protocol) is to reduce greenhouse gas emissions to 8% below 1990 levels by 2008-2012.

The energy system is the largest source of greenhouse gas (GHG) emissions. Its contribution to total GHG emissions increased from 79.7% in 1990 to 81.7% in 1999. This resulted in part from a more rapid reduction in GHG emissions from sources outside the energy system, which decreased by 13.9% while energy-related emissions only fell by 1.9% over the same period.

Carbon dioxide (CO_2) emissions from the energy system are by far the largest single contributor to total GHG emissions. However, CO_2 emissions fell slightly between 1990 and 1999, despite an increase in final energy consumption. The 20.8% increase in nitrous oxide (N_2O) emissions results in part from the increased use of catalytic converters in motor vehicles. Methane (CH_4) emissions fell by 30.7% over the same period, but nitrous oxide and methane together still account for only 3.3% of the total.

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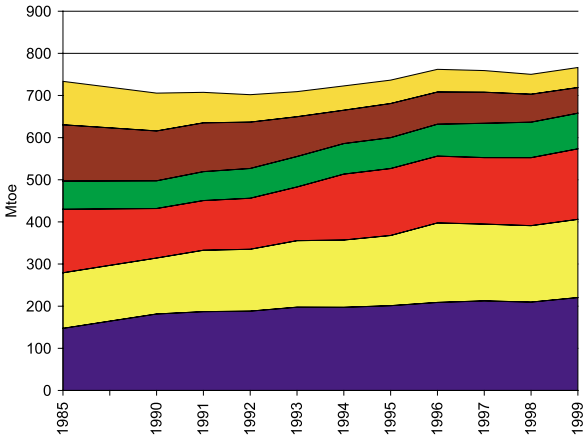
2 Energy Supply

Indicator 2.1 Primary Energy Production, by Fuel



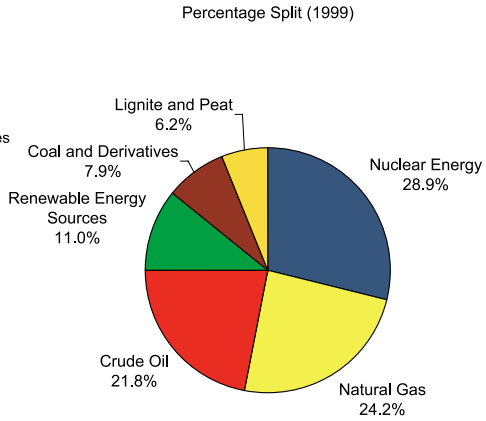


Table 2.1 Primary Energy Production, by Fuel

Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Nuclear Energy	147 378	181 438	187 020	188 267	197 558	197 272	201 240	208 864	212 615	209 663	220 501	28.9%
Natural Gas	131 875	132 871	145 680	146 838	157 894	159 737	166 597	188 632	182 123	181 467	185 468	24.2%
Crude Oil	150 658	117 481	117 872	121 083	127 409	156 468	158 859	158 697	157 807	161 276	167 455	21.8%
Renewable Energy Sources	67 026	65 690	68 769	70 690	72 279	72 499	73 203	75 736	81 422	84 269	84 553	11.0%
Coal and Derivatives	133 616	118 387	115 765	109 893	94 508	79 080	81 041	76 275	73 820	66 363	60 891	7.9%
Lignite and Peat	103 008	89 832	72 357	65 118	59 450	57 689	55 566	53 890	51 302	47 217	47 526	6.2%
Total	733 561	705 699	707 463	701 889	709 098	722 745	736 506	762 094	759 089	750 255	766 394	100.0%
Index (1990 = 100%)	103.9	100.0	100.2	99.5	100.5	102.4	104.4	108.0	107.6	106.3	108.6	

Data Source: Eurostat, Energy Statistics

Total primary energy production across the EU-15 increased by 8.6% between 1990 and 1999. However, production was lower in the early 1990s reflecting the lower level of economic growth during that period, and only climbed back above its 1985 level in 1995.

The balance of fuels contributing to total primary energy production has changed over the decade from 1990 to 1999. Production of both coal and lignite fell to approximately half the 1990 levels. This reflects reduced industrial energy demand, fuel switching (mainly in favour of natural gas), increased imports of cheaper solid fuels and phasing out of state aid for coal. In part, these changes were driven by the need to reduce emissions, since both coal and lignite have a relatively high carbon and sulphur content. Nuclear energy is now the largest single source of primary energy (28.9% of the total) in the EU after an increase in production until 1999. Little new nuclear capacity has been installed since 1993, though the production from the existing capacity has remained relatively static since then despite a 5.2% increase in 1999. Also, the production of crude oil and natural gas has increased, reflecting growth in production capacity and demand for these fuels. The primary energy production based on renewable energy sources has also grown in recent years, in absolute terms as well as in relative terms (reaching 11.0 % of the total in 1999).

Indicator 2.2 Net Imports of Solid Fuels and Oil

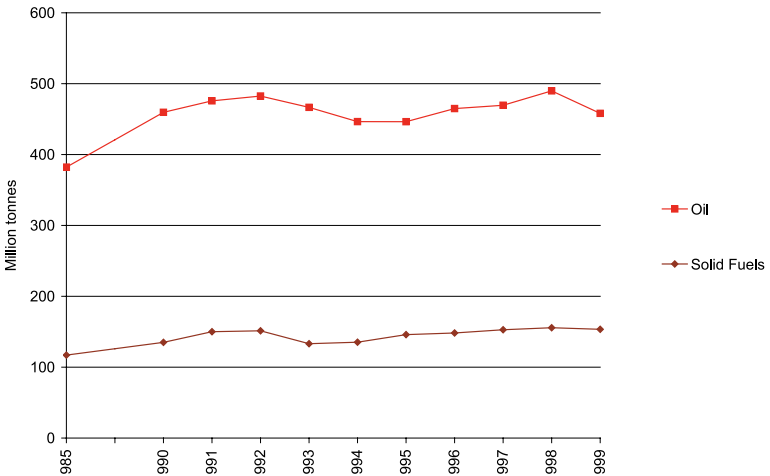


Table 2.2 Net Imports of Solid Fuels and Oil

kilotonnes (kt)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Solid Fuels	117 066	135 046	150 097	151 316	133 126	135 205	145 965	148 232	152 846	155 657	153 470
Index (1990 = 100%)	86.7	100.0	111.1	112.0	98.6	100.1	108.1	109.8	113.2	115.3	113.6
Oil	382 217	459 557	475 755	482 490	466 568	446 416	446 310	464 906	469 531	489 836	458 134
Index (1990 = 100%)	83.2	100.0	103.5	105.0	101.5	97.1	97.1	101.2	102.2	106.6	99.7

Data Source: Eurostat, Energy Statistics

Net imports (imports minus exports) of solid fuels (coal and lignite) rose by nearly 14% over the period from 1990 to 1999. This contrasts with a decline of 48% in the production of coal and lignite within the EU-15 over the same period (see indicator 2.1), and reflects increasing reliance on imported solid fuels as a result of lower prices and, in some cases, reduced state aid for EU internal production.

Net imports of oil into the EU-15 were almost the same in 1999 as in 1990. However, net imports rose sharply after 1990 following the Piper Alpha incident, as reductions in oil production capacity were reflected in increased imports of both oil and solid fuels. Oil imports then declined from 1993 to 1994 as new capacity came on stream, but rose steadily from 1995 to 1998. There was, however, a stronger reduction in oil imports from 1998 to 1999, possibly reflecting higher oil prices (see indicator 1.3) since oil production within the EU-15 also declined slightly (see indicator 2.1).

There have also been significant changes in the breakdown between primary production and net imports. In the case of solid fuels, net imports were noted at only 65% of primary production in 1990, but by 1999 this figure had risen to 142%. In the case of oil, net imports were 3.9 times greater than production in 1990 but by 1999 increased production had reduced this ratio to 2.7.

Indicator 2.3 Net Imports of Natural Gas

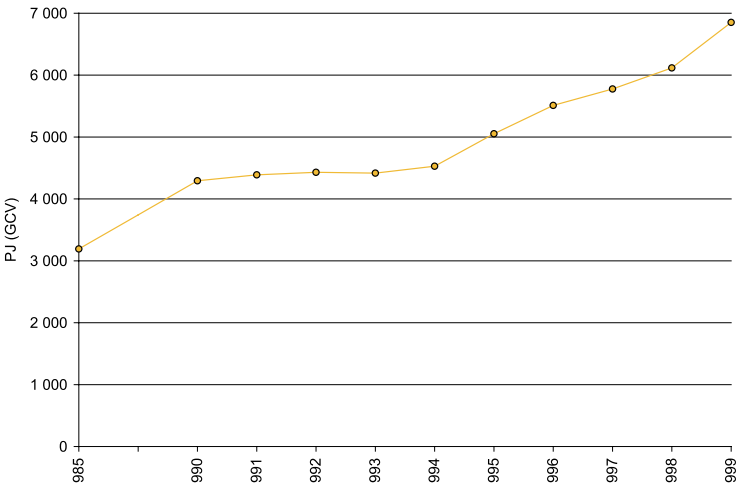


Table 2.3 Net Imports of Natural Gas

Terajoules (TJ) (Gross Calorific Value)	**1985**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Natural Gas	3 191 691	4 293 690	4 388 674	4 429 872	4 417 032	4 528 509	5 053 300	5 510 669	5 776 241	6 116 964	6 852 693
Index (1990 = 100%)	74.3	100.0	102.2	103.2	102.9	105.5	117.7	128.3	134.5	142.5	159.6

Data Source: Eurostat, Energy Statistics

Net imports (imports minus exports) of natural gas into the EU-15 rose by nearly 60% between 1990 and 1999, with a 12% increase in 1998 to 1999 alone. In contrast, gas production within the EU rose by 40% over the decade and just 2% on the last year. This reflects an increasing dependency ratio related to gas in recent years (see indicator 1.1). In 1990 net imports of gas were around 77% of primary production, but by 1999 this figure had risen to 88%.

The increase in natural gas imports results both from higher demand for gas and from its improved availability from sources outside the EU. There is now greater use of gas by industrial, services and household consumers (see indicators 3.4 and 3.9). Since 1995 there has been particularly strong growth in its use for electricity generation (see indicator 4.3). This reflects - inter alia - growing liberalisation of the energy markets with lower costs for power plants.

Indicator 2.4 Net Imports of Electricity

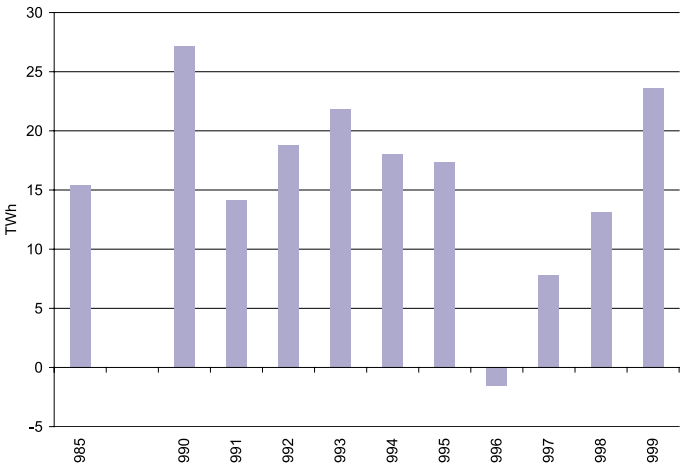


Table 2.4 Net Imports of Electricity

Gigawatt hours (GWh)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Electricity	15 428	27 134	14 170	18 792	21 873	18 046	17 402	-1 582	7 782	13 112	23 576
Index (1990 = 100%)	56.9	100.0	52.2	69.3	80.6	66.5	64.1	-5.8	28.7	48.3	86.9

Data Source: Eurostat, Energy Statistics

From 1990 to 1999, net imports of electricity (imports minus exports) into the EU-15 reduced by around 13%. Overall, there have been significant variations in net imports, with even a small net export balance recorded in 1996.

This volatility must be seen in the context that trade in electricity is very small compared to total generation. In 1999, 23.6 TWh were imported on a net basis compared to over 2 500 TWh generated (see indicator 4.3). Over the period 1990 to 1999 the amount of electricity imported on a net basis was never more than 1.3% of that generated. However, net imports increased progressively over the four years from 1996 to 1999.

Indicator 2.5 EU Electricity Trade

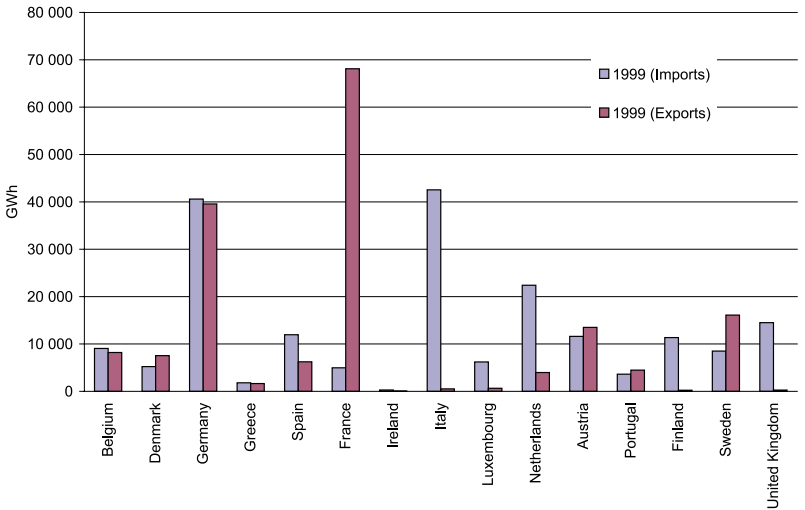


Table 2.5 EU Electricity Trade

Gigawatt hours(GWh)	EU-15	Belgium	Denmark	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
1999 Imports	194 662	9 059	5 223	40 598	1 811	11 959	4 965	290	42 538	6 212	22 408	11 608	3 628	11 356	8 500	14 507
1999 Export	171 086	8 207	7 536	39 558	1 647	6240	68 108	49	528	655	3 968	13 507	4 488	232	16 100	263
1999 Net Balance	23 576	852	-2 313	1 040	164	5 719	-63 143	241	42 010	5 557	18 440	-1 899	-860	11 124	-7 600	14 244

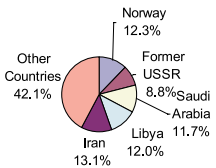
Data Source: Eurostat , Energy Statistics

National electricity trade data show considerable differences between Member States. In the internal market for electricity, the largest net exporter in the EU-15 is France. The largest net importer of electricity is Italy, followed by The Netherlands and the UK. Germany has a large trade activity, with imports and exports almost in balance.

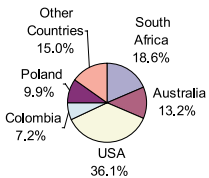
Looking at all 15 EU Member States, a total amount of 195 TWh of electricity was imported and 171 TWh exported. These figures are small compared to the total amount of electricity generated in the EU-15, which was 2 500 TWh in 1999 (see indicator 4.3).

Indicator 2.6 Imports of Energy Products and Country of Origin

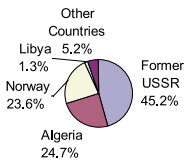
Crude Oil 1990



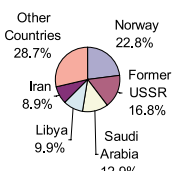
Hard Coal 1990



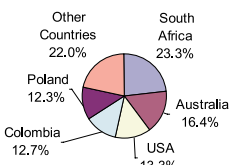
Natural Gas 1990



Crude Oil 1999



Hard Coal 1999



Natural Gas 1999

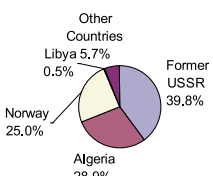


Table 2.6 Imports of Energy Products and Country of Origin

kilotonnes (kt)	Crude Oil	
	1990	1999
Norway	52 374	107 459
Former USSR	37 512	79 081
Saudi Arabia	49 691	61 025
Libya	50 908	46 607
Iran	55 595	41 981
Other Countries	178 970	135 089
Total	425 050	471 242

Data Source: Eurostat, Energy Statistics

kilotonnes (kt)	Hard Coal	
	1990	1999
South Africa	23 970	35 189
Australia	16 985	24 692
USA	46 548	20 023
Colombia	9 248	19 195
Poland	12 771	18 640
Other Countries	19 265	33 224
Total	128 787	150 963

Data Source: Eurostat, Energy Statistics

Terajoules (TJ)	Natural Gas	
	1990	1999
Former USSR	1 972 001	2 918 580
Algeria	1 077 541	2 122 014
Norway	1 030 691	1 837 989
Libya	58 029	40 329
Other Countries	229 225	421 047
Total	4 367 487	7 339 959

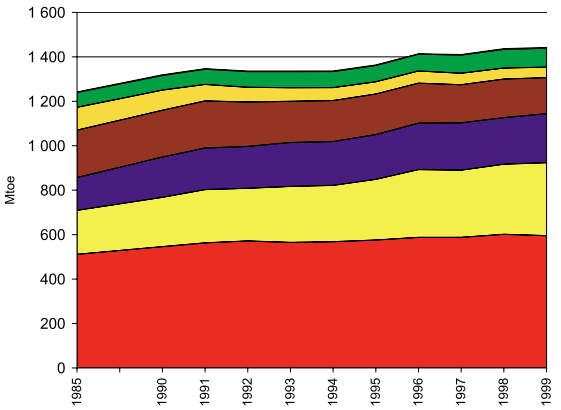
Data Source: Eurostat, Energy Statistics

Gross oil imports into the EU-15 from Norway, the (former) USSR and Saudi Arabia all increased substantially between 1990 and 1999, and together now account for 52.5% of the total imports from non EU countries (33% in 1990). Imports from all other countries fell over the same period. Overall oil imports remained at a similar level (see indicator 2.2).

Coal imports from countries producing cheaper and/or low sulphur coal (Indonesia, Colombia, Canada, South Africa and Poland) all increased substantially between 1990 and 1999, while imports from the USA declined. Total imports of all solid fuels grew by 13.6% over the same period (see indicator 2.2).

Imports of gas into the EU-15 from non EU Member States increased by 60% from 1990 to 1999 (see indicator 2.3). Imports from all supplying countries grew to meet increased consumer demand. However, the relative share of the (former) USSR diminished while the relative share of Algeria increased following the construction of new pipelines. The countries of the former USSR remain the EU's largest natural gas suppliers.

Indicator 2.7 Gross Inland Consumption, by Fuel



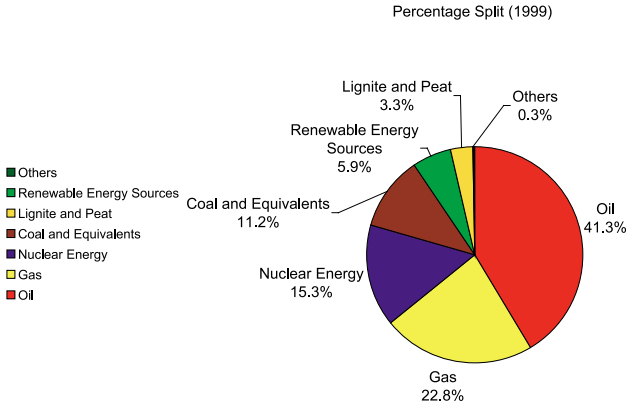


Table 2.7 Gross Inland Consumption, by Fuel

Thousand tonnes of oil equivalent(ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Oil	511 428	545 795	562 875	571 427	564 747	567 903	575 602	587 543	587 653	601 418	595 313	41.3%
Gas	197 965	222 052	239 693	237 113	252 230	253 635	273 351	305 137	302 540	315 499	328 302	22.8%
Nuclear Energy	147 378	181 439	187 021	188 267	197 558	197 271	201 239	208 864	212 615	209 664	220 502	15.3%
Coal and Equivalents	213 263	210 072	212 049	199 931	185 383	184 558	182 284	179 919	171 637	173 447	162 205	11.2%
Renewable Energy Sources	67 026	65 690	68 769	70 690	72 279	72 499	73 203	75 736	81 422	84 269	84 579	5.9%
Lignite and Peat	102 887	91 111	74 246	66 237	61 195	58 065	55 458	54 983	51 872	49 706	47 506	3.3%
Others	1 979	3 080	1 952	2 485	2 820	2 506	2 660	1 163	2 580	2 904	4 026	0.3%
Total	1 241 926	1 319 239	1 346 605	1 336 150	1 336 212	1 336 437	1 363 797	1 413 345	1 410 319	1 436 907	1 442 433	100.0%
Index (1990 = 100%)	94.4	100.0	102.1	101.3	101.3	101.3	103.3	107.1	106.9	108.9	109.3	

Data Source: Eurostat, Energy Statistics

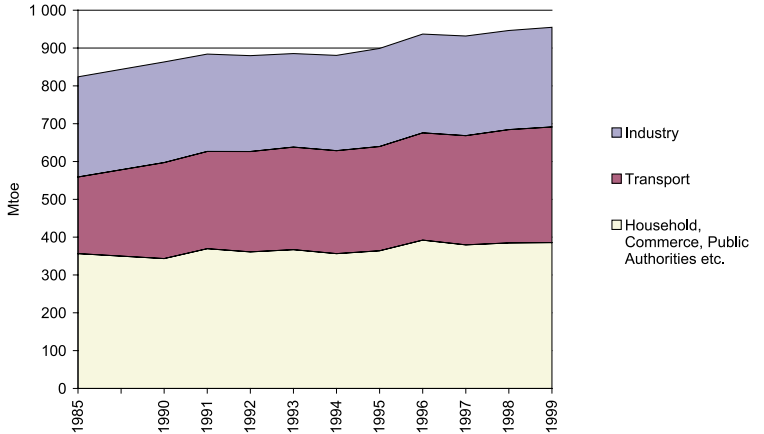
Note: *Gross inland consumption is the quantity of energy consumed within the borders of a country. "Others" contains the EU net electricity imports and the gross inland consumption of other fuels (mostly industrial waste).*

The total gross inland consumption of energy across the EU-15 increased by 9.3% between 1990 and 1999. However, the structure of this consumption changed considerably. The biggest change was in the gross inland consumption of gas, which grew by 47.8% over the observation period. There were also increases in the consumption of renewable energy (28.8%), nuclear energy (21.5%) and oil (9.1%) as well as energy from other sources. In contrast, the gross inland consumption of lignite and peat fell by 47.9% and the consumption of coal and equivalents fell by 22.8%.

Oil took the greatest share of total gross inland consumption in 1999 (41.3%), despite some volatility during the observation period. The share of gas increased from 16.8% to 22.8% of the total inland consumption over the same period, while nuclear power rose from 13.8% to 15.3%. In contrast, the share of coal and equivalents fell from 15.9% to 11.2% and the share of lignite and peat from 6.9% to 3.3%. Despite an increase in the gross inland consumption of energy from renewable sources, it still accounts for only 5.9% of total consumption.

3 Final Energy Consumption

Indicator 3.1 Final Energy Consumption, by Sector



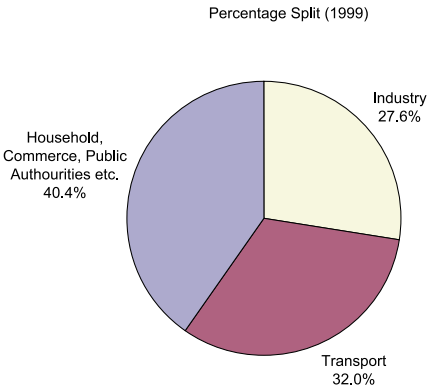


Table 3.1 Final Energy Consumption, by Sector

Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Household, Commerce, Public Authorities, etc.	356 343	343 411	369 525	361 043	366 920	356 425	363 933	392 187	379 536	384 794	385 564	40.4%
Transport	202 622	253 843	257 122	265 361	271 208	272 232	275 741	283 449	288 855	299 529	305 827	32.0%
Industry	264 892	266 007	257 337	253 496	247 306	251 957	259 263	261 292	263 441	262 123	263 456	27.6%
Total	823 857	863 261	883 984	879 900	885 434	880 614	898 937	936 928	931 832	946 446	954 847	100.0%
Index (1990 = 100%)	95.4	100.0	102.4	101.9	102.6	102.0	104.1	108.5	107.9	109.6	110.6	

Data Source: Eurostat, Energy Statistics

Note: *Final Energy Consumption is the energy actually consumed by end-users. It is lower than the Gross Inland Consumption (indicator 2.7), which is the total supply of energy available for transformation into other products or for final consumption.*

Total final energy consumption across the EU-15 increased by 10.6% over the years 1990 to 1999. After a period of relative stability in the early 1990s, final consumption has grown steadily since 1994. The consumption peak in 1996 was due to a relatively severe winter in Europe.

Industry was the only sector where final energy consumption fell over the period from 1990 to 1999, although this fall was just 1%. Industry accounted for 30.8% of total consumption in 1990 but by 1999 this relative share had fallen to 27.6%, reflecting, among other reasons, improvements in energy efficiency.

Final energy consumption in the transport sector increased steadily, and by 1999 was 20.5% higher than in 1990. This reflects the growth in travel (particularly by road and air) over the observation period. The households, commerce and public sector remains the largest final energy consuming sector, accounting for 40.4% of the total in 1999 compared to 39.8% in 1990. In absolute terms, this represents a 12.3% increase in consumption over the observation period.

Indicator 3.2 Ratio of Final Energy Consumption to Gross Inland Energy Consumption

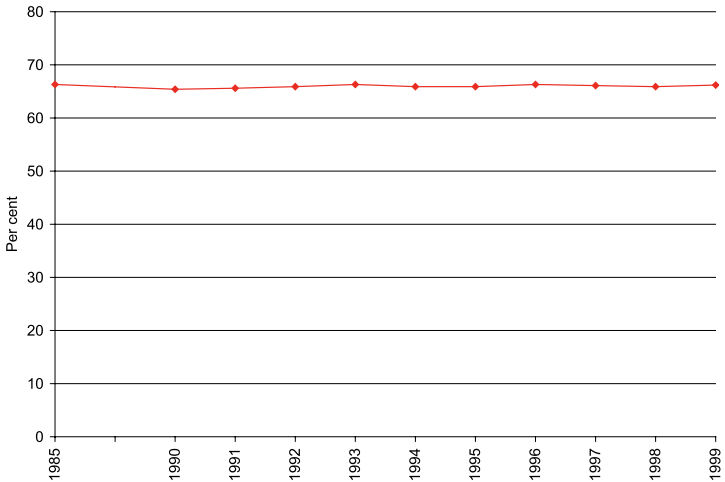


Table 3.2 Ratio of Final Energy Consumption to Gross Inland Energy Consumption

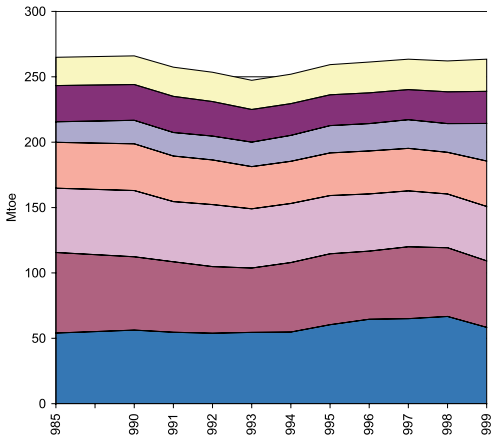
Per cent (%)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Final Energy Consumption / Gross Inland Energy Consumption	66.3	65.4	65.6	65.9	66.3	65.9	65.9	66.3	66.1	65.9	66.2
Index (1990 = 100%)	101.4	100	100.3	100.8	101.4	100.8	100.8	101.4	101.1	100.8	101.2

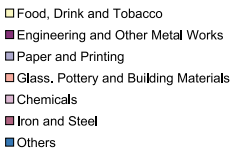
Data Source: Eurostat, Energy Statistics

Note: *The difference between Gross Inland Energy Consumption (GIC) and Final Energy Consumption (FEC) is accounted for mainly by losses incurred during energy conversion processes (e.g. electricity generation from fossil fuels), by distribution losses (e.g. in electricity transmission), and by the consumption of energy by the energy industry itself. In addition , a small quantity of energy products are used for non-energy purposes.*

The ratio of FEC to GIC remained relatively stable throughout the period from 1990 to 1999, ranging between 65.4% in 1990 to 66.3% in 1993 and 1996. This is also true for the following years with a ratio of 66.2% in 1999 being slightly higher than the value observed in 1990.

Indicator 3.3 Final Energy Consumption, by Industrial Sector





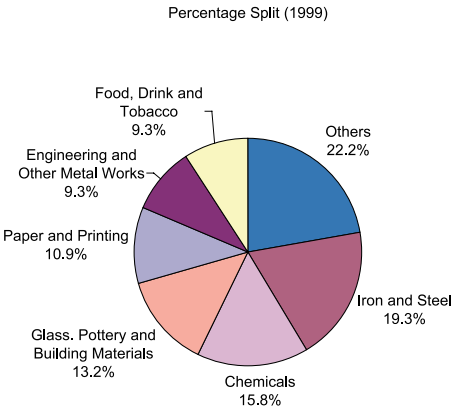


Table 3.3 Final Energy Consumption, by Industrial Sector

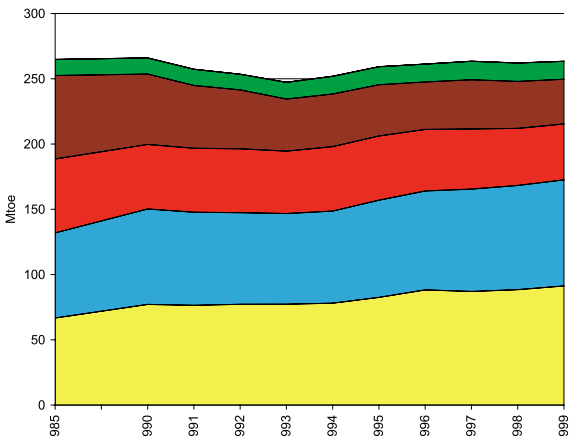
Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Iron and Steel	61 580	56 108	53 891	50 966	49 209	53 136	54 222	52 057	54 977	52 538	50 826	19.3%
Chemicals	49 167	50 640	46 044	47 404	45 321	45 178	44 575	43 777	42 795	41 117	41 619	15.8%
Glass, Pottery and Building Materials	35 062	35 750	34 818	34 161	32 239	32 260	32 588	32 826	32 511	31 850	34 759	13.2%
Paper and Printing	15 719	17 980	18 021	18 260	18 770	19 869	20 857	20 930	21 908	21 985	28 746	10.9%
Food, Drink and Tobacco	21 589	21 937	22 324	22 436	22 319	22 475	23 022	23 571	23 248	23 639	24 592	9.3%
Engineering and Other Metal Works	27 723	27 341	27 607	26 387	24 934	24 258	23 602	23 534	23 001	24 276	24 544	9.3%
Others	54 052	56 251	54 632	53 882	54 514	54 781	60 397	64 597	65 001	66 718	58 370	22.2%
Total	264 892	266 007	257 337	253 496	247 306	251 957	259 263	261 292	263 441	262 123	263 456	100.0%
Index (1990 = 100%)	99.6	100.0	96.7	95.3	93.0	94.7	97.5	98.2	99.0	98.5	99.0	

Data Source: Eurostat, Energy Statistics

All of the more energy intensive industrial sectors showed significant reductions in final energy consumption over the period from 1990 to 1999. Consumption in the iron and steel sector fell by 9.4%, but this sector remains the largest energy consumer with 19.3% of the total final consumption in industry compared to 21.1% in 1990. Consumption in the chemicals sector declined by 17.8% over the same period, while consumption in the glass, pottery and building materials sector and the less energy intensive engineering sector also fell by 2.8% and 10.2% respectively.

In contrast, final energy consumption in other industrial sectors increased over the same period. In the paper and printing sector final energy consumption rose by 59.9% between 1990 and 1999. Consumption in the food, drink and tobacco sector increased by 13.7% and in other sectors (not separately classified) by 3.8%.

Indicator 3.4 Final Energy Consumption in Industry, by Fuel



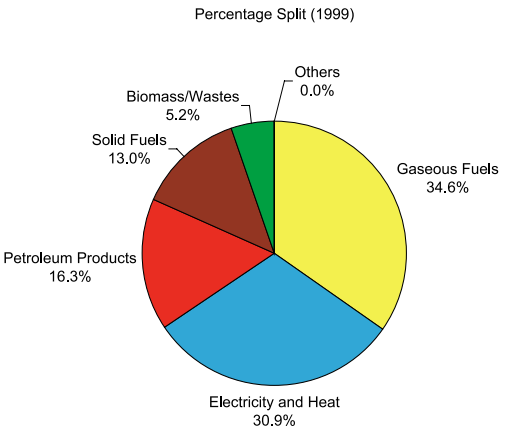


Table 3.4 Final Energy Consumption in Industry, by Fuel

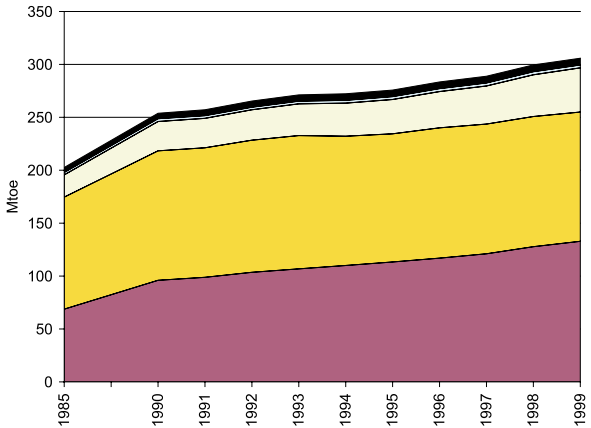
Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Gaseous Fuels	66 712	77 160	76 435	77 248	77 302	78 106	82 532	88 238	87 053	88 442	91 260	34.6%
Electricity and Heat	65 189	73 111	71 321	70 186	69 456	70 566	74 447	75 812	78 427	79 847	81 314	30.9%
Petroleum Products	56 622	49 437	48 997	48 924	47 791	49 347	49 214	47 158	46 052	43 694	42 812	16.3%
Solid Fuels	63 945	53 904	48 132	45 150	39 926	40 350	39 225	36 341	37 697	35 973	34 260	13.0%
Biomass/Wastes	12 342	12 366	12 426	11 967	12 816	13 573	13 831	13 730	14 199	14 154	13 764	5.2%
Others	82	29	26	21	15	15	14	13	13	13	46	0.0%
Total	264 892	266 007	257 337	253 496	247 306	251 957	259 263	261 292	263 441	262 123	263 456	100.0%

Data Source: Eurostat, Energy Statistics

Over the period from 1990 to 1999 gas accounted for the greatest proportion (31.9%) of final energy consumption in industry, with consumption increasing by 18.3% over the period. Over the same period the consumption of solid fuels fell by 36.4%, and in 1999 it accounted for only 13.0% of the total final energy consumption in industry (20.3% in 1990). The use of petroleum products fell by 13.4%, while the consumption of electricity and heat increased by 11.2%. Although the consumption of biomass and wastes grew by 11.3%, these fuels still account for only 5.2% of the total.

The expansion in the use of gas relative to solid fuels and petroleum products reflects the operational benefits that it offers. These include convenience, cleanliness and efficiency, as well as (in many cases) lower costs.

Indicator 3.5 Final Energy Consumption in Transport, by Fuel



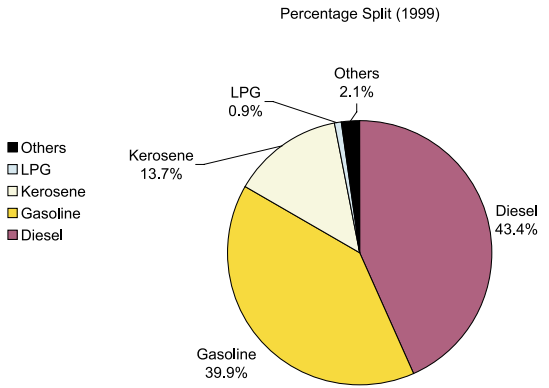


Table 3.5 Final Energy Consumption in Transport, by Fuel

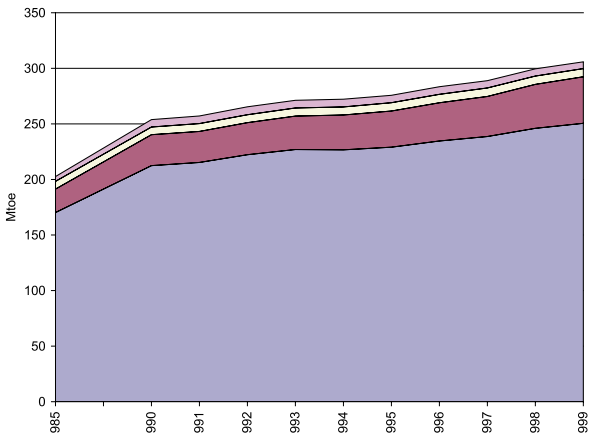
Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Diesel	68 742	95 991	98 824	103 545	106 796	109 995	113 329	116 918	121 043	127 749	132 811	43.4%
Gasoline	105 880	122 318	122 417	124 871	125 979	122 177	121 077	123 130	122 588	122 989	122 164	39.9%
Kerosene	21 007	27 717	27 783	28 717	29 971	31 249	32 435	34 281	35 986	39 428	41 801	13.7%
LPG	2 314	2 688	2 617	2 482	2 564	2 690	2 772	2 810	2 897	2 981	2 768	0.9%
Others	4 679	5 129	5 481	5 746	5 898	6 122	6 128	6 309	6 341	6 383	6 282	2.1%
Total	202 622	253 843	257 122	265 361	271 208	272 232	275 741	283 449	288 855	299 529	305 827	100.0%
Index (1990= 100%)	79.8	100.0	101.3	104.5	106.8	107.2	108.6	111.7	113.8	118.0	120.5	

Data Source: Eurostat, Energy Statistics

During the last decade the relative contribution by the fuels listed to the total final energy consumption in transport has changed considerably. Between 1990 and 1999 diesel fuel gained market share (with an increase of 38.4%), taking its share of the total consumption from 37.8% to 43.4%. Over the same period the final consumption of gasoline remained broadly constant in absolute terms, while in 1999 it accounted for 39.9% of the total fuels consumed compared to 48.2% in 1990. Diesel and gasoline are used mainly for road transport, although diesel is also used in inland navigation and rail transport These structural changes reflect the increasing market share of diesel-fuelled road vehicles.

Kerosene is used almost exclusively as an aircraft fuel; its consumption increased by 50.8% between 1990 and 1999 in line with the growth in air traffic (see indicator 3.6). LPG consumption increased by 3.0% between 1990 and 1999, but its share of the total remains small at around 1%.

Indicator 3.6 Final Energy Consumption, by Mode of Transport



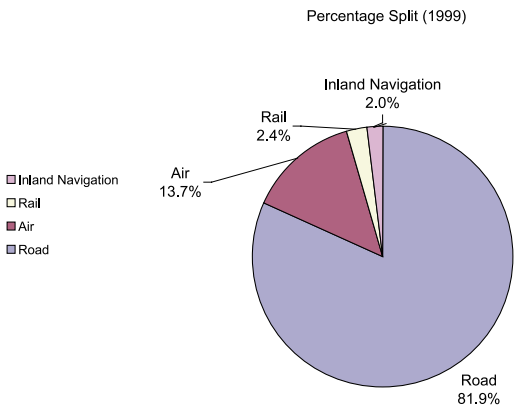


Table 3.6 Final Energy Consumption, by Mode of Transport

Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Road	170 205	212 455	215 315	222 285	226 928	226 665	229 038	234 611	238 625	246 003	250 500	81.9%
Air	21 098	27 818	27 877	28 796	30 049	31 303	32 545	34 367	36 060	39 519	41 915	13.7%
Rail	6 966	6 887	7 097	7 151	7 331	7 295	7 470	7 604	7 649	7 527	7 354	2.4%
Inland Navigation	4 353	6 683	6 833	7 129	6 900	6 969	6 688	6 867	6 521	6 480	6 058	2.0%
Total	202 622	253 843	257 122	265 361	271 208	272 232	275 741	283 449	288 855	299 529	305 827	100.0%
Index (1990= 100%)	79.8	100.0	101.3	104.5	106.8	107.2	108.6	111.7	113.8	118.0	120.5	

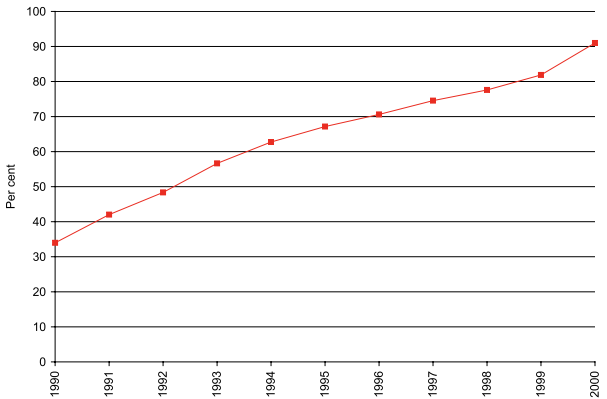
Data Source: Eurostat, Energy Statistics

All modes of transport except inland navigation showed substantial increases in energy consumption over the period from 1990 to 1999. Over this period total final energy consumption for transport services grew by 20.5%.

Road transport consumes by far the largest share, accounting for 81.9% of the total in 1999 (83.7% in 1990). Although final energy consumption for road transport increased by 17.9% over the period, the growth in the air sector was no less than 50.7%. As a result, air transport in 1999 accounted for 13.7% of total transport consumption compared to an 11.0% share in 1990.

Final energy consumption for rail transport increased by 6.8% between 1990 and 1999, while final energy consumption by inland navigation fell by 9.4%. However, in 1999 rail and inland navigation together accounted for only 4.4% of the total final energy consumption in transport.

Indicator 3.7 Inland Deliveries of Unleaded Motor Spirit



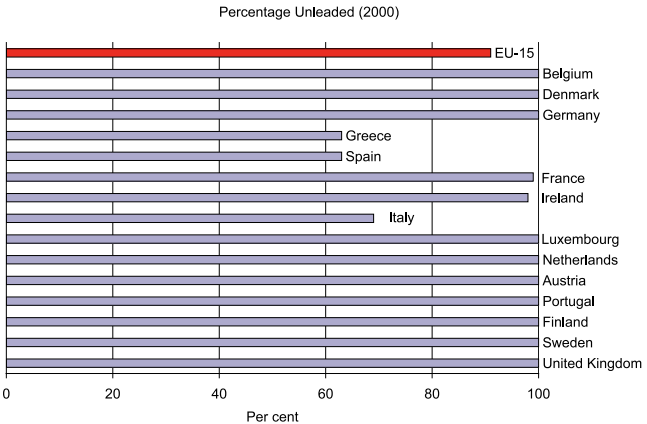


Table 3.7 Inland Deliveries of Unleaded Motor Spirit

Per cent (%)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Unleaded Gasoline/Total Gasoline	34	42	48	57	63	67	71	75	78	82	91

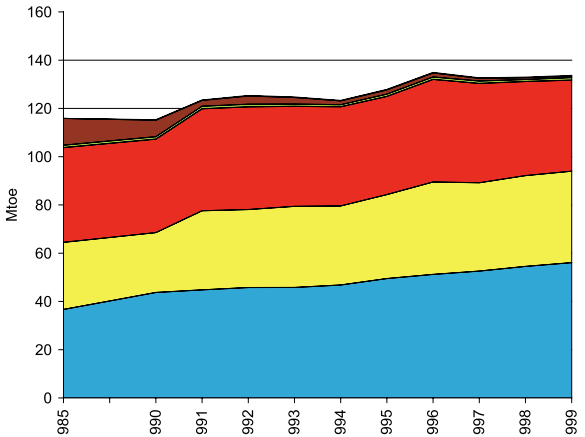
Data Source: Eurostat, Energy Statistics

Across the EU-15, the conversion from leaded to unleaded motor spirit has increased steadily over the last decade. By 1999 unleaded petrol accounted for 82% of the total inland deliveries, although there remained marked differences between Member States.

The percentage of unleaded motor spirit had increased to 91% by 2000. In 10 of the 15 Member States only unleaded motor spirit was delivered. While there was a considerably lower conversion rate in Spain, Greece and Italy, in all of these countries the ratios were higher than in 1998.

In order to encourage conversion, in many Member States unleaded motor spirit was taxed at a lower rate than leaded fuel, particularly during the early 1990s. However, now that conversion is substantially complete, this tax differential has been reduced in many countries (see indicators 7.7 and 7.8).

Table 3.8 Final Energy Consumption in Services and Agriculture, by Fuel



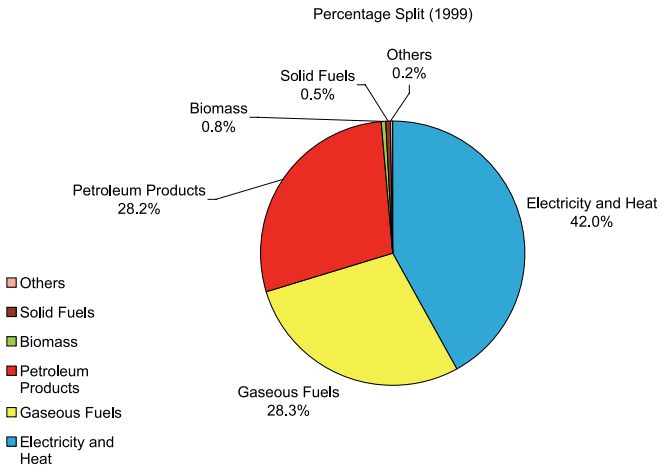


Table 3.8 Final Energy Consumption in Services and Agriculture, by Fuel

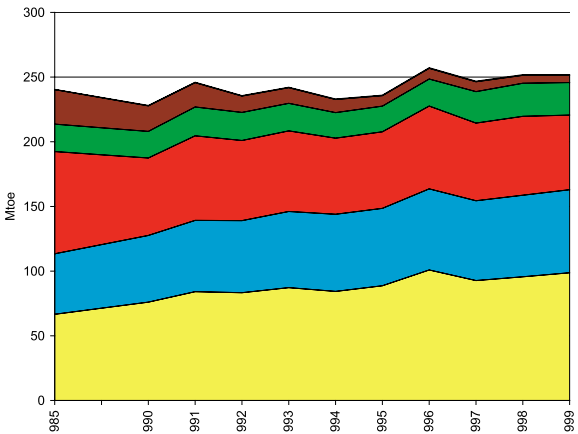
Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Electricity and Heat	36 681	43 706	44 802	45 766	45 799	46 812	49 486	51 210	52 579	54 509	56 083	42.0%
Gaseous Fuels	27 809	24 826	32 785	32 319	33 620	32 748	34 806	38 290	36 593	37 649	37 885	28.3%
Petroleum Products	39 275	38 718	42 246	42 563	41 454	41 114	40 674	42 522	41 166	38 985	37 756	28.2%
Biomass	1 003	1 032	1 080	1 098	921	850	954	1 011	1 027	847	1 076	0.8%
Solid Fuels	11 071	6 855	2 405	3 409	2 737	1 600	1 747	1 670	1 105	720	620	0.5%
Others	11	189	184	206	201	202	214	223	230	233	259	0.2%
Total	115 849	115 326	123 501	125 361	124 732	123 326	127 881	134 926	132 700	132 943	133 679	100.0%
Index (1990 = 100%)	100.5	100.0	107.1	108.7	108.2	106.9	110.9	117.0	115.1	115.3	115.9	

Data Source: Eurostat, Energy Statistics

The final energy consumption in the services and agriculture sectors increased by 15.9% over the period from 1990 to 1999. The final consumption in these sectors accounted for 14.0% of consumption across all sectors in 1999. Like the household sector (see indicator 3.9), the final energy consumption of these sectors is mainly related to space heating and electricity consumption for building services.

The consumption of solid fuels fell by over 90% between 1990 and 1999; in the latter year it accounted for less than 1% of the total final consumption (5.9% in 1990). In contrast, the consumption of gas increased by 52.6% and has now overtaken the use of petroleum products (which actually fell by 2.5%) to become the most significant fuel apart from electricity. This reflects the increasing use of gas as a cleaner, more efficient and (often) cheaper fuel for heating buildings. The consumption of electricity and heat increased by 28.3% over the same period, and accounts for 42.0% of total final energy consumption in the sectors in question. This is due to a growth in electricity consumption for heating, lighting and other electrical equipment. The use of petroleum products remained relatively stable over the observation period, as did the use of biomass. However, in 1999 petroleum products accounted for 28.2% of the total final energy consumption of the sectors, while biomass accounted for only 0.8%.

Indicator 3.9 Final Energy Consumption in Households, by Fuel



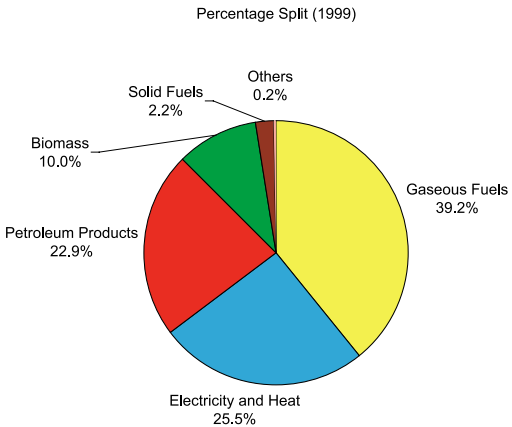


Table 3.9 Final Energy Consumption in Households, by Fuel

Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Gaseous Fuels	66 627	76 039	84 126	83 305	87 232	84 319	88 664	100 897	92 723	95 595	98 715	39.2%
Electricity and Heat	46 757	51 544	55 107	55 697	58 853	59 649	59 833	62 689	61 665	63 066	64 221	25.5%
Petroleum Products	79 043	59 861	65 380	61 959	62 310	58 790	59 189	64 008	60 059	61 019	57 671	22.9%
Biomass	21 185	20 576	22 278	21 701	21 329	19 780	19 861	20 906	24 282	25 543	25 204	10.0%
Solid Fuels	26 711	19 754	18 791	12 670	12 093	10 156	8 086	8 294	7 646	6 153	5 608	2.2%
Others	172	311	343	350	371	405	419	467	461	475	466	0.2%
Total	240 494	228 085	246 024	235 682	242 188	233 099	236 052	257 261	246 836	251 851	251 885	100.0%
Index (1990 = 100%)	105.4	100.0	107.9	103.3	106.2	102.2	103.5	112.8	108.2	110.4	110.4	

Data Source: Eurostat, Energy Statistics

Final household energy consumption increased by 10.4% between 1990 and 1999, and now accounts for 26.4% of the total final consumption across all sectors. The household sector mainly uses energy for space heating, water heating, lighting and other building services.

Over the period from 1990 to 1999 gas remained the dominant fuel in this sector, with final consumption increasing by 29.8% so that in 1999 it accounted for 39.2% of the total final energy consumption. In contrast, the consumption of solid fuels fell by 71.6%, declining from 8.7% of the total in 1990 to only 2.2% in 1999. The final energy consumption of petroleum products fell by 3.7% over the same period. As in the agriculture and services sector, this resulted mainly from fuel switching due to the better performance, improved availability and lower price of gas.

The consumption of electricity and heat in the household sector increased by 24.6% over this period, again reflecting increased use of power-consuming services. The use of biomass as a fuel increased by 22.5%, and in 1999 accounted for 10.0% of total final energy consumption in the sector.

4 Energy Industry

Indicator 4.1 Employment in the Energy Sector

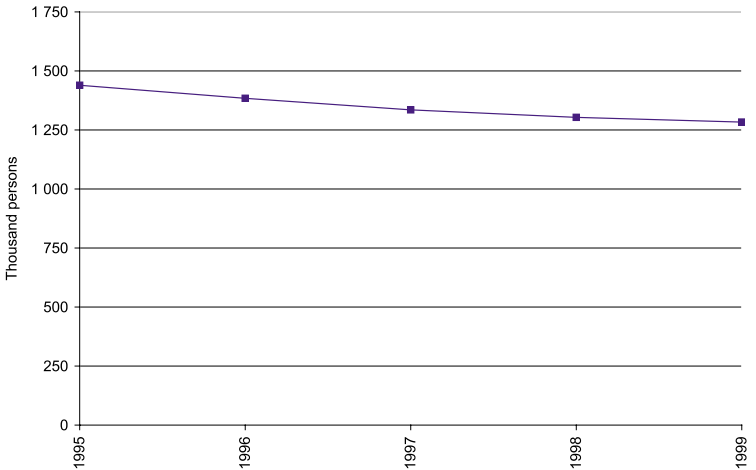


Table 4.1 Employment in the Energy Sector

Thousand persons	1995		1996		1997		1998		1999
Employment in the Energy Sector	1 439		1 384		1 335		1 303		1 283
Share of Industrial Employment	5.2%		4.8%		4.7%		4.5%		4.4%

Data Source: Eurostat, Structural Business Statistics

Definition: *The Energy Sector covers the economic activities of the NACE divisions 10, 11, 12, 23 and 40 (see also annex A on methodology). Industry is defined as mining and quarrying, manufacturing, electricity, gas and water supply (= NACE sections C,D,E).*

Employment in the energy sector dropped by 10.8% between 1995 and 1999, an average fall of 2.8% per annum. Employment in the energy sector also fell more rapidly than employment in industry as a whole over the same period, with the energy sector's share of total industrial employment falling by 0.8 percentage points. This occurred despite the reduction in employment across the industry that resulted (in part) from improved efficiency in many of the more labour-intensive sectors.

Indicator 4.2 Value Added of the Energy Sector

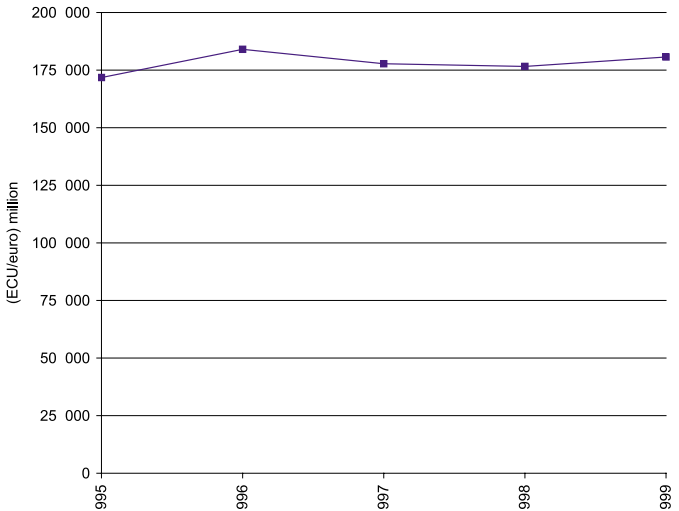


Table 4.2 Value Added of the Energy Sector

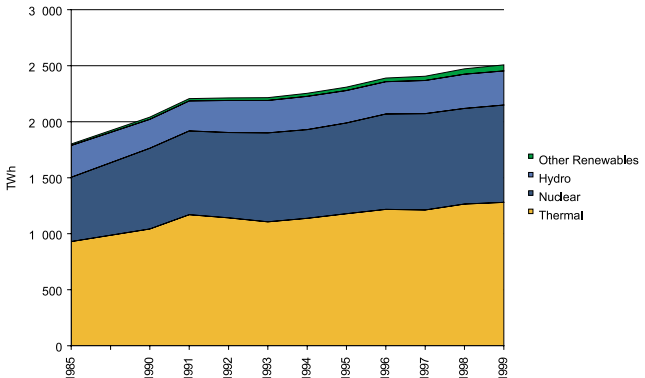
(ECU/euro) million	**1995**		**1996**		**1997**		**1998**		**1999**
Value Added by the Energy Sector	171 757		184 028		177 764		176 592		180 682
Share of Industrial Value Added	13.4%		13.4%		12.4%		12.0%		11.9%

Data Source: Eurostat, Structural Business Statistics

Definition: *Value Added at factor cost (in current prices) is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. The Energy Sector covers the economic activities of the NACE divisions 10, 11, 12, 23 and 40 (see also annex A on methodology). Industry is defined as mining and quarrying, manufacturing, electricity, gas and water supply (NACE sections C,D,E).*

The value added generated by the energy sector increased by 5.2% in absolute terms between 1995 and 1999 (i.e. by 1.3% p.a. on average). However, it rose by 7.1% from 1995 to 1996 and then declined for the next two years. This reflects a steep fall in the value added in the mining and quarrying of solid fuels as well as other factors. Over the same period total industrial added value saw a rise of 18.4%, so that the share of value added by the energy sector actually fell from 13.4% to 11.9%.

Indicator 4.3 Power Station Generation, by Type



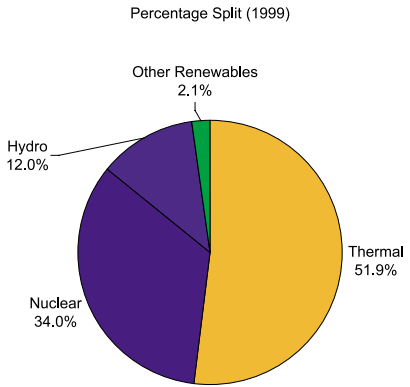


Table 4.3 Power Station Generation, by Type

Gigawatt-hours (GWh)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Thermal	1 043 085	1 159 414	1 182 800	1 160 296	1 125 987	1 153 546	1 204 212	1 244 674	1 243 163	1 300 468	1 323 231	51.9%
Nuclear	575 023	720 189	747 352	759 925	794 284	791 953	810 266	851 200	859 893	854 182	867 244	34.0%
Hydro	283 781	259 048	268 456	285 944	289 379	296 969	290 128	288 591	296 016	305 445	304 735	12.0%
Other Renewables	13 455	19 431	20 229	22 370	24 975	27 336	30 190	32 845	38 626	47 403	53 788	2.1%
Total	1 915 344	2 158 082	2 218 837	2 228 535	2 234 625	2 269 804	2 334 796	2 417 310	2 437 698	2 507 498	2 548 998	100.0%

Data Source: Eurostat, Energy Statistics

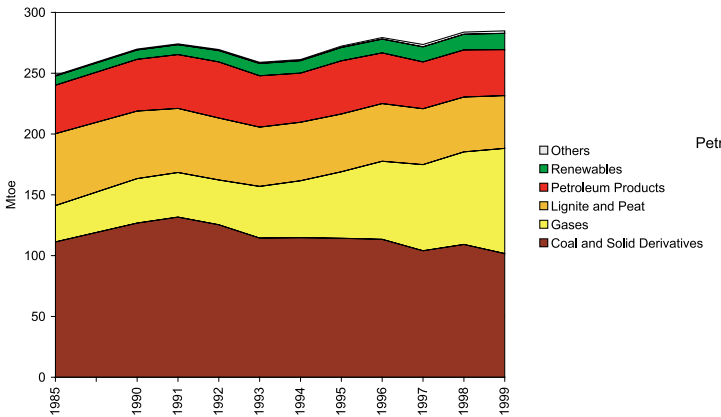
Definition: *Power station generation covers the total amount of electricity generated, measured at the output terminals of the main generators. For thermal and nuclear power generation the whole data series shown covers Germany after reunification (i.e. including Eastern Germany).*

Between 1990 and 1999 the total amount of electricity generated across the EU-15 rose by 18.1%, an average of 1.9% p.a. The increase from 1990 to 1991 was followed by a period of low growth, during the recession of the early 1990s. Since 1994 steady year-on-year growth is observed.

Thermal power stations have consistently accounted for just over half of the total electricity generated. In 1990 they accounted for 53.7% and in 1999 they accounted for 51.9% of the total electricity generated.

The output from nuclear power stations has risen steadily with a 20.4% total increase between 1990 and 1999. However, the share of total electricity generation accounted for by nuclear electricity remained rather stable between 1990 and 1999 (at 33.4% in 1990 and 34.0% in 1999). The amount of hydroelectricity generated in the EU-15 increased by 17.6% between 1990 and 1999. However, its contribution to the total power station generation remained broadly constant at around 12%. In contrast, the amount of electricity generated from other renewable energy sources has seen the most rapid growth, increasing by no less than 177.6% between 1990 and 1999, although it still accounted for only 2.1% of the total.

Indicator 4.4 Fuel Inputs to Thermal Power Stations



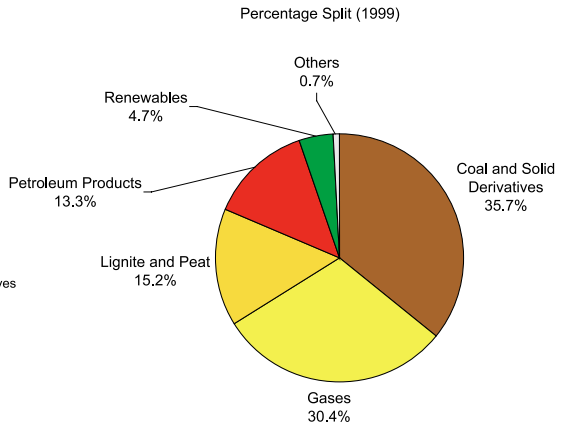


Table 4.4 Fuel Input to Thermal Power Stations

Thousand tonnes of oil equivalent (ktoe)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Coal and Solid Derivatives	111 251	126 800	131 671	125 383	114 440	114 742	114 279	113 432	104 020	109 190	101 713	35.7%
Gases	29 904	36 530	36 708	36 839	42 462	46 843	54 646	64 156	70 825	76 091	86 496	30.4%
Lignite and Peat	59 123	55 518	52 678	50 945	48 744	48 081	47 541	47 430	45 953	45 146	43 353	15.2%
Petroleum Products	39 864	42 552	44 274	46 114	42 253	40 398	43 713	41 670	38 489	38 733	37 814	13.3%
Renewables	7 525	7 729	8 094	9 338	10 106	10 231	10 942	11 350	12 399	12 900	13 423	4.7%
Others	653	747	733	870	939	955	1 163	1 298	1 903	1 763	2 007	0.7%
Total	248 320	269 876	274 158	269 489	258 944	261 250	272 284	279 336	273 589	283 823	284 806	100.0%
Total (TWh)	2 888	3 139	3 188	3 134	3 012	3 038	3 167	3 249	3 182	3 301	3 312	

Data Source: Eurostat, Energy Statistics

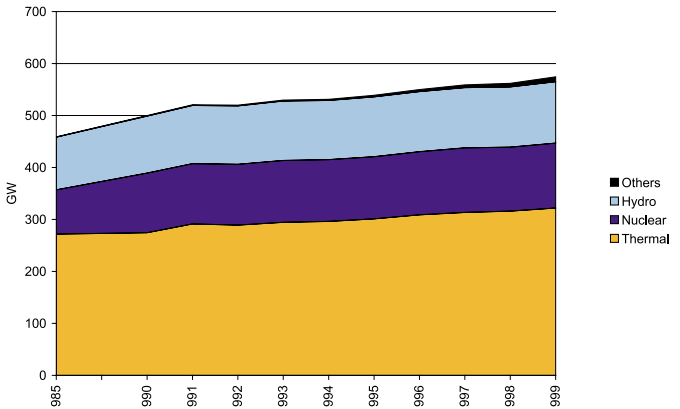
Definition: *Fuel input to thermal power stations comprises fuels used both in plants producing only electricity and in combined heat and power plants.*

Overall, fuel input to thermal power stations rose by 5.5% between 1990 to 1999. As the amount of electricity generated at thermal power stations increased by 14.1% over the same period (see indicator 4.3), large efficiency gains were achieved in thermal power stations.

Part of these efficiency gains were due to the wider use of gas as a fuel. The consumption of gas increased by 136.8% between 1990 and 1999, and by 13.7% in 1999 alone (compared to 1998). Gas accounted for over 30% of the total fuel input to thermal power stations in 1999. In contrast, the consumption of solid fuels (coal and solid derivatives, lignite and peat) fell by 20.4% between 1990 and 1999; in 1999 this consumption accounted for only just over half of the total fuel input compared to 67.6% in 1990.

The use of oil (petroleum products) in thermal power stations rose in the early 1990s, and peaked in 1992. Since then it declined steadily, falling by 11.1% overall between 1990 and 1999. The input of renewable fuels has grown by 73.7% between 1990 and 1999; however in 1999 these fuels accounted for only 4.7% of the total fuel input to thermal power stations.

Indicator 4.5 Installed Capacity of Electricity Generation Plant, by Type



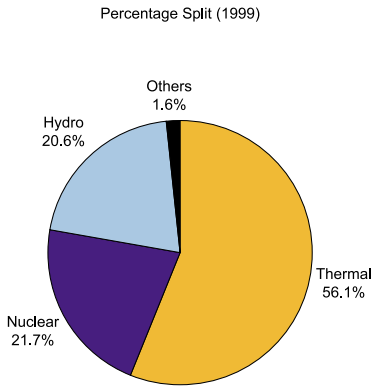


Table 4.5 Installed Capacity of Electricity Generation Plants, by Type

Megawatts (MW)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Thermal	271 850	274 500	291 356	289 131	294 577	296 333	301 114	308 888	313 509	316 010	322 104	56.1%
Nuclear	85 062	114 670	116 004	117 003	118 850	118 718	119 560	121 449	124 180	123 130	124 700	21.7%
Hydro	101 480	109 764	112 070	112 356	114 499	113 956	115 223	115 708	115 985	115 962	118 241	20.6%
Others	500	993	1 237	1 396	1 742	2 183	2 982	3 926	5 189	6 851	9 422	1.6%
Total	458 892	499 927	520 667	519 886	529 668	531 190	538 879	549 971	558 863	561 953	574 467	100.0%

Data Source: Eurostat, Energy Statistics

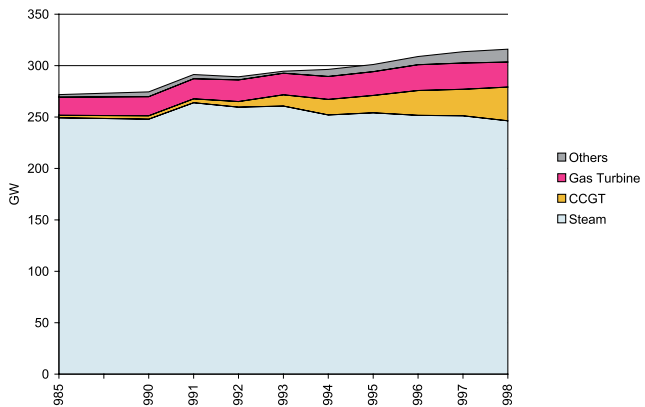
Definition: *The installed capacity of an electrical generator is its maximum instantaneous output throughout a given period of operation. "Others" includes wind, solar and geothermal installed capacity. For all data series shown, a break in series can be observed from 1990 to 1991 due to the inclusion of Eastern Germany from 1991 onwards.*

The total installed capacity of electricity generation plants increased by 14.9% over the period 1990 to 1999. This growth should be viewed in conjunction with the 18.1% growth in electricity generated over the same period (see indicator 4.3).

Installed thermal generation capacity has risen most rapidly, with a 17.3% increase in capacity from 1990 to 1999. It now accounts for 56.1% of total installed capacity, compared to 54.9% in 1990. Installed nuclear generation capacity expanded by 8.7% from 1990 to 1999, to account for 21.7 % of total capacity (22.9% in 1990).

Installed hydroelectric capacity increased by 16.5% from 1985 to 1999. Most of this growth took place in 1990, due to the inclusion of East German power plants. However, there was a 2.0% rise in installed capacity in 1999, following a period of relative stability from 1995 to 1998. Other renewable capacity (i.e. wind and geothermal capacity) expanded by almost 850% between 1990 and 1999, but still contributes only 1.6% of total installed capacity of electricity generation plants.

Indicator 4.6 Installed Capacity of Thermal Power Stations, by Type



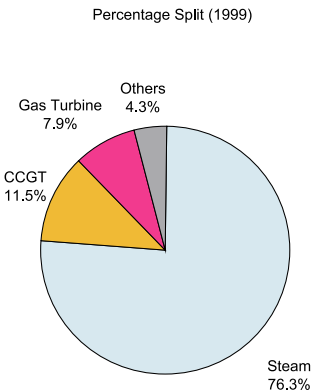


Table 4.6 Installed Capacity of Thermal Power Stations, by Type

Megawatts (MW)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Steam	249 290	247 954	263 924	259 617	260 676	252 043	254 137	251 630	251 223	246 350	245 831	76.3%
CCGT	2 453	3 271	3 792	5 450	10 928	15 122	16 842	24 196	25 774	32 777	37 042	11.5%
Gas Turbine	17 611	18 566	19 535	21 051	20 986	22 309	23 184	25 043	25 544	24 367	25 519	7.9%
Others	2 496	4 709	4 105	3 013	1 987	6 859	6 951	8 019	10 968	12 516	13 712	4.3%
Total	271 850	274 500	291 356	289 131	294 577	296 333	301 114	308 888	313 509	316 010	322 104	100.0%

Data Source: Eurostat, Energy Statistics

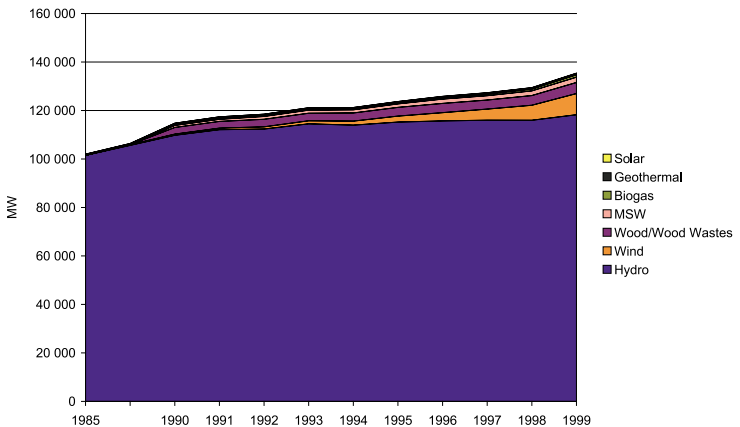
Note: *Traditional thermal power stations operate by producing steam and passing it through steam turbines in order to generate electricity. Gas turbines burn gas in order to generate electricity, but make no further use of the exhaust heat from the process. A higher efficiency is achieved by combining both of these technologies into Combined Cycle Gas Turbines (CCGT).For all data series shown, a break in series can be observed from 1990 to 1991 due to the inclusion of Eastern Germany from 1991 onwards.*

The types of thermal power station making up the installed capacity changed considerably during the reference period 1990 to 1999.

The installed capacity of steam-only generating plant fell by 0.9% over the period 1990 to 1999. There was an increase of 6.4% in 1991 (mainly due to the inclusion of capacity from Eastern Germany), followed by a period of decline. However, steam plants still account for the largest share of total installed capacity (76.3%).

Installed gas turbine capacity rose by 45.0% from 1985 to 1997, but has declined slightly since and in 1999 accounted for 7.9% of total installed capacity of thermal power stations. In contrast, the capacity of the more efficient CCGT plants only accounted for 1.2% of thermal capacity in 1990 but increased more than ten-fold to provide 11.5% of total capacity by 1999.

Indicator 4.7 Installed Capacity of Power Stations Fuelled by Renewables



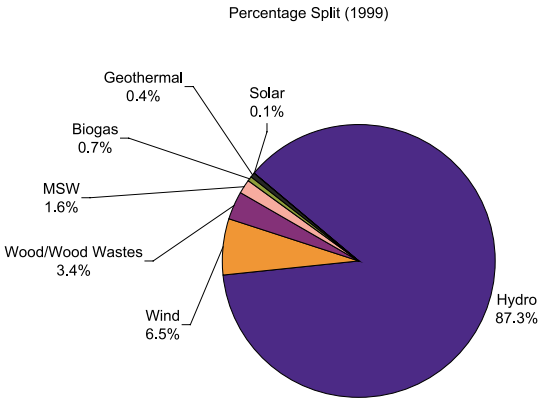


Table 4.7 Installed Capacity of Power Stations Fuelled by Renewables

Megawatts (MW)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Hydro	101 480	109 764	112 070	112 356	114 499	113 956	115 223	115 708	115 985	115 962	118 241	87.3%
Wind	60	483	657	905	1 245	1 674	2 472	3 391	4 600	6 213	8 745	6.5%
Wood/Wood Wastes	-	2 742	2 762	3 120	3 123	3 352	3 574	3 826	3 721	3 981	4 567	3.4%
Municipal Solid Waste (MSW)	-	856	880	1 162	1 293	1 301	1 458	1 784	1 797	1 931	2 189	1.6%
Biogas	-	381	413	437	465	443	466	586	638	719	996	0.7%
Geothermal	440	503	572	476	476	480	480	495	539	559	597	0.4%
Solar	-	7	8	15	21	29	30	40	50	79	80	0.1%
Total	101 980	114 736	117 362	118 471	121 122	121 235	123 703	125 830	127 330	129 444	135 415	100.0%
Index (1990 = 100%)	88.9	100.0	102.3	103.3	105.6	105.7	107.8	109.7	111.0	112.8	118.0	

Data Source: Eurostat, Energy Statistics

Hydropower stations have by far the largest installed capacity of power stations fuelled by renewable energy sources (87.3%). However, hydro has shown the slowest growth with an increase of only 7.7% between 1990 and 1999.

The installed capacity of wind power plants rose most rapidly, particularly in recent years. It was over 18 times higher in 1999 than in 1990, while the percentage increase in wind capacity was 40.7% from 1998 to 1999 compared to increases of around 35% in the two preceding years. Approximately two thirds of this installed wind capacity is located in Germany and Denmark.

Solar capacity has also expanded rapidly, with capacity in 1999 being over 11 times that in 1990. There have also been increases in the installed capacity of plants fuelled by biogas, waste and wood wastes (161.4%, 155.7% and 66.6% respectively). The expansion in geothermal capacity has not been as strong with capacity in 1999 being only 18.7% higher than that in 1990. However, all renewable sources except hydropower remain relatively small-scale contributors to total installed capacity of power stations fuelled by renewables, which in total accounts for only 14.1% of total electricity generation (see indicator 4.3).

Indicator 4.8 Efficiencies of Power Stations, by Type

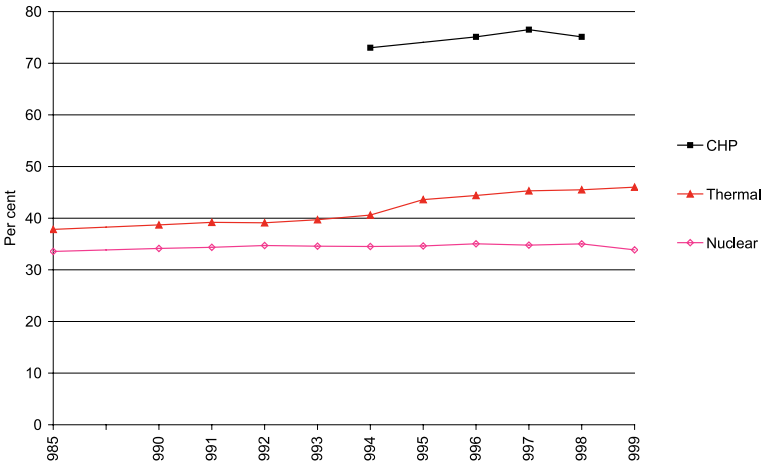


Table 4.8 Efficiencies of Power Stations, by Type

Per cent (%)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CHP	:	:	:	:	:	73.0	:	75.1	76.5	75.1	:
Thermal	37.8	38.7	39.2	39.1	39.7	40.6	43.6	44.4	45.3	45.5	46.0
Nuclear	33.6	34.1	34.4	34.7	34.6	34.5	34.6	35.0	34.8	35.0	33.9

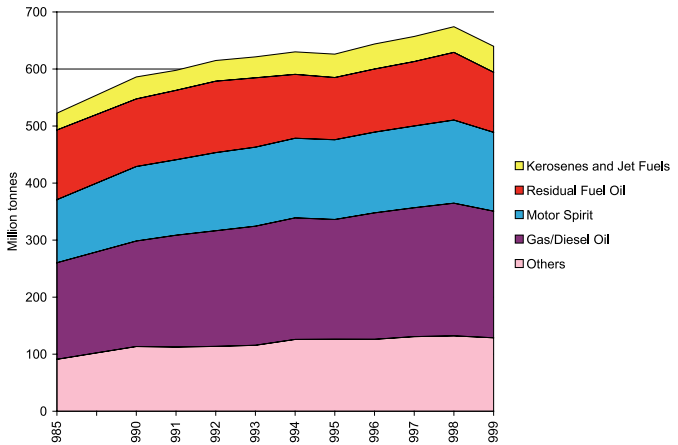
Data Source: Eurostat, Energy Statistics

Definition: *The efficiency of a power station is defined as the gross production of electricity relative to the energy input of the fuel used. In the case of nuclear power, this input is defined as the energy in the steam at entry into the turbines driving the generators. In the case of Combined Heat and Power (CHP) plants, the output is defined as the sum of the heat and electricity output. The CHP data is based on a pilot study and provides only partial coverage.*

The efficiency of thermal power stations has steadily increased, rising from 37.8% in 1985 to 46.0% in 1999. The main reasons for this improvement are fuel switching from solid fuels to gas (see indicator 4.4) and the use of more efficient generation systems, such as combined cycle gas turbines (see indicator 4.6). The efficiency of nuclear power plants fell marginally from 34.1% in 1990 to 33.9% in 1999, although the average efficiency in 1998 (35.0%) was actually higher than in 1990. The lower efficiency level (compared to thermal power plants) reflects the limited opportunities for energy recovery within the nuclear energy production cycle. Similarly, the relatively stable levels of efficiency reflect both the high load factors achieved by most nuclear plants and the lack of investment in new (and potentially more efficient) plants during the observation period.

CHP plants have intrinsically higher overall efficiencies due to their double stage energy utilisation.

Indicator 4.9 Output from Refineries



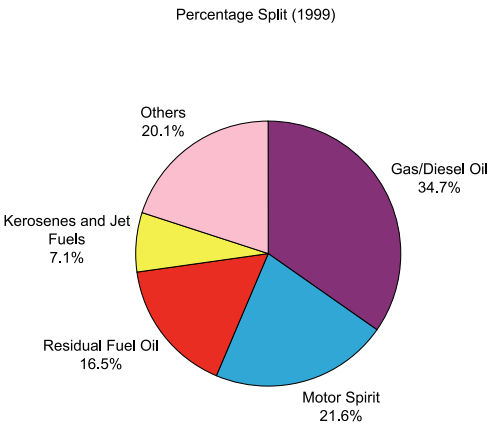


Table 4.9 Output from Refineries

Thousand tonnes (kt)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Gas/Diesel Oil	169 304	184 890	196 014	202 717	208 669	213 153	209 978	221 619	225 897	232 625	221 952	34.7%
Motor Spirit	110 564	130 600	132 311	136 928	138 586	139 569	139 790	141 480	143 355	145 700	138 220	21.6%
Residual Fuel Oil	122 137	118 503	121 725	125 268	121 584	111 992	109 057	110 672	112 902	118 657	105 297	16.5%
Kerosenes and Jet Fuels	29 535	38 471	35 022	36 246	36 746	39 473	40 994	43 854	44 067	44 963	45 571	7.1%
Other	91 060	113 538	112 551	113 724	115 708	125 865	126 217	126 190	130 871	132 137	128 797	20.1%
Total Petroleum Products	522 600	586 002	597 623	614 883	621 293	630 052	626 036	643 815	657 092	674 082	639 837	100.0%

Data Source: Eurostat, Energy Statistics

Definition: *The output from refineries is the production of finished products at the refinery or the blending plant.*

Between 1985 and 1999 total refinery output in the EU-15 increased by 22.4%. However, 1999 was the first year in which there was a considerable decline (5.1%) in refinery output. Reasons include price effects and further efficiency gains in the consuming sectors. The only fuel with a higher output in 1999, compared to 1998, was kerosene and jet fuel (up 1.4%). Over the same period the production of residual fuel oil experienced the largest fall (11.3%), while the production of other petroleum products reduced by the smallest amount (2.5%).

Over the period from 1990 to 1999, the output of gas/diesel oil retained the largest share of total refinery output (34.7% in 1999). This reflects the growth in road freight transport, together with the increased use of diesel cars. The growth in air traffic is reflected in the demand for kerosene and jet fuel (up 18.5%), while the output of motor spirit increased by only 5.8% over the observation period. Residual fuel oil was the only fuel whose output declined (by 11.1%), reflecting reduced demand from the industries that use this fuel.

5 Renewable Energy Sources

Indicator 5.1 Renewables Contribution to Gross Inland Consumption

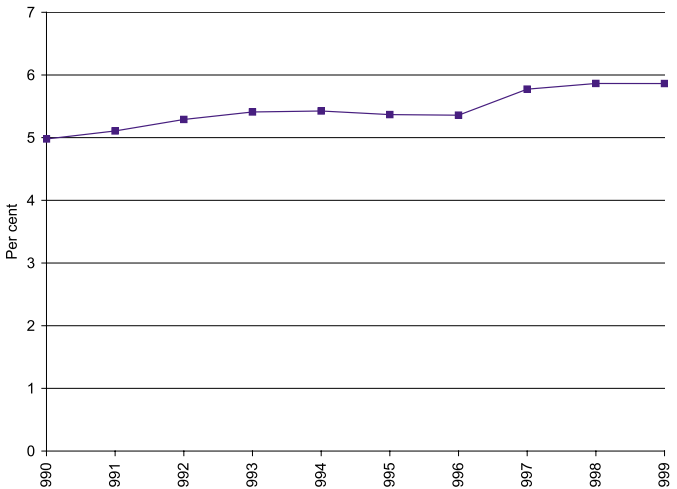


Table 5.1 Renewables Contribution to Gross Inland Consumption

Thousand tonnes of oil equivalent (ktoe)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Gross Inland Consumption from Renewable Energy Sources	65 690	68 769	70 690	72 279	72 499	73 203	75 736	81 422	84 269	84 579
Contribution to Total Gross Inland Consumption	4.98%	5.11%	5.29%	5.41%	5.42%	5.37%	5.36%	5.77%	5.86%	5.86%

Data Source: Eurostat, Energy Statistics

The quantity of energy provided by renewable energy sources (RES) across the EU-15 increased by 28.8% between 1990 and 1999. However, in 1999 RES accounted for only 5.9% of gross inland consumption (GIC) compared to 5.0% in 1990. Over the same period, GIC increased by 9.3% (see indicator 2.7).

From 1990 to 1993 the share of RES grew only modestly; this was followed by three years during which the RES share stagnated, mainly due to lower contributions from hydropower because of dry weather conditions.

The greatest growth in the contribution of renewables to GIC took place from 1996 to 1998, with an increase of 0.5 percentage points over this period.

Indicator 5.2 Gross Inland Consumption from Renewables, by Source

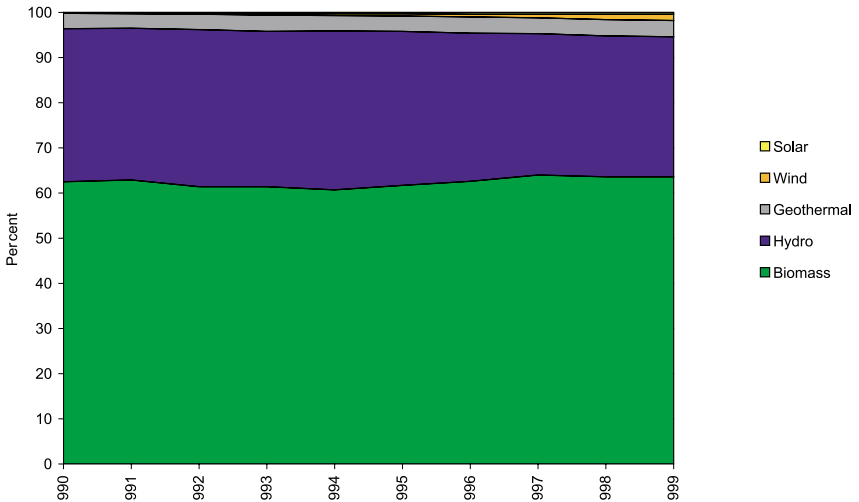


Table 5.2 Gross Inland Consumption from Renewables, by Source

Per cent (%)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Solar	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Wind	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.2	1.4
Geothermal	3.4	3.2	3.4	3.6	3.4	3.4	3.6	3.5	3.6	3.6
Hydro	33.9	33.6	34.8	34.4	35.2	34.1	32.8	31.3	31.2	31.0
Biomass	62.5	62.9	61.4	61.4	60.7	61.7	62.6	64.0	63.6	63.6
Total (ktoe)	65 690	68 769	70 690	72 279	72 499	73 203	75 736	81 422	84 269	84 579

Data Source: Eurostat, Energy Statistics

Biomass (mainly in the form of wood and wood waste) is the most widely used renewable energy source (RES) across the EU-15. It accounted for more than 60% of the RES share of gross inland consumption (GIC) over the whole observation period. Hydropower makes the second largest contribution, and accounted for more than 30% of the total in all years.

The use of geothermal energy increased between 1990 and 1998, but this energy source accounts for only 3.6% of the renewables contribution to GIC. Its growth is limited by the lack of economically viable geothermal resources in most EU Member States.

In contrast to these relatively mature renewable energy sources, the contribution of wind energy has significantly expanded over the observation period, reflecting the increase in installed capacity (see indicator 4.7) although its share of the total GIC of renewables is only 1.4%. Similarly, the contribution of solar energy increased four-fold in percentage terms between 1990 and 1999, but accounts for only 0.4% of the total.

Indicator 5.3 Contribution of Electricity Generation from Renewables to Total Electricity Consumption

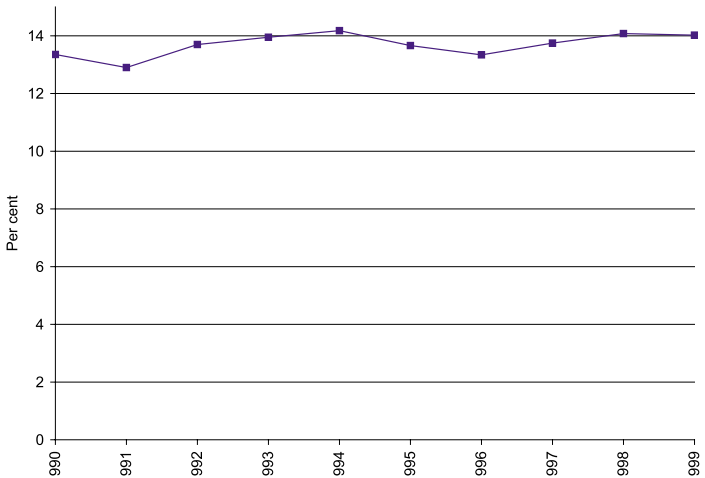


Table 5.3 Contribution of Electricity Generation from Renewables to Total Electricity Consumption

Gigawatt-hours (GWh)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Electricity Generation from Renewable Energy Sources (RES)	278 479	288 685	308 314	314 354	324 305	320 318	321 436	334 642	352 848	358 523
Contribution of RES to Total Electricity Consumption	13.4%	12.9%	13.7%	13.9%	14.2%	13.7%	13.3%	13.7%	14.1%	14.0%

Data Source: Eurostat, Energy Statistics

The contribution of renewable energy sources (RES) to total electricity generation in the EU-15 stayed nearly constant over the period from 1990 to 1999. This reflects the fact that the 28.7% increase in the contribution of renewables was largely offset by an 18.1% growth in total electricity generation (see indicator 4.3). The peak value of RES contribution to the total electricity consumption was reached in 1994, with 14.2%.

Indicator 5.4 Electricity Generation from Renewables, by Source

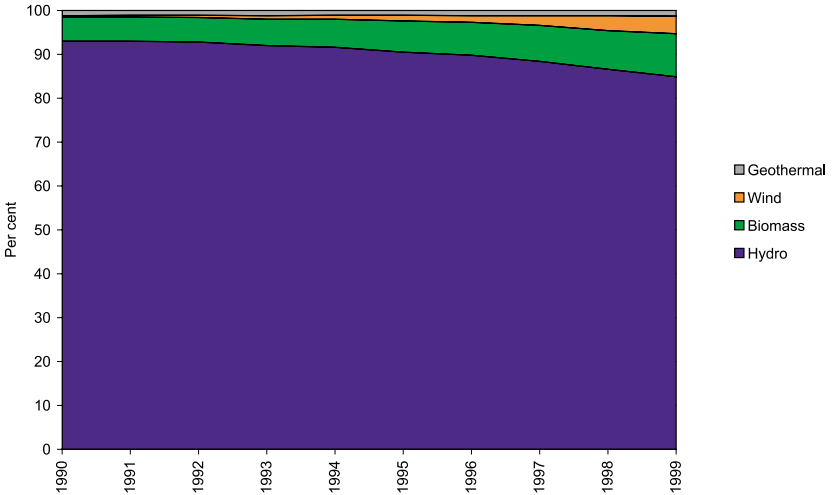


Table 5.4 Electricity Generation from Renewables, by Source

Per cent (%)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hydro	93.0	93.0	92.8	92.0	91.6	90.5	89.8	88.4	86.6	84.9
Biomass	5.5	5.5	5.6	6.0	6.4	7.1	7.5	8.2	8.8	9.8
Wind	0.3	0.4	0.5	0.8	0.9	1.3	1.5	2.2	3.4	4.0
Geothermal	1.2	1.1	1.1	1.2	1.1	1.1	1.2	1.2	1.2	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total (GWh)	278 479	288 685	308 314	314 354	324 305	320 318	321 436	334 642	352 848	358 523

Data Source: Eurostat, Energy Statistics

While biomass is the most important renewable energy source (RES) with regard to the RES share of gross inland consumption (see indicator 5.2), hydropower contributes most to the total electricity generation from renewables. In 1990 hydropower accounted for 93.0% of the total, but by 1999 this figure had fallen to 84.9% as the contribution of other RES grew. Although the potential for large-scale hydropower has largely been exploited, potential remains for an increase in small-scale hydropower, which to date only contributes a small percentage of total hydropower generation. The contribution of geothermal power has been relatively stable in the range 1.1% to 1.3%, again reflecting the natural limitations for new plants (see indicator 5.2).

Electricity generated from biomass contributed 5.5% in 1990 but with steady year-on-year rises this renewable energy source increased its share to 9.8% by 1999. However, the most rapid growth was in the contribution of wind power, which contributed a share of 4.0% in 1999 compared to only 0.3% in 1990.

6 Energy Efficiency

Indicator 6.1 Gross Inland Consumption per Capita

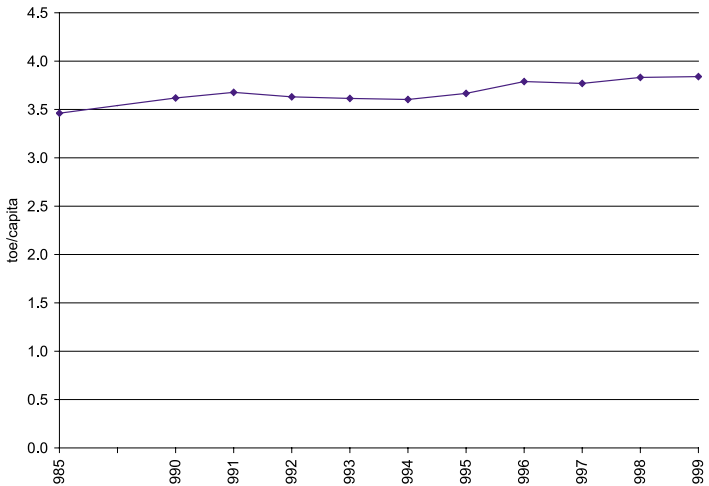


Table 6.1 Gross Inland Consumption per Capita

Tonne of oil equivalent / capita (toe/capita)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Gross Inland Consumption per Capita	3.46	3.62	3.68	3.63	3.61	3.60	3.67	3.79	3.77	3.83	3.84
Index (1990 = 100%)	95.6	100.0	101.6	100.3	99.9	99.6	101.3	104.7	104.1	105.9	106.1

Data Source: Eurostat, Energy Statistics, Social Statistics

Gross inland consumption of energy per head of the EU-15 population increased by 6.1% between 1990 and 1999.

This indicator grew at a fairly uniform rate of about 1% per year between 1985 and 1991. A period of lower growth or even reduction followed, as the EU went through a period of recession. Per capita energy consumption increased again from 1994 onwards as the economy recovered, although there was a small reduction in 1997.

In 1999 the per capita gross inland consumption in the United States was 8.31 toe/capita, i.e. 2.2 times above the EU level, while in Japan it was 4.07 toe/capita, 6% above the EU level. (Data Source for USA and Japan: The International Energy Agency).

Indicator 6.2 Final Consumption of Electricity per Capita

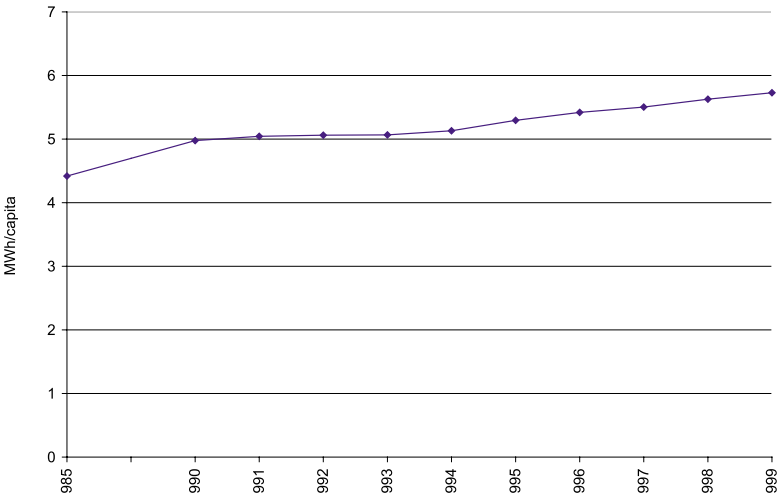


Table 6.2 Final Consumption of Electricity per Capita

kilowatt-hours per capita (kWh/capita)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Final Electricity Consumption per Capita	4 418	4 976	5 043	5 061	5 066	5 131	5 295	5 420	5 503	5 627	5 729
Index (1990 = 100%)	88.8	100.0	101.3	101.7	101.8	103.1	106.4	108.9	110.6	113.1	115.1

Data Source: Eurostat, Energy Statistics, Social Statistics

The overall final electricity consumption per capita in the EU-15 countries rose by 15.1% between 1990 and 1999, continuing the trend observed in preceding years. However, this increase was significantly greater than the 6.1% growth in gross inland consumption per capita over the same period (see indicator 6.1). This is due to the growing share of electricity in the total final energy consumption in all sectors, i.e. in industry (see indicator 3.4), in services and agriculture (see indicator 3.8) and in households (see indicator 3.9).

In 1999 the per capita electricity consumption in the United States was slightly over 12 000 kWh/capita, i.e. 2.1 times above the EU level, while in Japan it was just under 7 500 kWh/capita , 30% above the EU level. (Data Source for US and Japan: International Energy Agency).

Indicator 6.3 Final Consumption of Electricity in Households per Capita

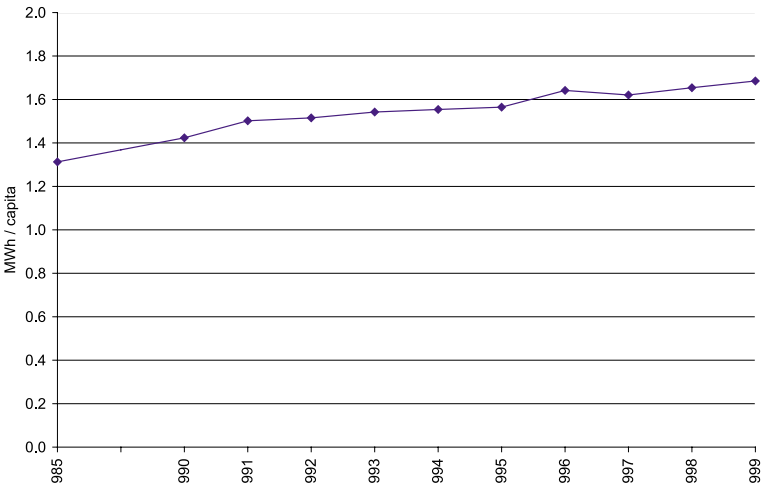


Table 6.3 Final Consumption of Electricity in Households per Capita

kilowatt-hours per capita (kWh/capita)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Final Consumption of Electricity in Households per Capita	1 313	1 424	1 502	1 515	1 542	1 554	1 565	1 642	1 621	1 654	1 685
Index (1990 = 100%)	92.2	100.0	105.5	106.5	108.3	109.2	109.9	115.3	113.9	116.2	118.3

Data Source: Eurostat, Energy Statistics, Social Statistics

Between 1990 and 1999 the per capita final consumption of electricity in households rose by 18.3% in the EU-15 Member States. This is slightly higher than the increase in overall electricity consumption per head (see indicator 6.2).

Thus electricity consumption in households is increasing more rapidly than electricity consumption in other sectors, e.g. in industry, final electricity consumption increased by 11.2% between 1990 and 1999 (see indicator 3.4).

This continuous growth is in part due to more electrical appliances in households and the installation of more lighting systems.

Indicator 6.4 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Iron and Steel Industry

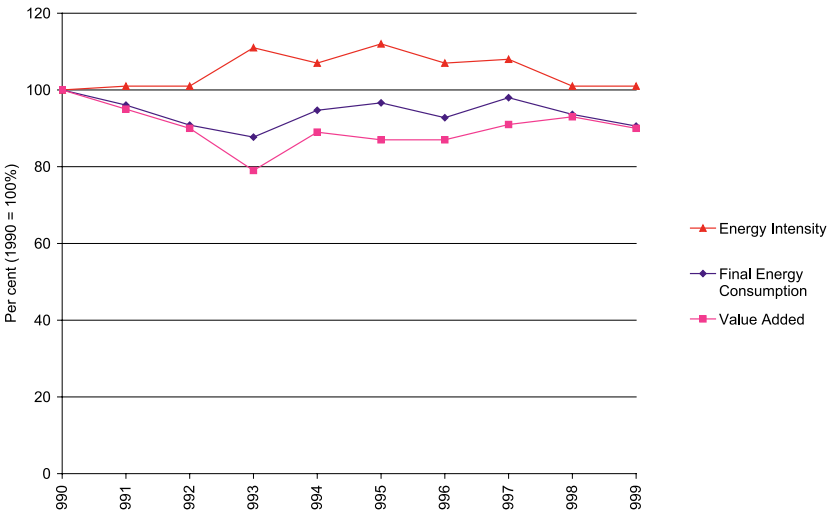


Table 6.4 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Iron and Steel Industry

Index (1990 = 100%)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Final Energy Consumption	100	96	91	88	95	97	93	98	94	91
Value Added	100	95	90	79	89	87	87	91	93	90
Energy Intensity	100	101	101	111	107	112	107	108	101	101

Data Source: Eurostat, Energy Statistics, Structural Business Statistics

Note: *The value added at factor cost, based on Structural Business Statistics, is calculated at constant prices. The energy intensity of a sector is the ratio of the final energy consumption of the sector to the value added generated by that sector. The iron and steel industry is defined as activities classified under the NACE codes 27.1, 27.2, 27.3, 27.51 and 27.52.*

In the iron and steel industry the final energy consumption fell by 9% across the EU-15 between 1990 and 1999. However, despite a significant decline over the two most recent years shown, consumption in 1999 was still higher than the minimum reached during the recession of the early 1990s (1993).

In 1999 the energy intensity of the sector remained at about the same level as it was in the early 1990s. However, energy intensity was highest during the recession, as many plants were working at low capacity. Since then efficiency improvements have been achieved through the restructuring of the industry that has taken place, with many older, less efficient plants being closed or replaced.

Indicator 6.5 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Chemical Industry

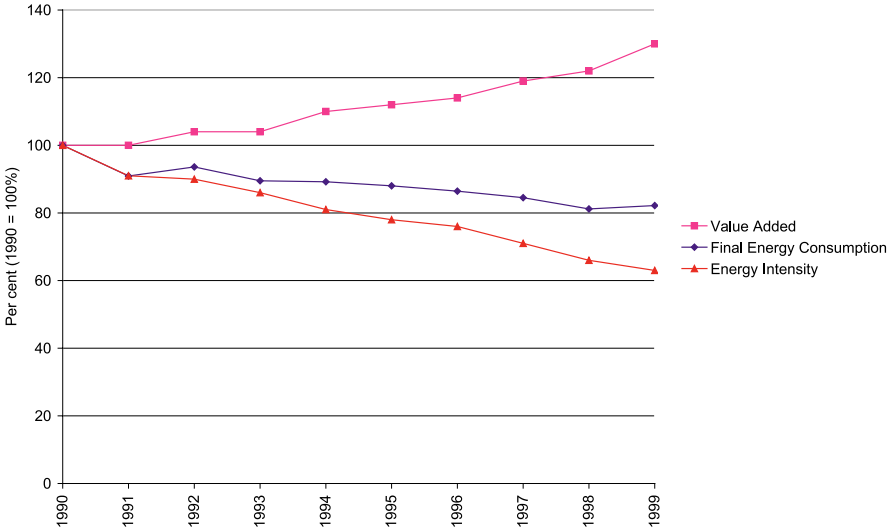


Table 6.5 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Chemical Industry

Index (1990 = 100%)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Final Energy Consumption	100	91	94	89	89	88	86	85	81	82
Value Added	100	100	104	104	110	112	114	119	122	130
Energy Intensity	100	91	90	86	81	78	76	71	66	63

Data Source: Eurostat, Energy Statistics, Structural Business Statistics

Note: *The value added at factor cost, based on Structural Business Statistics, is calculated at constant prices. The energy intensity of a sector is the ratio of the final energy consumption of the sector to the value added generated by that sector. The chemical industry is defined as activities classified under NACE code 24.*

Across the EU-15 final energy consumption in the chemical industry fell by 18% between 1990 and 1999. At the same time, value added in the sector increased by 30%, so that energy intensity improved by 37% over the decade.

This is due to structural changes in the chemical industry. EU chemical manufacturers have lost global market share in basic chemicals, the production of which is highly energy intensive. However, the rubber and plastics industry has grown at a more rapid rate than the chemical industry as a whole.

Indicator 6.6 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Glass, Pottery and Building Materials Industry

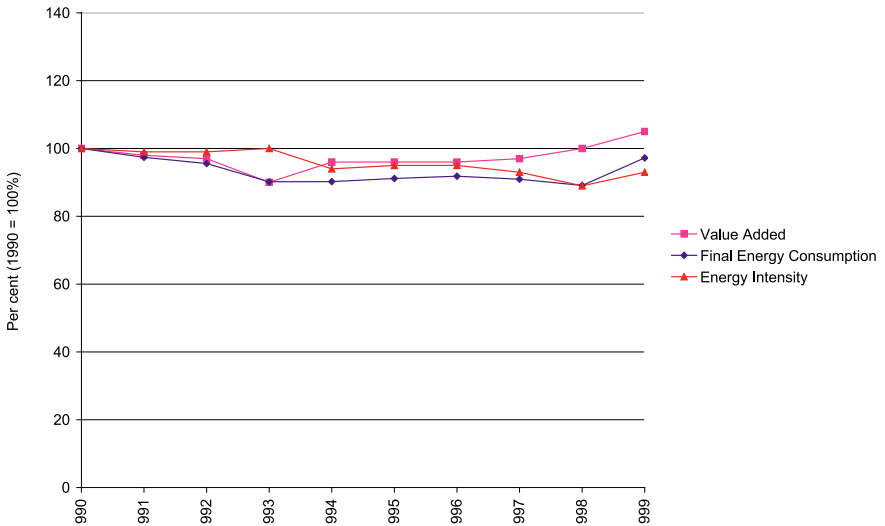


Table 6.6 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Glass, Pottery and Building Materials Industry

Index (1990 = 100%)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Final Energy Consumption	100	97	96	90	90	91	92	91	89	97
Value Added	100	98	97	90	96	96	96	97	100	105
Energy Intensity	100	99	99	100	94	95	95	93	89	93

Data Source: Eurostat, Energy Statistics, Structural Business Statistics

Note: *The value added at factor cost, based on Structural Business Statistics, is calculated at constant prices. The energy intensity of a sector is the ratio of the final energy consumption of the sector to the value added generated by that sector. The glass, pottery and building materials industry is defined as activities classified under NACE code 26.*

Final energy consumption in the glass, pottery and building materials industry declined by 10% across the EU-15 during the recession of the early 1990s (1990 to 1993). Following a period of relative stability from 1993 to 1998, consumption increased by 8% points in 1999.

Value added generated by the industry also fell by 10% from 1990 to 1993, with the result that energy intensity remained almost constant over this period. By 1998 value added had increased back to its 1990 level, and energy efficiency had improved

As no major structural changes took place in this industry during the observation period, the energy intensity gains were mainly due to a combination of efficiency improvements achieved through investments in production equipment, along with the growth rate in the sector being lower than that of the economy as a whole.

Indicator 6.7 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Paper and Printing Industry

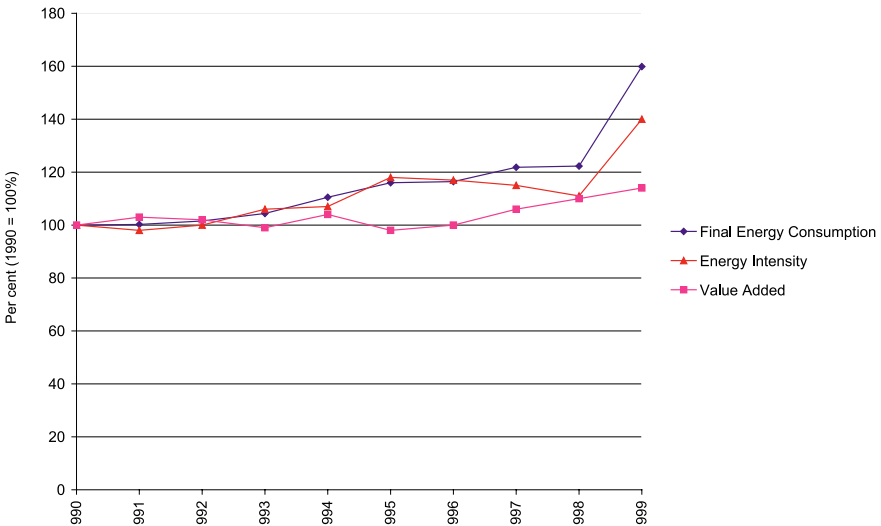


Table 6.7 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Paper and Printing Industry

Index (1990 = 100%)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Final Energy Consumption	100	100	102	104	111	116	116	122	122	:
Value Added	100	103	102	99	104	98	100	106	110	114
Energy Intensity	100	98	100	106	107	118	117	115	111	:

Data Source: Eurostat, Energy Statistics, Structural Business Statistics

Note: *The value added at factor cost, based on Structural Business Statistics, is calculated at constant prices. The energy intensity of a sector is the ratio of the final energy consumption of the sector to the value added generated by that sector. The paper and printing industry is defined as activities classified under NACE codes 21 and 22.*

The final energy consumption in the paper and printing industry in the EU-15 increased steadily by a total of 22% between 1990 and 1998. The industry was affected only marginally by the recession of the early 1990s, with value added remaining stable across those years.

The value added in the sector was relatively stable over the period from 1990 to 1996, but increased by 14% between 1996 and 1999. From 1996 to 1998 energy intensity improved because value added increased more rapidly than the final energy consumption. In 1998, the energy intensity ratio remained above the 1990 level.

Indicator 6.8 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Food, Drink and Tobacco Industries

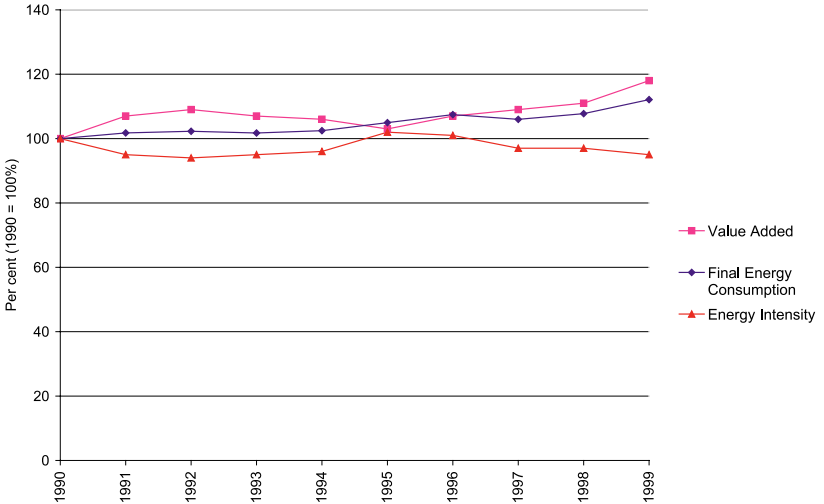


Table 6.8 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Food, Drink and Tobacco Industries

Index (1990 = 100%)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Final Energy Consumption	100	102	102	102	102	105	107	106	108	112
Value Added	100	107	109	107	106	103	107	109	111	118
Energy Intensity	100	95	94	95	96	102	101	97	97	95

Data Source: Eurostat, Energy Statistics, Structural Business Statistics

Note: *The value added at factor cost, based on Structural Business Statistics, is calculated at constant prices. The energy intensity of a sector is the ratio of the final energy consumption of the sector to the value added generated by that sector. The food, drink and tobacco industry is defined as activities classified under NACE codes 15 and 16.*

The final energy consumption in the food, drink and tobacco industries increased by 12% across the EU-15 between 1990 and 1999. Consumption was stable during the recession (1991 to 1994), but grew over the next five years with the greatest single increase (4% points) taking place in 1999.

Over the same period the value added generated by the industry grew by 18%, with the largest increases occurring in 1991 and 1999 (both 7% higher relative to 1990 = 100%).

Energy intensity in this sector improved by 5% between 1990 and 1999. There was, however, a short period from 1995 to 1996 when the energy intensity ratio was higher (worse) than in 1990, while the lowest (and best) intensity ratio was achieved in 1992.

Indicator 6.9 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Textile, Leather and Clothing Industries

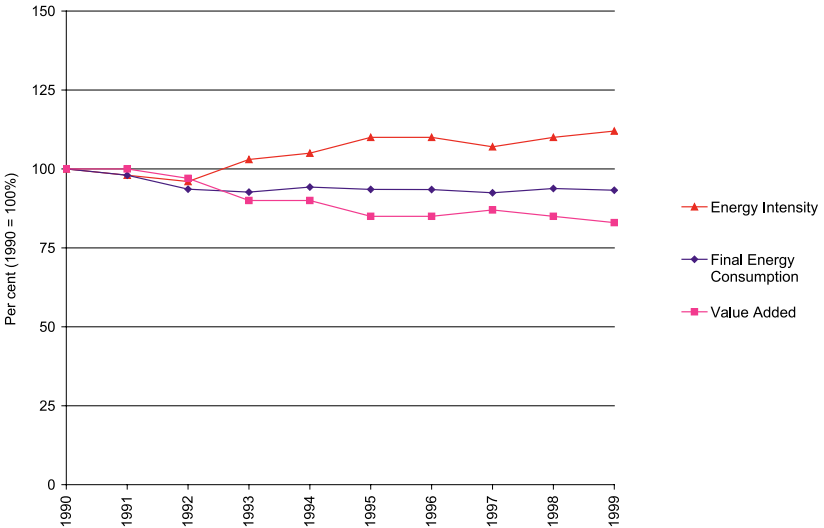


Table 6.9 Indices of Final Energy Consumption, Value Added and Energy Intensity for the Textile, Leather and Clothing Industries

Index (1990 = 100%)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Final Energy Consumption	100	98	94	93	94	94	93	92	94	93
Value Added	100	100	97	90	90	85	85	87	85	83
Energy Intensity	100	98	96	103	105	110	110	107	110	112

Data Source: Eurostat, Energy Statistics, Structural Business Statistics

Note: *The value added at factor cost, based on Structural Business Statistics, is calculated at constant prices. The energy intensity of a sector is the ratio of the final energy consumption of the sector to the value added generated by that sector. The textile, leather and clothing industry is defined as activities classified under NACE codes 17, 18 and 19.*

Across the EU-15 final energy consumption in the textile, leather and clothing industries fell by 7% between 1990 and 1999. This reduction took place during the recession of the early 1990s (1990 to 1993), since when final energy consumption in the sector has been relatively stable.

The value added in the sector fell by 10% between 1990 and 1993, and by a further 7% points between 1993 and 1999. Thus the overall reduction in value added (17%) was higher than the reduction in final energy consumption (7%). As a result, the energy intensity ratio was 12% higher (worse) in 1999 than in 1990.

Indicator 6.10 Contribution of CHP Plant to Total Electricity Generation (1998), by Member State

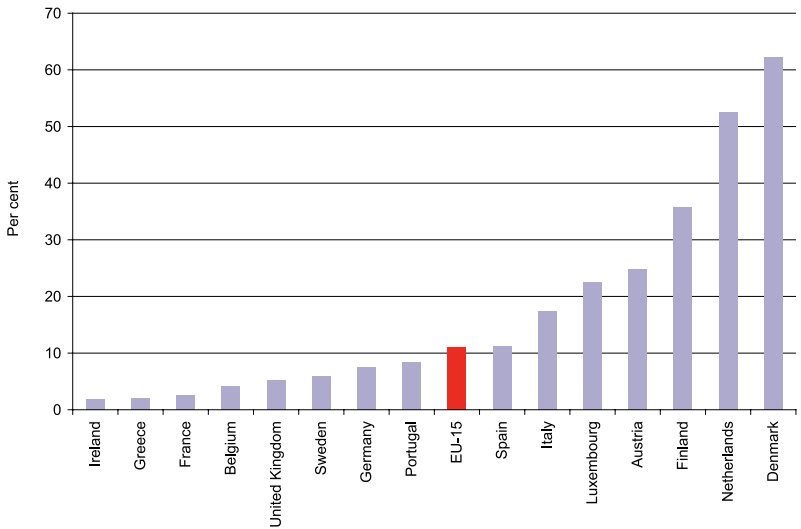


Table 6.10 Contribution of CHP Plant to Total Electricity Generation (1998), by Member State

Per cent (%)	EU-15	Belgium	Denmark	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
Electricity Generated by CHP Plant	11.0	4.1	62.3	7.5	2.1	11.2	2.5	1.9	17.3	22.5	52.6	24.8	8.4	35.8	6.0	5.2

Data Source: Eurostat, Energy Statistics

Note: *Combined Heat and Power (CHP) or co-generation plants generate both electricity and heat. Conventional (thermal) power plants typically convert only 35% to 50% of the energy content of the primary fuel into electricity (see indicator 4.8), with the remainder of this energy being discharged as waste heat rather than used. In a CHP plant much of this heat is used, typically for space heating and/or in industrial processes. As a result, the overall efficiency of a CHP plant is much higher and typically reaches 65% to 80%.*

Across the EU-15 combined heat and power (CHP) or co-generation plants contribute 11.0% to total electricity generation. However, this contribution varies widely between the Member States.

The highest contribution of CHP plants to total electricity generation is recorded in Denmark and The Netherlands, where more than half of all electricity generated is produced in these plants (62.3% and 52.6% respectively). Both of these countries have extensive district heating networks, which provide the heating base-load needed to run CHP plants in an economically viable manner. Conversely, CHP plants contribute the lowest amount in Ireland (1.9%) and Greece (2.1%) where there is hardly any district heating.

7 Energy Prices

Indicator 7.1 Current and Constant Import Prices of Steam Coal

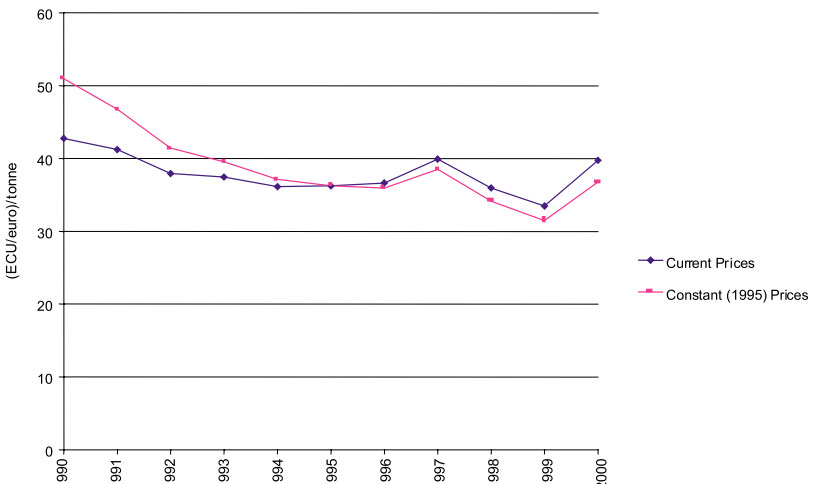


Table 7.1 Current and Constant Import Prices of Steam Coal

(ECU/euro)/tonne (ECU, €/t)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Current Prices	42.7	41.2	38.0	37.5	36.1	36.3	36.6	39.9	36.0	33.5	39.7
Constant (1995) Prices	51.0	46.8	41.4	39.6	37.1	36.3	35.9	38.5	34.1	31.5	36.8
Index (1995 = 100%)	140.6	129.0	114.3	109.1	102.4	100.0	99.1	106.2	94.2	86.8	101.4

Data Source: Eurostat, COMEXT

Definition: *Imported steam coal is used mainly for power generation but also in large, coal-fired boilers in industry.*

Between 1990 and 2000 the price of imported steam coal fell by 7.0% in nominal terms (current prices) and by 27.8% at constant (1995) prices. Although there was a year-on-year price reduction over this period, price increases took place in 1997 and in 2000.

Although the consumption of coal and solid derivatives in power stations fell by 19.8% between 1990 and 1999 (see indicator 4.4), net imports of solid fuels increased by 13.6% over the same period (see indicator 2.2). Power station operators were therefore purchasing more coal from low cost suppliers outside the EU-15.

The increase in the price of steam coal in 1997 and 2000 was related to the rise in world oil prices in these years (see indicator 1.3). However, higher coal and oil prices in 1997 resulted in only a marginal reduction in the use of these fuels for power generation.

Indicator 7.2 Current and Constant Import Prices of Coking Coal

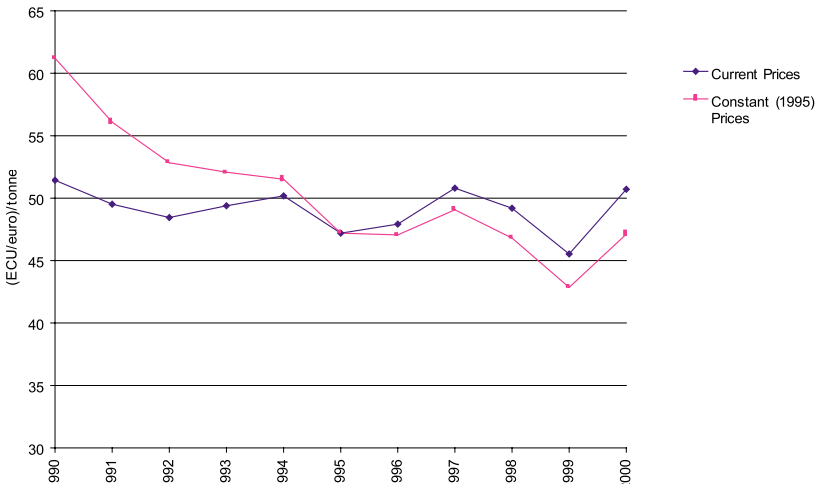


Table 7.2 Current and Constant Import Prices of Coking Coal

(ECU/euro)/tonne *(ECU,€/t)*	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Current Prices	51.4	49.5	48.5	49.4	50.2	47.2	47.9	50.8	49.2	45.5	50.7
Constant (1995) Prices	61.2	56.1	52.8	52.1	51.5	47.2	47.1	49.1	46.8	42.9	47.1
Index (1995 = 100%)	129.7	118.9	112.0	110.4	109.2	100.0	99.7	104.0	99.2	90.8	99.8

Data Source: Eurostat, COMEXT

Definition: *Coking coal is used almost exclusively for coking plants which produce coke for the iron and steel industry.*

Between 1990 and 2000 the price of imported coking coal fell by just 1.4% in nominal terms (current prices) and by 23.0% at constant (1995) prices. This is less of a decline than that observed in the price of steam coal (see indicator 7.1).

The price of coking coal fell by 22.9% (at constant prices) between 1990 and 1995, since when it has been relatively stable. This coincides with a period of decline in the EU steel industry, with plants being closed and others sourcing coking coal from cheaper suppliers outside the EU in order to remain competitive. The price increases observed in 1997 and 2000 also coincided with higher world oil prices (see indicator 1.3).

Indicator 7.3 Indices of VAT-free Industrial Fuel Prices

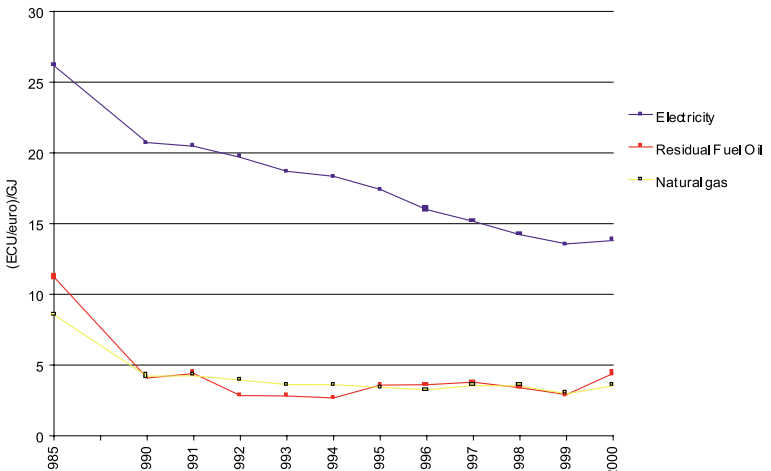


Table 7.3 Indices of VAT-free Industrial Fuel Prices

(ECU/euro)/Gigajoule (ECU,□/GJ)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Natural Gas	8.6	4.2	4.2	3.9	3.6	3.6	3.4	3.3	3.6	3.5	3.0	3.5
Index (1995 = 100%)	250.1	123.1	123.8	114.9	105.9	105.5	100.0	95.0	103.8	102.6	86.7	103.3
Residual Fuel Oil	11.2	4.1	4.4	2.8	2.8	2.7	3.6	3.6	3.8	3.4	2.9	4.4
Index (1995 = 100%)	312.8	113.8	122.6	79.4	78.5	74.6	100.0	100.7	105.6	94.8	81.3	123.1
Electricity	26.2	20.7	20.5	19.7	18.7	18.3	17.4	16.0	15.2	14.2	13.6	13.8
Index (1995 = 100%)	150.2	119.0	117.5	113.0	107.4	105.3	100.0	91.8	87.1	81.7	77.9	79.3

Data Source: Eurostat, Energy Price Statistics

***Note:** Data presented at constant (1995) prices.*

Between 1990 and 2000, industrial fuel prices net of VAT (Value Added Tax) fell in the case of natural gas and electricity (by 16.7% and 33.3% respectively) but rose by 7.3% in the case of residual fuel oil.

The price of natural gas declined steadily over the period, although there were increases in 1997 and 2000 which coincided with higher world oil prices in those years (see indicator 1.3). The price of residual fuel oil is more closely linked to world oil prices, and therefore rose particularly strongly in 2000 when a 51.7% price growth was observed.

The price of electricity fell in every year from 1990 to 1999, but increased slightly in 2000. This reflects the move towards cheaper fuels such as gas for electricity generation, falling prices for fossil fuels generally and greater competition in electricity markets as a result of energy market liberalisation in several Member States.

Indicator 7.4 Tax Component of Industrial Fuel Prices

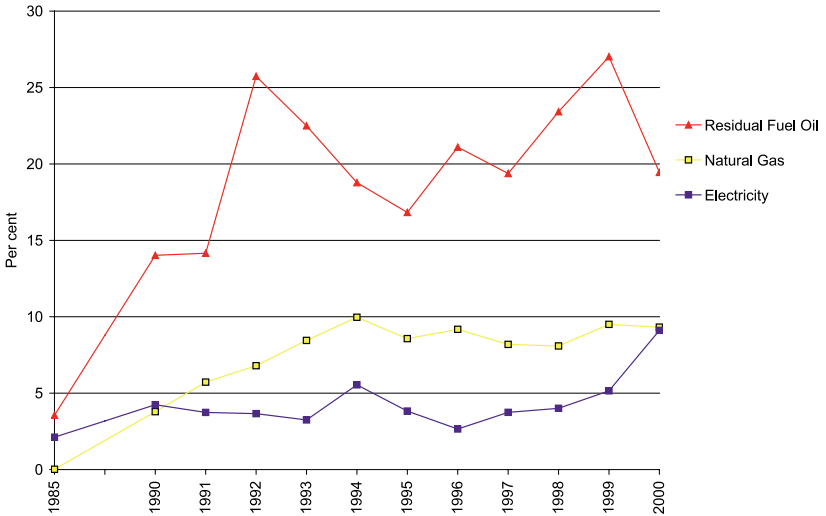


Table 7.4 Tax Component of Industrial Fuel Prices

Per cent (%)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Residual Fuel Oil	3.6	14.0	14.2	25.7	22.5	18.8	16.8	21.1	19.4	23.4	27.0	19.4
Natural Gas	0.0	3.8	5.7	6.8	8.5	10.0	8.6	9.2	8.2	8.1	9.5	9.3
Electricity	2.1	4.2	3.7	3.7	3.2	5.5	3.8	2.7	3.7	4.0	5.2	9.1

Data Source: Eurostat, Energy Price Statistics

Note: *The tax component does not include VAT. Percentages are based on constant (1995) prices.*

From 1990 to 2000 the tax rate on all industrial fuels increased across the EU-15. However, the levels of tax on energy prices are set by individual Member States and vary significantly between countries.

Over the observation period the greatest tax increase was on natural gas (5.5 percentage points), but both residual fuel oil and electricity experienced similar increases of 5.4 and 4.9 percentage points respectively. The tax component on residual fuel oil is volatile, growing when world oil prices are low and often decreasing when oil prices are high (see indicator 1.3).

The highest reduction in the tax on residual fuel oil was observed in 2000, when the tax fell by 7.6 percentage points in response to the 78.1% increase in world oil prices (see indicator 1.3). Despite this reduction, oil remains the most heavily taxed fuel with tax rates more than twice those for natural gas and electricity.

Indicator 7.5 Tax-inclusive Household Fuel Prices

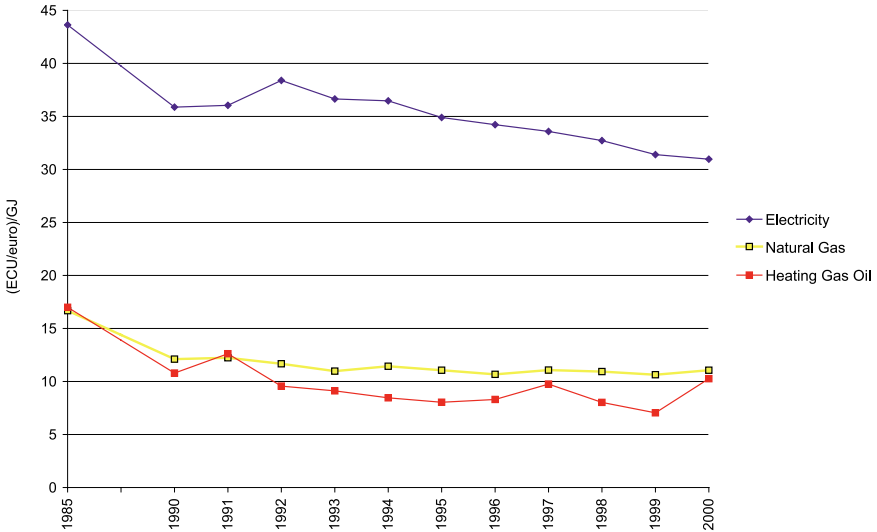


Table 7.5 Tax-inclusive Household Fuel Prices

(ECU/euro)/Gigajoule (ECU,€/GJ)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Electricity	43.6	35.9	36.0	38.4	36.6	36.5	34.9	34.2	33.6	32.7	31.4	31.0
Index (1995 = 100%)	125.0	102.8	103.3	110.0	105.0	104.5	100.0	98.1	96.2	93.8	90.0	88.7
Natural Gas	16.7	12.1	12.2	11.7	11.0	11.4	11.1	10.7	11.1	10.9	10.6	11.1
Index (1995 = 100%)	150.8	109.5	110.6	105.5	99.3	103.4	100.0	96.5	100.2	98.8	96.2	100.0
Heating Gas Oil	17.0	10.8	12.6	9.6	9.1	8.5	8.0	8.3	9.8	8.0	7.0	10.3
Index (1995 = 100%)	211.3	134.2	156.9	118.9	113.4	105.1	100.0	103.3	121.3	99.8	87.6	127.6

Data Source: Eurostat, Energy Price Statistics

Note : *Data presented at constant (1995) prices.*

The tax-inclusive prices of all domestic (housing) fuels fell in real terms (constant 1995 prices) between 1990 and 2000. Unlike industrial fuel prices, household fuel prices are, among other things, affected by weather conditions, with colder years pushing up demand and prices.

Over the observation period, the price of electricity fell by 13.6% while the price for natural gas and heating gas oil fell by 8.3% and 4.6% respectively.

In 2000, prices increased strongly for heating gas oil (47.1%) largely as a result of increases in world oil prices (see indicator 1.3). Natural gas prices also rose in 2000 (4.7%), while the decline in electricity prices continued with a 1.3% fall.

The gas price rises in 1994 and 1997 are caused by the cold winters in those years, which increased demand (and prices) for this fuel which was by then the dominant heating fuel in the housing sector (see indicator 3.9).

Indicator 7.6 Tax Component of Household Fuel Prices

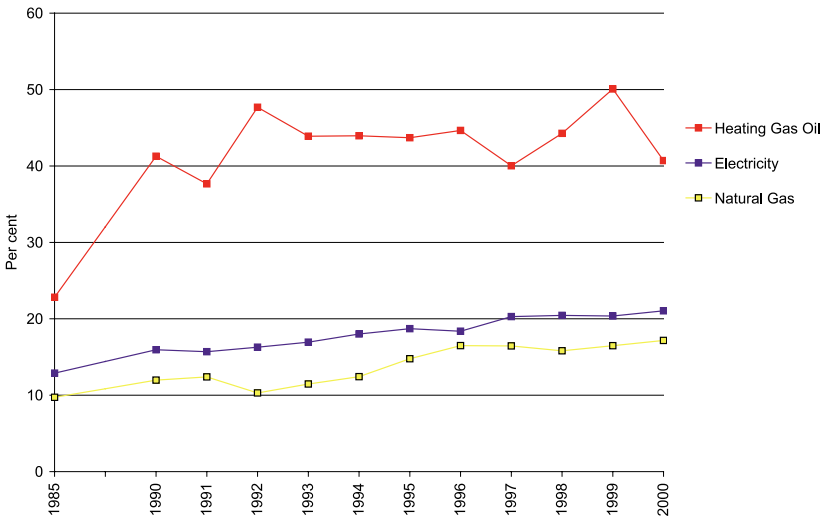


Table 7.6 Tax Component of Household Fuel Prices

Per cent (%)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Heating Gas Oil	22.8	41.3	37.7	47.7	43.9	44.0	43.7	44.6	40.0	44.3	50.1	40.7
Electricity	12.9	15.9	15.7	16.3	16.9	18.0	18.7	18.4	20.3	20.4	20.4	21.0
Natural Gas	9.7	12.0	12.4	10.3	11.5	12.4	14.8	16.5	16.5	15.8	16.5	17.2

Data Source: Eurostat, Energy Price Statistics

Note: *VAT is included within the tax component. The percentages are based on constant (1995) prices.*

The levels of tax on energy prices are set by individual Member States, and vary significantly between countries. Between 1990 and 2000, the tax rate on natural gas and electricity increased by 43.3% and 32.1% respectively, while the tax rate on heating gas oil fell by 1.5%.

The tax rate on heating gas oil was more volatile, with tax rates tending to increase as oil prices fell and drop back when oil prices rose. Thus there was an 18.8% reduction in the tax on heating gas oil between 1999 and 2000, compensating (in part) for the rise in world oil prices (see indicator 1.3). On the other hand, the tax rate on electricity and natural gas continued to rise in 2000, by 2.9% and 4.2% respectively. Despite these changes, heating gas oil remains the most heavily taxed household fuel.

Indicator 7.7 Retail Prices of Transport Fuels

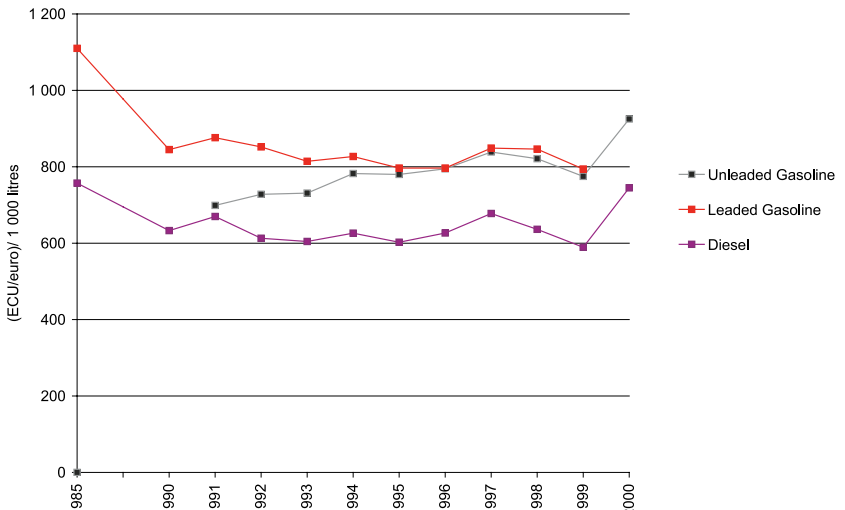


Table 7.7 Retail Prices of Transport Fuels

(ECU/euro) / 1 000 litres (ECU, □/1 000 l)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Unleaded Gasoline	:	:	699	728	731	782	780	795	839	821	775	925
Index (1995 = 100%)	:	:	89.6	93.3	93.7	100.3	100.0	101.9	107.5	105.3	99.4	118.6
Leaded Gasoline	1110	845	876	852	814	827	796	797	849	846	794	:
Index (1995 = 100%)	139.3	106.1	110.0	107.0	102.2	103.8	100.0	100.0	106.7	106.3	99.7	:
Diesel	757	633	670	613	604	626	602	627	678	636	589	745
Index (1995 = 100%)	125.7	105.1	111.2	101.7	100.3	103.9	100.0	104.0	112.5	105.6	97.8	123.6

Data Source: Eurostat, Energy Price Statistics

Note: *Data is presented at constant (1995) prices. Unleaded gasoline was not widely available before 1991, and leaded gasoline gradually went out of the market in a number of Member States before 1999. To a certain extent, the figures are biased as the Member States which still have considerable consumption of leaded gasoline (e.g. Greece and Spain) often also have the lowest prices for transport fuels in the EU.*

Between 1991 and 1999 the retail (tax inclusive) price of unleaded gasoline rose by 10.9% while the prices of leaded gasoline and diesel fell by 9.4% and 12.1% respectively. The price of unleaded gasoline was kept low during the early 1990s to encourage conversion from leaded to unleaded motor spirit. In contrast, the price of leaded gasoline fell only slightly over the same period.

The price of diesel fuel remained around 25% lower than leaded gasoline, with similar volatility over the period 1990 to 1999 reflecting global oil market price developments (see indicator 1.3). In 2000, the price of unleaded gasoline and diesel grew by 19.4% and 26.5% respectively. These increases (both around □150/1 000 litres in absolute terms) were due to the rapid rise in world oil prices in 2000 (see indicator 1.3). In 2000, leaded gasoline is only used to a significant extent in Italy, Spain and Greece (see indicator 3.7).

Indicator 7.8 Tax Component of Transport Fuel Prices

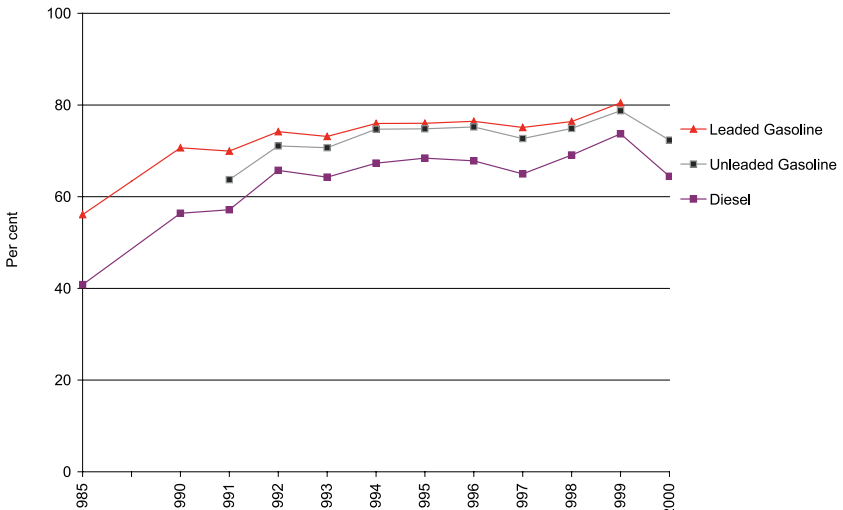


Table 7.8 Tax Component of Transport Fuel Prices

Per cent (%)	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Leaded Gasoline	56	71	70	74	73	76	76	76	75	76	80	:
Unleaded Gasoline	:	:	64	71	71	75	75	75	73	75	79	72
Diesel	41	56	57	66	64	67	68	68	65	69	74	64

Data Source: Eurostat, Energy Price Statistics

Note: *Percentages are based on constant (1995) prices. Unleaded gasoline was not widely available before 1991. Leaded gasoline has gradually gone out of the market to the point of almost total exclusion in all Member States by 1999, though this occurred earlier in a number of Member States. The taxes covered include all energy taxes and Value Added Tax (VAT).*

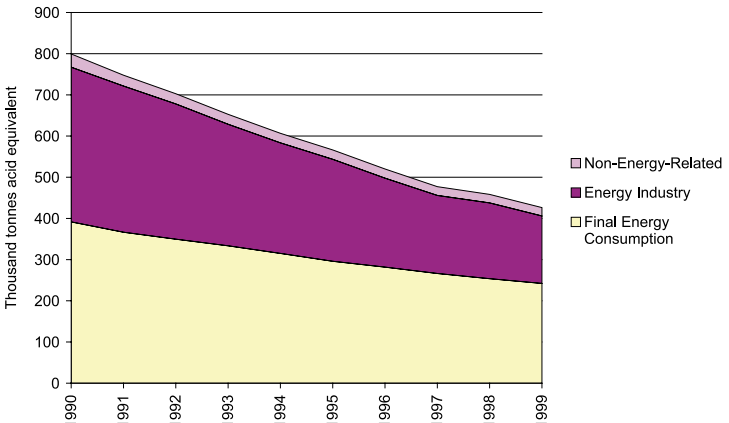
The tax component of all transport fuels has increased over the decade from 1990 to 2000. The tax on leaded gasoline increased by 9 percentage points between 1990 and 1999, while the tax on unleaded gasoline rose by 15 percentage points (1991 to 1999).

Although the tax on diesel increased by 18 percentage points between 1990 and 1999, it remains the transport fuel with the lowest relative tax burden.

The oil price rise in 2000 (see indicator 1.3) led to reductions in the tax on diesel and on unleaded gasoline of 10 and 7 percentage points respectively. This resulted from national changes to tax rates in order to reduce the impact of oil price rises on their economies, with particular regard to the transport sector.

8 Energy & Emissions

Indicator 8.1 Emissions of Acidifying Gases, by Source



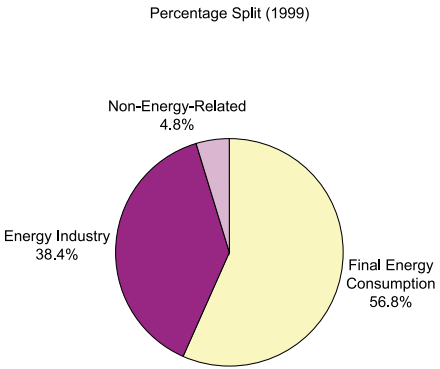


Table 8.1 Emissions of Acidifying Gases, by Source

Thousand tonnes acid equivalent (kt acid eq.)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Non-Energy-Related	32	26	25	24	23	23	22	21	21	20	4.8%
Energy Industry	376	355	328	295	268	248	216	189	184	164	38.4%
Final Energy Consumption	392	367	350	333	315	296	282	266	254	242	56.8%
Total Emissions	800	748	703	652	606	567	520	476	459	426	100.0%
Index (1990 = 100%)	100.0	93.4	87.8	81.4	75.7	70.9	65.0	59.5	57.4	53.3	

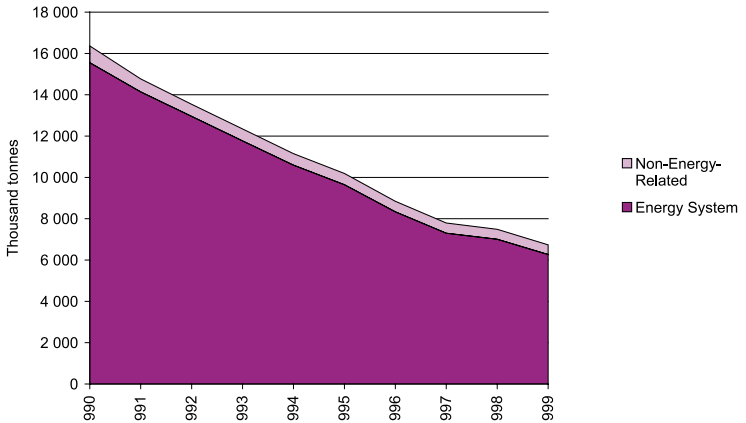
Data Source: European Environment Agency

Note: *The units used for this indicator adjust the tonnes of emissions by their relative potential acid (hydrogen ion) production, i.e. tonnes x 1/32 (for SO_2) and tonnes x 1/46 (for NO_x as NO_2). Emissions of acidifying gases (sulphur dioxide and nitrogen oxides) contribute to acidification, eutrophication and ground level ozone. Ammonia (NH_3) is not included in the data.*

Total EU-15 emissions of acidifying gases fell by 46.7% over the period 1990 to 1999. The energy industry and final energy consumption (together comprising the Energy System) contributed 95.2% of total emissions in 1999, almost the same as in 1990 (96.0%).

Over this period, emissions from the energy industry fell by 56.4%. This was mainly due to the installation of flue gas desulphurisation (FGD) equipment at power stations and to the move away from solid fuels (e.g. lignite and coal) to natural gas containing less sulphur. The lower emissions were achieved despite an 18.1% increase in electricity output over the same period (see indicator 4.3). Acidifying gas emissions from the use of energy by final consumers fell by 38.3% over the same period. This is mostly due to the industrial sector, exhibiting a trend of reduced use of solid fuels, as well as to the reduction in the sulphur content of liquid fuels. Acidifying gas emissions from non-energy-related activities were down by 37.5% over the observation period, but they remained a very small component of the total.

Indicator 8.2 Sulphur Dioxide Emissions, by Source



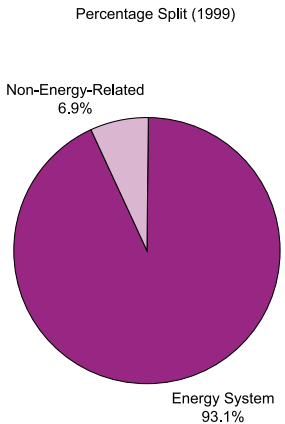


Table 8.2 Sulphur Dioxide Emissions, by Source

Thousand tonnes SO_2 (kt SO_2)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Non-Energy-Related	811	628	587	580	558	543	509	495	480	467	6.9%
Energy System	15 551	14 140	12 953	11 766	10 593	9 647	8 334	7 298	7 008	6 267	93.1%
Total SO_2 Emissions	16 362	14 768	13 540	12 346	11 151	10 190	8 843	7 793	7 488	6 734	100.0%
Index (1990 = 100%)	100.0	90.3	82.8	75.5	68.2	62.3	54.0	47.6	45.8	41.2	

Data Source: European Environment Agency

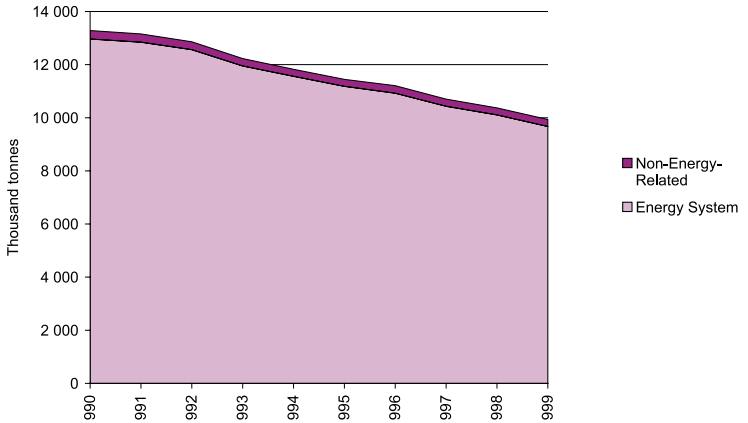
Note: *Sulphur dioxide (SO_2) emissions contribute to acid deposition which leads to changes in soil and water quality, damage to forests, crops and other vegetation and also damages buildings and monuments.*

The majority of sulphur dioxide emissions (95.0% in 1990 and 93.1% in 1999) come from the energy system. The major source of these emissions is the combustion of solid fuels and the combustion of some oil products.

From 1990 to 1999, total emissions of sulphur dioxide decreased by 58.8%. Emissions of SO_2 from the energy system fell by 59.7%, despite a 9.3% increase in total energy consumption (see indicator 2.7).

The amount of sulphur dioxide emitted per unit of energy used has therefore fallen significantly. The main reasons for this fall are the reduction in the use of high sulphur content coal and lignite, the installation of flue gas desulphurisation equipment at many solid fuel power stations and the reduced sulphur content of liquid fuels (both driven by legislative actions).

Indicator 8.3 Total NO_x Emissions, by Source



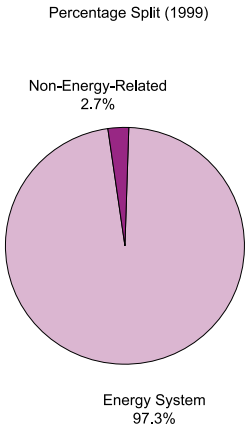


Table 8.3 Total NO_X Emissions, by Source

Thousand tonnes NO_X (kt NO_X)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Non-Energy-Related	319	309	294	277	264	262	285	270	265	266	2.7%
Energy System	12 965	12 846	12 564	11 950	11 560	11 184	10 924	10 431	10 106	9 670	97.3%
Total NO_X Emissions	13 284	13 155	12 858	12 227	11 824	11 446	11 209	10 701	10 371	9 936	100.0%
Index (1990 = 100%)	100.0	99.0	96.8	92.0	89.0	86.2	84.4	80.6	78.1	74.8	

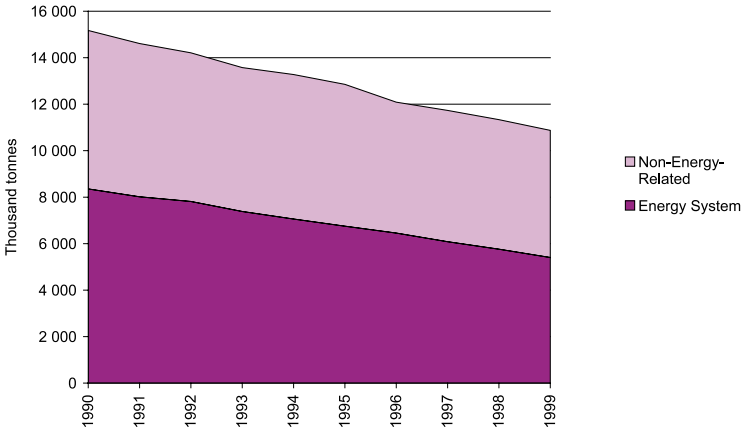
Data Source: European Environment Agency

Note: *Nitrogen oxides, which are not to be confused with nitrous oxide (see indicator 8.8) are partly responsible for a series of environmental problems. These include acidification, eutrophication and photochemical smog, including ground level ozone which is a threat to human health. Nitrogen oxides also contribute to the build-up of tropospheric ozone which is a potent greenhouse gas.*

The vast majority of nitrogen oxide emissions (97.6% in 1990 and 97.3% in 1999) are produced by the energy system, with the major source being the combustion of fossil fuels.

From 1990 to 1999, total emissions of nitrogen oxides fell by 25.2%. Emissions from the energy system fell by a very similar magnitude (25.4%), despite a 9.3% rise in total energy use (see indicator 2.7). The level of nitrogen oxide emissions per unit of energy used has therefore decreased. This is mainly due to an expansion in the use of "low NO_X" combustion technology, together with three-way catalytic converters on petrol cars, although these also lead to higher emissions of the potent greenhouse gas nitrous oxide (see indicator 8.8).

Indicator 8.4 NMVOC Emissions, by Sources



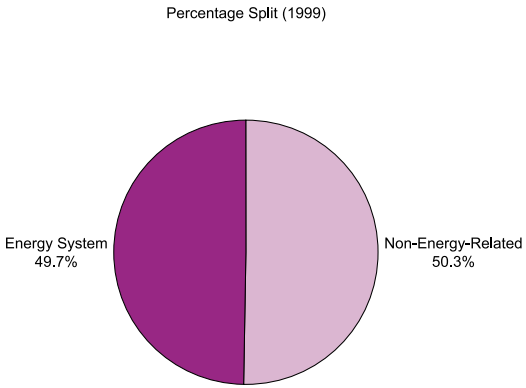


Table 8.4 NMVOC Emissions, by Sources

Thousand tonnes NMVOC (kt NMVOC)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Non-Energy-Related	6 818	6 595	6 397	6 194	6 217	6 102	5 634	5 651	5 575	5 470	50.3%
Energy System	8 355	8 015	7 814	7 383	7 058	6 752	6 453	6 082	5 761	5 402	49.7%
Total NMVOC Emissions	15 173	14 610	14 211	13 577	13 275	12 854	12 087	11 733	11 336	10 872	100.0%
Index (1990 = 100%)	100.0	96.3	93.7	89.5	87.5	84.7	79.7	77.3	74.7	71.7	

Data Source: European Environment Agency

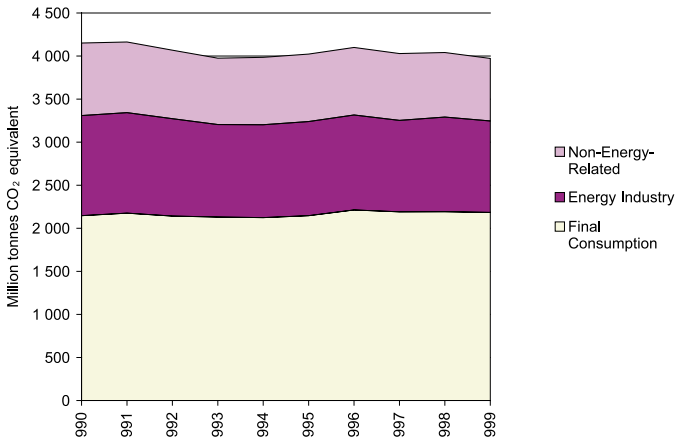
Note: *Non Methane Volatile Organic Compounds (NMVOCs) include gaseous hydrocarbons and other gaseous organic compounds which (in combination with nitrogen oxides) contribute to the formation of photo-chemical smog and tropospheric ozone. NMVOCs therefore contribute indirectly to global warming as tropospheric ozone is a greenhouse gas.*

Around half of NMVOC emissions originate from the energy system (55.1% in 1990 and 49.7% in 1999). Major sources of these emissions are fossil fuel combustion (particularly in the transport sector), evaporative emissions from industrial processes and non-industrial uses of organic solvents.

Between 1990 and 1999, total emissions of NMVOCs fell by 28.3%. Emissions from the energy system fell by 35.3%, while emissions from other sources reduced by only 19.8%. As for other emissions, this development contrasts with the 9.3% rise in total energy use (see indicator 2.7), showing that emissions of NMVOCs per unit of energy used have considerably diminished. This is mainly due to the fitting of catalytic converters to gasoline-engined cars.

A reduction in fugitive emissions from petrol stations is another factor in the reduction of NMVOC emissions.

Indicator 8.5 Greenhouse Gas Emissions, by Source



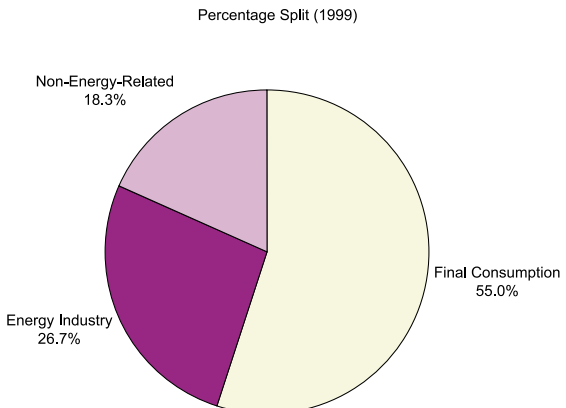


Table 8.5 Greenhouse Gas Emissions, by Source

Thousand tonnes CO_2 equivalent (kt CO_2 eq.)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Non-Energy-Related	842 768	820 788	795 104	770 338	782 971	783 410	784 846	775 937	749 402	726 082	18.3%
Energy Industry	1 162 146	1 166 765	1 131 193	1 073 980	1 078 816	1 092 734	1 102 269	1 061 477	1 099 099	1 061 986	26.7%
Final Consumption	2 146 468	2 175 982	2 141 705	2 130 906	2 123 584	2 146 909	2 213 196	2 191 460	2 192 387	2 184 158	55.0%
Total Emissions	4 151 382	4 163 535	4 068 002	3 975 224	3 985 371	4 023 053	4 100 311	4 028 874	4 040 888	3 972 226	100.0%
Index (1990 = 100%)	100.0	100.3	98.00	95.8	96.0	96.9	98.8	97.1	97.3	95.7	

Data Source: European Environment Agency

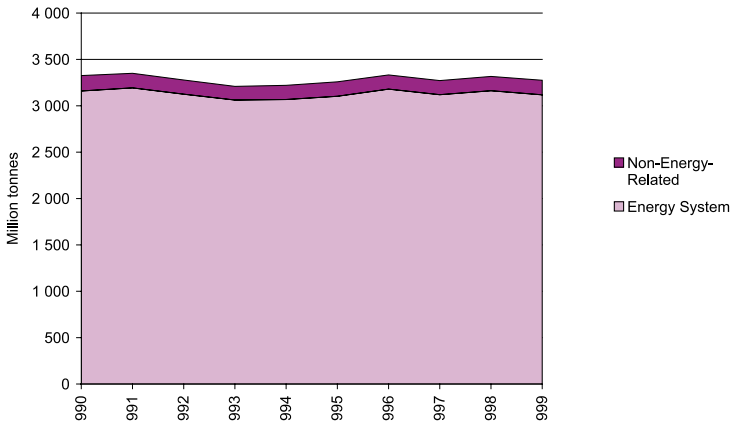
Note: *Greenhouse gas emissions are widely acknowledged to give rise to climate change. The greenhouse gases considered for this indicator are carbon dioxide, nitrous oxide and methane.*

Total emissions of greenhouse gases across the EU-15 decreased by 4.3% over the period 1990 to 1999. However, the share of emissions related to non-energy sources fell by 13.8% while the share of emissions caused by the energy industry and by final energy consumption (which together make up the Energy System) fell by just 1.9%.

While the emissions from the energy industry reduced by 8.6% between 1990 and 1999, emissions associated with final energy consumption rose by 1.8%. The latter accounted for 55.0% of total greenhouse gas emissions in 1999, compared to 51.7% in 1990. Most of the higher emissions are due to the transport sector using more fuel, while other sectors reduced their emissions over this period.

The reduction in greenhouse gas emissions by the energy industry was achieved despite an 18.1% increase in electricity output (see indicator 4.3). This was mainly due to efficiency gains in energy transformation and structural changes in fuel input.

Indicator 8.6 Carbon Dioxide Emissions, by Source



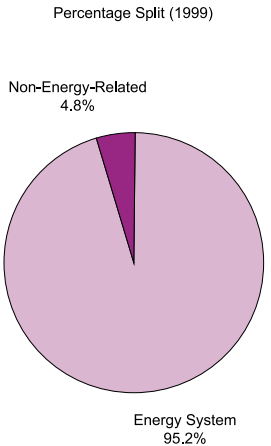


Table 8.6 Carbon Dioxide Emissions, by Source

Thousand tonnes CO_2 (kt CO_2)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Non-Energy-Related	165 931	157 103	152 526	146 778	152 817	155 458	153 050	152 309	154 344	156 777	4.8%
Energy System	3 159 538	3 193 494	3 125 500	3 062 417	3 067 953	3 102 658	3 179 916	3 119 782	3 162 621	3 118 449	95.2%
Total CO_2 Emissions	3 325 469	3 350 597	3 278 026	3 209 195	3 220 770	3 258 116	3 332 966	3 272 091	3 316 965	3 275 226	100.0%
Index (1990 = 100%)	100.0	100.8	98.6	96.5	96.9	98.0	100.2	98.4	99.7	98.5	

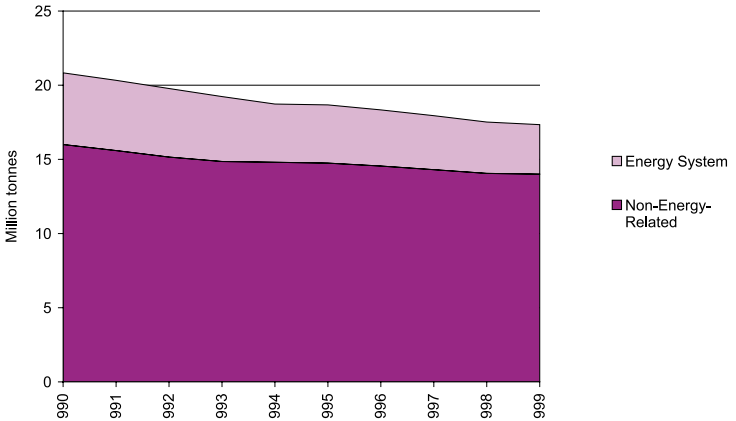
Data Source: European Environment Agency

Note: *The "Energy System" refers to the energy industry (i.e. the energy transformation sector) and the energy consumed by final consumers.*

Emissions of carbon dioxide are generated largely by the energy system, which accounted for 95.2% of the total emissions in 1999 (95.0% in 1990). Over the observation period 1990 to 1999 total carbon dioxide emissions from the energy system fell by 1.3%, while non-energy-related emissions fell by 5.5%.

Emissions of carbon dioxide have broadly followed the economic cycle, although reductions have also been achieved by energy efficiency gains and by switching to fuels with lower or zero carbon content (e.g. natural gas).

Indicator 8.7 Methane Emissions, by Source



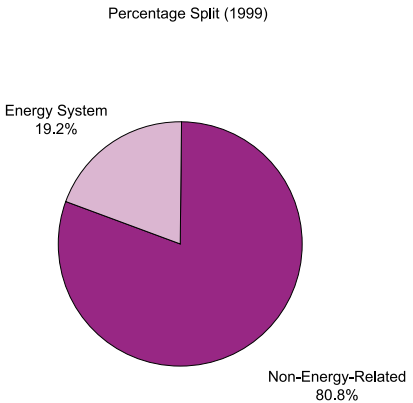


Table 8.7 Methane Emissions, by Source

Thousand tonnes CH_4 (kt CH_4)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Energy System	4 832	4 739	4 621	4 380	3 925	3 927	3 788	3 639	3 462	3 337	19.2%
Non-Energy-Related	16 002	15 592	15 156	14 856	14 804	14 746	14 549	14 306	14 054	14 003	80.8%
Total CH_4 Emissions	20 834	20 331	19 777	19 236	18 729	18 673	18 337	17 945	17 516	17 340	100.0%
Index (1990 = 100%)	100.0	97.6	94.9	92.3	89.9	89.6	88.0	86.1	84.1	83.2	

Data Source: European Environment Agency

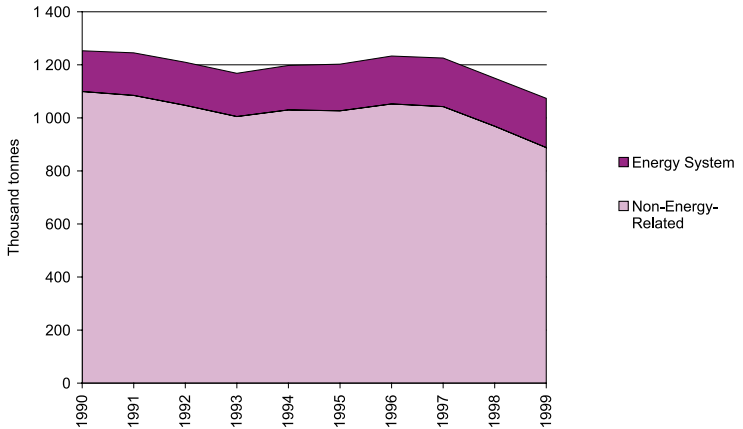
Note: *Methane (CH_4) is a powerful greenhouse gas with each tonne of methane equivalent in global warming terms to 21 tonnes of carbon dioxide, over a time span of 100 years. The main sources of methane within the energy system are coal mining and the production and transmission of natural gas. Sources outside the energy system include agriculture (mainly ruminant animals) and landfill sites used for waste disposal.*

During the period 1990 to 1999, total methane emissions fell by 16.8%. Methane emissions from the energy system accounted for around a fifth of the total emissions (19.2% in 1999 compared to 23.2% in 1990).

Over the observation period, emissions of methane from the energy system (the energy industry plus final energy consumption) fell by 30.9% while methane emissions from other sources fell by only 12.5%.

The reduced methane emissions were, among other things, due to the reduction in coal mining, improved control of methane emissions from landfill sites, reduced leakage from gas transmission/distribution pipelines and improvements in oil and gas extraction processes.

Indicator 8.8 Nitrous Oxide Emissions, by Source



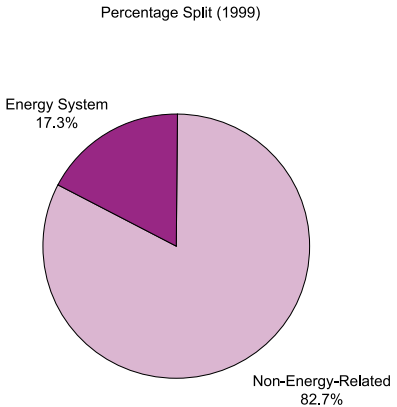


Table 8.8 Nitrous Oxide Emissions, by Source

Thousand tonnes N_2O (kt N_2O)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Energy System	154	160	162	163	168	176	181	183	181	186	17.3%
Non-Energy-Related	1 099	1 085	1 047	1 005	1 030	1 027	1 052	1 043	968	888	82.7%
Total N_2O Emissions	1 253	1 245	1 209	1 168	1 198	1 203	1 233	1 226	1 149	1 074	100.0%
Index (1990 = 100%)	100.0	99.4	96.5	93.2	95.6	96.0	98.4	97.8	91.7	85.7	

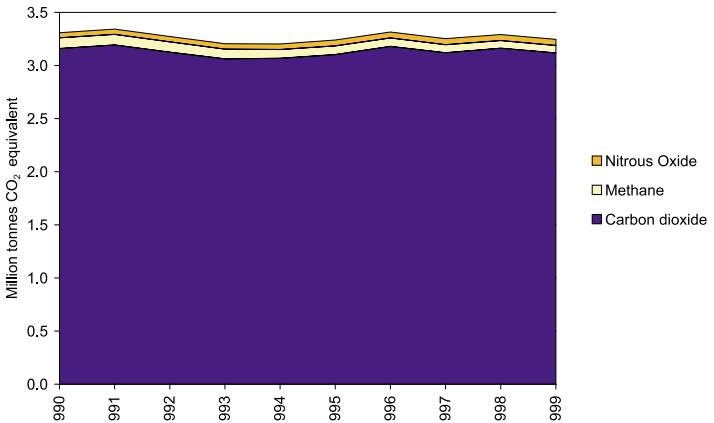
Data Source: European Environment Agency

Note: *Nitrous oxide (N_2O) is a very powerful greenhouse gas, with each tonne equivalent in global warming terms to 310 tonnes of carbon dioxide, over a time span of 100 years. The main sources of nitrous oxide are industrial processes (particularly nitric and adipic acid production), agriculture and fuel combustion.*

From 1990 to 1999, total emissions of nitrous oxide fell by 14.3%. However, nitrous oxide emissions from the energy system increased by 20.8%, so the share of the emissions caused by the energy system has increased from 12.3% in 1990 to 17.3% in 1999. This development coincides with a 9.3% rise in total energy use (see indicator 2.7), which demonstrates that the level of nitrous oxide emissions per unit of energy used is growing. An important factor here is the fact that N_2O emissions from gasoline-engined cars fitted with three-way catalytic converters are higher than from older cars without catalysts.

Non-energy-related nitrous oxide emissions reduced by 19.2% between 1990 and 1999, although most of this fall took place in the two most recent years shown. The main reasons were newly installed N_2O removal equipment at German adipic acid plants (adipic acid is used in the production of nylon and plasticisers).

Indicator 8.9 Greenhouse Gas Emissions from the Energy System



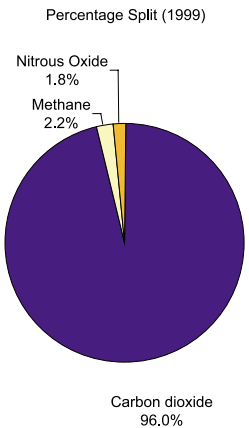


Table 8.9 Greenhouse Gas Emissions from the Energy System

Thousand tonnes CO_2 equivalent (kt CO_2 eq.)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Nitrous Oxide	47 607	49 742	50 352	50 500	52 018	54 523	55 995	56 739	56 169	57 614	1.8%
Methane	101 469	99 511	97 046	91 970	82 429	82 462	79 554	76 416	72 695	70 082	2.2%
Carbon dioxide	3 159 538	3 193 494	3 125 500	3 062 417	3 067 953	3 102 658	3 179 916	3 119 782	3 162 621	3 118 449	96.0%
Total GHG Emissions	3 308 614	3 342 747	3 272 898	3 204 887	3 202 400	3 239 643	3 315 465	3 252 937	3 291 485	3 246 145	100.0%
Index (1990 = 100%)	100.0	101.0	98.9	96.9	96.8	97.9	100.2	98.3	99.5	98.1	

Data Source: European Environment Agency

Note: *As with indicator 8.5, methane (CH_4) and nitrous oxide (N_2O) emissions are expressed in terms of carbon dioxide (CO_2) equivalent.*

Between 1990 and 1999, total greenhouse gas emissions from the energy sector have fallen by just 1.9%. However, there have been changes in the contribution of the different greenhouse gases. Carbon dioxide is dominant, accounting for 95.5% of the total in 1990 and 96.0% in 1999, with a fall of 1.3% in CO_2 emissions between 1990 and 1999.

In contrast, the contribution of nitrous oxide increased by 21.0% to reach 1.8% of the total emissions in 1999 (1.4% in 1990). Over the same period the contribution of methane fell by 30.9% to 2.2% of the total emissions in 1999 compared to 3.1% in 1990.

Indicator 8.10 Greenhouse Gas Emissions per Capita

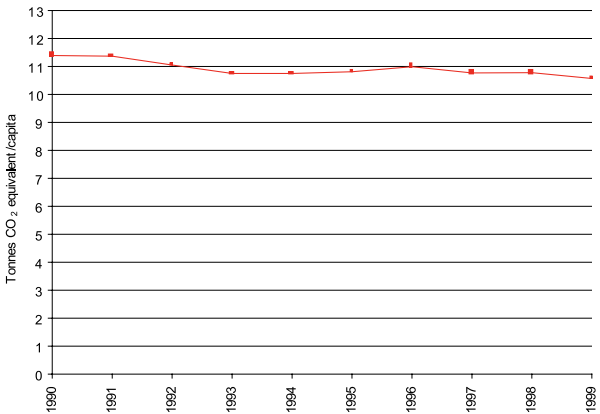


Table 8.10 Greenhouse Gas Emissions per Capita

Tonnes CO_2 equivalent/person (t CO_2 eq./person)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
GHG Emissions/Capita	11.39	11.37	11.05	10.75	10.75	10.81	10.99	10.77	10.78	10.57
Index (1990 = 100%)	100.0	99.9	97.0	94.4	94.4	94.9	96.5	94.6	94.6	92.8

Data Source: European Environment Agency; Eurostat, Social Statistics

Total greenhouse gas emissions per capita across the EU fell by 7.2% between 1990 and 1999.

These emissions relate mainly to the energy system. While greenhouse gas emissions from sources outside the energy system fell by 13.8% over the observation period, they accounted for only 18.3% of the total in 1999 (see indicator 8.5).

The decline in per capita emissions was steepest in the early part of the decade as a result of the economic slowdown. Only in 1999 did the per capita greenhouse gas emissions fall below the minimum level achieved in 1993 and 1994. The peak in 1996 (10.99 tonnes per capita) was linked to the cold winter that year.

Indicator 8.11 Greenhouse Gas Emissions per Unit of GDP

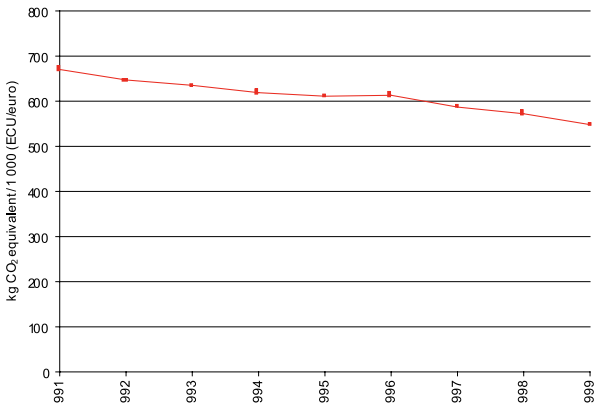


Table 8.11 Greenhouse Gas Emissions per Unit of GDP

kg CO_2 equivalent/1 000 (ECU/euro) (kg CO_2 eq./ 1 000 ECU/□)	1991	1992	1993	1994	1995	1996	1997	1998	1999
GHG Emissions/GDP	670	647	635	619	611	613	587	572	548
Index (1990 = 100%)	100.0	96.5	94.7	92.4	91.2	91.5	87.6	85.3	81.8

Data Source: European Environment Agency; Eurostat, National Accounts

Note: *The greenhouse gas emissions per unit of gross domestic product (GDP) links emissions to economic output. GDP is expressed at constant 1995 prices.*

Total greenhouse gas emissions per unit of GDP fell by 18.2% between 1991 and 1999. This reflects a combination of a 16.6% growth in GDP and a 4.3% drop in total greenhouse gas emissions (see indicator 8.5).

The increase in GDP took place mainly in sectors that are less energy intensive, such as the service sector. In addition, there has also been a contraction in a number of more energy intensive industries (such as the iron and steel industry) over the observation period.

Additional factors relating to the reduction in greenhouse gas emissions include an expansion in the use of lower carbon content fuels, improvements in energy efficiency and better controls over landfill gas emissions.

Indicator 8.12 Greenhouse Gas Emissions per Unit of Gross Inland Consumption of Energy

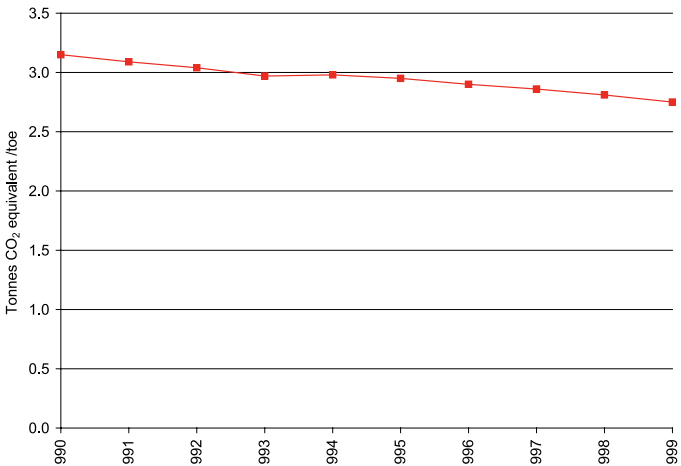


Table 8.12 Greenhouse Gas Emissions per Unit of Gross Inland Consumption of Energy

Tonnes CO_2 equivalent/toe (t CO_2 eq./ toe)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
GHG Emissions/GIC	3.15	3.09	3.04	2.97	2.98	2.95	2.90	2.86	2.81	2.75
Index (1990 = 100%)	100.0	98.1	96.5	94.3	94.6	93.7	92.1	90.8	89.2	87.3

Data Source: European Environment Agency; Eurostat, Energy Statistics

Total greenhouse gas emissions per unit of gross inland consumption (GIC) of energy fell by 12.7% over the period from 1990 to 1999.

This development is largely due to the switch from fuels such as coal and lignite, which emit high levels of greenhouse gases (particularly CO_2) per unit consumed, towards fuels such as natural gas which produce lower emissions.

In addition, the expansion in the use of renewable energy and nuclear power reduced emissions, since neither produce greenhouse gas emissions (except where the combustion of waste or biomass is involved).

Indicator 8.13 Indices of Carbon Dioxide Emissions from Energy Transformation and Consumption, by Fuel

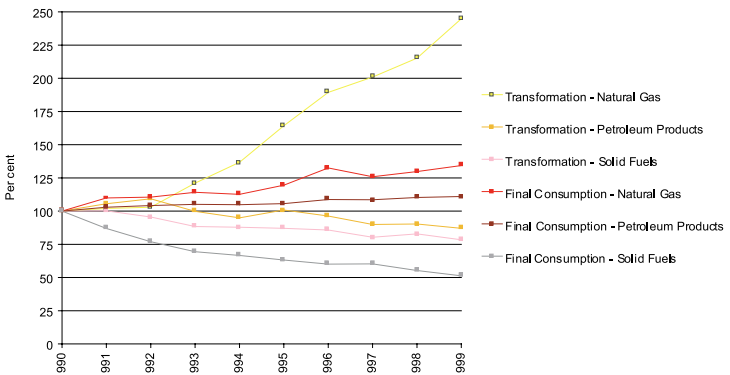


Table 8.13 Indices of Carbon Dioxide Emissions from Energy Transformation and Consumption, by Fuel

Per cent (1990 = 100%) (%)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Transformation - Natural Gas	100	102	103	121	137	164	189	201	215	245
Transformation - Petroleum Products	100	106	109	100	95	101	96	90	90	87
Transformation - Solid Fuels	100	100	96	88	88	87	86	80	83	78
Final Consumption - Natural Gas	100	110	111	114	113	119	132	126	130	134
Final Consumption - Petroleum Products	100	103	104	105	105	106	109	109	110	111
Final Consumption - Solid Fuels	100	87	77	69	67	63	60	60	55	51

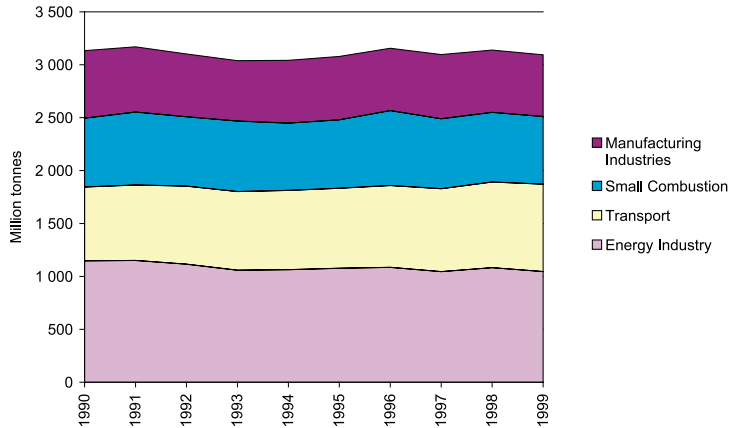
Data Source: Eurostat, Energy Statistics

Note: *Indices relating to transformation cover fuels used in thermal power stations, district heating systems and oil refineries. Indices relating to final energy consumption cover energy use by final consumers in the transport, industrial, commercial, agricultural, public and household sectors.*

In energy transformation and final consumption, the steepest decline was observed with regard to CO_2 emissions from the use of solid fuels, while CO_2 emissions from the use of natural gas increased considerably. These developments are influenced by fuel switching, partly due to the wider availability of natural gas but also due to economic and environmental considerations. Despite the drop in CO_2 emissions from solid fuels, these fuels give rise to more than twice the volume of CO_2 emissions produced by the use of oil fuels and natural gas together.

In the energy transformation sector emissions from the use of oil decreased during the observation period. In contrast, emissions from the final consumption of petroleum products grew steadily. The key reason was the continuing growth in the consumption of transport fuels (see indicator 3.5).

Indicator 8.14 Carbon Dioxide Emissions, by Sector



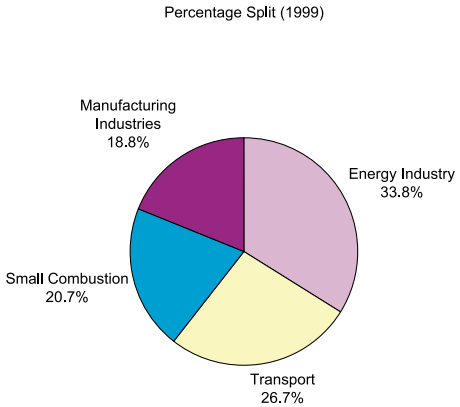


Table 8.14 Carbon Dioxide Emissions, by Sector

Thousand tonnes(kt)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999
Manufacturing Industries	638 445	616 305	593 131	570 403	593 094	599 090	588 702	606 499	588 101	582 747	18.8%
Small Combustion	650 417	689 527	655 389	666 573	636 167	646 545	708 048	660 896	658 610	639 725	20.7%
Transport	697 683	712 744	737 863	743 030	749 211	756 149	773 012	783 278	809 112	825 973	26.7%
Energy Industry	1 147 030	1 151 159	1 115 602	1 058 896	1 063 455	1 077 058	1 086 066	1 045 530	1 082 775	1 045 668	33.8%
Total	3 133 575	3 169 735	3 101 985	3 038 901	3 041 926	3 078 842	3 155 827	3 096 202	3 138 599	3 094 112	100.0%

Data Source: European Environment Agency

Note: *The "Small Combustion" sector comprises the commercial and service sectors, households, agriculture and public institutions. In accordance with the guidelines of the United Nations Framework Convention on Climate Change, data for the transport sector do not include emissions from international aviation or international marine transport.*

Although emissions from the energy industry fell by 8.8% between 1990 and 1999, it still contributes most to the total CO_2 emissions (33.8% in 1999 compared to 36.6% in 1990). This occurred mainly as a result of switching from fossil fuels to natural gas, increased use of renewable energy and nuclear generation and energy efficiency gains in general. Over the same period, emissions from the transport sector rose by 18.4% (mainly due to road transport) , and the share of this sector grew from 22.3 % to 26.7% between 1990 and 1999.

Carbon dioxide emissions from manufacturing industries and from the small combustion sector both fell between 1990 and 1999, by 8.7% and 1.6% respectively. Emissions from the small combustion sector are volatile from year to year, mainly reflecting annual weather conditions.

Indicator 8.15 Carbon Dioxide Emissions from Electricity Generation

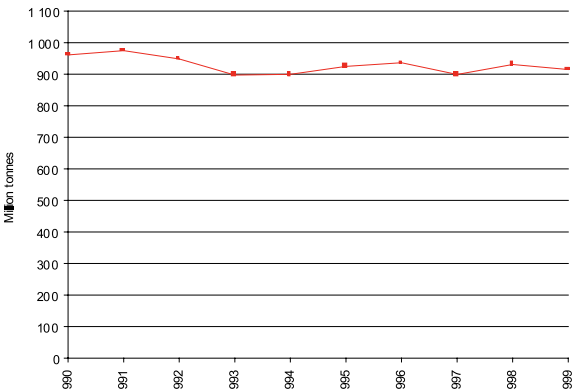


Table 8.15 Carbon Dioxide Emissions from Electricity Generation

Thousand tonnes (kt)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CO_2 Emissions	961 235	974 736	948 499	897 148	899 651	924 630	936 210	899 149	930 643	914 852
Index (1990 = 100%)	100.0	101.4	98.7	93.3	93.6	96.2	97.4	93.5	96.8	95.2

Data Source: Eurostat, Energy Statistics

The emissions of carbon dioxide linked to the generation of electricity decreased by 4.8% between 1990 and 1999. Over this period electricity generation consistently contributed around 30% of the CO_2 emissions from the energy system, which in turn took a share of approximately 95% of the total CO_2 emissions.

The decrease in CO_2 emissions associated with electricity generation was achieved despite an 18.1% growth in total electricity generated (see indicator 4.3). Switching to fuels with a relatively low carbon content (e.g. natural gas) at the expense of solid fuels such as coal and lignite, a modest expansion of renewable and nuclear energy, gains in the efficiency of electricity generating plants (combined cycle gas turbine technology etc.) and the decommissioning of older, less efficient units were the main causes for this decrease.

9 Member State Data

Indicator 9.1 Energy Intensity (1999), by Member State

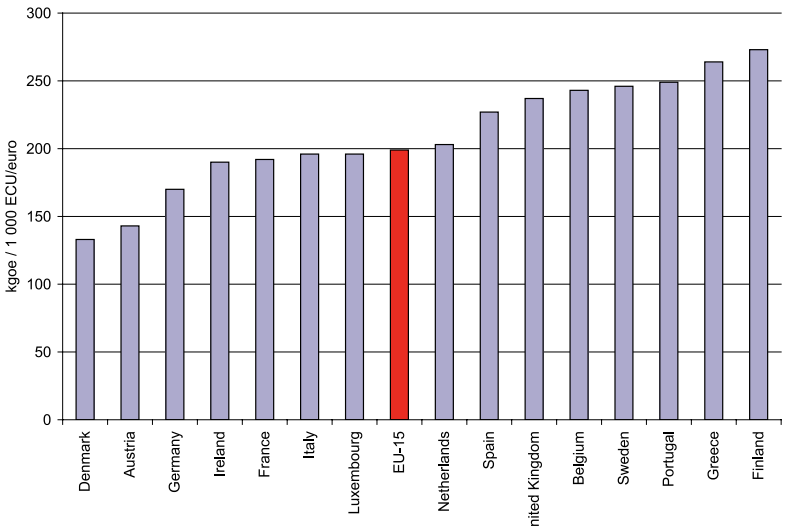


Table 9.1 Energy Intensity (1999), by Member State

kgoe/1 000 ECU (euro)	EU-15	Belgium	Denmark	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
Energy Intensity	199	243	133	170	264	227	192	190	196	196	203	143	249	273	246	237

Data Source: Eurostat , Energy Statistics

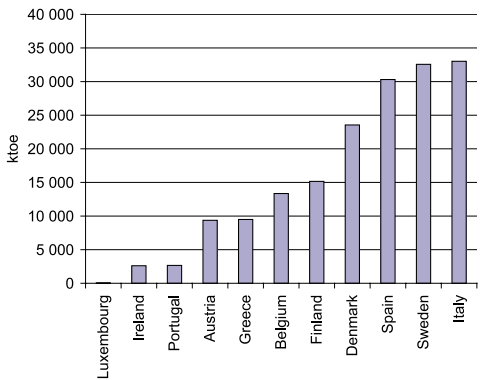
Note: *While indicator 1.2 presents the data for the whole EU, this indicator looks at individual Member States. Energy intensity is calculated by dividing the gross inland consumption of energy by the gross domestic product (GDP)*

Energy intensity measures the energy used to produce a unit of output. The de-coupling of growth in economic activity from increasing energy consumption is often quoted as a goal for sustainable development.

In the EU-15, energy intensity has fallen steadily over the last decade, with an 8.2% drop in the absolute figure between 1991 and 1999. Seven Member States had energy intensities lower than the EU average of 199 kgoe/1000 euro. Denmark was the country with the lowest energy intensity, some 33.2% lower than the EU average in 1999. The figures for Austria and Germany were 28.1% and 14.6% lower than the EU average.

Eight Member States had higher energy intensities compared to the EU average. The energy intensity of Finland was 37.2% above the EU average, followed by Greece (32.7%) and Portugal (25.1%).

Indicator 9.2 Total Primary Energy Production (1999), by Member State



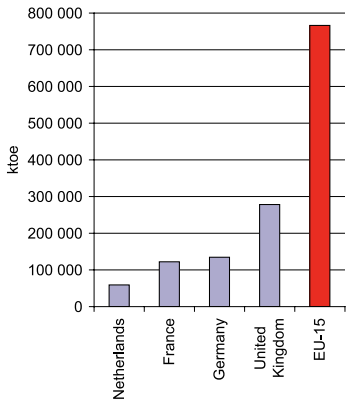


Table 9.2 Total Primary Energy Production (1999), by Member State

Thousand tonnes of oil equivalent (ktoe)	EU-15	Belgium	Denmark	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
Total Primary Energy Production	766 394	13 351	23 550	134 576	9 491	30 305	122 173	2 611	33 019	46	59 208	9 365	2 656	15 153	32 568	278 322

Data Source: Eurostat, Energy Statistics, National Accounts

Note: *Indicator 2.1 presents total primary energy production by fuel for the whole of the EU-15 while this indicator breaks the total down into national primary energy production.*

Total primary energy production in the EU-15 grew by 8.6% between 1990 and 1999. However, production decreased in the early 1990s, reflecting the economic development during that period, and only climbed back above its 1985 level in 1995. Since 1996 primary energy production has remained relatively stable, although there was an increase of 2.2% in 1999.

The Member State with by far the highest primary energy production was the UK, which accounted for 36.3% of the EU total value. Germany accounted for 17.6% and France for 15.9%.

About 75% of the EU primary energy production is based on nuclear energy, natural gas and crude oil. The UK is a major producer of oil and gas as well as coal while the primary energy production of Germany and France is dominated by nuclear energy with coal also making a significant contribution in Germany.

Indicator 9.3 Gross Inland Consumption, by Fuel and Member State (1999)

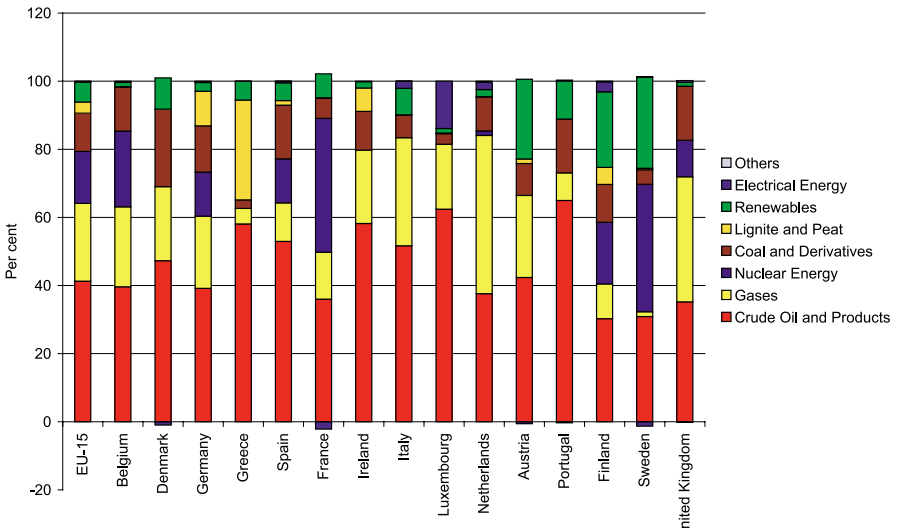


Table 9.3 Gross Inland Consumption, by Fuel and Member State (1999)

Thousand tonnes of oil equivalent(ktoe)	EU-15	Belgium	Denmark	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
Crude Oil and Products	595 313	22 527	9 635	132 933	15 560	62 209	89 945	8 093	90 515	2 147	27 990	12 014	15 572	9 902	15 576	80 695
Gases	329 533	13 340	4 424	71 996	1 218	13 289	34 481	2 997	55 569	656	34 581	6 831	1 940	3 338	714	84 160
Nuclear Energy	220 206	12 644	-	43 853	-	15 181	98 194	-	-	-	988	-	-	5 926	18 879	24 540
Coal and Derivatives	161 726	7 334	4 636	46 090	672	18 519	14 907	1 581	11 754	107	7 469	2 660	3 790	3 637	2 151	36 419
Lignite and Peat	47 506	86	1	34 509	7 852	1 573	264	956	14	6	17	373	-	1 637	217	-
Renewables	84 575	706	1 874	8 731	1 470	6 130	17 553	257	13 651	46	1 547	6 643	2 656	7 261	13 474	2 577
Electrical Energy	2 027	73	-199	89	14	492	-5 429	21	3 612	478	1 586	-163	-74	956	-653	1 225
Others	1 547	134	-1	1 211	-	76	-	-1	55	-	253	-	82	66	81	408
Total	1 442 433	56 844	20 370	339 412	26 786	117 469	249 915	13 904	175 170	3 440	74 431	28 358	23 966	32 723	50 439	229 208

Data Source: Eurostat, Energy Statistics

Note: *Negative values of Gross Inland Consumption of electrical energy indicate that exports exceed imports.*

Crude oil and products account for 41.3% of gross inland consumption in the EU-15. This is the main energy source in all Member States except Sweden and France (nuclear energy), The Netherlands and the UK (natural gas). The countries with the greatest oil dependency are Luxembourg (62.4%), Ireland (58.2%) and Greece (58.1%). Gas is the second most used fuel (with a 22.8% share in the EU), and is now the main energy source in the UK (36.7%) as well as The Netherlands (46.5%). Gas is only used to a very limited extent in Sweden (1.4%) and Greece (4.5%).

Nuclear energy accounts for 15.3% of EU total gross inland consumption. It is the most important energy source in France (39.3%) and Sweden (37.4%), while seven Member States do not have any nuclear power plants. Solid fuels (coal and derivatives plus lignite and peat) account for a 14.5% share of the total gross inland consumption in the EU-15. The countries with the greatest reliance on solid fuels are Greece (31.8%), Germany (23.7%) and Denmark (22.8%), while Luxembourg (3.3%) and Sweden (4.7%) use this fuel the least. Renewable energy accounts for 5.9% of total energy consumption across the EU (see indicator 9.4).

Indicator 9.4 Contribution of Renewable Energy Sources to Gross Inland Consumption (1999), by Member State

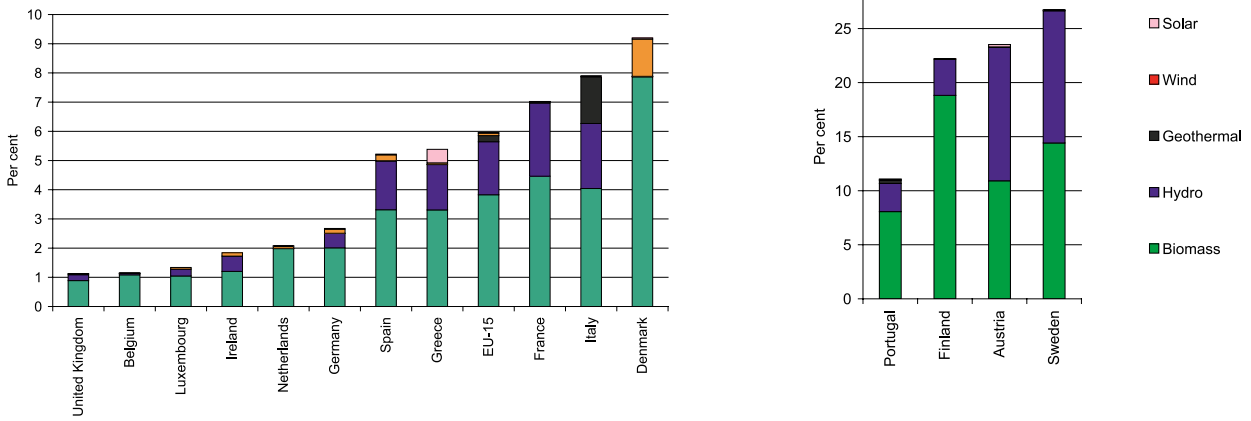


Table 9.4 Contribution of Renewable Energy Sources to Gross Inland Consumption (1999), by Member State

Per cent (%)	EU-15	Belgium	Denmark	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
Solar	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0
Wind	0.1	0.0	1.3	0.1	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0
Geothermal	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	-	-	0.0	0.3	-	-	0.0
Hydro	1.8	0.1	0.0	0.5	1.6	1.7	2.5	0.5	2.2	0.2	0.0	12.3	2.6	3.4	12.2	0.2
Biomass	3.8	1.1	7.9	2.0	3.3	3.3	4.5	1.2	4.0	1.0	2.0	10.9	8.1	18.8	14.4	0.9
RES Total/GIC	5.9	1.2	9.2	2.6	5.5	5.2	7.0	1.8	7.8	1.3	2.1	23.4	11.1	22.2	26.7	1.1

Data Source: Eurostat, Energy Statistics

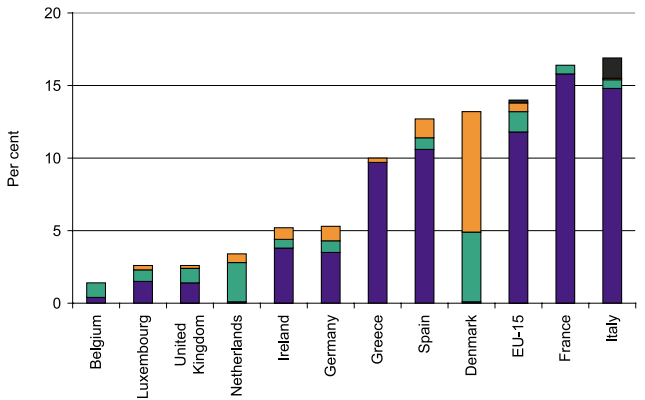
The contribution of renewable energy sources to gross inland consumption (GIC) varies widely between Member States. Overall, this share is around one third of the share which these energy sources contribute to total electricity generation (see indicator 9.5).

Renewable energy sources contribute the most to GIC in Sweden (26.7%), Austria (23.4%) and Finland (22.2%). Renewable energy makes the lowest contribution in the UK (1.1%), Belgium (1.2%) and Luxembourg (1.3%).

In Austria, Finland and Sweden, the countries where renewables take the greatest share of GIC, there are significant hydropower or biomass sources of energy production.

Renewable energy sources based on solar and wind are growing, but they still make a relatively minor contribution to the gross inland production of most Member States.

Indicator 9.5 Contribution of Renewable Energy Sources to Electricity Generation, by Source and Member State (1999)



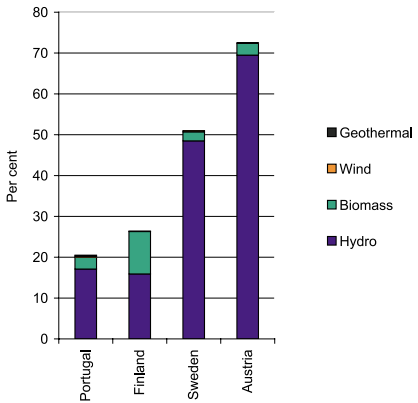


Table 9.5 Contribution of Renewable Energy Sources to Electricity Generation, by Source and Member State (1999)

Per cent (%)	EU-15	Belgium	Denmark	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg	Netherlands	Austria	Portugal	Finland	Sweden	United Kingdom
Geothermal	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Wind	0.6	0.0	8.3	1.0	0.3	1.3	0.0	0.8	0.1	0.3	0.6	0.1	0.3	0.1	0.3	0.2
Biomass	1.4	1.0	4.8	0.8	0.0	0.8	0.6	0.6	0.6	0.8	2.7	2.9	2.9	10.4	2.2	1.0
Hydro	11.8	0.4	0.1	3.5	9.7	10.6	15.8	3.8	14.8	1.5	0.1	69.5	17.1	15.9	48.5	1.4
Total	14.0	1.4	13.2	5.3	10.0	12.7	16.4	5.2	16.9	2.6	3.4	72.5	20.5	26.4	51.0	2.6

Data Source: Eurostat, Energy Statistics

The contribution of renewables to total electricity generation is highest in Austria (72.5%), Sweden (51.0%), Finland (26.4%) and Portugal (20.5%). The countries with the lowest contribution are Belgium (1.4%), Luxembourg (2.6%) and the UK (2.6%).

Hydro-electric power is the most significant source of renewable electricity in the EU-15, accounting for 84.3% of all renewable electricity. Hydropower is the largest source of renewable electricity in all countries except Belgium (biomass), Denmark (wind power and biomass) and The Netherlands (biomass and wind power).

The contribution of biomass is increasing and it is the second most important source of renewable electricity in the EU-15.

The share accounted for by wind power is also growing. It has now reached 4.3% of the total electricity generated from renewables in the EU. Wind takes the greatest share in Denmark (62.9% of all renewable energy sources).

Geothermal energy accounts for 8.3% of renewable electricity in Italy, the only country where this energy source is used to a significant extent.

10 Accession Countries Data

Indicator 10.1 Gross Inland Consumption, by Fuel and Accession Country (1998)

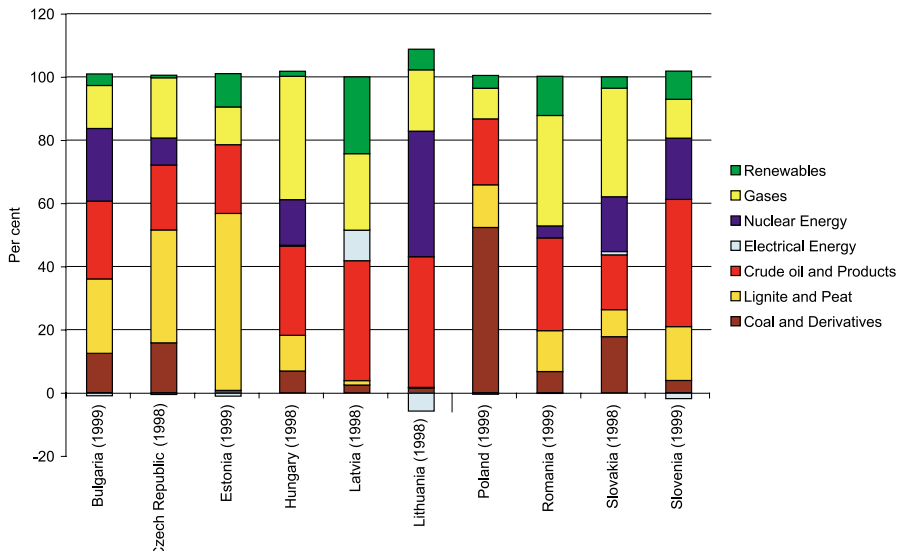


Table 10.1 Gross Inland Consumption, by Fuel and Accession Country (1998)

Per cent (%)	Coal and Derivatives	Lignite and Peat	Crude oil and Products	Electrical Energy	Nuclear Energy	Gases	Renewables
Bulgaria (1999)	12.5	23.5	24.6	-0.9	23.0	13.6	3.7
Czech Republic (1998)	15.8	35.7	20.6	-0.5	8.6	19.1	0.8
Estonia (1999)	0.8	56.0	21.8	-1.1	-	11.9	10.6
Hungary (1998)	6.9	11.3	28.3	0.3	14.4	39.0	1.6
Latvia (1998)	2.5	1.4	38.0	9.7	-	24.2	24.3
Lithuania (1998)	1.5	0.2	41.4	-5.8	39.7	19.4	6.5
Poland (1999)	52.3	13.5	20.9	-0.5	-	9.7	4.1
Romania (1999)	6.7	12.9	29.4	-0.2	3.8	34.9	12.4
Slovakia (1998)	17.8	8.6	17.3	1.1	17.4	34.3	3.6
Slovenia (1999)	3.9	17.1	40.3	-1.8	19.4	12.3	8.9

Data Source: Eurostat, Energy Statistics

Note: *Negative values of Gross Inland Consumption of electrical energy indicate that exports exceed imports.*

For all the accession countries included in this analysis, coal and its derivatives as well as crude oil and oil products remain the most important fuels used.

The contribution that the various fuels make varies significantly between countries. Solid fuels take the largest share of total gross inland consumption in Poland (65.8%), Estonia (56.8%) and the Czech Republic (51.5%). These are all countries with substantial reserves of coal, lignite or (in the case of Estonia) oil-shale.

Oil is the most important fuel in Slovenia (40.3%), Lithuania (41.4 %) and Latvia (38.0%). Gas is the most used fuel in Hungary (39.0%), Romania (34.9%) and Slovakia (34.3%).

Nuclear energy takes a high share in Lithuania (39.7%), Bulgaria (23.0%) and Slovenia (19.4%). Only Estonia, Latvia and Poland have no nuclear power generation capacity. Renewable energy makes the greatest contribution in Latvia (24.s3%), Romania (12.4%) and Estonia (10.6%). These countries are characterised by favourable conditions for the use of biomass and/or hydro-electric power.

Indicator 10.2 Electricity Generation, by Type of Plant and Accession Country (1999)

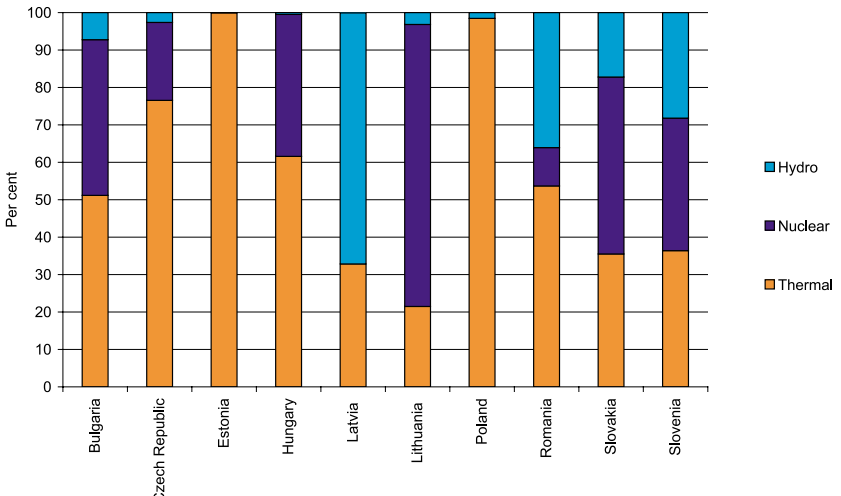


Table 10.2 Electricity Generation, by Type of Plant and Accession Country (1999)

Gigawatt hours (GWh)	Thermal	Nuclear	Hydro	Wind	Other Fuel Sources	Total
Bulgaria	19 452	15 814	2 753	0	0	38 019
Czech Republic	49 117	13 357	1 680	1	3	64 158
Estonia	8 263	0	4	0	0	8 267
Hungary	22 877	14 096	181	0	0	37 154
Latvia	1 350	0	2 757	2	1	4 110
Lithuania	2 812	9 862	414	0	0	13 088
Poland	137 842	0	2 155	4	0	140 001
Romania	27 222	5 198	18 290	0	0	50 710
Slovakia	9 850	13 117	4 776	0	0	27 743
Slovenia	4 825	4 696	3 740	0	0	13 261

Data Source: Eurostat, Energy Statistics

Thermal power stations are the dominant means of electricity generation in the accession countries covered in this analysis, accounting for 71.5% of total electricity generation. Nuclear electricity accounts for 19.2% and renewable energy sources (almost exclusively hydropower) for the remaining 9.3%.

Thermal power plants are the dominant form of generation in Poland (98.5%), the Czech Republic (76.6%) and Hungary (61.6%). They also account for more than half of the electricity generated in Romania and Bulgaria.

Nuclear power contributes most to electricity generation in Lithuania (75.4%), followed by Slovakia (47.3%), Bulgaria (41.6%) and Hungary (37.9%). Electricity generated in nuclear power plants also contribute more than 10% of total electricity output in Slovenia, the Czech Republic and Romania.

The most significant source of renewable energy is hydropower which contributes 67.1% in Latvia, 36.1% in Romania and 28.2% in Slovenia. The contribution of hydropower is much smaller in the other countries, while wind power remains in its infancy.

Indicator 10.3 Greenhouse Gas Emissions (1997), by Accession Country

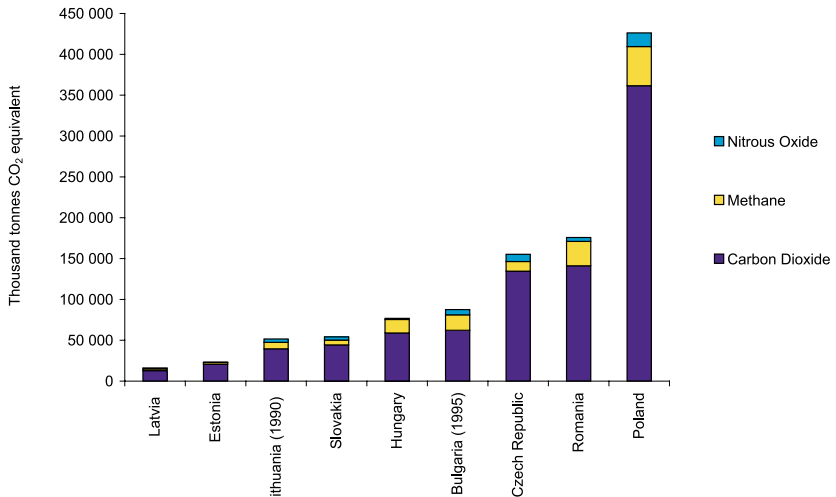


Table 10.3 Greenhouse Gas Emissions (1997), by Accession Country

Thousand tonnes CO_2 equivalent (kt CO_2 eq.)	Carbon Dioxide	Methane	Nitrous Oxide	Total
Bulgaria (1995)	62 227	18 929	6 386	87 542
Czech Republic	134 585	11 808	8 882	155 274
Estonia	20 716	2 164	217	23 097
Hungary	58 893	16 548	1 364	76 805
Latvia	12 842	2 138	1 184	16 164
Lithuania (1991)	39 535	7 937	4 077	51 548
Poland	361 626	47 850	16 743	426 219
Romania	141 177	29 852	4 721	175 750
Slovakia	44 376	5 856	3 894	54 125

Data Source: European Environment Agency

Total greenhouse gas (GHG) emissions from the accession countries for which data is available were 1 066 million tonnes of CO_2 equivalent, while in 1999 total GHG emissions from the EU-15 Member States were 3 972 million tonnes (see indicator 8.5).

The breakdown of emissions between the three main greenhouse gases is different for the accession countries than for Member States. Carbon dioxide is by far the most significant one and accounts for 82.1% of the total greenhouse gas emissions, compared to 82.5% in the EU-15. However, the contribution of methane in the accession countries (13.4%) is higher than in the EU-15 (9.2%), while the contribution of nitrous oxide (4.5%) is lower than the 8.4% in the EU-15.

Annex A Glossary of Terms used in this Publication

Acid Equivalent:

The acid equivalent of a gas is a measure of the acidifying effect of that gas. The concept is used in order to determine the acidifying effect of a combination of different gases. This is achieved by first multiplying the quantities of the individual gases by their respective acid equivalents and then adding these equivalent quantities together. For the gases included in this publication, the acid equivalent of sulphur dioxide (SO_2) is 1/32, and that of oxides of nitrogen (NO_x) is 1/46.

Acidifying Gases:

The acidifying gases considered in this publication are sulphur dioxide (SO_2) and oxides of nitrogen (NO_x). Emissions of these gases are associated with the formation of acid rain.

CHP:

See "Combined Heat and Power"

CO_2 Equivalent:

The CO_2 equivalent of a greenhouse gas is obtained by multiplying the quantity of that gas by its global warming potential (q.v.). This is achieved by first multiplying the quantities of the individual gases by their respective global warming potentials and then adding these equivalent quantities together.

Cogeneration:

See "Combined Heat and Power"

Combined Heat and Power:

A combined heat and power (also referred to as a cogeneration or a CHP) unit is an installation in which heat energy released from fuel is transmitted to electrical generator sets which are designed

and operated in such a way that energy is partly used for generating electrical energy and partly for supplying heat for various purposes. The thermal efficiency of a combined heat and power unit is significantly higher than that of a unit producing electricity only.

Constant Price:

The constant price of a commodity is its price considered in constant terms, taking account of inflation.

Current Price:

The current (or nominal) price of a commodity is its price considered in current terms, without taking account of inflation.

Energy Dependency:

Energy dependency shows the extent to which a country relies upon imports in order to meet its energy needs. It is calculated using the following formula: net imports / gross inland consumption.

Energy Intensity:

Energy intensity gives an indication of the effectiveness with which energy is being used to produce added value. It is defined as the ratio of Gross Inland Consumption of energy to Gross Domestic Product.

Energy System:

The energy system is the total of the energy transformation sector and final energy consumption.

Final Energy Consumption:

Final energy consumption is the energy finally consumed in the transport, industrial, commercial, agricultural, public and household sectors. It excludes deliveries to the energy transformation sector and to the energy industries themselves.

GCV:

See "Gross Calorific Value"

GDP:

See "Gross Domestic Product"

Global Warming Potential:

The global warming potential of a greenhouse gas is a measure of its ability to trap heat in the Earth's atmosphere over a 100-year period. This is quoted relative to the potential of carbon dioxide which has a global warming potential of 1. With regard to the other gases included in this publication, the global warming potential of methane (CH_4) is 21, and that of nitrous oxide (N_2O) is 310.

Greenhouse Gases:

The main greenhouse gas emissions considered in this publication are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Emissions of these gases are associated with the "Greenhouse Effect" which gives rise to an increase in the Earth's temperature.

Gross Calorific Value:

The gross calorific value (GCV) is the total amount of heat released by a unit quantity of fuel, when it is burned completely with oxygen, and when the products of combustion are returned to ambient temperature. This quantity includes the heat of condensation of any water vapour contained in the fuel and of the water vapour formed by the combustion of any hydrogen contained in the fuel.

Gross Domestic Product:

The gross domestic product (GDP) is the value of the output of all goods and services produced within the borders of a country.

Gross Inland Consumption:

Gross inland consumption is the quantity of energy consumed within the borders of a country. It is calculated using the following formula: primary production + recovered products + imports + stock changes - exports - bunkers (i.e. quantities supplied to sea-going ships).

Hard Coal and Derived Products:

Hard coal and derived products include hard coal, patent fuels, hard coke, gasworks coke and coal semi-coke.

Lignite and Derived Products:

Lignite and derived products include lignite, peat, brown coal briquettes and peat briquettes.

Natural Gas:

Natural gas occurs in natural underground deposits, and may or may not be associated with oil deposits. It contains essentially methane, but also small proportions of other gases. It also covers methane recovered in coal mines.

NCV:

See "Net Calorific Value"

Net Calorific Value:

The net calorific value (NCV) is the amount of heat released by a unit quantity of fuel, when it is burned completely with oxygen, and when the products of combustion are returned to ambient temperature. This quantity does not include the heat of condensation of any water vapour contained in the fuel nor of the water vapour formed by the combustion of any hydrogen contained in the fuel.

Nominal Price:

See "Current Price"

Power Station Efficiency:

The efficiency of a thermal or nuclear power station is defined as the ratio between the output, i.e. the gross electricity generated, and the fuel input. In the case of a combined heat and power installation the output is the gross electricity generated plus the heat produced.

Primary Energy Production:

Primary energy production is the extraction of energy from a natural source. The precise definition depends on the fuel involved:

Hard coal, lignite: Quantities of fuels extracted or produced, calculated after any operation for removal of inert matter. In general, production includes the quantities consumed by the producer during the production process (e.g. for heating or operation of equipment and auxiliaries) as well as any quantities supplied to other on-site producers of energy for transformation or other uses.

Crude oil: Quantities of fuels extracted or produced within national boundaries, including off-shore production. Production includes only marketable production, and excludes any quantities returned to formation. Production includes all crude oil, natural gas liquids (NGL), condensates and oil from shale and tar sands, etc.

Natural gas: Quantities of dry gas, measured after purification and extraction of natural gas liquids and sulphur. The production includes only marketable production, and excludes any quantities re-injected, vented and flared, and any extraction losses. The production includes all quantities used within the natural gas industry, in gas extraction, pipeline systems and processing plants.

Nuclear heat: Quantities of heat produced in a reactor. Production is the actual heat produced or the heat calculated on the basis of the gross electricity generated and the thermal efficiency of the nuclear plant.

Hydropower, Wind energy, Solar photovoltaic energy: Quantities of electricity generated. Production is calculated on the basis of the gross electricity generated and a conversion factor of 3 600 kJ/kWh.

Geothermal energy: Quantities of heat extracted from geothermal fluids. Production is calculated on the basis of the difference between the enthalpy of the fluid produced in the production borehole and that of the fluid disposed of via the reinjection borehole.

Biomass / Wastes: In the case of municipal solid wastes (MSW), wood, wood wastes and other solid wastes, production is the heat produced after combustion and corresponds to the heat content (NCV) of the fuel.

In the case of anaerobic digestion of wet wastes, production is the heat content (NCV) of the biogases produced. The production includes all quantities of gas consumed in the installation for the fermentation processes, and excludes all quantities of flared gases.

In the case of biofuels, the production is the heat content (NCV) of the fuel.

Real Price:

See "Constant Price"

Renewable Energy:

Renewable energy includes hydroelectricity, biomass, wind, solar, tidal and geothermal energies.

Value Added:

The value added (to a product, or added value of a product) is the increase in the value of that product as the result of a particular stage of the production process.

Annex B Methodology for the Calculation of EU-wide Average Fuel Prices

All available price data have been used in the calculation of EU-wide fuel price averages in the section on energy prices. However, in the majority of the series in this section, price data for the three countries most recently acceded to the Union (Sweden, Finland and Austria) are not available before 1995. Since the overall EU price is an average of the prices in the individual countries weighted by their consumption, the impact on the EU price of these Member States will be minimal due to their relatively low consumption.

Electricity

Electricity prices are collected by Eurostat from the Member States of the EU based on the principles of Directive 90/377/EEC for Price Transparency. The prices are as of 1 January in the year shown. Prices are collected at a variety of locations in each country and for a number of different consumers. For *domestic* prices, the standard consumer used is Dd - one with an annual consumption of 7 500 kWh which corresponds to a standard dwelling of 100m^2 with 4-5 rooms plus a kitchen. For *industrial* prices, the standard consumer used is Ig - one with an annual consumption of 24 GWh and a maximum demand of 4 000 kW. More detailed information on the collection of electricity prices can be found in Eurostat's Electricity Prices publication.

The average price in each country is calculated as the median of the prices in the various locations. The average EU price is then calculated by taking a weighted average of the prices in individual countries. *Domestic* prices are weighted by the final energy consumption of electricity in households recorded annually by Eurostat. *Industrial* prices are weighted by the final energy consumption of electricity in industry recorded by the same survey. Since price data are available for 2000 and 2001 but consumption data is not, the prices for 2000 and 2001 have been weighted by 1999 consumption; this should have only a small effect on the EU average.

The survey collects prices all taxes included, prices without VAT and prices all taxes excluded. The *domestic* prices shown here are prices all taxes included while *industrial* prices are shown without VAT (i.e. what industry will actually pay for the energy).

Gas

Natural gas prices are collected by Eurostat on a similar basis to electricity prices following the same regulation. Again, the prices are as of 1 January in the year shown. The EU averages are also calculated in the same way albeit using different standard consumers and different consumption measures to weight the country prices. For *domestic* consumers, the standard consumer used is D2 (annual consumption of 16.74 GJ i.e. 4 652 kWh) while for *industrial* consumers it is I4-1 (annual consumption of 418 600 GJ i.e. 116.30 GWh). More detailed information on the collection of natural gas prices can be found in Eurostat's Gas Prices publication.

The average price in each country is calculated as the median of the prices in the various locations. The average EU price is then calculated by taking a weighted average of the prices in individual countries. -*Domestic* natural gas prices are weighted by final energy consumption of gas in households while *industrial* prices are weighted by final consumption in industry. Since price data are available for 2000 and 2001 but consumption data is not, the prices for 2000 and 2001 have been weighted by 1999 consumption; this should have only a small effect on the EU average.

The survey collects prices all taxes included, prices without VAT and prices all taxes excluded. The *domestic* prices shown here are prices all taxes included while industrial prices are shown without VAT (i.e. what industry will actually pay for the energy).

Petroleum products

The heating gasoil, residual fuel oil and gasoline and automotive diesel prices are supplied to DG-TREN of the Commission by the Member States as those being the most representative price levels actually charged to consumers for the specific categories of sale listed below. This data collection is based on Council Decision 1999/280/EC and Commission Decision 1999/566/EC. The prices given are as of 15 January in each year.

The heating gasoil prices given are for deliveries of between 2 000 and 5 000 litres while those for residual fuel oil are for monthly deliveries of less than 2 000 tonnes or annual deliveries of less than 24 000 tonnes. Average pump prices are given for premium (leaded) gasoline, unleaded gasoline and automotive diesel fuel.

The EU average prices are calculated by weighting the prices from each country by the final energy consumption of heating gasoil in households, of residual fuel oil in industry and of the three automotive fuels (separately) in transport for the respective products. Since price data are available for 2000 and 2001 but consumption data is not (with the exception of unleaded gasoline for which consumption figures are available also for 2000), the prices for 2000 and 2001 have been weighted by 1999 consumption; this should have only a small effect on the EU average.

EU-wide prices for premium gasoline are not given for 1997 to 2001 because falling consumption means that some of the prices have become unreliable.

Coal

The average import prices of steam coal are taken from Eurostat's Comext database of trade in goods of EU Member States. The prices include imports from within and outside the EU. They are calculated by taking the total value of imports to each Member State and dividing it by the total quantity. The EU average is then calculated by weighting the results from each Member State by the coal input into conventional thermal power stations (for steam coal) and by coal input into coking plants (for coking coal).

All available price data has been used in the calculation of EU-wide fuel price averages in the section on energy prices. However, in the majority of the series in this section, price data for the three countries most recently acceded to the Union (Sweden, Finland and Austria) are not available before 1993. (This is not the case for the data presented in the other sections which include all Member States for the entire period, including, unless otherwise stated, the former East Germany). Since the overall EU price is an average of the prices in the individual countries weighted by their consumption, the impact on the EU price of these Member States will be minimal due to their relatively low consumption.

Annex C Calorific Values and Conversion Factors

		kJ (NCV)	kgoe (NCV)
Hard coal	1 kg	17 200 - 30 700	0.411 - 0.733
Recovered hard coal	1 kg	13 800 - 28 300	0.330 - 0.676
Patent fuels	1 kg	26 800 - 31 400	0.640 - 0.750
Hard coke	1 kg	28 500	0.681
Brown coal	1 kg	5 600 - 10 500	0.134 - 0.251
Black lignite	1 kg	10 500 - 21 000	0.251 - 0.502
Peat	1 kg	7 800 - 13 800	0.186 - 0.330
Brown coal briquettes	1 kg	20 000	0.478
Tar	1 kg	37 700	0.900
Benzol	1 kg	39 500	0.943
Oil equivalent [1]	1 kg	41 868	1
Crude oil	1 kg	41 600 - 42 800	0.994 - 1.022
Feedstocks	1 kg	42 500	1.015
Refinery gas	1 kg	50 000	1.194
LPG	1 kg	46 000	1.099
Motor spirit	1 kg	44 000	1.051
Kerosenes, jet fuels	1 kg	43 000	1.027
Naphtha	1 kg	44 000	1.051
Gas diesel oil	1 kg	42 300	1.010
Residual fuel oil	1 kg	40 000	0.955
White spirit, industrial spirit	1 kg	44 000	1.051
Lubricants	1 kg	42 300	1.010
Bitumen	1 kg	37 700	0.900
Petroleum cokes	1 kg	31 400	0.750
Others petroleum products (paraffins, waxes, etc.)	1 kg	30 000	0.717
Natural gas	1 MJ (GCV)	900	0.0215
Coke-oven gas	1 MJ (GCV)	900	0.0215
Blast-furnace gas	1 MJ (GCV)	1 000	0.0239
Works gas	1 MJ (GCV)	900	0.0215
Nuclear energy	1 MJ (GCV)	1 000	0.0239
Biomass	1 MJ (GCV)	1 000	0.024
Solar energy	1 MJ (GCV)	1 000	0.024
Geothermal energy	1 MJ (GCV)	1 000	0.024
Hydro energy	1 kWh	3 600	0.086
Wind energy	1 kWh	3 600	0.086
Derived heat	1 MJ (GCV)	1 000	0.024
Electrical energy	1 kWh	3 600	0.086

(1) The tonne of oil equivalent is a conventional standardised unit defined on the basis of a tonne of oil with a net calorific value of 41 868 kilojoules/kg. The conversion coefficients from the specific units to kgoe (kilogramme of oil equivalent) are thus computed by dividing the conversion co-efficients to the kilojoules by 41 868.

The following prefixes are used for multiples of toe, joules, watts and watt hours:

kilo (k)	=	1 000	or 10^3
mega (M)	=	1 000 000	or 10^6
giga (G)	=	1 000 000 000	or 10^9
tera (T)	=	1 000 000 000 000	or 10^{12}
peta (P)	=	1 000 000 000 000 000	or 10^{15}

Conversion Factors

Energy *To*	**TJ**	**Gcal**	**Mtoe**	**MBtu**	**GWh**
From					
TJ	1	238.8	2.388×10^{-5}	947.8	0.2778
Gcal	4.1868×10^{-3}	1	1×10^{-7}	3.968	1.163×10^{-3}
Mtoe	4.1868×104	1×107	1	3.968×10^{7}	11 630
Mbtu	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
GWh	3.6	860	8.6×10^{-5}	3 412	1