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Energy Policies of IEA Countries

1999 Review

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FOREWORD

Each year, the International Energy Agency reviews the energy policies of its 24 Member countries. This process of regular peer review has contributed significantly over the years to co-operation among IEA Members.

An in-depth review for each Member country take place every four years; the countries reviewed in depth in 1999 were Finland, Hungary, Ireland, Italy, Japan and Switzerland. This book contains summaries of these six in-depth studies. The full texts of all in-depth reviews are published separately.

Shorter standard reviews were conducted for six other Member countries: Australia, Belgium, New Zealand, Norway, Spain and Turkey. They outline the significant recent developments in energy policy in these countries.

In addition to individual country reviews, an Overview Report focuses on recent developments in the energy market and on energy policy. Among subjects highlighted this year are energy and environment, including the key provisions of the Kyoto Protocol, and regulatory reform.

This year, the IEA celebrated its 25th anniversary. The IEA Ministers met in Paris on 24-25 May 1999. Annexes include the full text of the 1999 IEA Ministerial Communiqué.

Robert Priddle
Executive Director

ACKNOWLEDGEMENT OF SECRETARIAT CONTRIBUTIONS TO THE 1999 REVIEW CYCLE

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Belgium	Richard Baron	Mel Kliman
Canada	John Cameron	Michael Landwehr
Denmark	John Cameron	Takashi Okano
Finland	Gudrun Lammers	Koichiro Nakamura
France	Gudrun Lammers	Mel Kliman
Germany	Pierre-Marie Cussaguet	Ken Friedman
Greece	John Paffenbarger	Ken Friedman
Hungary	Gudrun Lammers	Madeline Woodruff
Ireland	John Cameron	Takashi Okano
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New Zealand	Gudrun Lammers	Koichiro Nakamura
Norway	Pierre-Marie Cussaguet	David Wallace
Portugal	Gudrun Lammers	Michael Landwehr
Spain	Pierre-Marie Cussaguet	David Wallace
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INTRODUCTION

Along with the central interest in energy security which prompted the IEA's formation in 1974, energy policies in the IEA reflect deep concerns for dealing with climate change and pursuing energy market reform. These two linked and relatively new objectives of the 1990s now occupy centre-stage in all Member countries, although energy security has by no means disappeared from the horizon. In 1993, IEA Energy Ministers embedded this broad policy orientation in their statement of Shared Goals and reiterated it in their Communiqué of May 1999.[1] This annual review of Members' national energy policies reveals both the progress and the variety of approaches which have developed as countries have sought to balance global and national interests.

In 1998-99, oil prices dropped sharply, then rose again. They fell in 1998 to their lowest levels since the 1970s, with real prices dropping back to where they stood just before the Arab oil embargo and nominal prices to post-embargo levels. Average wellhead crude oil prices in the United States bottomed in December 1998 at levels not seen since the Great Depression of the 1930s (only US data are available that far back).

Oil prices reversed course in early 1999, however, following an agreement by OPEC and a few non-OPEC producers to cut production still further and to honour more assiduously production-cut commitments made in 1998. The combination of producer restraint and the re-emergence of economic growth in Asia pushed prices up from about $10 per barrel to well over $25 per barrel by November 1999. Currency effects have softened or intensified the price impacts, depending on individual country circumstances.

Energy consumption grew steadily in the 1990s. Demand for electricity and gas increased sharply. Energy intensity fell significantly in most countries over the past two decades, while it stayed almost the same level in the 1990s in the transport sector. Prices for oil products and gas to the end user varied among Member countries, reflecting differences in market structures, costs and the taxes levied on them.

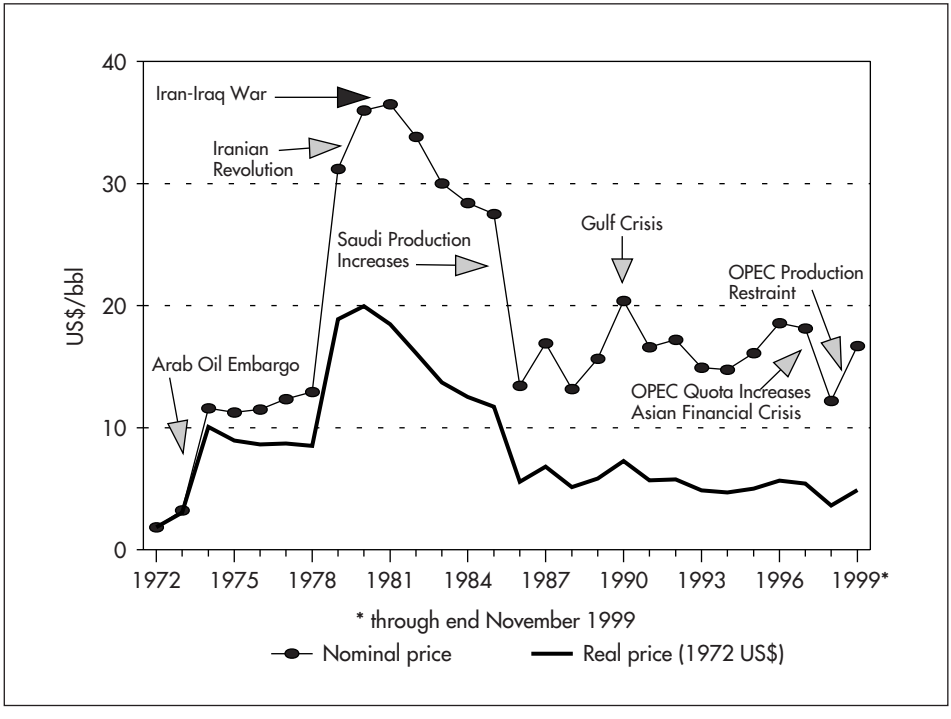
In 1999, IEA governments – along with more than a hundred non-Member countries – continued to seek out policies to reduce the emission of carbon dioxide and other gases that contribute to climate destabilisation. In November, nearly every country in the world met at COP 5 (the fifth Conference of the Parties to the United Nations Framework Convention on Climate Change) in Bonn, Germany. The session, largely technical in nature, concentrated on details of implementation due to be decided at COP 6, in November 2000.

1. The statement of Shared Goals and the 1999 Communiqué are reproduced in full in Annexes C and E.

COP 5 was the most recent development in a world-wide effort to mitigate climate change. The process began with the Rio de Janeiro summit in 1992. Its high point came at COP 3 in Kyoto, Japan, in late 1997. Under the Kyoto Protocol adopted at that meeting, the world's industrialised countries – including all IEA Members – undertook to reduce their CO_2 and other greenhouse gas emissions by 5% below 1990 levels by 2008-2012. The details of many aspects of the Protocol remain to be spelt out, and few countries have actually ratified the document.

But the policy process continues. And several important trends in energy use are becoming clearer.

Crude Oil Prices, 1972-1999



Sources: 1972-1986 Arabian Light prices from the *Oil Economists' Handbook*. 1987-1996 Dubai prices from the *OPEC Annual Statistical Bulletin 1996*. 1997-January to November-1999 Dubai prices from the *Oil Market Report*.

During the 1990s, energy consumption grew steadily, with demand for electricity and gas rising sharply. At the same time, the industrial, residential and commercial sectors have experienced a significant drop in energy intensity, while there has been little change in the transport sector.

For the IEA as a whole, per capita emissions of energy-related carbon have risen gradually since the early 1980s This trend masks substantial differences among

Member countries, among sectors and among different fuels. The energy economy of the IEA is not, in this sense, a monolith, and different countries face different problems.

One issue is, however, present in all countries: that of capital-stock turnover – buildings, factories, manufacturing processes and vehicles. Since such stock is renewed only slowly, energy-consumption patterns and the resulting carbon emissions react to price movements only after relatively long lags, when new investment replaces or modifies existing capital stock. As a result, the sharp but brief price swings of 1998-99 had little visible effect on the long-term trends in consumption of fossil fuels, and emissions, in the IEA area.

For the IEA area as a whole, energy-related CO_2 emissions per capita continued their slowly rising trend begun in early 1980s. This trend masks differences in performance among individual Member countries, in the different sectors of energy use and for different fuels.

At COP 5 held in Bonn from October 25 through November 5, developed and developing countries alike got down to the business of defining the rules of the game under the Kyoto Protocol. Nevertheless, there remain many difficult issues to be resolved before IEA Members will be prepared to ratify the Protocol and become legally bound to reduce their greenhouse gas emissions.

The overview section briefly describes the policy actions taken by Member countries to reduce their greenhouse gas emissions. These actions cover a wide variety of sectors and policy instruments. The instruments themselves fall into four broad categories:

- *Market instruments* including taxation, emissions trading and subsidies for energy efficiency improvements or greenhouse gas reductions.

- *Regulatory actions and voluntary agreements* including specific greenhouse gas emissions caps, energy efficiency targets and fuel-switching mandates.

- *R&D policies* including incentives to the private sector and new funding to government research agencies to promote research and development for climate-friendly technologies.

- *Policy "processes",* that is, co-ordinated action both to develop policies and programmes, and to promote public approval for them. Some countries set up these processes before taking direct policy action of the types listed above.

Energy market reform in 1998-99 focused primarily on the electricity sector and to a lesser extent on gas. Reform in both sectors offers strong potential gains in efficiency through the unbundling of production, transmission and distribution. The aim is to introduce competition among suppliers and enhance supplier choices for consumers. In most IEA countries, market reform is expected to reduce prices. However, in some countries where prices to consumers had been subsidised, they have risen to allow the market to function and encourage investment.

The year 1999 was the deadline for the implementation of the European Union Electricity Directive. The directive set out obligations for gradually allowing certain consumers to choose their suppliers, and it defined three basic models for network regulation, all designed to achieve comparable market access and equivalent market outcomes. Some countries have gone beyond the obligations in the directive. Outside the European Union (EU), virtually all IEA countries are developing legislation to introduce competition into the retail electricity market.

The EU Gas Directive is to be implemented by August 2000. Some IEA Members in the EU have gone beyond the obligations. Progress has been observed in some non-EU IEA Members. The overview describes progress in reducing or eliminating subsidies to production of hard coal in IEA countries.

POLICIES IN INDIVIDUAL MEMBER COUNTRIES

In-depth Reviews

The IEA conducted and published in-depth reviews of six Member countries in 1999. Part 2 of this report contains summaries of the findings of each and the full list of recommendations made to each government.

Finland. Finnish energy markets have undergone much reform and restructuring in the last half-decade. The review focused on electricity and gas market reforms as well as the 1998 merger of Finland's largest oil company and its largest electricity supply companies. It credits Finland with an original design for its electricity market, a design which other countries might profitably learn from. The chief point of concern was adequate curbs on excessive market power. Climate change remains a key issue, and environmental protection has strong support. With this support, and partly because of a cold climate and scarce indigenous energy resources, the country has already exploited much of its energy efficiency potential. Finland pioneered a carbon tax in 1990 and it has one of the highest shares of combined heat and power production in the world. Yet CO_2 emissions continue to rise; greater use of natural gas could be a promising abatement strategy.

Hungary joined the IEA in 1997. A transition economy operating under difficult conditions, Hungary has nevertheless made great strides in restructuring, liberalising and privatising its energy sector. The electricity and gas markets received particular attention in the 1999 review. The power market has been unbundled and the industry brought up to standards that have allowed it to run in parallel with the Western European grid since 1995. Foreign investors largely operate the separate generation and distribution/supply facilities. Full competition, to be phased in when Hungary accedes to the European Union, is just a couple of steps away. For gas, the main policy task involves further adapting and preparing the gas market for competition while ensuring security of supply.

Ireland. Ireland is experiencing rapid economic growth and stronger energy efficiency measures may be required to ensure sustainable growth. Ireland's energy

sector is at present dominated by four state-owned bodies with considerable influence in the market. Reform is constrained by the Government's social and energy security objectives. In the electricity sector, the Electricity Supply Board may continue to dominate the market and impede the development of competition. In the gas market, there is a need to develop new sources of supply to match growth in demand. Ireland's concerns with energy security influence policy on the peat industry and the future of the country's single oil refinery. The programme to phase out existing peat-fired power stations should be confirmed and the mandatory requirement for purchases from the Whitegate refinery should be removed.

Italy. The Government is implementing numerous measures to liberalise and increase the efficiency of the energy sector. In February 1999, it issued a Legislative Decree to implement the EU Directive on Electricity, and in May Parliament mandated the Government to put the EU Directive on Natural Gas into effect within a year. A 1998 legislative decree, still to be fully implemented, devolves much energy policy responsibility to Italy's local authorities. The Government aims at creating a market-based energy economy and scrapping a "command and control" system in which public-sector companies ENI (oil and gas) and ENEL (electricity), both partially privatised, implemented government policy. The Government needs to continue to develop clear arm's length relationships between the State on the one hand, and ENI and ENEL on the other. Italy has high energy taxes relative to other IEA countries, including a 1998 CO_2 tax. Multiple tax rates on electricity and natural gas, which mingle fiscal, social and regional policies, distort competition between fuels and industries.

Japan. Since the last review in 1994, Japan has sought to reform the regulatory framework in the energy sector and to develop measures to respond to climate change. Japan's decision to move forward with partial liberalisation of the electricity market is an important, irreversible step. A timetable for reform should be developed to take reforms further. Nuclear power and energy efficiency improvements are expected to play major roles in achieving Japan's CO_2 reduction target. The review concludes that if energy efficiency measures are not successful, then additional fuel switching (from coal to nuclear, gas and renewables) would be required. Japan's nuclear production target is considered to be achievable, but attention should be given to improving the capacity utilisation factor of nuclear plants. Energy security continues to be a major theme of Japan's energy policy because of the country's dependence on imported energy. Liberalisation of the oil sector has nevertheless made progress, consistent with energy security objectives. The review recommends further reform measures in gas procurement and marketing, and reliance on the international coal market to ensure security of coal supply.

Switzerland. The "Energy 2000 Action Plan" is the core of Swiss energy policy. It aims to stabilise electricity consumption, reduce fossil-fuel use and CO_2 emissions, and increase supplies of renewable and nuclear energy. The plan places heavy stress on assessing the cost-effectiveness of the measures implemented under it. Energy intensity in Switzerland is already low, but a potential exists for further efficiency gains. Nuclear energy (40% of electricity supply) and hydropower

together make Swiss electricity production 98% carbon-free. The country is one of the lowest emitters of CO_2 per unit of GDP in the IEA. Both the Government and the cantons (which share power and policy responsibility) have put strong emphasis on promoting non-hydro renewables. Energy and CO_2 taxes receive serious consideration. The Government has made an initiative to introduce competition in the electricity sector, but many problems, including stranded costs, will need resolution to bring the plan into effect. The Government is also considering introducing competition in the natural gas sector.

STANDARD REVIEWS

Part 2 of this report also contains standard reviews of six additional IEA Members, for which in-depth reviews were not conducted in 1999: Australia, Belgium, New Zealand, Norway, Spain and Turkey.[2] These reviews report on recent energy-market developments and recent policy changes, but do not contain the extensive and detailed analysis and recommendations to governments that characterise the in-depth reviews. In general, the two main themes of this report, energy market reforms and measures to deal with climate change, stand out in the policies of these countries as well.

2. In-depth reviews are conducted in a four-year cycle; six IEA countries were reviewed in 1999. The standard reviews are conducted in each country two years after their own in-depth review and two years before the next. When they are not subject to either in-depth or standard reviews, countries submit basic energy statistics, which are also included in this report.

PART 1

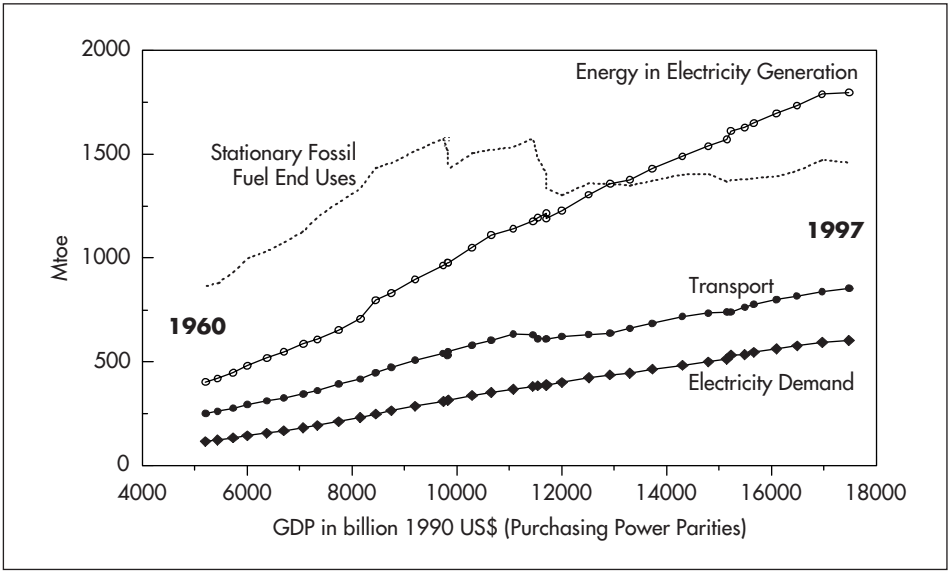
OVERVIEW OF ENERGY POLICY AND MARKET DEVELOPMENTS

ENERGY MARKET TRENDS

ENERGY CONSUMPTION

Energy demand in IEA countries has increased as their GDP grew over decades. Figure 1 shows the relationship over time between sectoral energy demand and GDP in IEA countries. Energy demand in the transport and electricity generation sectors increased in nearly direct proportion to GDP growth.

Figure 1
Energy Demand: A Sectoral View in IEA Countries, 1960-1997



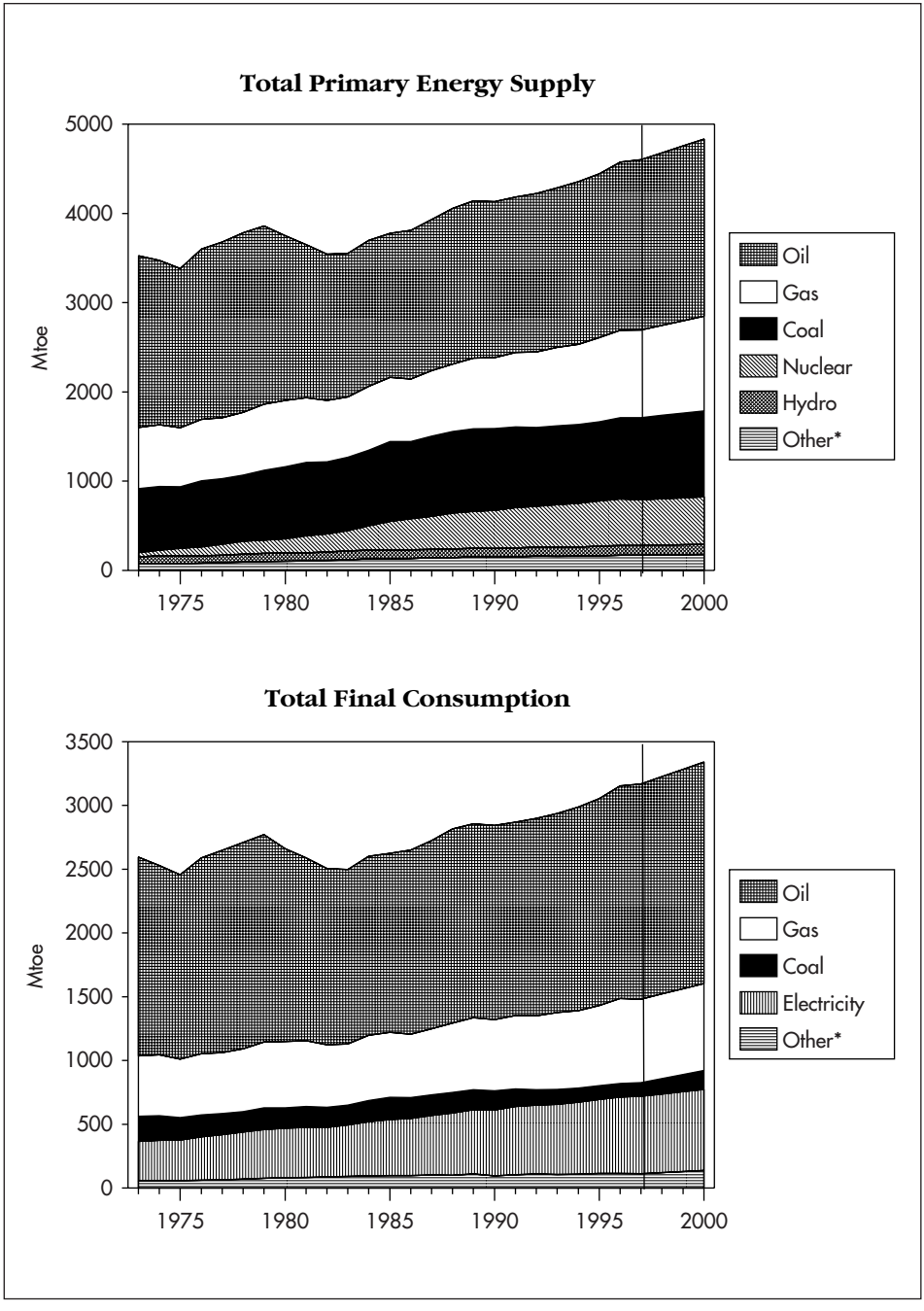
Note: US autoproducers are estimated prior to 1991 and are included in Energy in Electricity Generation.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 2 shows growth in total primary energy supply and total final consumption. Energy consumption grew significantly in the 1990s. Demand for electricity and gas was particularly strong.

Figure 3 shows energy demand per capita in 1997[3]. Figure 4 shows energy intensities in IEA countries, defined as total final consumption divided by GDP. The apparently high intensities in Hungary and Turkey are the result of currency exchange rates which do not reflect purchasing power parities.

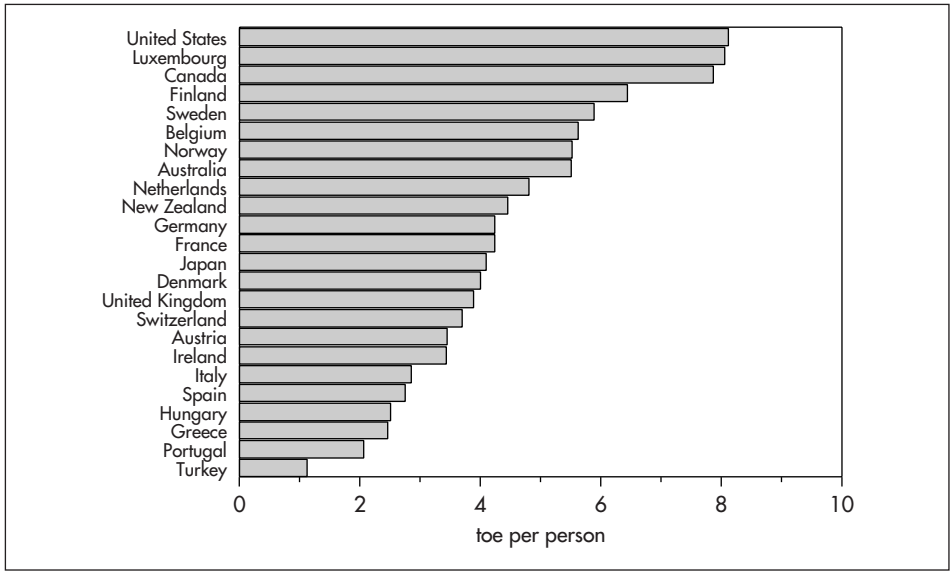
3. In the per capita figure, Luxembourg data are distorted by the fact that residents of the neighbouring countries come to fill their tanks in Luxembourg.

Figure 2
Total Primary Energy Supply and Total Final Consumption in IEA Countries, 1973-2000



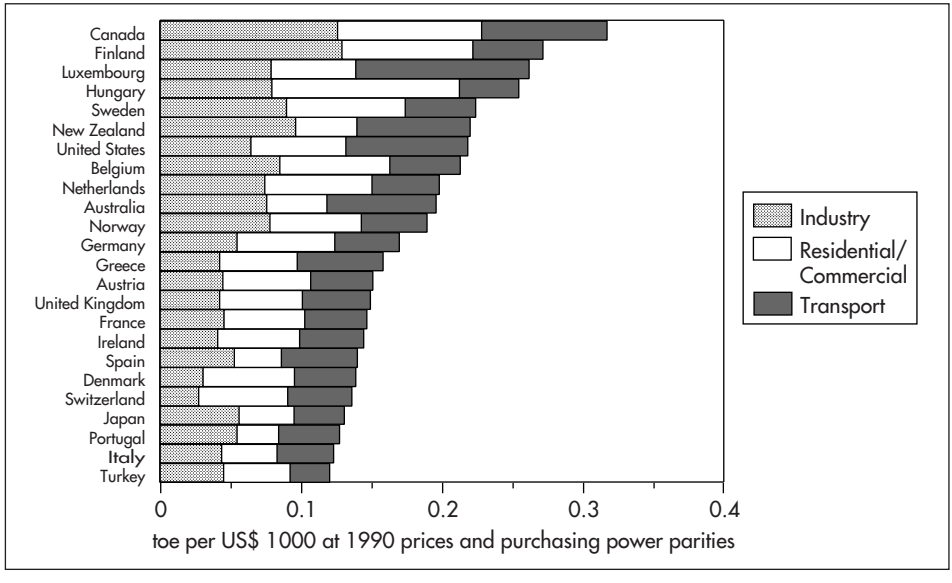
* Includes solar, wind, tidal and wave energy and ambient heat used in heat pumps.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submissions.

Figure 3
Total Primary Energy Supply per Capita in IEA Countries, 1997



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

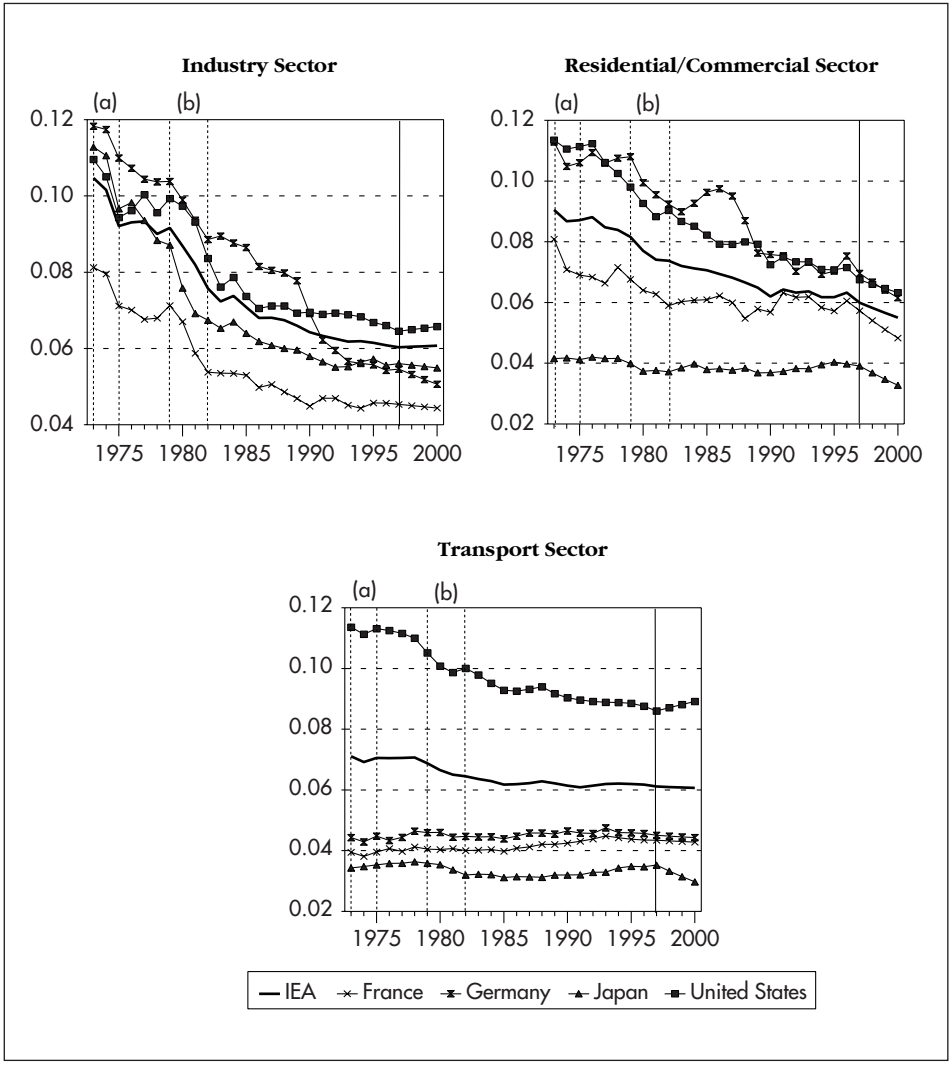
Figure 4
Energy Intensity by Final Consumption Sector in IEA Countries, 1997
(toe per thousand US$ at 1990 prices and purchasing power parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 5 shows energy intensity from 1973 to 2000 in several IEA countries. Energy intensity in the residential/commercial sector in the four largest IEA countries fell dramatically over the past two decades, whereas the transport sector did not change much.

Figure 5
Final Consumption by Sector per GDP (PPP)
in Selected IEA Countries, 1973-2000
(toe per thousand US$ at 1990 prices and purchasing power parities)

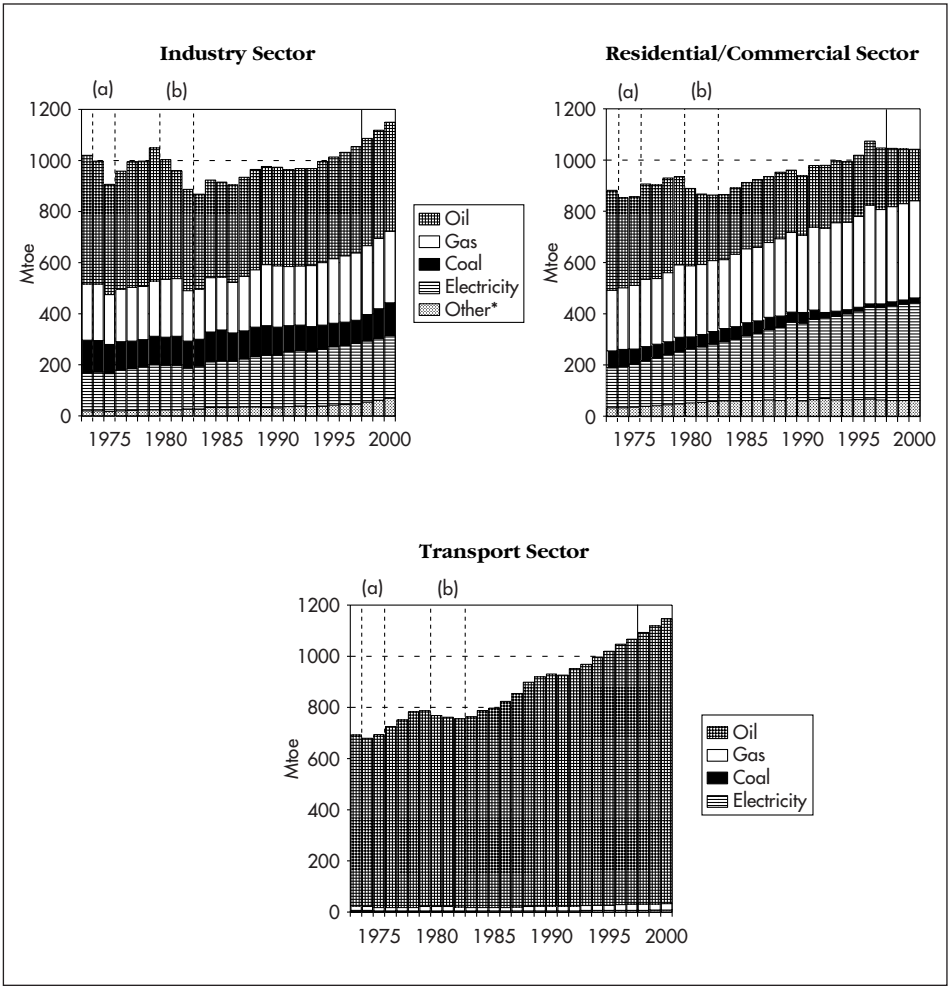


(a) the first oil shock (end 1973) and the macro-economic recession induced by this shock.
(b) the second twin oil shocks (early 1979 and end 1980) and the macro-economic recession induced by this double shock.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris, 1998; and country submissions.

IEA total energy demand in the transport sector, mainly oil demand, has grown rapidly since 1973 (Figure 6). Electricity demand in the residential/commercial sector has also grown signficantly.

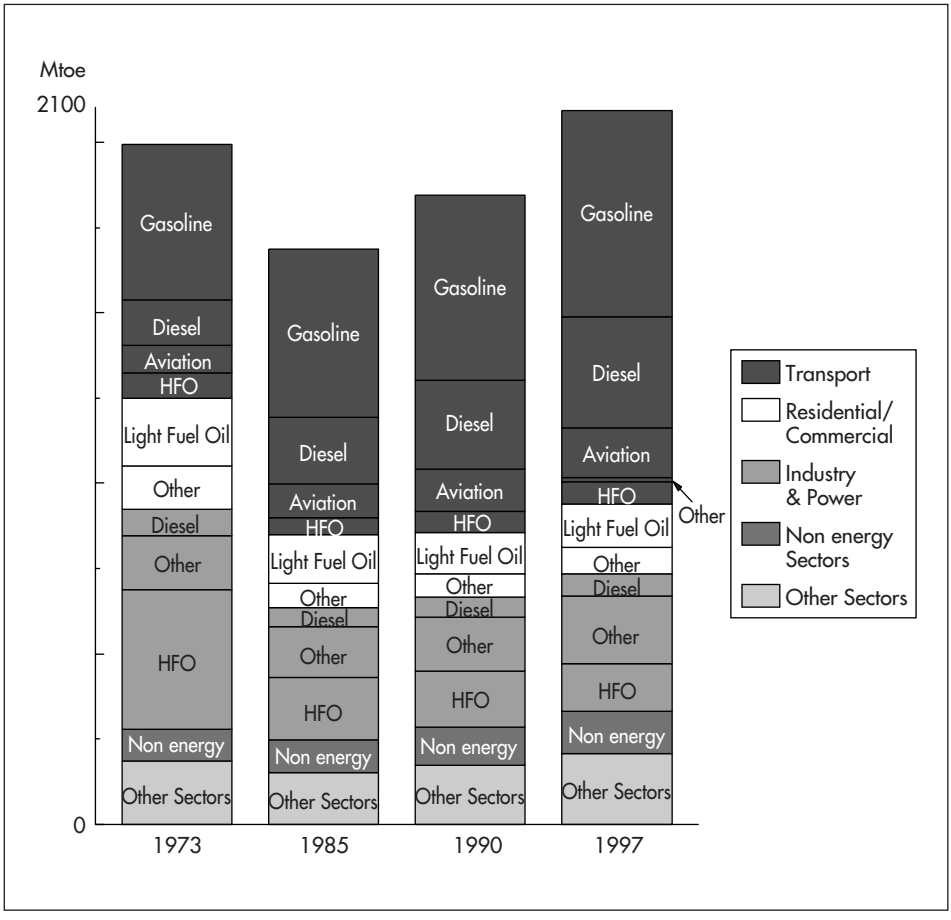
Figure 6
Final Consumption by Sector and by Fuel in IEA Countries, 1973-2000



(a) the first oil shock (end 1973) and the macro-economic recession induced by this shock.
(b) the second twin oil shocks (early 1979 and end 1980) and the macro-economic recession induced by this double shock.
* includes solar, wind, tide, wave and ambient heat used in heat pumps.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris, 1998, and country submissions.

The demand for oil for industry and power generation in IEA countries has declined since 1973, while oil consumption in the transport sector has increased (Figure 7). Total oil consumption in IEA countries increased from 1985 to 1997.

Figure 7
Consumption of Oil Products by Sector in IEA Countries, 1973-1997

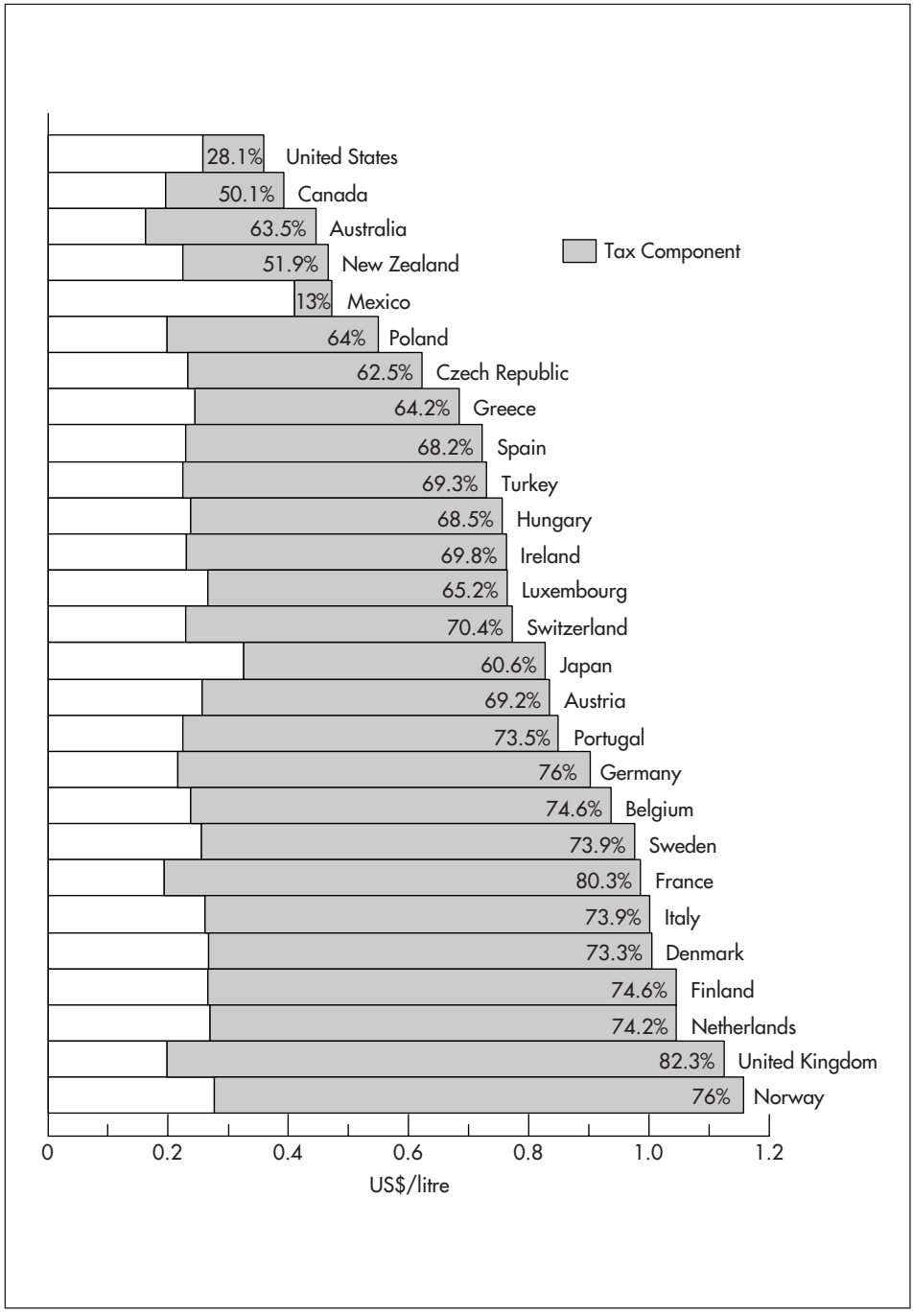


Note: HFO is heavy fuel oil.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

OIL AND GAS PRICES

Policies on oil consumption vary among countries and oil and taxes differ significantly. Gas consumption increased steadily from 1973 to 1997 (Figure 2). The sector with the largest growth in gas consumption is power generation. With regulatory reform in the electricity sector, the majority of power generators now choose combined cycle gas turbines for their new investments, because they are the least expensive. Gas turbines are also preferred, because they can be built much faster than hydro and nuclear plants. Recent developments in gas prices are shown in Figure 10. Japan, with no connection to an international gas grid, imports its natural gas in the form of liquefied natural gas. Thus, gas prices in Japan are quite high.

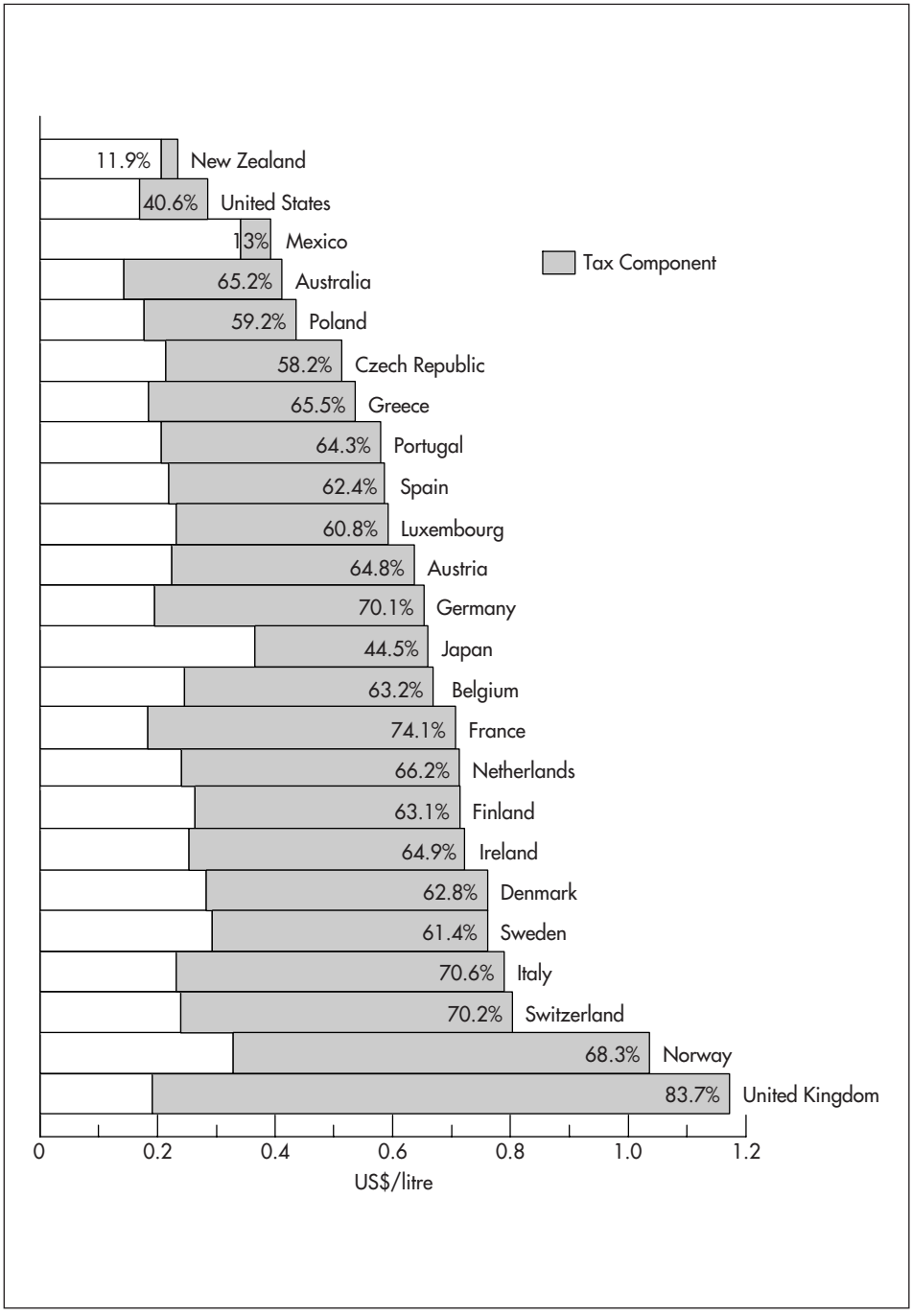
Figure 8
Gasoline Prices and Taxes in OECD Countries, 2nd Quarter 1999



Note: 1st quarter 1999 for Japan.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

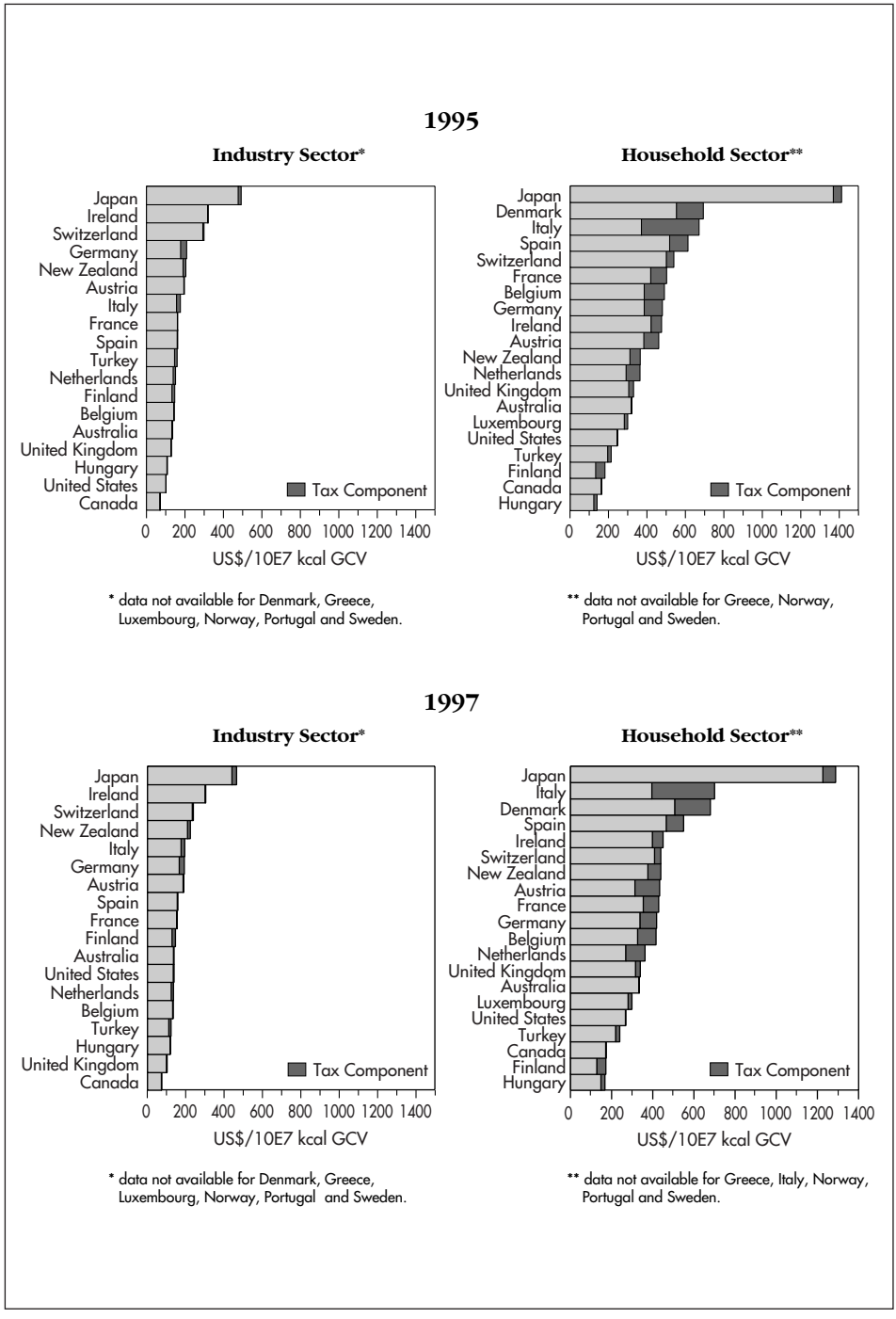
Figure 9

Automotive Diesel Prices and Taxes in OECD Countries, 2nd Quarter 1999



Note: data not available for Canada, Hungary and Turkey; 1st Quarter 1999 for Australia and Japan.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

Figure 10
Gas Prices in IEA Countries, 1995 and 1997



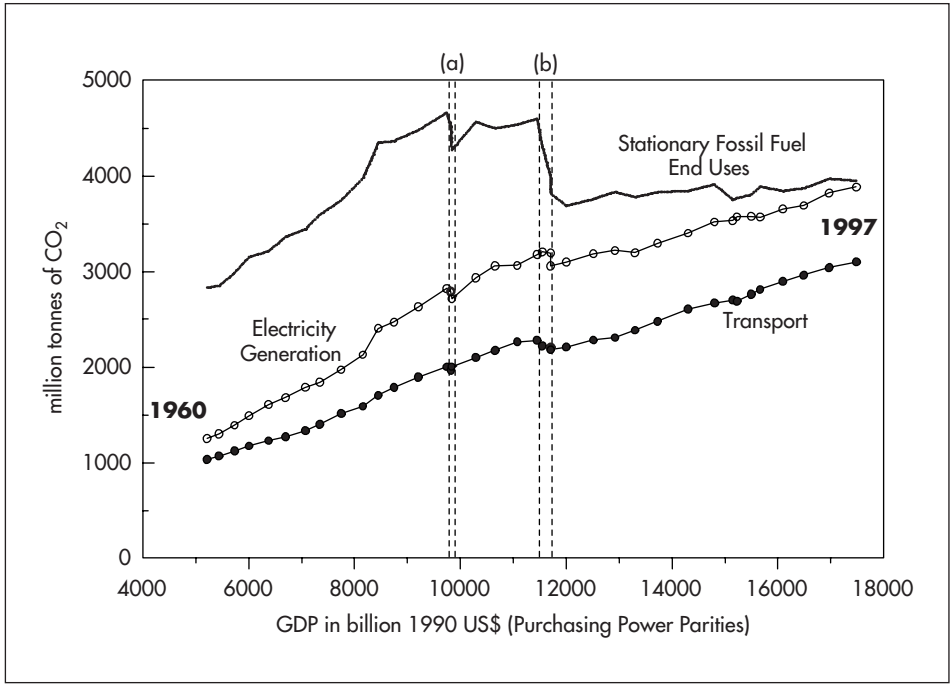
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

ENERGY AND CLIMATE CHANGE

CO_2 EMISSIONS FROM ENERGY USE

Carbon dioxide emissions in IEA countries continued to grow in 1998. The relationship between gross domestic product (GDP) and energy-related CO_2 emissions is shown in Figure 11. Emissions from electricity generation and transport grew consistently with GDP. Emissions from stationary fossil fuel end uses decreased dramatically during the two energy crises, but grew slowly in the 1980s and early 1990s. Historical changes in the IEA totals and in the four major countries are shown in Figure 12[4]. Emissions per capita for the IEA as a whole have been growing since the mid-1990s.

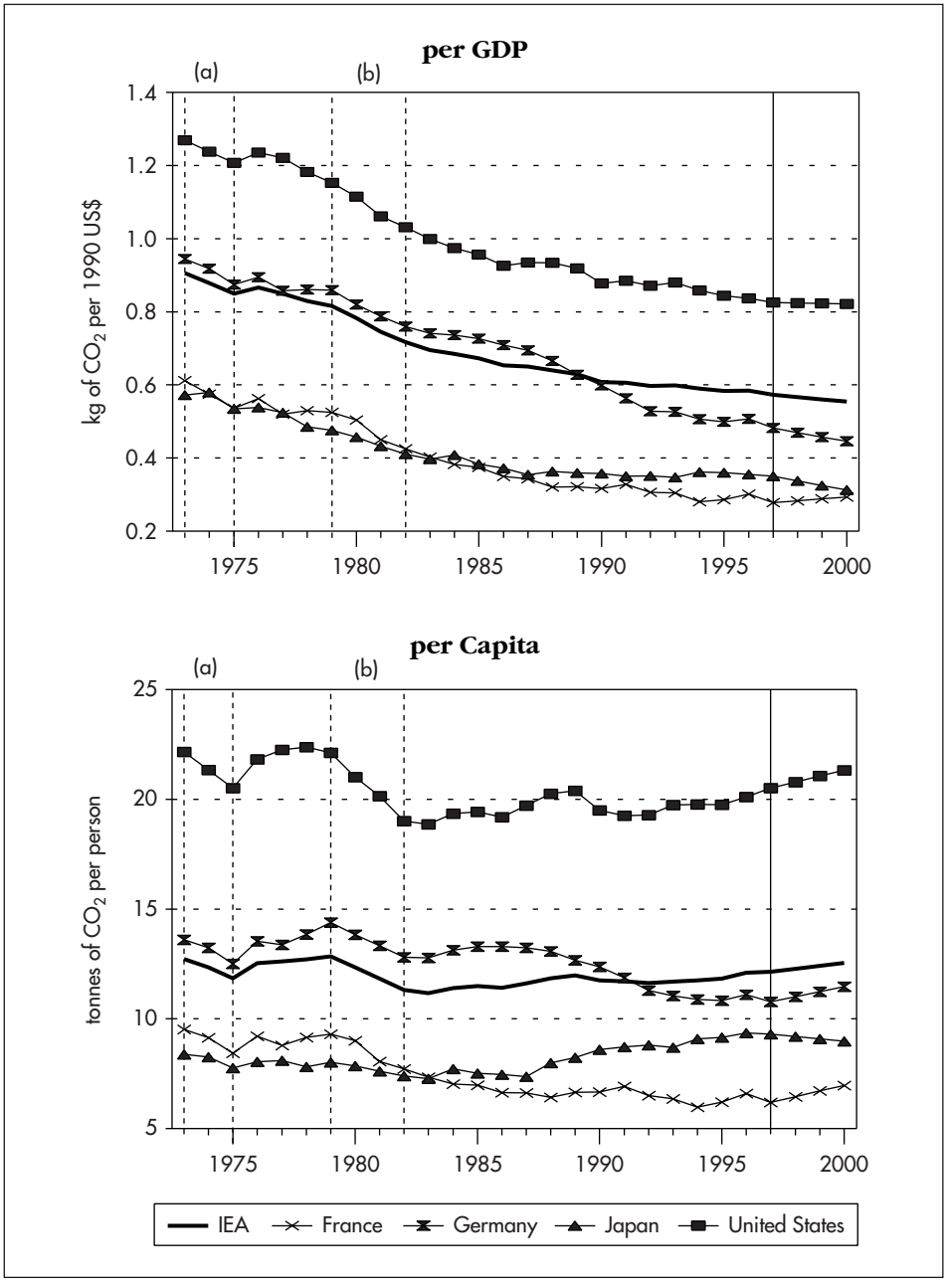
Figure 11
Energy-related CO_2 Emissions Relative to GDP (PPP) in IEA Countries, 1960-1997



(a) the first oil shock (end 1973) and the macro-economic recession induced by this shock.
(b) the second twin oil shocks (early 1979 and end 1980) and the macro-economic recession induced by this double shock.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

4. The size of the IEA's overall energy-related emissions reflects the importance of emissions in the United States, which emits 49% of the total.

Figure 12
Energy-related CO_2 Emissions in IEA Countries, 1973-2000

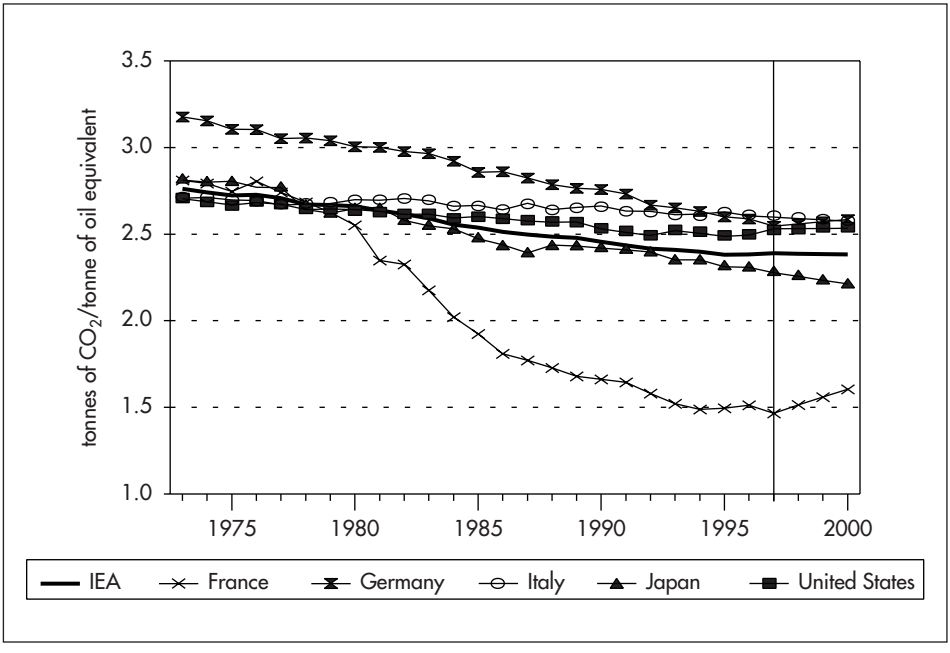


(a) the first oil shock (end 1973) and the macro-economic recession induced by this shock.
(b) the second twin oil shocks (early 1979 and end 1980) and the macro-economic recession induced by this double shock.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 13 shows the change in CO_2 emissions per unit of energy over time in some IEA countries. France reduced its CO_2 emissions per unit of energy during the 1980s to a level well below the IEA average by increasing the share of nuclear power in electricity generation. Japan is pursuing an active nuclear programme in order to reduce CO_2 emissions, but the proportion of nuclear is likely to remain far below that of France, and is reducing its CO_2 emissions per unit of energy by increasing the use of nuclear and gas. Germany reduced CO_2 emissions per unit of energy steadily from a level above the IEA average, mainly by reducing its share of coal.[5] Italy, which still has a substantial proportion of oil-fired power generation[6], has CO_2 emissions per unit of energy which are above those in Germany. Italy introduced a carbon tax in January 1999 with the aim, among other things, of encouraging switching from oil to gas in power generation.

Figure 13

CO_2 Emissions per Unit of Energy in Selected IEA Countries, 1973-2000

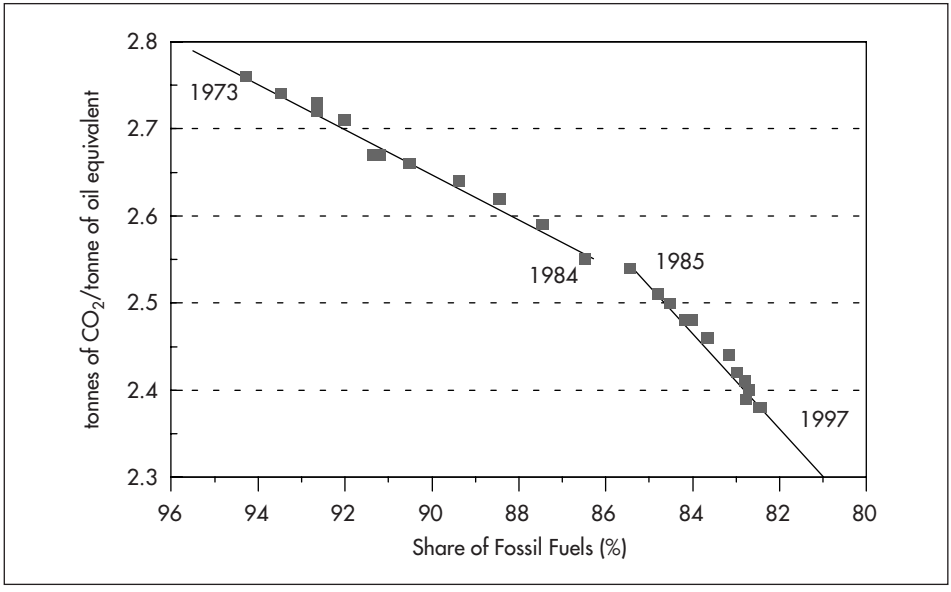


Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submissions.

Figure 14 shows the relation between the IEA's total CO_2 emissions per unit of energy and the share of fossil fuels in the IEA's total primary energy supply from 1973 to 1997. The rate of decline in CO_2 emissions per unit of energy accelerated after 1985, largely because of a significant reduction in the share of coal. Figure 15

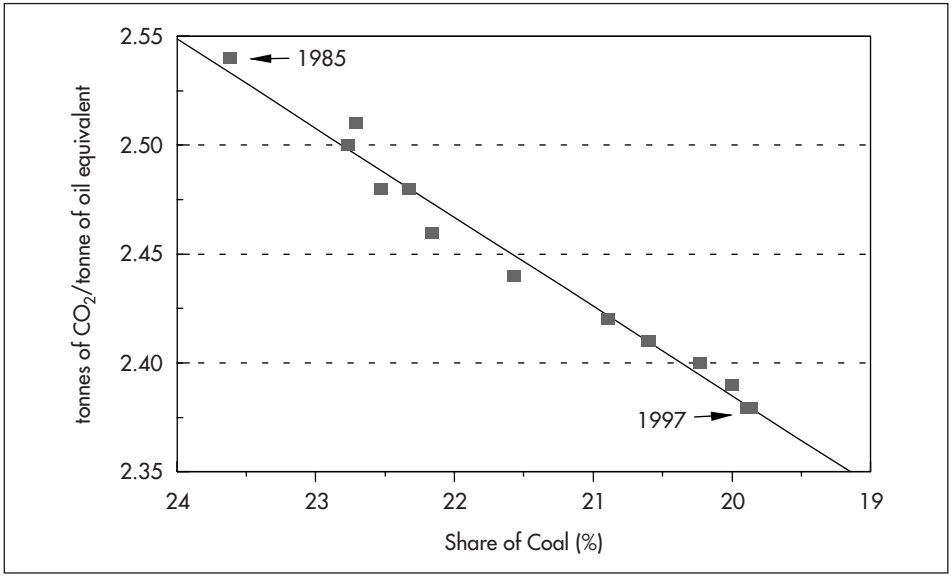
5. Germany developed coal-fired power plants based on its national resources.
6. In 1987, there was a moratorium on the use of nuclear power and this, combined with local resistance to the use of coal, explains the high share of oil.

Figure 14
CO_2 Emissions per Unit of Energy and Share of Fossil Fuels in IEA Countries, 1973-1997



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

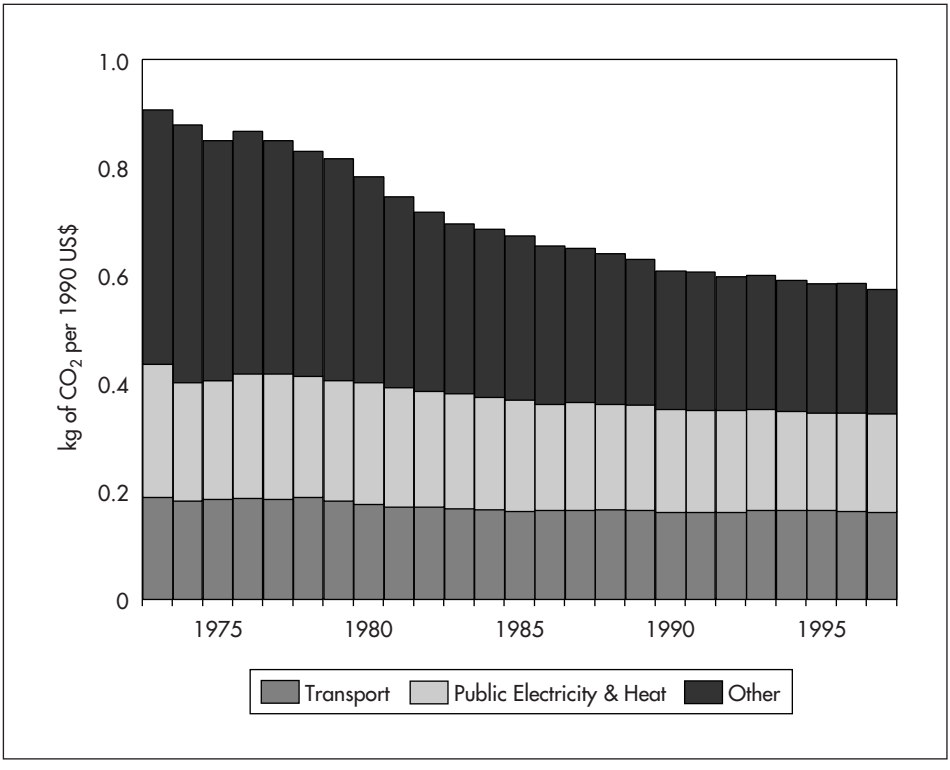
Figure 15
CO_2 Emissions per Unit of Energy and Share of Coal in IEA Countries, 1985-1997



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

shows the relation between the IEA's total CO_2 emissions per unit of energy and the share of coal in the IEA total primary energy supply from 1985 to 1996. During this period, the share of coal decreased, speeding the decline in CO_2 emissions per unit of energy.[7]

Figure 16
CO_2 Emissions per GDP by Sector in IEA Countries, 1973-1997



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 16 shows total CO_2 emissions per GDP in IEA countries. Emissions per GDP in sectors other than transport and public electricity and heat have fallen since 1973. CO_2 emissions in transport and public electricity and heat were 48% of the total in 1973 and increased to 59% in 1997.

7. Two factors have contributed to the reduction in the share of coal. One was a short-term change from fuel switching in dual-fired power plants, and the other was a long-term trend towards building non-coal power plants. In 1986, fuel switching played a major role, because a drop in oil prices allowed heavy fuel oil to substitute for coal during a few summer weeks in North America. More recently, investment in gas-fired power plants was the main reason for reductions in the proportion of coal.

ENERGY-RELATED CO_2 EMISSIONS BY IEA COUNTRIES

Table 1 shows the evolution of energy-related CO_2 emissions in IEA countries. Table 2 provides key energy and CO_2 data for IEA and OECD countries.

Table 1
Energy-related CO_2 Emissions, Excluding International Marine Bunkers
(Million tonnes)

	1990	1997	2000*	*% change from 1990*
Canada	428	477	477	*12*
United States	4 873	5 470	5 865	*20*
North America	**5 301**	**5 948**	**6 342**	***20***
Australia	263	306	330	*26*
Japan	1 062	1 173	1 143	*8*
New Zealand	25	33	31	*21*
Pacific	**1 350**	**1 512**	**1 504**	***11***
Austria	59	64	61	*3*
Belgium	109	123	111	*2*
Denmark	53	62	53	*0*
Finland	54	64	64	*19*
France	378	363	414	*10*
Germany	981	884	907	*-8*
Greece	72	81	94	*30*
Hungary	68	58	59	*-14*
Ireland	33	38	38	*15*
Italy	408	424	426	*4*
Luxembourg	11	9	8	*-27*
Netherlands	161	184	186	*15*
Norway	30	34	32	*9*
Portugal	41	52	55	*33*
Spain	215	254	270	*25*
Sweden	53	53	54	*3*
Switzerland	44	45	41	*-6*
Turkey	138	187	245	*77*
United Kingdom	585	555	556	*-5*
IEA Europe	**3 496**	**3 534**	**3 676**	***5***
IEA Total	**10 147**	**10 993**	**11 552**	***14***

* Forecasts are based on IEA calculations using IPCC default methodology for CO_2 inventories based on energy data reported in country submissions (2000).

Source: IEA calculations using the IPCC default methodology for CO_2 inventories based on energy balance data (1990; 1997).

Table 2

Climate Change: Key Energy and CO_2 Emissions Data for OECD Countries, 1997

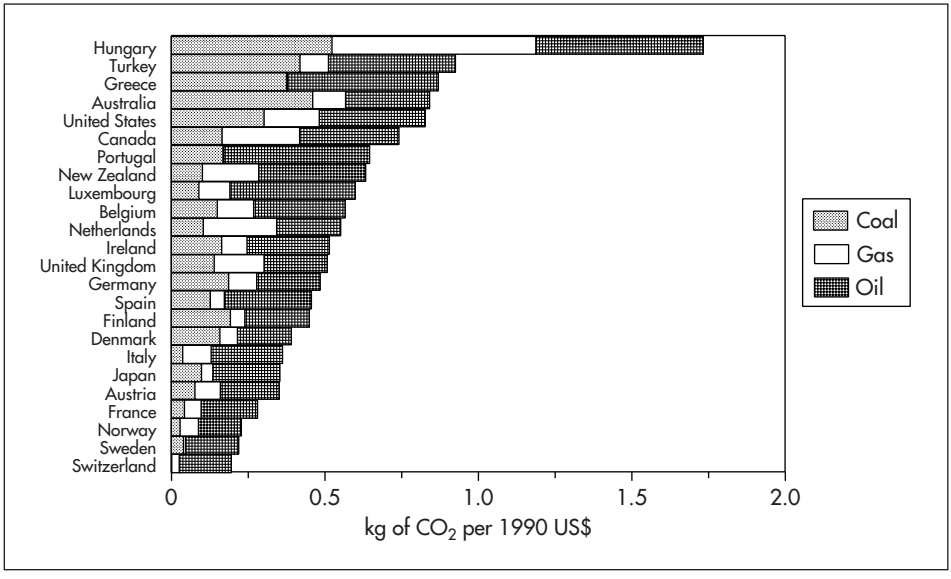
	TPES (Mtoe)	TPES/ capita (toe/ person)	TPES/GDP (toe/1990 US$ 1000)	TFC (Mtoe)	Energy-related CO_2 emissions (Mt CO_2)	Energy-related CO_2/capita (t CO_2/person)	Energy-related CO_2/GDP (t CO_2/1990 US$ 1000)	% total OECD energy-related CO_2 emissions	International marine bunkers (Mtoe)	CO_2 emissions from international marine bunkers (Mt CO_2)
Australia	101.63	5.48	0.279	67.55	306.1	16.52	0.841	2.50	0.79	2.50
Austria	27.76	3.44	0.151	22.55	64.1	7.94	0.349	0.52	0.00	0.00
Belgium	57.12	5.61	0.262	40.41	122.6	12.04	0.562	1.00	5.10	16.25
Canada	237.98	7.86	0.368	187.52	477.4	15.76	0.737	3.90	0.53	1.70
Czech Rep.	40.58	3.94	1.494	26.54	120.9	11.74	4.451	0.99	0.00	0.00
Denmark	21.11	3.99	0.131	15.81	62.4	11.81	0.388	0.51	1.50	4.71
Finland	33.07	6.43	0.230	23.99	64.1	12.47	0.445	0.52	0.41	1.29
France	247.53	4.22	0.189	161.16	362.9	6.19	0.278	2.97	2.95	9.41
Germany	347.27	4.23	0.189	244.34	884.0	10.77	0.482	7.23	2.17	6.85
Greece	25.56	2.44	0.274	17.96	80.6	7.69	0.865	0.66	3.15	9.98
Hungary	25.31	2.49	0.753	17.29	58.2	5.73	1.731	0.48	0.00	0.00
Iceland	2.33	8.60	0.327	1.89	2.4	8.85	0.337	0.02	0.05	0.15
Ireland	12.49	3.42	0.170	9.31	37.6	10.27	0.512	0.31	0.15	0.47
Italy	163.32	2.84	0.138	125.45	424.3	7.38	0.359	3.47	2.41	7.62
Japan	514.90	4.08	0.154	340.46	11 72.6	9.29	0.351	9.58	5.06	16.18
Korea	176.35	3.83	0.429	129.72	422.1	9.18	1.027	3.45	5.78	18.40
Luxembourg	3.39	8.04	0.236	3.21	8.6	20.42	0.598	0.07	0.00	0.00
Mexico	141.52	1.51	0.444	94.86	345.9	3.70	1.084	2.83	0.81	2.49
Netherlands	74.91	4.80	0.223	58.08	184.3	11.81	0.548	1.51	12.18	38.77
New Zealand	16.68	4.43	0.317	12.43	33.1	8.81	0.630	0.27	0.34	1.08
Norway	24.23	5.50	0.160	19.34	34.3	7.79	0.227	0.28	0.96	3.01
Poland	105.15	2.72	1.410	68.73	350.3	9.06	4.696	2.86	0.15	0.48
Portugal	20.40	2.05	0.253	15.91	52.0	5.22	0.644	0.42	0.50	1.57
Spain	107.33	2.73	0.192	74.93	253.8	6.45	0.455	2.07	5.75	18.20
Sweden	51.93	5.87	0.214	35.65	52.9	5.98	0.218	0.43	1.31	4.17
Switzerland	26.22	3.69	0.113	20.23	44.7	6.29	0.193	0.37	0.01	0.04
Turkey	71.27	1.12	0.351	53.62	187.5	2.94	0.923	1.53	0.16	0.50
United Kingdom	227.98	3.86	0.207	157.21	554.7	9.40	0.504	4.53	2.93	9.23
United States	21 62.19	8.10	0.326	1 445.25	5 470.5	20.50	0.825	44.71	23.40	74.09
EU (15)	**1 421.18**	**3.80**	**0.189**	**1 005.96**	**3 208.9**	**8.58**	**0.426**	**26.23**	**40.50**	**128.53**
IEA (23)	**4 601.59**	**5.08**	**0.240**	**3 169.66**	**10 993.4**	**12.15**	**0.573**	**89.85**	**71.75**	**227.63**
OECD (25)	**5 067.52**	**4.63**	**0.253**	**3 491.40**	**12 235.0**	**11.18**	**0.611**	**100**	**78.54**	**249.14**

Note: In the table above, and throughout this document, the term "energy-related CO_2 emissions" specifically means CO_2 from the combustion of the fossil fuel components of TPES (i.e., coal and coal products, crude oil and derived products, natural gas and peat), while CO_2 emissions from the remaining components of TPES (i.e., electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included in accordance with the IPCC greenhouse gas inventory methodology. TPES, by its definition, excludes international marine bunkers. Intergovernmental Negotiating Committee for a Framework Convention on Climate Change-IX decided in Geneva on 18 February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. The last two columns in the table show quantities of fuels delivered for international marine bunkers and the emissions arising from their use. Data for deliveries of fuel to international aviation bunkers are not generally available to the IEA.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; IEA Databases.

Figure 17 shows CO_2 emissions per GDP by fuel for IEA countries. Although figures for the largest and smallest emitters vary by a factor of nine, the apparent high figures for Hungary and Turkey are a result of exchange rates which do not reflect purchasing power parity. Excluding these two countries, emissions per GDP vary by a factor of five.

Figure 17
CO_2 Emissions per GDP by Fuel in IEA Countries, 1997

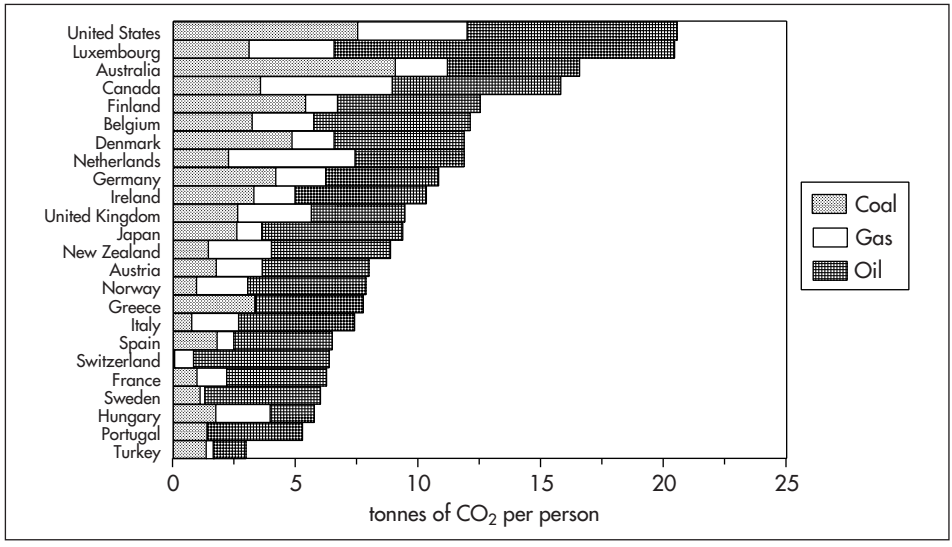


Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 18 shows CO_2 emissions per capita and by fuel for IEA countries. Figures for the largest and smallest emitters vary by a factor of nine, although data for Luxembourg are strongly biased by high petrol sales to motorists from neighbouring countries. Industrial energy intensity is also high in Luxembourg because of its large iron and steel industry.

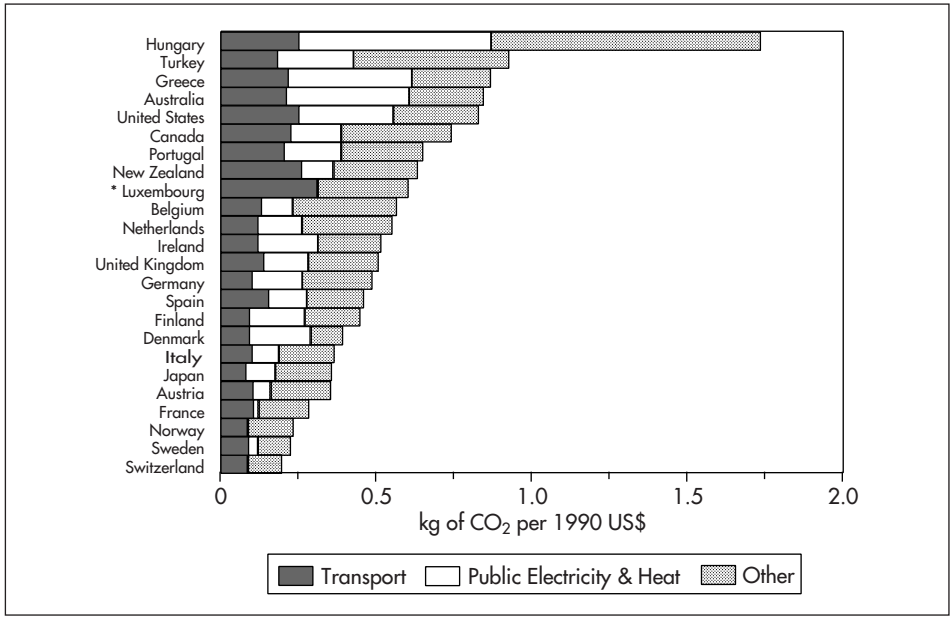
Figure 19 shows the same CO_2 emissions per GDP, but divided into energy-related services. The level of CO_2 emissions from public electricity and heat differs dramatically among countries depending on the fuel mix in power generation. In the five countries with the lowest CO_2 emissions per GDP – Switzerland, Sweden, Norway, France and Austria – the majority of electricity is generated by hydro or nuclear power or both. CO_2 emissions from energy use in the transport sector are more homogeneous than those from electricity generation because of the limited possibilities for fuel switching. Here, variations correspond to end-user prices and, to a lesser extent, to lifestyle factors such as the use of public transport.

Figure 18
CO_2 Emissions per Capita by Fuel in IEA Countries, 1997



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 19
CO_2 Emissions per GDP by Sector in IEA Countries, 1997

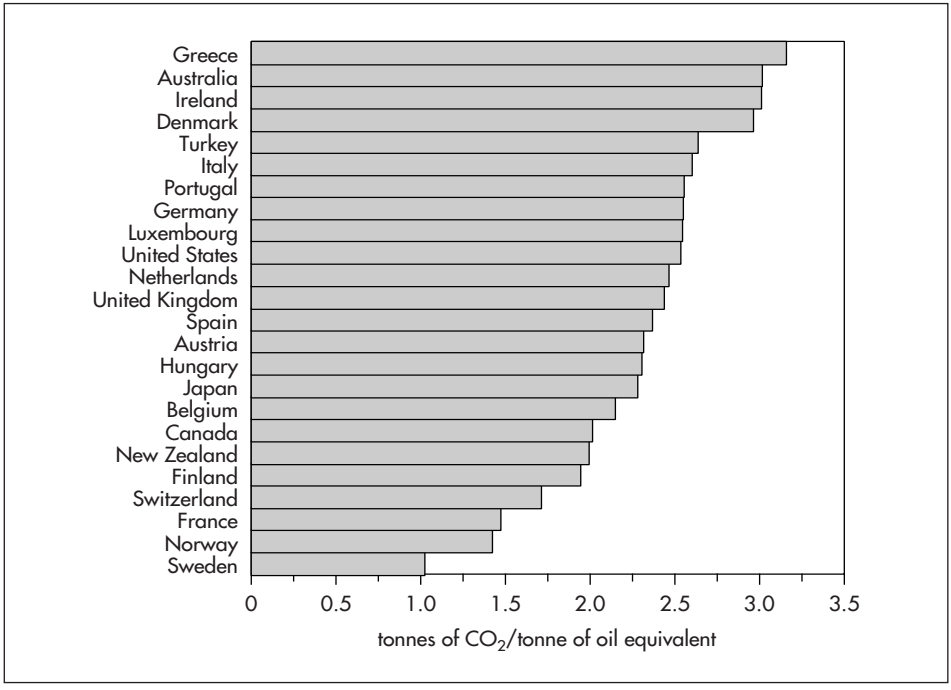


* CO_2 emissions from the transport sector in Luxembourg are exaggerated by substantial gasoline sales to drivers in neighbouring countries.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

FUEL COMPOSITION

CO_2 emissions per unit of total primary energy supply for IEA countries are shown in Figure 20. These emissions vary from 1.0 to 3.2 t CO_2/toe. This disparity is the result of fuel choices which are shown in Figure 21. Sweden, Norway, France and Switzerland, the four countries with the lowest fossil fuel use and, in particular, the lowest coal use, are also the countries with the lowest CO_2 emissions per energy use (Figure 20) and the lowest CO_2 emissions per GDP (Figures 17 and 19).

Figure 20
CO_2 Emissions per Energy Use in IEA Countries, 1997



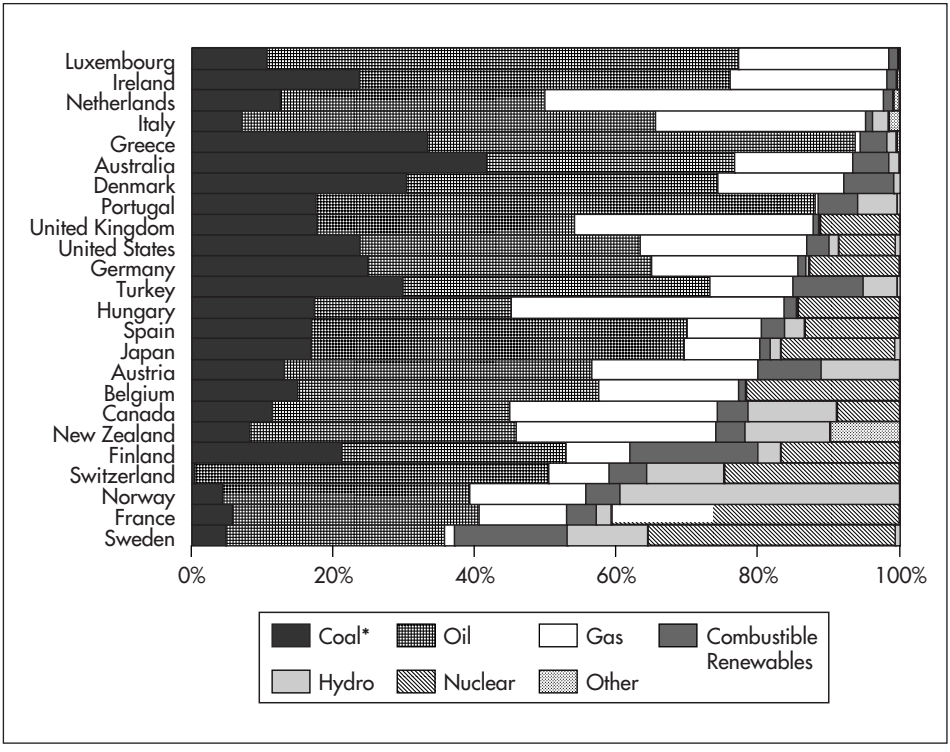
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1998.

FIFTH CONFERENCE OF THE PARTIES TO THE UNFCCC

Given that energy-related carbon dioxide represents about 85% of global greenhouse gas emissions, the energy sector is the focus of many countries' policies and measures to limit greenhouse gas emissions. Consequently, what happens in international climate change negotiations has critical implications for energy policy-making in IEA Member countries.

COP 5, the Fifth Meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) met in Bonn, Germany, from

Figure 21
Fuel Share by Country, 1997
(Ranked by the share of fossil fuels)



* Coal includes all coal, both primary and derived fuels. Peat is also included in this category.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

25 October to 5 November 1999. It was designed at the outset as an "interim step", and was thus a more technical and less political meeting than COP 3 (1997) and COP 4 (1998). Considerable progress was made on important technical and procedural issues such as inventories, reporting and the meeting schedule. However, there were few concrete results on larger political and more contentious issues: the Kyoto mechanisms, matters relating to compliance, "sinks" and developing country participation remain unresolved.

Nonetheless, Ministers attending COP 5 sent a clear message that there is a need to intensify the negotiating process so that concrete decisions can be taken at COP 6 which is to take place from 13 to 24 November 2000 in the Hague, Netherlands. Decisions on all of these "big" issues will be required for COP 6 to be successful, and to allow Parties to proceed with ratification and implementation of the Kyoto Protocol. COP 5 agreed to modify the schedule of meetings for the year 2000 to give negotiators more opportunity to work out details and reconcile differences. 2000 could prove the busiest year ever for negotiators, as the calendar includes two formal negotiating sessions in June and

September, both preceded by a week of informal meetings, supplemented by at least 10 other workshops/meetings sponsored by the UNFCCC process.

In the Kyoto Protocol[7] adopted at COP 3, Annex I countries[8] agreed to reduce their overall emissions of six greenhouse gases by at least 5% below 1990 levels between 2008 and 2012. Some of the critical elements of the Protocol are its provisions for international emissions trading, for Joint Implementation (JI) and for a Clean Development Mechanism (CDM), collectively referred to as the Kyoto Mechanisms. These mechanisms seek to minimise the cost of meeting the Kyoto objective by giving Parties the opportunity to achieve emissions reductions where it is most cost-effective to do so. While negotiators at COP 5 avoided such difficult issues as whether use of the mechanisms should be capped, they did produce a framework with the basic guidelines, rules and procedures for the mechanisms, which will form the basis of a negotiating text by early 2000.

Because the commitments are to be legally binding, the Annex I Parties which have taken on quantified targets will need to prove that they have met them using relevant data. Overall compliance will probably be judged on various data-based indicators. This places significant demands on data gathering, compilation and review. At COP 5, discussions advanced on a number of these important, if technical, elements of the Protocol.

Of particular note in the context of this book were the discussions on national communications and greenhouse gas inventories. The Convention requires Parties to "formulate, implement, publish and regularly update" national and regional programmes on climate change mitigation measures, the so-called "national communications". Under the Protocol, Annex I countries are to implement policies and measures in such areas as energy efficiency, renewable energy sources, market imperfections and the application of market instruments. Reporting and monitoring domestic policies and measures as well as the impact of their implementation requires Parties to collect detailed sectoral data. Revised national communications and inventory guidelines were agreed at COP 5, which make reporting more consistent between countries but also more data-intensive.

The Protocol also includes articles on international co-operation in: the transfer of, or access to, environmentally sound technology, know-how, practices and processes; scientific and technical research; and education and training programmes on climate change. IEA/OECD Member countries are particularly implicated, as they are the ones required under the Convention to promote, facilitate and finance the

7. A full text of the Kyoto Protocol can be found on the UNFCCC web site (http://www.unfccc.de).
8. Annex I countries are those listed in Annex I of the UNFCCC. They originally included OECD Member countries as of 1992 (Mexico and South Korea are therefore not Annex I countries), the European Union, and industrialised countries undergoing a transition to a market economy (Central and Eastern European States, Baltic States and some Republics of the former Soviet Union). The list was formally amended at COP 3 to add Croatia, Liechtenstein, Monaco and Slovenia, as well as listing the Czech Republic and Slovakia separately. The present list also includes Belarus and Turkey which have not yet ratified the Convention.

transfer of these technologies, especially to developing countries. COP 5 agreed to extend the consultative process (established at COP 4), to advance the understanding of technology transfer under the Convention and develop a framework to enhance technology transfer in time for COP 6. The consultative process has thus far underscored the important role of the private sector which, rather than governments, owns most of the technologies.

Procedures and mechanisms to determine and address cases of non-compliance with the provisions of the Kyoto Protocol were not defined in any way in the Protocol but left to future negotiations. Elaboration of this feature of the Protocol is seen by most countries as a critical precondition for ratification. A Joint Working Group on Compliance was established at COP 4 and continued discussion at COP 5, primarily on procedural issues. However, at COP 5 there was also a first substantive discussion on possible consequences of non-compliance, including the prospects of financial penalties. A report is to be prepared by the Joint Working Group outlining a proposal for a workable compliance regime, so that COP 6 can take a decision on the compliance system.

A final COP 5 discussion with particular implications for IEA Member countries' policies centred on Articles 4.8 and 4.9 of the Convention (known as "adverse effects"). These cover two very different concerns. One is from OPEC countries – which argue that they should be compensated for actions which would reduce demand for oil. The second is from the least developed countries and small island states – which seek money and technology to ameliorate the adverse effects of climate change. The first issue remains contentious and threatens to continue to disrupt the broader negotiations. COP 5 agreed to continue the talks to seek some middle ground and two further workshops will take place by the end of March 2000. One will focus on adaptation and the other on mitigation impacts.

Although it was not a formal COP 5 decision, Parties also agreed to hold a workshop on "best practices" in policies and measures, to be hosted by Denmark in collaboration with France in April 2000. Results of the workshop will be reported to COP 6.

There were many other issues negotiated at COP 5 – including land use, land-use change and forestry (i.e. "sinks"), capacity building, amendments to Annexes, and budget – but these are not discussed here because they are less relevant in the context of energy policies of IEA Member countries. All COP 5 decisions and the reports from the meeting can be found at the UNFCCC web site (www.unfccc.de).

RECENT POLICY ACTIONS TO REDUCE OR LIMIT GREENHOUSE GAS EMISSIONS

Over the past year, many IEA Member countries have begun taking actions to reduce their emissions of greenhouse gases. These actions cover a wide array of sectors and policy instruments.

National policies fall into a number of broad categories, including:

- fiscal instruments;
- regulatory actions;
- increased funding for research and development;
- the creation of policy processes.

Fiscal instruments – *taxation, emissions trading and subsidies for energy efficiency or greenhouse gas reductions.*

While the array of potential fiscal instruments that might be used is quite broad, taxes are perhaps the most commonly used. Many countries have adopted climate-related taxes. Others are in the process of developing tax policies. France has proposed to extend its tax on polluting activities to cover intermediary energy consumption. Germany implemented the first step in its ecological tax with an energy charge on diesel, gasoline, heating oil and electricity. Italy too has established a tax; introduced in 1998, it is to be fully phased in by 2005, and is to apply to fuels used in electricity generation. The United Kingdom, in its 1999 budget, introduced a climate change levy, scheduled for implementation in 2001. It will be applied to natural gas, coal, and electricity used by business, agriculture and the public sector – but not to electricity producers or to the transport sector. Other countries are still debating tax policies – Sweden's Government has proposed to increase energy taxes by SKr 1.7 billion (about US$ 200 m) next year. Some countries, such as Switzerland, plan to use tax policies only as a backstop measure, indicating that if the other policy levers fail to generate adequate reductions, they will impose a tax.

Establishing subsidies has also been a widely used approach: Subsidies range from Australia's funding for renewable energy supplies (A$ 321 million over four years), to a French subsidy of approximately FF 500 million for energy efficiency.

Emissions caps and trades are mainly in the planning phase. Denmark has plans to establish a domestic emissions trading system (although it is to allow domestic participants to offset emissions through Joint Implementation and the Clean Development Mechanism). Norway is in the process of developing a cap-and-trade system to apply specifically to those sectors exempt from CO_2 taxes (currently set at NKr 100 per tonne of CO_2). Similarly, the United Kingdom is considering a domestic emissions trading system.

Regulations and voluntary agreements – *covering many parts of the energy sector, and including specific greenhouse gas emissions caps, energy efficiency targets and fuel switching, as well as voluntary agreements with private companies.*

Regulatory and voluntary initiatives can – and do – take many forms. France has called for the installation of 1 000 MW of new wind capacity. Japan has introduced an aggressive new Energy Efficiency Act which includes higher efficiency standards for appliances and vehicles (the Top Runner Programme), as well a call for a 59% increase in nuclear electricity output. One of the most aggressive – and explicit – regulatory approaches is that adopted by Switzerland: in 1999, the Swiss Parliament approved a law requiring that CO_2 emissions be reduced 10% below 1990 levels by 2010, and with separate targets set for different fuels (e.g., a reduction of 15% for heating oils and 8% for motor fuels). Meanwhile, recent US initiatives have focused on federal government expenditures and emissions. In June, all federal agencies were ordered to improve efficiency in government buildings by 35% from 1985 levels by 2010, and to reduce greenhouse gas emissions from building energy use to 30% below 1990 levels by 2010.

Voluntary initiatives are also widely used – although few countries implemented new voluntary programmes in 1999. One exception is Switzerland, which will allow companies to take voluntary measures rather than be subject to a regulatory regime – so long as overall targets are met.

R&D policies – *including incentives to the private sector and new funding to government research agencies to promote research and development of climate-friendly technologies.*

Support for research and development is another widely used tool. Nearly all Member countries offer some form of R&D support. Many of these policies do not anticipate near-term emissions reductions, but are designed as part of a longer-term strategy.

Examples include Canada's "Technology Early Action Measures" programme, in which Can$ 56 million has been earmarked for cost-effective technology projects that will lead to reductions in GHG emissions, and including various special projects on such subjects as electric vehicles and an ethanol production process. The Irish National Greenhouse Gas Abatement Strategy includes Ir£ 40 million for research and development. Sweden has focused its R&D strategy in the transport sector. The current budget provides for SKr 500m to be used over the next six years to develop technology for environmentally sustainable cars in co-operation with Swedish car manufacturers. One of the largest R&D programmes is that of the United States, where nearly $1.4 billion has been committed to research, develop and deploy clean energy technologies.

Policy "processes" – *to develop policies and measures, and to promote public approval for government initiatives.*

Some countries set up "policy processes" as a precursor to the policies listed above. Some involve extensive consultative efforts – like the Canadian series of "Tables". This Can$ 34 million programme to analyse options to meet Canada's emission target under the Kyoto Protocol supports sixteen experts groups (on electricity, industry, the Kyoto Mechanisms and technology, for example), involving more than 450 experts from the private sector, environmental groups, academia and governments. Belgium has an extensive process, with a series of state- and federal-level policy analyses underway. The Irish programme, announced in April, established a national institution to promote consultation and dialogue on sustainable development, with a mandate to make recommendations on climate change and how Ireland can meet its Kyoto commitments.

Some countries have consulted experts on specific issues. The Norwegian Government has charged a commission of experts appointed by the Government with preparing a proposal for a domestic emissions trading system based on GHG quotas; the results of the work are to be presented to the Ministry of Environment by the end of 1999. Sweden has adopted a similar approach, establishing a "Government Commission on the Use of Flexible Mechanisms", which has already presented an interim report. That report considers the possibility of introducing emissions trading before the Protocol is ratified and before international monitoring of such systems is introduced.

This above description of actions is by no means exhaustive. But it does give a sense of the directions governments are taking to reduce emissions. In addition, the discussion does not seek to assess the effectiveness of any specific policy approaches. Some governments have released information on the expected GHG reduction to be achieved by their policies – but this is rarely the case. Thus, no conclusions can be drawn on whether countries will in fact reduce their emissions by any specific amount. The IEA's latest statistics show that Member countries' carbon dioxide emissions were still growing by nearly 1% between 1996 and 1997. Clearly the policies taken up to that time were not adequate to the task of curbing emissions growth, much less to the significant reductions called for in the Kyoto Protocol.

ENHANCING COMPETITION IN THE ENERGY SECTOR

PROGRESS IN THE ELECTRICITY SECTOR

Implementation of the EU Directive

Under the European Union Electricity Directive on the internal electricity market, EU Member countries are gradually allowing certain consumers to choose their suppliers. Eligibility for those programmes depends on the minimum consumption of each consumer. Those minimums are spelt out in the EU Directive. Table 3 summarises the obligations contained in the Directive.

Table 3
Eligible Consumers under the EU Directive

*Date**	*Percentage of the national electricity market open to competition** (Consumption of eligible consumers relative to national electricity consumption)*	*Minimum consumption of eligible consumers (EU average) in GWh*
February 1999	26.8%	40%
February 2000	28%	20%
February 2003	33%	9%

* Exceptions: Belgium and Ireland were given one additional year to comply with the Directive. Greece was given two additional years. (Belgium in fact decided not to delay its implementation of the Directive.)

** These figures are for 1998 and will be updated yearly.

Some countries have chosen to go beyond the eligibility limits imposed by the Directive. Finland, Germany, Sweden and the United Kingdom have extended free choice to all consumers. Denmark is planning to establish full consumer choice by 2003; Spain and the Netherlands, by 2007.

The Directive defines three basic models for network regulation, all designed to achieve comparable market access and an equivalent economic outcome. In regulated third party access (TPA), there is mandatory open access to the network at a regulated price. In negotiated third party access, there is mandatory open access to the network at a price negotiated between buyers and sellers. In a Single Buyer (SB) access model, network access is restricted to a single entity. Table 4 summarises the EU Member countries' choices.

Table 4
Future Regulation of the Electricity Network in the EU

Regulated TPA	*Negotiated TPA*	*Single Buyer*
Austria	Germany	
Belgium*	Greece*	
Denmark		
Finland		
France*		
Ireland*		
Italy		Portugal**
Netherlands		
Portugal**		
Spain		
Sweden		
United Kingdom		

* Legislation not completed as of December 1998.

** Portugal combines the two systems.

Sources: EU DG XVII and IEA.

Transmission tariffs are a key determinant of competition in electricity markets. The Directive does not restrict these tariffs to a specific level but requires the system operators in all countries to publish a range of indicative prices in the year following its implementation. The assessment of tariff levels will take place in 2000.

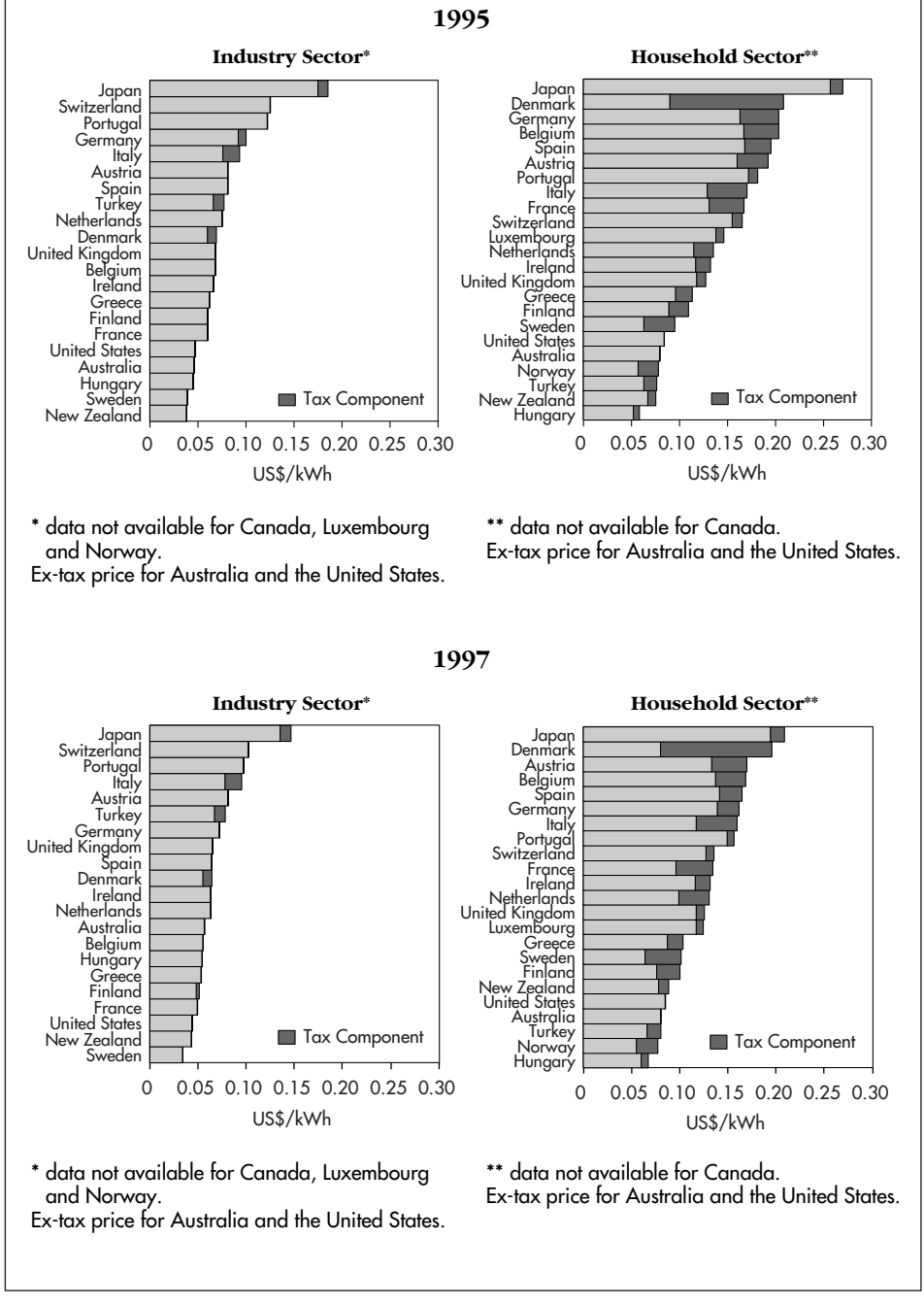
Regulated TPA can manage with a variety of pricing techniques. Both Sweden and the United Kingdom apply some variety of non-uniform transmission tariffs, which depend on the capacity and utilisation of the lines. The Netherlands, Portugal and Spain have adopted a "postage stamp" tariff, or geographically-uniform price. Postage stamp tariffs are justified when congestion of transmission lines is not significant, as is the case in the Netherlands, Portugal and Spain, or where the service area is relatively small, as in the Netherlands.

Developments in Other Countries

In the United States, several states have been working on legislation to introduce competition into the retail electricity market. Figure 23 shows the status in each state. Independent System Operators have also been created in some areas.

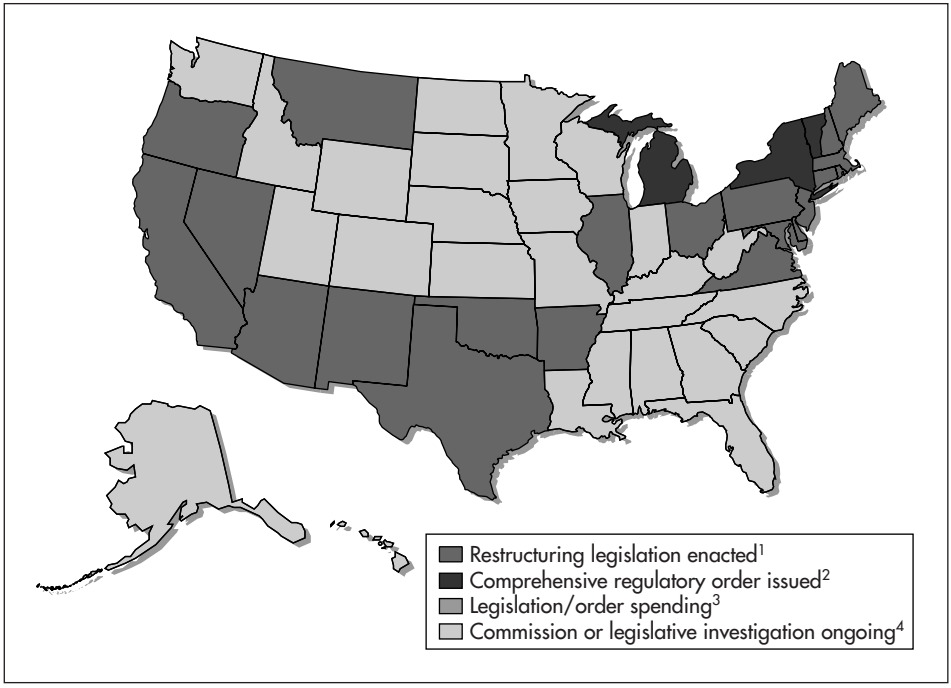
In 1998, the Japanese Government adopted a programme of partial liberalisation of the electricity supply industry which allows consumers connected to power lines with voltages higher than 2.2 kV to choose their suppliers. Electricity demand by such consumers amounted to 28% of total electricity demand in Japan in fiscal year 1997. Ten vertically-integrated utilities, all privately owned, must unbundle their

Figure 22
Electricity Prices in IEA Countries, 1995 and 1997



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

Figure 23
Status of Electric Utility Deregulation Activity in the United States
(as of 1 August 1999)



1. Arizona, Arkansas, California, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Montana, Nevada, New Hampshire, New Jersey, New Mexico, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas and Virginia.
2. Michigan, New York and Vermont.
3. None.
4. Alabama, Alaska, Colorado, District of Columbia, Florida, Georgia, Hawaii, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, South Carolina, South Dakota, Tennessee, Utah, Washington, West Virginia, Wisconsin and Wyoming.

Source: US Department of Energy.

accounts for generation, transmission and distribution, and must allow third party access to their grids. The transmission tariff will be regulated. This reform will be implemented by 2000 and will be reviewed three years later.

Electricity Prices

Market reform in the electricity sector in IEA countries continued in 1998, with the aim of enhancing competition for economic efficiency. In most IEA countries, market reform reduces energy prices. In some countries including Hungary, energy prices for consumers, which were kept below costs for political reasons, have risen to allow the market to function and to encourage investment. Electricity prices for

1995 and 1997 are shown in Figure 23. These prices are not always comparable among countries because of the fluctuation of exchange rates and differences in calculating some cost sectors, such as financial costs.

PROGRESS IN THE GAS SECTOR

The past year has shown a confirmation of plans or trends within IEA Member countries to increase or introduce competition into the gas sector. Despite significant differences in individual market circumstances and gas supply situations, the IEA membership as a whole has now taken the road towards reform and competition in natural gas. On this road, some IEA countries have taken the lead and are in a process of market consecration and regulatory refinement. Others have engaged more or less recently in the process or are about to do so. That said, countries are in very different situations in terms of their gas supply and demand (e.g. import dependency, distance of supply sources to market, demand structure), market matureness, industry structure and regulatory background. These factors will be central in shaping individual country approaches to gas sector reform.

Implementation of the EU Gas Directive

The European Union approach to the internal market for natural gas is very similar to the one for electricity. The Gas Directive to be implemented by August 2000 contains provisions for third party access and eligibility of consumers to benefit from competition. The Gas Directive is based on gradually allowing certain consumers to choose their suppliers. It requires that EU Member States, *as a minimum*, make final gas consumers which exceed specifically set consumption thresholds eligible for network access, and give local distribution companies access for the volumes of gas consumed by the customers in their distribution area that have been designated as eligible. In addition, all power producers should automatically be eligible to third party access (though thresholds can be set for co-generation). The definition of eligibility of final customers is governed by threshold levels of gas consumption, but also by the total percentage share of market opening. On both the thresholds and the market opening, the Directive sets precise rules: in a first step, final customers taking at least 25 mcm/a should become eligible. After 5 years, this threshold should reduce to 15 mcm/a, and again 5 years later to 5 mcm/a. If these thresholds fail to achieve a total market opening of at least 20% at the start, 28% 5 years later, and 33% thereafter, Member States are obliged to lower them in order to reach at least these targets. On the other hand, Member States may apply higher thresholds if they wish to avoid exceeding market opening levels of respectively 30%, 38% and 43%. Table 5 summarises the obligations in respect of eligibility and market opening that are contained in the Directive.

Table 5
Consumer Eligibility under the EU Gas Directive

	August 2000 latest	*August 2003*	*August 2008*
Power producers	all	all	all
Final consumers with a minimum consumption of	> 25 mcm/a	> 15 mcm/a	> 5 mcm/a
Minimum market opening	20%	28%	33%
Optional ceiling of market opening	30%	38%	43%

Countries having already exceeded or chosen to go beyond the eligibility thresholds are for example the United Kingdom, Germany, Spain, Denmark and the Netherlands. Others may do so soon.

Complementary in terms of generating competition and consumer choice are the Directive's provisions to ensure freedom to build and operate natural gas facilities through the granting of authorizations or licences on the basis of objective, non-discriminatory and transparent criteria.

The Directive defines two approaches to third party access (TPA): negotiated and regulated third party access. Regulated TPA implies a right of access to the system on the basis of published and fixed tariffs for use of that system. Under negotiated TPA, the parties are asked to engage into commercial negotiations for access, but gas companies are to publish their "main commercial conditions" for the use of their system. So far, the United Kingdom, Ireland and Spain have chosen regulated TPA, whereas Germany, Belgium and the Netherlands are favouring the negotiated approach.

The so-called EU accession countries of Central Europe are working at adapting their gas sector legislation to the requirements of the Gas Directive.

Developments in Other Countries

Several US states have completed or are engaged in a restructuring and access programme to introduce gas-to-gas competition at retail level. The focus is on retail unbundling, or restructuring, of the services required to supply natural gas to consumers into various components that can then be separately purchased. With complete unbundling, consumers can choose their own gas supplier and the local distribution company (LDC) still provides local transportation and distribution services. The various unbundling programmes are often called "customer choice" programmes.

In Japan an important step was taken with the revision of the Gas Utility Industry Law that took effect in 1995 and allowed large consumers (consuming 2 million m^3 per year or more) to negotiate prices and conditions of supply directly. By 1998/99,

this has led to noticeable market liberalisation and contractual supply improvements for hundreds of large-scale consumers. A further revision of the Gas Utility Industry Law was promulgated in May 1999 and came into effect in November 1999. Its main reform elements are:

- gas utilities will no longer have to seek government approval for changes of their gas tariffs in case of tariff reduction;
- consumer eligibility threshold for direct access is reduced at 1 mcm per year;
- the major gas companies are required to publish their tariff and supply conditions for third party access.

COAL: REDUCTION IN SUBSIDIES

In 1998, IEA Member countries produced 1 104.3 million tonnes of coal equivalent (tce) of hard coal[9]. Of this amount, around 5.5% received state aid as measured by the Producer Subsidy Equivalent (PSE). The PSE is a method of estimating the level of financial assistance to indigenous hard coal producers[10]. A breakdown of the 61.1 million tce of assisted hard coal production is shown in Table 6.

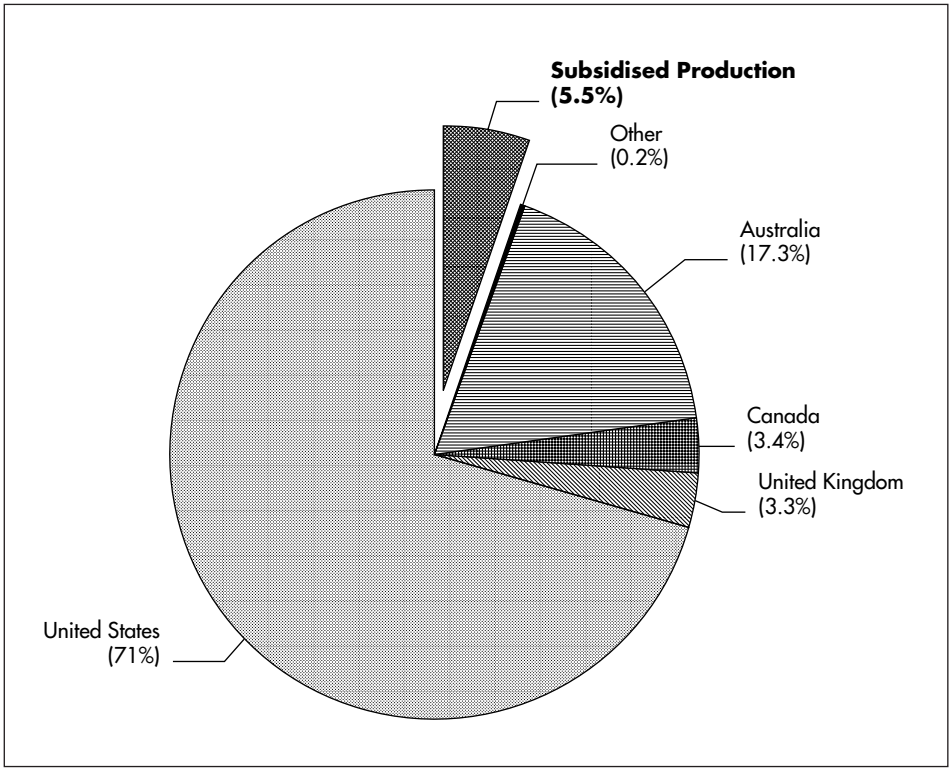
The total amount of IEA hard coal production receiving government financial assistance, as measured by the PSE, declined over the past decade, both in absolute and in percentage terms (Figure 25). Belgium halted production in September 1992, Portugal closed its last mine in December 1994 and the last remaining subsidies in the United Kingdom ended with the expiry of five-year contracts with the electricity generators in March 1998.

French, German and Japanese production has declined significantly, while Spanish and Turkish production only began to decline in 1998. The trend to reduce subsidised production in the IEA is expected to continue. Germany, France and Spain have restructuring plans which should result in further mine closures. By 2002, Germany plans to reduce production by a further 11% (from 41.6 million tce to 37 million tce) and Spain by a further 9% (from 11 million tce to 10 million tce). France intends to halt all indigenous coal production by 2005.

The amount of aided production is clearly declining, but it is difficult to ascertain an overall trend with respect to aid in the period from 1991 to 1998. While there have been setbacks, the last few years have seen a general reduction in subsidies. In measuring aid in terms of US dollars per tce, account needs to be taken of exchange

9. Production of brown coal and peat is also subsidised in some instances, but no systematic analysis has been conducted. Hard coal includes steam coal for power stations and coking coal used in steel-making.
10. An explanation of the PSE and of the data in Figure 25 appears in Annex D.

Figure 24
IEA Hard Coal Production, 1998



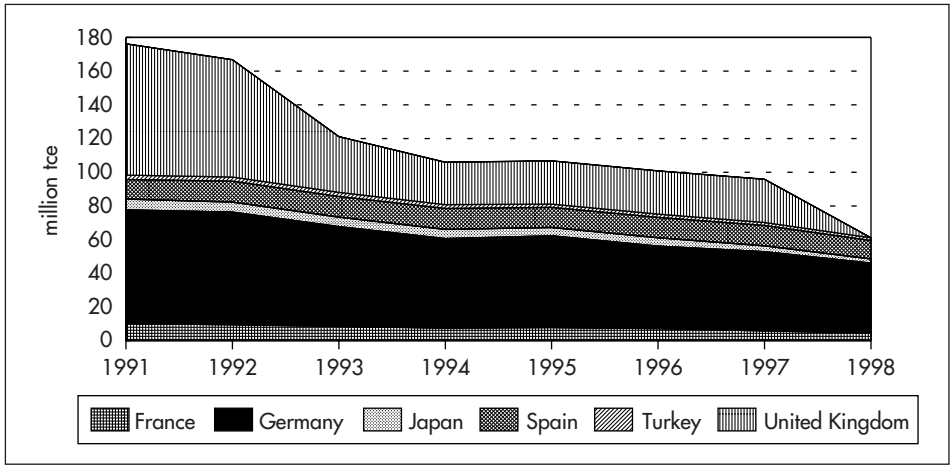
Source: *Coal Information 1998*, IEA/OECD Paris, 1999.

Table 6
Subsidised Hard Coal Production in Selected IEA Countries, 1998

	Million tce	*Percent*
France	4.4	0.40
Germany	41.6	3.77
Japan	2.4	0.22
Spain	11.0	1.00
Turkey	1.6	0.15
Total subsidised	**61.1**	**5.53**
Non-subsidised	1 043.2	94.47
Total IEA production	1 104.3	

Note: Production of hard coal is subsidised in Norway (0.4 Mtce 1998). Production subsidies have not been systematically examined in other IEA countries.

Figure 25
Subsidised Hard Coal Production* in Selected IEA Countries, 1991-1998

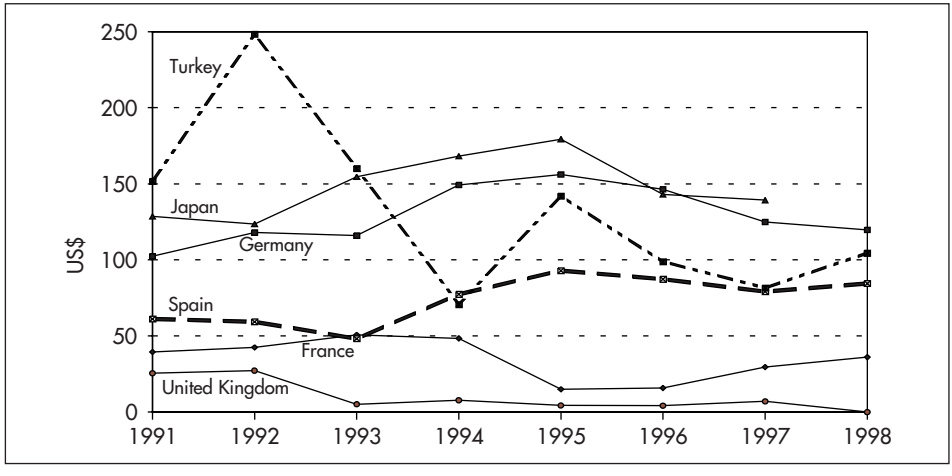


* Includes assisted sub-bituminous production in Spain.

Note: Belgium (production halted in 1992) and Portugal (production halted in 1994) have not been included.
The remaining small element of financial assistance to the United Kingdom production ended in March 1998.

Source: *Coal Information 1998*, IEA/OECD Paris, 1999.

Figure 26
Aid per Tonne of Coal Equivalent, 1991-1998
(US$)



Note: Belgium (production halted in 1992) and Portugal (production halted in 1994) have not been included.
Loans taken out by Charbonnages de France have increased since 1994, as have production costs. Aid for France has not been approved by the European Commission for 1997 and 1998.
In Japan figures for the financial year 1998/99 are not available.

Source: *Coal Information 1998*, IEA/OECD Paris, 1999.

Table 7

IEA Secretariat Estimates of Producer Subsidy Equivalent (PSE) for Coal Production in Selected IEA Countries

Country		*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998p*
France	Production (million tce)	10.07	9.45	8.30	7.46	7.80	7.07	5.73	4.43
	Aid per tce (FF)	222.34	225.07	287.57	268.77	53.21[1]	85.43[1]	[2]	[2]
	Aid per tce (US$)	39.42	42.51	50.79	48.41	10.66[1]	16.70[1]	[2]	[2]
Germany	Production (million tce)	67.57	66.86	59.29	53.15	54.45	48.94	47.06	41.62
	Aid per tce (DM)	169.88	184.20	191.63	242.15	223.76	220.34	216.64	210.55
	Aid per tce (US$)	102.40	117.93	115.93	149.20	156.15	146.41	124.94	119.70
Japan	Production (million tce)	6.34	5.98	5.68	5.46	4.93	5.10	3.37	3.37
	Aid per tce (Yen)	17 289.13	15 649.49	17 191.61	17 183.85	16 877.90	15 552.88	16 848.54	n.a.
	Aid per tce (US$)	128.54	123.52	154.60	168.14	179.36	142.95	139.24	n.a.
Spain	Production (million tce)	11.60	12.39	12.33	12.39	11.94	11.95	12.07	11.00
	Aid per tce (Pta)	6 354.11	6 073.90	6 133.60	10 370.04	11 593.61	11 058.25	11 591.40	12 624.50
	Aid per tce (US$)	61.16	59.32	48.22	77.39	92.97	87.28	79.18	84.50
Turkey	Production (million tce)	2.69	2.47	2.46	2.34	1.88	1.97	1.94	1.64
	Aid per tce (TL)	636 763.87	1 713 382.80	1 760 165	2 105 578	6 487 216	8 031 420	12 371 000	27 212 127
	Aid per tce (US$)	151.61	248.32	160.02	70.66	141.95	98.79	81.60	104.46
UK	Production (million tce)	78.11	69.75	56.41	41.23	46.97	43.10	41.70	35.42
	Aid per tce (£)	14.45	15.51	3.45	5.03	2.76	2.67	4.30	0.00
	Aid per tce (US$)	25.49	27.21	5.18	7.71	4.35	4.16	7.03	0.00

p Preliminary data, subject to revision.

[1] Note that loans taken out by Charbonnages de France have increased since 1994, as have production costs.

[2] Aid for the French coal industry has not been authorised by the European Commission for the years 1997 and 1998.

Note: tce is tonne of coal equivalent.

Indicative Prices on the International Coal Market

(Average CIF* Prices for Hard Coal Imported into the European Union from non-EU Countries)

	1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998p*
Power station steam coal (US$/tce)	52.00	51.81	44.70	43.68	50.20	48.64	47.89	41.48
Coking coal (US$/tonne)	59.55	57.93	56.15	54.20	57.82	57.50	57.53	55.41

* Cost, Insurance and Freight.

Source: *Coal Information 1998*, IEA/OECD Paris, 1999.

rate fluctuations. The reference point for aid (international prices) is a moving target. Variations in aid intensity do not therefore necessarily reflect a lack of commitment on the part of any government to reduce such aid.

Of the remaining countries still giving financial assistance, France is the only one to have presented a firm timetable for ending uncompetitive indigenous hard coal production.

ENERGY R&D BUDGET

Energy R&D budgets in IEA Member countries have declined in recent years. Annex B contains 14 tables covering IEA Member Governments' research and development budgets. The total reported IEA Government energy R&D budget was US$ 9 087.3 million in 1990 (at 1998 prices and exchange rates). The budget was reduced to US$ 7 515.9 million in 1997 (Table B3 in Annex B). The reduction was substantial in some countries such as the United Kingdom, where the R&D budget was reduced from US$ 355.4 million in 1990 to US$ 83.4 million in 1997. In several countries, however, this trend appears to have levelled off or been reversed recently. Between 1990 and 1997, the total IEA budget for coal R&D was reduced from US$ 1 390.7 million to US$ 321.1 million (Table B7). R&D expenditures for nuclear breeders were reduced from US$ 791 million to US$ 267.1 million (Table B9) over the same period. The R&D budget for renewable energy sources was increased from US$ 584.9 million in 1990 to US$ 587.4 million in 1997 (Table B11).

International collaboration in energy R&D remains important. The IEA's Implementing Agreements have drawn attention, not only from Member governments but also from industries. There are many active projects in the EU framework, notably in the area of renewable energy sources.

PART 2

THE COUNTRY REPORTS

IN-DEPTH REVIEWS: SUMMARIES

Part 2 contains summaries of the findings and the full list of recommendations of the 1999 in-depth reviews. The full reviews have been published separately.

The 1999 in-depth reviews, presented in alphabetical order, and the participants in the review teams are shown below.

Finland	Team Leader	Spyros Lioukas (Greece)
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		Alice Guimaraes-Purokoski (EC)
		Ivan Vera (NEA)
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		Loraine Dawson (United Kingdom)
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FINLAND

Over the past few years, Finnish energy markets have undergone a period of reform and restructuring. It has seen the introduction of competition into the electricity market in 1995 and the successive adaptation to competition in the domestic market as well as closer integration with the Nordic electricity market. Reform also brought competition to the natural gas market in full compliance with the EU Directive. This reform was realised despite the fact that, as of early 1999, Finland was not interconnected to the European Union's natural gas network. Finally, Fortum Oyj was created in 1998 in a merger of Neste, Finland's largest oil company, and IVO, its largest electricity supply company.

Finland has designed its electricity market in an original way, in that regulation is limited and the market relies largely on competitive mechanisms, consumer choice, and consumer information. Finland has avoided some of the problems that competitive power markets experienced elsewhere. For example, the rules put in place to cope with transmission bottlenecks are straightforward and predictable but nevertheless provide proper incentives. The Finnish example may be worthwhile for other countries to study.

However, attention needs to be given to market power, especially in the electricity market. Finland and the wider Nordic market are still relatively concentrated. Finland does not rely on price regulation according to a fixed formula, neither a price cap nor revenue control. Prices are controlled through *ex post* plaintiff action by the competition or regulatory authority. This approach appears to be cumbersome. The authorities in charge are active, but it is not clear if they are strong enough to prevent abuses.

Some of these concerns also apply to the natural gas market, especially price regulation. Finland's decision to introduce the full EU Natural Gas Directive is laudable. But before Finland is connected to the western gas grid, competition will remain limited and effective regulation will be necessary. The Government is well advised to give its support to the two interconnection projects now under discussion.

Concerns about market power are particularly relevant to the creation of Fortum Oyj. The intention behind the creation of Fortum was to form a large player in the EU energy market. Yet Neste owns Gasum, Finland's only gas transportation company, and so its merger with IVO has created diagonal integration between electricity and natural gas. The decision to oblige Neste to reduce its stake in Gasum was a very important precondition for workable competition in the domestic electricity market.

Climate change is another important issue in Finnish energy policy. The country has already exploited much of its energy efficiency potential, partly because of its cold climate and the scarcity of indigenous energy resources, but also because there

is strong support for environmental protection in Finland. Finland was the first country in the world to introduce a carbon tax in 1990. Finland also has one of the highest shares of combined heat and power production in the world. Carbon dioxide emissions, however, continue to rise, and Finland is looking for ways to address this problem. Greater use of natural gas, especially in electricity and heat production, could be a promising strategy, provided that the gas market can deliver the additional quantities and that appropriate incentives for gas use are in place.

RECOMMENDATIONS

The Government should:

Energy Market and General Policy Recommendations

- ☐ Take care that there is sufficient antitrust surveillance of the energy market in general, and that there is sufficient regulatory oversight of remaining monopoly areas.

- ☐ Work towards extending and strengthening the cross-border links in grid-bound industries as soon as economically feasible.

- ☐ Ensure that, during the privatisation of energy companies, ownership is spread among a large number of players and that cross-ownership is reduced.

Energy Efficiency and Environment Recommendations

- ☐ Commit to a strategy to achieve its carbon dioxide emissions targets, prioritise a small number of key instruments, and implement them. The Government should clearly define what savings are aimed at, carefully monitor progress, and adjust the instruments if necessary.

- ☐ In its voluntary agreements, set concrete targets for the different sectors, based on thorough audits and estimates of likely trends, and further develop monitoring of the results.

- ☐ Continue its vigorous efforts to meet its international obligations in the area of climate change.

- ☐ Stabilise the structure of the CO_2 tax and avoid further dramatic changes in the near future.

Fossil Fuels Recommendations

☐ Phase out preferential tax treatment for peat. Regional and social policy objectives should be addressed with policy instruments other than energy prices.

☐ Continue the policy of non-interference in the oil market, combined with effective antitrust oversight.

☐ Continue, and if possible intensify, efforts to create alternative gas supply routes to diversify the supply of natural gas, by lending political support to the new pipeline projects that are under consideration in the gas industry.

☐ Supply the new Gas Market Act with an effective mechanism to regulate pipeline prices as well as prices for other services which are not competitive. Encourage new supply arrangements among different types of gas consumers.

☐ Ensure effective regulatory and antitrust oversight.

Electricity Recommendations

☐ Ensure that all aspects of the electricity market that need regulatory surveillance are adequately supervised and in particular:

☐ Ensure that the Electricity Market Authority (EMA) has all of the powers and resources it needs to monitor the market. Make sure EMA, perhaps with support from other institutions, develops a transparent and effective methodology to assess the "reasonableness" of prices and to identify and eliminate monopoly rents and internal subsidisation.

☐ Ensure that the Office of Free Competition (OFC) continues to monitor market power in the wholesale market and, where necessary, uses the new provisions in the Competition Act. Exert adequate antitrust scrutiny. Concentration in the electricity market, including cross-ownership, should be closely monitored.

☐ Ensure co-operation and division of work between EMA and OFC, since both are comparatively small organisations.

☐ Continue to ensure that end users are fully informed of electricity prices. Consider the introduction of a register for all electricity retailers which can easily be accessed by consumers. It would provide information, including information on prices, and a basic examination for good business practice in addition to the regular company register.

☐ Through EMA, monitor Fingrid's ownership and governance, making sure that the large shareowners do not significantly expand their ownership, and work towards broadening Fingrid's ownership base. Since Fingrid is at the core of the

Finnish power market, all interests in the market should eventually be reflected in this company.

☐ Further strive to reduce information and transaction costs to small consumers through mandatory guidelines for billing and model power supply contracts.

☐ Consider involving EMA in the OFC's monitoring of district heating prices, especially cross-subsidies between heat and electricity supply.

Nuclear Recommendations

☐ Consider past electricity demand and supply trends and assess the role that nuclear power can play (through lifetime extension or nuclear capacity additions) in reducing CO_2 and air pollutant emissions, in helping to ensure security of supply and in diversifying input fuels. Clarify the future role of nuclear based on the economic, environmental and security impacts of all energy resources.

☐ Continue to ensure progress in the design and development of a final repository site for the disposal of high-level radioactive waste.

R&D Recommendation

☐ Take measures towards improving the use of R&D results.

FINLAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**4.9**	**11.7**	**13.6**	**10.99**	**10.24**	**14.2**	**14.3**
Peat		0.1	1.8	2.2	2.6	2.2	2.2	2.2
Oil		–	–	0.0	0.1	–	–	–
Comb. Renewables & Wastes[2]		3.9	4.0	5.3	5.9	5.4	5.7	5.8
Nuclear		–	5.0	5.1	5.4	5.2	5.2	5.2
Hydro		0.9	0.9	1.0	1.1	1.1	1.1	1.1
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.0	0.0
TOTAL NET IMPORTS[4]		**16.6**	**17.7**	**17.5**	**18.5**	**18.6**	**20.5**	**20.9**
Coal[1]	Exports	0.0	0.0	–	–	0.0	0.0	0.0
	Imports	2.4	4.4	4.6	4.8	5.2	5.3	5.3
	Net Imports	2.4	4.4	4.6	4.8	5.2	5.3	5.3
Oil	Exports	0.2	1.7	5.0	4.3	4.5	4.5	4.5
	Imports	14.0	12.5	15.0	14.9	14.2	14.2	14.2
	Bunkers	0.1	0.6	0.4	0.4	0.4	0.4	0.4
	Net Imports	13.8	10.2	9.7	10.1	9.3	9.3	9.3
Gas	Imports	–	2.2	3.0	2.9	3.5	5.2	5.6
	Net Imports	–	2.2	3.0	2.9	3.5	5.2	5.6
Electricity	Exports	0.0	0.0	0.1	0.0	–	–	–
	Imports	0.4	0.9	0.5	0.7	0.7	0.7	0.7
	Net Imports	0.4	0.9	0.3	0.7	0.7	0.7	0.7
TOTAL STOCK CHANGES		**–0.1**	**–0.6**	**1.0**	**–0.5**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**21.3**	**28.8**	**32.0**	**33.1**	**32.5**	**34.7**	**35.2**
Coal[1]		2.5	4.1	5.1	4.8	5.2	5.3	5.3
Peat		0.0	1.2	2.3	2.1	2.2	2.2	2.2
Oil		13.6	10.3	9.9	10.3	9.3	9.3	9.3
Gas		–	2.2	3.0	2.9	3.5	5.2	5.6
Comb. Renewables & Wastes[2]		3.9	4.2	5.3	5.9	5.4	5.7	5.8
Nuclear		–	5.0	5.1	5.4	5.2	5.2	5.2
Hydro		0.9	0.9	1.0	1.1	1.1	1.1	1.1
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.0	0.0
Electricity Trade[5]		0.4	0.9	0.3	0.7	0.7	0.7	0.7
Shares (%)								
Coal		*11.8*	*14.2*	*16.1*	*14.5*	*15.8*	*15.3*	*15.1*
Peat		*0.2*	*4.2*	*7.3*	*6.2*	*6.8*	*6.3*	*6.3*
Oil		*63.6*	*35.6*	*31.0*	*31.1*	*28.5*	*26.8*	*26.4*
Gas		–	*7.6*	*9.3*	*8.8*	*10.8*	*15.0*	*15.9*
Comb. Renewables & Wastes		*18.5*	*14.6*	*16.4*	*17.7*	*16.6*	*16.4*	*16.5*
Nuclear		–	*17.4*	*15.8*	*16.5*	*16.0*	*15.0*	*14.8*
Hydro		*14.2*	*3.2*	*3.2*	*3.2*	*3.4*	*3.2*	*3.1*
Electricity Trade		*1.7*	*3.2*	*1.0*	*2.0*	*2.1*	*2.0*	*2.0*

0 is negligible. – is nil. .. is not available.

Please note: All forecast data are based on the 1997 submission. Forecast data for electricity and heat generation are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**19.4**	**22.6**	**23.2**	**24.0**	**23.3**	**25.5**	**26.3**
Coal[1]	1.0	1.2	0.7	0.8	0.8	0.8	0.8
Peat	0.0	0.4	0.4	0.3	0.4	0.4	0.4
Oil	11.5	9.7	8.5	8.5	7.4	7.4	7.4
Gas	0.0	1.2	1.2	1.2	1.5	2.6	2.7
Comb. Renewables & Wastes[2]	3.9	3.2	4.0	4.4	4.0	4.2	4.3
Electricity	2.3	5.1	5.7	6.1	6.9	7.6	8.0
Heat	0.6	1.9	2.8	2.7	2.4	2.5	2.6
Shares (%)							
Coal	*5.3*	*5.2*	*3.0*	*3.4*	*3.2*	*3.1*	*3.0*
Peat	*0.1*	*1.8*	*1.6*	*1.3*	*1.7*	*1.6*	*1.5*
Oil	*59.2*	*42.8*	*36.4*	*35.4*	*31.7*	*29.1*	*28.3*
Gas	*0.1*	*5.4*	*5.3*	*4.9*	*6.4*	*10.2*	*10.3*
Comb. Renewables & Wastes	*20.3*	*14.0*	*17.3*	*18.4*	*17.1*	*16.3*	*16.2*
Electricity	*11.9*	*22.5*	*24.6*	*25.2*	*29.5*	*29.7*	*30.6*
Heat	*3.1*	*8.5*	*11.8*	*11.2*	*10.3*	*9.9*	*10.1*
TOTAL INDUSTRY[6]	**7.6**	**10.7**	**10.8**	**11.4**	**11.5**	**12.7**	**13.3**
Coal[1]	0.9	1.2	0.7	0.8	0.7	0.8	0.8
Peat	0.0	0.4	0.3	0.3	0.4	0.4	0.4
Oil	5.0	2.6	2.0	1.9	2.0	1.9	1.9
Gas	0.0	1.2	1.2	1.1	1.4	2.2	2.3
Comb. Renewables & Wastes[2]	–	2.5	2.9	3.3	2.9	3.1	3.2
Electricity	1.6	2.8	3.1	3.4	3.9	4.2	4.6
Heat	0.1	0.2	0.6	0.6	0.2	0.2	0.2
Shares (%)							
Coal	*12.1*	*10.8*	*6.4*	*7.2*	*6.4*	*6.2*	*5.9*
Peat	*0.2*	*3.6*	*2.9*	*2.5*	*3.4*	*3.0*	*2.9*
Oil	*66.2*	*24.2*	*18.1*	*16.7*	*17.4*	*15.1*	*14.4*
Gas	*0.1*	*10.9*	*10.8*	*9.5*	*12.0*	*16.9*	*16.9*
Comb. Renewables & Wastes	*–*	*22.9*	*27.2*	*28.9*	*25.2*	*24.0*	*23.6*
Electricity	*20.4*	*26.1*	*28.8*	*29.7*	*33.9*	*33.0*	*34.5*
Heat	*1.0*	*1.6*	*5.8*	*5.5*	*1.8*	*1.8*	*1.8*
TRANSPORT[7]	**2.6**	**4.4**	**4.1**	**4.4**	**4.1**	**4.2**	**4.2**
TOTAL OTHER SECTORS[8]	**9.3**	**7.5**	**8.3**	**8.2**	**7.8**	**8.5**	**8.7**
Coal[1]	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Peat	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Oil	3.9	2.7	2.4	2.3	1.4	1.4	1.4
Gas	0.0	0.0	0.1	0.1	0.1	0.4	0.4
Comb. Renewables & Wastes[2]	3.9	0.7	1.1	1.1	1.1	1.1	1.1
Electricity	0.8	2.2	2.6	2.6	2.9	3.3	3.4
Heat	0.5	1.7	2.1	2.1	2.2	2.3	2.4
Shares (%)							
Coal	*1.1*	*0.1*	*–*	*–*	*0.1*	*0.1*	*0.1*
Peat	*0.1*	*0.2*	*0.7*	*0.4*	*0.2*	*0.2*	*0.2*
Oil	*42.3*	*36.7*	*29.1*	*28.0*	*18.0*	*16.4*	*16.1*
Gas	*–*	*0.6*	*0.7*	*0.8*	*1.3*	*4.8*	*4.7*
Comb. Renewables & Wastes	*42.6*	*9.3*	*13.0*	*13.7*	*14.2*	*12.9*	*12.6*
Electricity	*8.2*	*29.9*	*30.9*	*31.8*	*37.8*	*38.7*	*38.8*
Heat	*5.7*	*23.2*	*25.5*	*25.3*	*28.4*	*26.9*	*27.6*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.5**	**11.9**	**15.4**	**15.4**	**15.6**	**16.4**	**16.7**
OUTPUT (Mtoe)	**2.2**	**4.7**	**6.0**	**5.9**	**6.5**	**7.2**	**7.7**
(TWh gross)	26.1	54.4	69.4	69.2	75.2	83.4	89.2
Output Shares (%)							
Coal	*18.7*	*18.5*	*22.4*	*19.0*	*25.5*	*29.1*	*32.2*
Peat	*9.4*	*14.6*	*9.4*	*9.3*	*8.9*	*8.0*	*7.5*
Oil	*31.6*	*3.1*	*1.9*	*2.0*	*1.7*	*1.6*	*1.5*
Gas	*–*	*8.6*	*12.3*	*10.0*	*11.0*	*12.8*	*13.5*
Comb. Renewables & Wastes	*–*	*–*	*8.9*	*11.8*	*9.2*	*9.2*	*8.6*
Nuclear	*–*	*35.3*	*28.1*	*30.2*	*26.5*	*23.9*	*22.4*
Hydro	*40.3*	*20.0*	*17.1*	*17.7*	*17.0*	*15.3*	*14.3*
Solar/Wind/Other	*–*	*–*	*0.0*	*0.0*	*0.0*	*0.2*	*0.1*
TOTAL LOSSES	**2.0**	**6.9**	**8.6**	**8.5**	**9.2**	**9.2**	**8.9**
of which:							
Electricity and Heat Generation[10]	0.6	5.1	6.4	6.5	6.5	6.5	6.2
Other Transformation	0.5	0.6	0.7	0.6	2.2	2.2	2.2
Own Use and Losses[11]	0.9	1.2	1.4	1.4	0.5	0.5	0.5
Statistical Differences	**–0.1**	**–0.7**	**0.2**	**0.6**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	82.91	134.81	135.82	143.99	157.34	178.88	199.45
Population (millions)	4.67	4.99	5.13	5.14	5.17	5.21	5.23
TPES/GDP[12]	0.26	0.21	0.24	0.23	0.21	0.19	0.18
Energy Production/TPES	0.23	0.41	0.42	0.46	0.43	0.41	0.41
Per Capita TPES[13]	4.57	5.78	6.25	6.43	6.29	6.66	6.73
Oil Supply/GDP[12]	0.16	0.08	0.07	0.07	0.06	0.05	0.05
TFC/GDP[12]	0.23	0.17	0.17	0.17	0.15	0.14	0.13
Per Capita TFC[13]	4.16	4.53	4.54	4.67	4.52	4.89	5.02
Energy-related CO_2 Emissions (Mt CO_2)[14]	49.3	54.4	65.8	64.1	64.4	69.0	70.0
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	1.8	1.2	1.3	1.3	1.3	1.3

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	2.3	1.5	1.8	3.2	–0.6	1.3	0.3
Coal	7.4	0.6	3.9	–6.6	2.4	0.6	–
Peat	48.1	10.6	11.4	–11.7	2.4	–	–
Oil	–0.5	–2.3	–0.5	3.5	–3.4	0.0	–
Gas	–	9.4	5.2	–2.0	6.4	8.2	1.5
Comb. Renewables & Wastes	–2.4	1.9	3.8	11.6	–2.7	1.1	0.3
Nuclear	–	10.0	0.2	7.3	–1.5	–	–
Hydro	0.6	–0.0	1.5	3.2	1.5	–	–
Solar/Wind/Other	–	–	–	–	44.2	_	10.8
TFC	0.4	1.2	0.5	3.2	–0.9	1.8	0.6
Electricity Consumption	4.7	4.7	2.0	5.8	4.4	1.9	1.2
Energy Production	4.7	5.6	2.5	10.9	–2.6	0.4	0.1
Net Oil Imports	1.1	–3.3	–0.9	5.0	–2.9	0.0	–
GDP	2.1	3.3	0.1	6.0	3.0	2.6	2.2
Growth in the TPES/GDP Ratio	0.1	–1.7	1.7	–2.6	–3.5	–1.3	–1.9
Growth in the TFC/GDP Ratio	–1.7	–2.1	0.4	–2.7	–3.8	–0.8	–1.6

Please note: Rounding may cause totals to differ from the sum of the elements.

HUNGARY

Hungary, the most recent IEA Member country joined the IEA on 3 June 1997. Following the collapse of the former Soviet Union (FSU) and the loosening of Hungary's economic ties with the countries of the Council of Mutual Economic Assistance (CMEA), the country underwent a difficult period of transition from a state-controlled economy to a market economy. Industrial output and GDP dropped sharply and unemployment and inflation surged. Since 1996, the country has moved increasingly toward macro-economic stability, although the complete transformation and modernisation of its infrastructure will take significantly more time.

Starting in 1991, Hungary restructured, liberalised and privatised its energy sector. Today, the country's energy industry is majority privately owned. The downstream oil market is competitive. The natural gas industry is now largely privatised, with foreign investment in gas distribution and supply. The Hungarian oil and gas company MOL retains a dominant position in natural gas production, imports and exports, pipeline transportation, and wholesale trading. Competition is to be phased in when the country accedes to the European Union, which is expected around 2003. At present, all gas prices are regulated by the Minister of Economic Affairs, based on recommendations made by the Hungarian Energy Office (MEH), the regulatory authority for gas and electricity.

Security of gas supply is an important issue because the country has long had to rely on Russia (or the FSU and CIS) as the sole supplier, and because natural gas use amounts to almost 40% of Hungarian energy use, twice as much as in IEA Europe. Hungary has only been interconnected to the Western gas grid since October 1996, via Austria through the Gyõr-Baumgarten pipeline. Russian gas remains the cheapest option, but the new pipeline allows the exchange of "swap gas" as well as real deliveries, and the traded volumes are increasing.

The task that lies ahead for Hungary is to further adapt and prepare the gas market for competition while ensuring security of supply. Access to and pricing of essential services, and particularly gas transportation, must be made non-discriminatory. This is likely to require a greater and more independent role for the Hungarian Energy Office, including ultimate price-setting authority.

Most of the options to guarantee security of supply, including gas deliveries from Western suppliers or strategic storage, come at extra cost. Thus, a mechanism should be designed to cover these costs in the competitive gas market. It is important to make this mechanism as market-compatible as possible, since competition itself may improve security of supply to some degree.

The Hungarian electricity supply industry was restructured in such a way that electricity generation is now largely separate from transmission. There are also separate distribution/retailing companies. Generation and distribution/supply are

largely owned by foreign investors. At present, the modus operandi of the industry is based on long-term power purchase agreements. Price regulation covers most prices in the industry, and as in the gas industry, the ultimate price setting authority lies with the Ministry of Economic Affairs. Competitive rules are to be phased in when Hungary accedes to the European Union.

The progress made in the Hungarian power industry in the past half decade is considerable. Not only was the industry restructured and privatised, but it was also brought up to the technical standards of the Western European UCPTE grid, and has been running in parallel with the latter since 1995. The electricity supply industry, more than the gas industry, has been reformed to a point which is only one step away from competition. This step would require introducing non-discriminatory open access to the power grids, and the appropriate adaptation of the regulatory mechanisms, as in the gas industry. This step should be taken soon. Some further unbundling would be necessary, particularly with respect to system operation, but this unbundling would be a very minor step compared to the restructuring that has already occurred.

Under Annex B of the Kyoto Protocol, Hungary is committed to reduce its CO_2 emissions by 6% in the time period 2008-2012 (six gases). Hungary's economy and its energy use collapsed at the beginning of the 1990s, and energy consumption has not yet returned to its pre-transition levels. As an economy in transition, Hungary has the right to choose its base year, and has opted for 1985-1987, the peak consumption years before the collapse, as its baseline period.

For these reasons, the country has a relatively favourable starting point for meeting its CO_2 commitments. While the inefficient patterns of energy use dating from the centrally planned economy mean that the country must catch up with international standards, they also mean there is much room for efficiency improvements at comparatively low cost. The main precondition for rapid development in the right direction is that all remaining distortions in energy prices must be eliminated as soon as possible. Again, compared to the progress that Hungary has already made, the remaining task is clearly manageable and should be undertaken as soon as possible.

RECOMMENDATIONS

The Government should:

Energy Market and Energy Policy

- ☐ Define and establish effective framework conditions for competition wherever possible in the energy market.

☐ Separate its roles as a policy and law-maker; as a regulator; as an owner of energy companies, and as a promoter of social cohesion. Where this has not yet been done, establish separate institutions for these different roles.

☐ Establish independent price regulation. Strengthen the independence of the electricity and gas regulator, the Hungarian Energy Office.

Energy Demand, Energy Efficiency, Climate Change and the Environment

☐ Continue its move toward improvement of environmental quality and energy efficiency.

☐ Make sure that all remaining price distortions in all energy markets, all below-cost pricing and all cross-subsidies are dismantled as quickly as possible.

☐ Phase in a balanced mix of regulation and economic instruments, such as fuel taxation, to internalise the external cost of energy use – notably environmental costs related to local air pollution and carbon dioxide emissions. Complete the basket of measures by using public information and awareness campaigns as well as voluntary agreements.

☐ Continue to implement progressive environmental regulation. Strive to cover all thermal power plants as soon as possible, including existing and smaller facilities, which can be major polluters.

☐ Ensure, as planned, that new capacity combines the best economic and thermal efficiency and lowest environmental emissions available, and that efficient choice of new technology is not hampered by distorted price signals.

☐ Implement stringent but realistic mandatory building codes as soon as possible, and ensure effective enforcement. Seek low-cost options to improve the housing stock.

☐ Continue co-operation with international funding organisations, which appears to have been very successful, and continue or even extend quality control and assessment of results.

Coal

☐ Pursue the policy of reducing coal production subsidies with a view to eliminating them. Phase out preferential coal purchase contracts between independent mines and the power industry as soon as this is feasible. Replace both these practices with social policy measures directed at those in need, and with development efforts designed to create new employment. New

recruitment in parts of the industry that survive only thanks to government support should be prevented.

Natural Gas

- ☐ In line with gas demand growth, encourage the gas industry to pursue its diversification strategy, be it through physical or contractual diversification. This diversification should be based on the Hungary-Austria gas pipeline and other routes, as appropriate.

- ☐ Monitor the development of security of supply, particularly as competition develops. Consider ways in which sufficient security of supply can be ensured in a competitive gas market. The Government should especially consider implementing a financing mechanism for security of supply, either a fee levied on pipeline transportation or interruptible service pricing with higher prices for non-interruptible supply contracts.

- ☐ Build upon the existing provisions to introduce competition into the gas industry. In particular, introduce regulated grid access. The Government should stipulate accounting separation at the least, but preferably operational separation as well.

- ☐ Design clear pipeline tariffs, and a mechanism for their regulation, to be carried out by the Hungarian Energy Office. Design access conditions and tariffs for other essential services such as storage.

- ☐ Confer the authority for gas price setting on the Hungarian Energy Office. Maintain regular price regulation. If changes have to be made, the Government should announce a clear strategy and timetable for transition to give sufficiently early warning, and adhere to its strategy and timetable.

- ☐ Continue to phase out below-cost price regulation and cross-subsidies. Work towards introducing a cost-based capacity charge into wholesale and retail prices.

- ☐ Continue to address social hardship through social policy measures, not energy policy.

Oil

- ☐ Establish clear regulations for open access to oil-product pipelines, modelled on those which will be developed for natural gas.

Electricity

- ☐ Establish clear, regulated transmission and distribution prices and non-discriminatory grid access rules as a precondition for competition in the power industry. Open the retail market to competition.

- ☐ Unbundle generation, transmission, and distribution and supply to end users. At the very least, system operation and wholesale trading should be fully unbundled from these functions by establishing an Independent System Operator. Independence of this System Operator from any particular interest, be it commercial interests or government intervention, is crucial.

- ☐ Consider maintaining the System Operator in public ownership, as this may be necessary to ensure neutrality of the System Operator and a level playing field for competition in a small country like Hungary.

- ☐ Strengthen the MEH's independence from short-term political interests, and, especially, give it full pricing authority as soon as possible. Establish Hungary's judicial system as the instance of appeal.

- ☐ In light of the country's anticipated EU membership, carefully choose a competitive model compatible with EU rules and suited to the structure of the unbundled Hungarian power market.

Nuclear

- ☐ Continue ensuring high performance and safety of operation by securing sound management practices and appropriate levels of maintenance resources and R&D.

- ☐ Continue to follow international safety standards.

- ☐ Ensure continued progress by defining comprehensive waste management and decommissioning programmes.

- ☐ Ensure that the cost of waste management continues to be covered by revenues from nuclear generation.

- ☐ Weigh the economic, environmental and security of supply effects of nuclear power against those of all other power-generating options and thus determine the role that nuclear can play in improving the environment, security and diversity of supply, and at what cost.

Technology, Research and Development

- ☐ Continue to develop the existing R&D strategy and make it more transparent. In particular, address the issues most pressing to Hungary.

- ☐ Maintain the development of energy efficiency, nuclear safety and renewables at the core of the R&D strategy.

HUNGARY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**12.71**	**14.20**	**12.88**	**12.75**	**11.95**	**12.01**	**10.11**
Coal[1]		6.05	4.14	3.21	3.30	3.11	3.13	2.38
Oil		2.02	2.29	2.14	1.99	1.47	1.47	1.07
Gas		4.02	3.81	3.60	3.36	2.71	2.71	1.91
Comb. Renewables & Wastes[2]		0.61	0.37	0.22	0.44	0.99	1.03	1.08
Nuclear		–	3.58	3.70	3.64	3.65	3.65	3.65
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	–	–	–
TOTAL NET IMPORTS[4]		**8.69**	**14.19**	**13.58**	**13.12**	**14.14**	**15.27**	**18.29**
Coal[1]	Exports	0.11	–	0.46	0.51	–	–	–
	Imports	1.77	1.63	1.86	1.61	0.90	1.50	3.00
	Net Imports	1.66	1.63	1.39	1.09	0.90	1.50	3.00
Oil	Exports	0.92	1.52	1.96	1.90	2.00	2.00	2.00
	Imports	7.39	7.96	6.71	7.20	7.69	8.05	8.68
	Bunkers	–	–	–	–	–	–	–
	Net Imports	6.48	6.44	4.75	5.30	5.69	6.05	6.68
Gas	Exports	0.01	0.02	–	–	–	–	–
	Imports	0.17	5.18	7.26	6.54	7.35	7.52	8.41
	Net Imports	0.15	5.16	7.26	6.54	7.35	7.52	8.41
Electricity	Exports	0.09	0.19	0.11	0.19	0.08	0.08	0.08
	Imports	0.49	1.14	0.30	0.38	0.28	0.28	0.28
	Net Imports	0.40	0.96	0.19	0.19	0.20	0.20	0.20
TOTAL STOCK CHANGES		**–0.09**	**0.08**	**–0.67**	**–0.56**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**21.31**	**28.46**	**25.80**	**25.31**	**26.09**	**27.28**	**28.40**
Coal[1]		7.92	6.12	4.60	4.35	4.01	4.63	5.38
Oil		8.21	8.52	6.85	6.98	7.16	7.52	7.75
Gas		4.17	8.90	10.22	9.70	10.06	10.23	10.32
Comb. Renewables & Wastes[2]		0.61	0.37	0.22	0.44	0.99	1.03	1.08
Nuclear		–	3.58	3.70	3.64	3.65	3.65	3.65
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	–	–	–
Electricity Trade[5]		0.40	0.96	0.19	0.19	0.20	0.20	0.20
Shares (%)								
Coal		*37.1*	*21.5*	*17.8*	*17.2*	*15.4*	*17.0*	*18.9*
Oil		*38.5*	*29.9*	*26.5*	*27.6*	*27.4*	*27.6*	*27.3*
Gas		*19.6*	*31.3*	*39.6*	*38.3*	*38.6*	*37.5*	*36.3*
Comb. Renewables & Wastes		*2.9*	*1.3*	*0.9*	*1.8*	*3.8*	*3.8*	*3.8*
Nuclear		*–*	*12.6*	*14.3*	*14.4*	*14.0*	*13.4*	*12.9*
Hydro		*–*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Electricity Trade		*0.9*	*3.4*	*0.7*	*0.7*	*0.8*	*0.7*	*0.7*

0 is negligible. – is nil. .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**17.59**	**21.17**	**17.73**	**17.30**	**18.00**	**18.80**	**19.23**
Coal[1]	4.16	2.50	0.86	0.61	1.12	1.23	1.20
Oil	6.71	7.41	5.22	5.17	5.15	5.51	5.74
Gas	3.07	5.90	7.20	7.05	6.97	7.15	7.26
Comb. Renewables & Wastes[2]	0.61	0.36	0.22	0.44	0.87	0.91	0.94
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.51	2.72	2.47	2.48	2.47	2.60	2.71
Heat	1.53	2.29	1.77	1.55	1.42	1.40	1.38
Shares (%)							
Coal	*23.6*	*11.8*	*4.9*	*3.5*	*6.2*	*6.5*	*6.2*
Oil	*38.1*	*35.0*	*29.4*	*29.9*	*28.6*	*29.3*	*29.8*
Gas	*17.5*	*27.9*	*40.6*	*40.8*	*38.7*	*38.0*	*37.8*
Comb. Renewables & Wastes	*3.5*	*1.7*	*1.2*	*2.5*	*4.8*	*4.8*	*4.9*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.6*	*12.8*	*13.9*	*14.3*	*13.7*	*13.8*	*14.1*
Heat	*8.7*	*10.8*	*10.0*	*8.9*	*7.9*	*7.4*	*7.2*
TOTAL INDUSTRY[6]	**8.32**	**8.03**	**5.49**	**5.40**	**4.68**	**4.89**	**4.98**
Coal[1]	0.90	0.62	0.42	0.27	0.30	0.38	0.35
Oil	2.34	2.11	1.58	1.57	1.45	1.55	1.65
Gas	2.29	3.46	2.26	2.26	1.90	1.90	1.90
Comb. Renewables & Wastes[2]	0.14	–	–	0.09	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.92	1.18	0.73	0.79	0.70	0.73	0.75
Heat	0.74	0.65	0.49	0.42	0.33	0.33	0.33
Shares (%)							
Coal	*22.8*	*7.8*	*7.7*	*5.0*	*6.4*	*7.8*	*7.0*
Oil	*28.1*	*26.3*	*28.8*	*29.1*	*31.0*	*31.7*	*33.1*
Gas	*27.5*	*43.1*	*41.2*	*41.8*	*40.6*	*38.9*	*38.2*
Comb. Renewables & Wastes	*1.7*	–	–	*1.7*	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.1*	*14.7*	*13.3*	*14.7*	*15.0*	*14.9*	*15.1*
Heat	*8.8*	*8.1*	*9.0*	*7.7*	*7.1*	*6.7*	*6.6*
TRANSPORT[7]	**2.37**	**3.15**	**2.72**	**2.85**	**2.73**	**2.94**	**3.07**
TOTAL OTHER SECTORS[8]	**6.90**	**9.99**	**9.53**	**9.05**	**10.59**	**10.97**	**11.18**
Coal[1]	1.88	1.88	0.44	0.34	0.82	0.85	0.85
Oil	2.45	2.25	1.01	0.85	1.05	1.10	1.10
Gas	0.78	2.44	4.94	4.79	5.07	5.25	5.36
Comb. Renewables & Wastes[2]	0.47	0.36	0.22	0.34	0.87	0.91	0.94
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.42	1.43	1.65	1.60	1.69	1.79	1.88
Heat	0.80	1.63	1.27	1.13	1.09	1.07	1.05
Shares (%)							
Coal	*27.3*	*18.8*	*4.6*	*3.8*	*7.7*	*7.7*	*7.6*
Oil	*35.5*	*22.5*	*10.6*	*9.4*	*9.9*	*10.0*	*9.8*
Gas	*11.3*	*24.4*	*51.9*	*52.9*	*47.9*	*47.9*	*47.9*
Comb. Renewables & Wastes	*6.8*	*3.6*	*2.3*	*3.8*	*8.2*	*8.3*	*8.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.5*	*14.3*	*17.3*	*17.7*	*16.0*	*16.3*	*16.8*
Heat	*11.5*	*16.3*	*13.4*	*12.5*	*10.3*	*9.8*	*9.4*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**6.41**	**10.54**	**10.56**	**10.21**	**10.68**	**11.18**	**11.96**
OUTPUT (Mtoe)	**1.52**	**2.45**	**3.02**	**3.04**	**3.12**	**3.29**	**3.47**
(TWh gross)	17.64	28.44	35.09	35.40	36.30	38.30	40.33
Output Shares (%)							
Coal	*69.9*	*32.4*	*29.0*	*29.8*	*25.9*	*29.8*	*32.7*
Oil	*15.0*	*4.5*	*12.8*	*15.3*	*16.3*	*15.4*	*14.6*
Gas	*14.5*	*14.1*	*17.1*	*14.8*	*18.4*	*17.4*	*17.1*
Comb. Renewables & Wastes	–	–	–	–	*0.3*	*0.4*	*0.3*
Nuclear	–	*18.3*	*40.4*	*39.5*	*38.6*	*36.6*	*34.7*
Hydro	*0.6*	*0.6*	*0.6*	*0.6*	*0.6*	*0.5*	*0.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
TOTAL LOSSES	**4.32**	**7.73**	**7.75**	**7.57**	**8.09**	**8.48**	**9.17**
of which:							
Electricity and Heat Generation[10]	3.36	5.81	5.77	5.62	5.97	6.32	6.94
Other Transformation	0.11	0.12	0.08	0.05	0.15	0.15	0.15
Own Use and Losses[11]	0.86	1.80	1.90	1.90	1.97	2.01	2.08
Statistical Differences	**–0.60**	**-0.44**	**0.32**	**0.44**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	24.18	35.78	32.16	33.64	36.75	42.61	49.39
Population (millions)	10.43	10.37	10.19	10.16	10.00	9.70	9.50
TPES/GDP[12]	0.88	0.80	0.80	0.75	0.71	0.64	0.57
Energy Production/TPES	0.60	0.50	0.50	0.50	0.46	0.44	0.36
Per Capita TPES[13]	2.04	2.75	2.53	2.49	2.61	2.81	2.99
Oil Supply/GDP[12]	0.34	0.24	0.21	0.21	0.19	0.18	0.16
TFC/GDP[12]	0.73	0.59	0.55	0.51	0.49	0.44	0.39
Per Capita TFC[13]	0.69	2.04	1.74	1.70	1.80	1.94	2.02
Energy-related CO_2 Emissions (Mt CO_2)[14]	64.2	68.1	60.3	58.2	58.6	62.5	66.5
CO_2 Emissions from Bunkers (Mt CO_2)	–	–	–	–	–	–	–

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	4.9	0.0	–1.6	–1.9	1.0	0.9	0.8
Coal	1.2	–3.0	–4.7	–5.3	–2.7	2.9	3.0
Oil	5.7	–2.6	–3.6	1.9	0.9	1.0	0.6
Gas	10.0	1.7	2.3	–5.2	1.2	0.3	0.2
Comb. Renewables & Wastes	–0.3	–4.4	–7.8	97.8	30.7	0.8	0.1
Nuclear	–	–	0.5	–1.5	0.1	–	–
Hydro	6.3	1.3	3.1	5.6	1.7	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
TFC	4.1	–0.5	–2.9	–2.4	1.3	0.9	0.5
Electricity Consumption	6.0	2.2	–1.6	0.5	–0.1	1.0	0.8
Energy Production	2.5	–0.3	–1.6	–1.0	–2.1	0.1	–3.4
Net Oil Imports	7.1	–3.8	–4.9	11.7	2.4	1.2	2.0
GDP	4.3	1.3	–1.8	4.6	3.0	3.0	3.0
Growth in the TPES/GDP Ratio	0.6	–1.3	0.1	–6.2	–1.9	–2.0	–2.1
Growth in the TFC/GDP Ratio	–0.1	–1.8	–1.2	–6.7	–1.6	–2.1	–2.5

Please note: Rounding may cause totals to differ from the sum of the elements.

IRELAND

GENERAL ENERGY POLICY

Three themes underlie Irish energy policy:

- Opening the electricity and gas markets.
- Achieving Ireland's greenhouse gas emissions target.
- Energy security, in particular diversity in the fuel mix.

The Irish energy sector is dominated by the activities of four state-owned bodies: the Electricity Supply Board, Bord Gáis Éireann (gas), Bord na Móna (peat) and the Irish National Petroleum Corporation (INPC, which owns and operates Ireland's only oil refinery on the island). The National Oil Reserves Agency, which is a subsidiary of INPC, ensures that sufficient oil stocks are maintained to meet emergency requirements. Important structural changes are underway in each of these organisations. There are good prospects for the creation of a competitive energy sector, which should bring lower energy costs in Ireland and contribute to sustaining growth in the Irish economy.

Change is being driven in particular by European Union (EU) Directives and programmes, and Kyoto commitments on reduction of greenhouse gas emissions, but constrained by long-standing social welfare responsibilities and energy security objectives of the major state energy bodies. In general, this report concludes that there is some uncertainty about the level of commitment to the market principles underlying EU policy and the IEA *Shared Goals*. Sustained effort will be required by the Government and the Regulator to achieve real structural change by promoting competition in the electricity and gas sectors.

Along with structural change, a change in attitude may be necessary. First, so far as energy security is concerned, a more outward-looking approach would be desirable. Many of the recommendations in this report suggest ways in which the Irish energy market might function as part of the wider European and global market. Second, the introduction of competition and the restructuring of state-owned organisations will inevitably lead to questions about their future ownership. Existing legislation would permit Bord na Móna to move into the private sector. As with Bord na Móna, options for the restructuring of other state-owned bodies should include privatisation. Third, as Ireland moves towards the establishment of an energy economy that operates largely independently of the Government, there will be a growing need for the Government to be clear about the rules of the game, and its own role. There is already a pressing need for a statement of general energy policy that is sufficiently final and detailed for each sector to guide the existing players and to encourage further private investment.

ELECTRICITY

Ireland is bringing in legislation to implement policies to comply with the EU Electricity Directive. The new legislation contains the basic regulatory tools needed to introduce competition. The plans laid down by the Irish Government to open the market to new entrants, to unbundle transmission activities and to establish a regulated third party access system are commendable. Ireland believes that a combination of growth in electricity demand allied to further market opening based on the experience of the initial period of competition will provide ample opportunity for new entrants.

Nevertheless, as part of maintaining tripartite support for opening the electricity market, the Government has agreed to limit the extent of market opening to the minimum requirement of the Directive despite evidence that many independent operators are interested in entering the market. The policy runs the risk of discouraging some investors from entering the market. There is also a question of the appropriate treatment of investors who may be willing to enter the market, but are unable to do so simply because the permitted level of market opening has been exceeded.

The policies being implemented are likely to leave the current structure of the Electricity Supply Board intact. There can be little doubt that the Electricity Supply Board will continue to enjoy a dominant position in the future electricity market. In these circumstances, competition may fail to develop, even if the letter of the Directive is observed. Recommendations in this report are directed to providing support for the development of competition in the wider interest of improving efficiency in the electricity sector. A very positive signal to the market would be for the first power station to be built under the new arrangements to be owned by a company other than the Electricity Supply Board.

REGULATION

The Commission for Electricity Regulation, which will be formally established by legislation, will be funded by industry. The Commission will have a statutory mandate to fulfil and the legislation imposes no constraints on its ability to fund its operations.

The role of the Regulator will be crucial to the successful development of competition in the electricity and gas markets. The Regulator will be exposed to considerable pressure. The Regulator will need independence and unambiguous rules of the game, including the possibility of applying sanctions. It will be vital to the successful implementation of competition that the Commission for Regulation be adequately staffed. Taking on the role of gas regulator will bring an additional burden although it is logical to combine these roles, particularly in a small market.

GAS

Decisions on the gas sector are becoming urgent because of the capacity limit of the single gas interconnector linking Ireland and the United Kingdom and because gas production from the Kinsale and Ballycotton fields has gone into decline. Decisions on the development of the gas and electricity sectors are closely related to decisions which might be taken to address the problem of the capacity of the present interconnector because gas is the preferred fuel for power generation.

Important relationships between the gas and electricity markets will come to a head when authorisations are granted for new gas-fired generation capacity and applications are made to Bord Gáis Éireann for gas allocations. Bord Gáis Éireann appears to accept that it will have a continuing role in the transition to competition in the gas market and is preparing options for making allocations between competing companies. The level of market opening currently stands at 75%, which would suggest a liberalised gas market has been established. However, this represents only a few major consumers and only a few new entrants have sought third party access since implementing legislation was passed in 1995. At a policy level it will be important for competition to be made more effective in the gas market, and future development of the gas and electricity sectors should be considered jointly.

Growth in gas-fired generation capacity gives rise to the possibility of growing dependence on gas imports. Security of supply considerations are not sufficient to justify restrictions on the growth of gas penetration although the growth should be monitored. Market mechanisms, such as electricity prices which reflect security of supply, penalties for failure to supply, and contractual arrangements with several gas suppliers, should be part of the response to security concerns. Because of the relatively recent and rapid growth in gas use, the most important response measures, so far as basic infrastructure is concerned, could be the successful development of the Corrib discovery and a second gas interconnector. The Corrib discovery would be important for security of supply. A second gas interconnector would address both security of supply and competition issues by more closely relating the Irish gas market to the wider European market.

OIL

Discoveries of oil and gas would clearly be of major benefit to the Irish economy and to security of supply. Exploration and production policies appear to provide a good framework for stimulating exploration and should continue in their present form.

The mandatory requirement to purchase from the Whitegate refinery is intended to contribute to energy security by ensuring that a range of products is available during an emergency. The Whitegate refinery is likely to continue to under-perform by international comparison, and there could be a continuing investment

requirement to contain the costs of its operations and to meet EU standards. An investment programme totaling I£ 70 million was approved in February 1999, primarily to enable the refinery to produce motor fuel products which satisfy the environmental standards set out in the EU Auto Oil Programme. The mandatory purchasing requirement should be removed as quickly as possible, and further consideration should be given to more cost-effective means of ensuring security.

PEAT

In general, the IEA does not consider appropriate the use of the energy sector for achieving social objectives such as employment generation. There are no convincing reasons for continuing the use of peat on energy security grounds and the economics of its use are poor. For these reasons, existing peat-fired plants are likely to be phased out, but a closure policy needs to be confirmed and a timetable for closures announced. The performance of the plant now under construction at Clonbulloge should be monitored and the plant should be operated consistent with its environmentally advanced design. No new plants should be built unless substantial improvements are made in the economic and environmental performance of peat-fired plants. Possibly more cost-effective means of diversifying the fuel mix, including renewables, should be considered as part of the response to energy supply security concerns.

ENERGY EFFICIENCY AND THE ENVIRONMENT

Ireland has committed to limiting growth in greenhouse gas emissions to 13% above the 1990 level by the target period 2008-2012, compared with a business-as-usual case of about 26% growth. The Government is presently considering a consultants' report on possible measures to achieve the target.

The recommendations made in this report on the supply side (on gas and peat) would go some way to assisting Ireland in meeting its Kyoto target. Demand-side measures, including the use of pricing, could be addressed more forcefully. Implementation of efficiency programmes, most of which are awareness-raising activities and will end in 1999, are presently left to the Irish Energy Centre. More ambitious energy efficiency policies appear to be necessary and need to be developed to replace the present Irish Energy Centre programmes. New measures will need to go beyond current programmes, for example to include pricing of externalities and emissions trading. It is important that any policies on the demand side are designed to be ongoing policies, which are integrated with economic policy to bring about permanent changes in the use of energy in all sectors. One-off changes are unlikely to be effective and should not form the basis of policy. In all cases, cost-effectiveness should be the criterion for selecting response measures, with particular attention taken of any impacts of greenhouse gas reduction measures on gas and electricity sector reform.

RESEARCH AND DEVELOPMENT AND RENEWABLES

Renewables are promoted through competitive tendering to meet targets under the Alternative Energy Requirement programme. Both Government and the private sector spend very little on energy research and development and there is very little information on what research and development does occur.

The current low level of expenditure appears inconsistent with the high level of economic growth in Ireland. A research and development programme could help in underpinning the Government's general goal of sustained economic growth. The Government has recently received a report recommending a substantial increase in expenditure on research and development, which is discussed in this report. Priority setting for research and development might be usefully guided by the results of the Alternative Energy Research programme.

There is a need for the development of an integrated policy approach to renewables, which would take into consideration not only the direct costs of renewable energy, but also the landscape value of proposed sites and the grid costs. Trading off plant costs, location values and grid operation efficiency may well lead to different investment choices, and should be included in criteria for selecting projects under future competitions for the Alternative Energy Requirement programme.

RECOMMENDATIONS

The Government should:

Environment

- ☐ Develop a national database on greenhouse gas emissions and projections, as a basis for quantifying and evaluating the cost-effectiveness of policy options to reduce the growth in greenhouse gas emissions.

- ☐ Develop and announce detailed response measures to achieve its greenhouse gas emissions target, including an assessment of expected quantitative outcomes in physical terms.

- ☐ Publish the report of the advisory group on domestic emissions trading and the implications for Ireland of an international trading regime; review the report in light of the possible economic advantages to Ireland of developing and exporting skills in financial services related to emissions trading.

Energy Efficiency

☐ Develop a programme of energy efficiency measures to replace the current programme of the Irish Energy Centre, which includes the use of pricing and mandatory regulations, and is based on quantitative analysis of possible cost-effectiveness.

☐ Discuss with industry the need for mandatory energy efficiency targets and measures, possibly implemented through enforceable agreements entered into voluntarily.

Electricity

☐ Give a public commitment to the development of competition in the electricity market and favour entry of new competitors, as a means of improving efficiency in the electricity sector; enhance certainty in the investment climate for new entrants by defining the Government's expectation of its future role, and by providing detailed and precise information for potential new entrants to the market.

☐ Allow the number of suitable potential new entrants, and the interest shown by consumers, to determine the pace and level of market opening, if the minimum market opening set by the EU Directive is exceeded.

☐ Ensure that the Commission for Regulation has sufficient resources and powers to undertake the task of regulating and promoting competition in the electricity and gas sectors.

☐ Require the Regulator to monitor the market influence of the Electricity Supply Board arising from its present structure, and require the Regulator to advise the Government on the Regulatory Commission's ability to promote competition without also having the power to address the extent of the Electricity Supply Board's influence.

☐ Require the Regulator to advise on any additional measures which may be needed to introduce effective competition in the electricity market.

Oil

☐ Work towards the objective of removing the mandatory requirement for purchases from the Whitegate refinery.

☐ Consider other possible means of responding to both the economic difficulties of operating the refinery and concerns about product security.

Gas

- ☐ Now that the gas market is open for larger consumers, develop means to make competition more effective, and ensure that policy developments in both the gas and electricity markets are co-ordinated.

- ☐ Review gas transmission tariffs with a view to ensuring that they are cost-reflective and transparent.

- ☐ Develop a policy for making allocations of gas between competing companies in the event that capacity limits arise.

- ☐ Give priority to gas market issues which impact on electricity sector reform, such as non-discriminatory allocation rules for potential gas-fired power generators, including small cogenerators in the commercial and household sectors.

- ☐ Allow gas penetration to continue to be determined by the market, while continuing to monitor the energy security implications of relying on growing gas use.

- ☐ Take into account the energy security and competition benefits in assessing the need for a second gas interconnector.

Peat

- ☐ Confirm a programme to phase out all existing peat-fired power plants and publish a timetable to give effect to the programme, based on the national economic and environmental benefits arising from the closures.

- ☐ Ensure an arm's-length relationship is maintained between the Government and the new peat-fired power plant on issues arising from commercial decisions taken by the plant operators.

- ☐ Seek to develop alternative, cost-effective means to promote employment in areas currently assisted by peat-fired power plants and Bord na Móna.

- ☐ Objectively identify the net impact on greenhouse gas emissions of the full cycle of peat production, including bogland drainage, peat harvesting and drying, transport, peat combustion and bogland rehabilitation.

Renewable Energy

- ☐ Analyse the basis for reduced costs for renewables under the Alternative Energy Requirement programme with a view to determining the net economic benefits to the Irish economy of different renewable technologies.

- ☐ Develop links between priority setting for energy research and development activities, and the renewable energy programme.

- ☐ Consider incorporating trade-offs between location site values, grid integration costs, and optimal physical performance in evaluating future projects to be supported by the renewable energy programme.

Energy Research and Development

- ☐ Collate information on energy research and development conducted by government and industry; evaluate the adequacy of the current level of expenditure, the priorities of current programmes, and the extent and effectiveness of collaboration with the private sector, bearing in mind the extent to which the current level and outlook for economic growth in Ireland rest on maintaining a lead in technology and international competitiveness.

- ☐ Respond to the report of the Energy Panel, giving close attention to the full cost of recommendations, including for so-called enabling policies, the willingness of industry to share the cost of implementing the recommendations, and the experience of other countries in funding research on the particular priorities recommended.

- ☐ Seek the views of the Energy Panel on concrete ways in which collaboration between researchers, industry, and education and training institutions might take place on an on-going basis.

- ☐ Develop a policy on energy research and development which relates energy, environment and industry policy goals to short- , medium- , and long-term goals in each of these areas.

IRELAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**1.120**	**3.359**	**3.607**	**2.871**	**1.875**	**1.134**	**1.037**
Coal[1]		0.045	0.016	–	–	–	–	–
Peat		1.020	1.411	1.261	0.740	0.802	0.689	0.541
Gas		–	1.872	2.176	1.906	0.770	–	–
Comb. Renewables & Wastes[2]		–	–	0.116	0.162	0.179	0.275	0.275
Hydro		0.055	0.060	0.062	0.058	0.068	0.070	0.071
Solar/Wind/Other[3]		–	–	0.001	0.004	0.056	0.100	0.150
TOTAL NET IMPORTS[4]		**5.901**	**7.353**	**8.403**	**9.562**	**11.215**	**13.559**	**15.660**
Coal[1]	Exports	0.073	0.023	0.017	0.013	0.007	0.006	0.004
	Imports	0.578	2.286	1.883	2.062	1.876	1.941	1.791
	Net Imports	0.505	2.263	1.866	2.049	1.869	1.935	1.787
Peat	Exports	–	–	–	–	0.005	0.004	0.003
	Net Imports	–	–	–	–	–0.005	–0.004	–0.003
Oil	Exports	0.472	0.680	0.836	1.334	1.341	1.341	1.341
	Imports	5.956	5.788	7.060	8.135	8.065	8.563	9.893
	Bunkers	0.092	0.018	0.159	0.153	0.031	0.042	0.052
	Net Imports	5.392	5.090	6.065	6.648	6.693	7.180	8.500
Gas	Imports	–	–	0.483	0.865	2.658	4.448	5.376
	Net Imports	–	–	0.483	0.865	2.658	4.448	5.376
Electricity	Exports	0.002	–	0.016	0.007	..	..	..
	Imports	0.006	–	0.005	0.006	..	..	..
	Net Imports	0.004	–	–0.011	–0.001	–	–	–
TOTAL STOCK CHANGES		**0.168**	**–0.250**	**–0.108**	**0.059**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**7.189**	**10.463**	**11.902**	**12 491**	**13.090**	**14.693**	**16.697**
Coal[1]		0.565	2.371	2.000	1.903	1.869	1.935	1.787
Peat		1.020	1.288	1.093	1.052	0.797	0.685	0.538
Oil		5.545	4.871	5.991	6.541	6.693	7.180	8.500
Gas		–	1.872	2.650	2.771	3.428	4.448	5.376
Comb. Renewables & Wastes[2]		–	–	0.116	0.162	0.179	0.275	0.275
Hydro		0.055	0.060	0.062	0.058	0.068	0.070	0.071
Solar/Wind/Other[3]		–	–	0.001	0.004	0.056	0.100	0.150
Electricity Trade[5]		0.004	–	–0.011	–0.001	–	–	–
Shares (%)								
Coal		*7.9*	*22.7*	*16.8*	*15.2*	*14.3*	*13.2*	*10.7*
Peat		*14.2*	*12.3*	*9.2*	*8.4*	*6.1*	*4.7*	*3.2*
Oil		*77.1*	*46.6*	*50.3*	*52.4*	*51.1*	*48.9*	*50.9*
Gas		–	*17.9*	*22.3*	*22.2*	*26.2*	*30.3*	*32.2*
Comb. Renewables & Wastes		–	–	*1.0*	*1.3*	*1.4*	*1.9*	*1.6*
Hydro		*0.8*	*0.6*	*0.5*	*0.5*	*0.5*	*0.5*	*0.4*
Solar/Wind/Other		–	–	–	–	*0.4*	*0.7*	*0.9*
Electricity Trade		*0.1*	–	*–0.1*	–	–	–	–

0 is negligible. – is nil. .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**5.416**	**7.732**	**8.811**	**9.306**	**9.770**	**10.973**	**12.861**
Coal[1]	0.520	1.137	0.551	0.499	0.368	0.243	0.217
Peat	0.408	0.427	0.263	0.248	0.250	0.200	0.150
Oil	3.856	4.149	5.251	5.647	5.871	6.649	7.960
Gas	0.103	0.998	1.270	1.336	1.420	1.622	1.864
Comb. Renewables & Wastes[2]	–	–	0.113	0.141	0.139	0.139	0.139
Electricity	0.529	1.021	1.363	1.435	1.702	2.100	2.511
Heat	–	–	–	–	0.020	0.020	0.020
Shares (%)							
Coal	*9.6*	*14.7*	*6.3*	*5.4*	*3.8*	*2.2*	*1.7*
Peat	*7.5*	*5.5*	*3.0*	*2.7*	*2.6*	*1.8*	*1.2*
Oil	*71.2*	*53.7*	*59.6*	*60.7*	*60.1*	*60.6*	*61.9*
Gas	*1.9*	*12.9*	*14.4*	*14.4*	*14.5*	*14.8*	*14.5*
Comb. Renewables & Wastes	–	–	*1.3*	*1.5*	*1.4*	*1.3*	*1.1*
Electricity	*9.8*	*13.2*	*15.5*	*15.4*	*17.4*	*19.1*	*19.5*
Heat	–	–	–	–	*0.2*	*0.2*	*0.2*
TOTAL INDUSTRY[6]	**1.920**	**2.324**	**2.443**	**2.652**	**2.980**	**3.022**	**3.373**
Coal[1]	0.044	0.272	0.124	0.092	0.130	0.122	0.143
Oil	1.662	0.879	0.943	1.047	1.206	1.020	1.072
Gas	0.025	0.787	0.772	0.845	0.868	0.955	1.059
Comb. Renewables & Wastes[2]	–	–	0.072	0.099	0.095	0.095	0.095
Electricity	0.189	0.386	0.532	0.569	0.681	0.840	1.004
Shares (%)							
Coal	*2.3*	*11.7*	*5.1*	*3.5*	*4.4*	*3.7*	*4.2*
Oil	*86.6*	*37.8*	*38.6*	*39.5*	*40.5*	*33.8*	*31.8*
Gas	*1.3*	*33.9*	*31.6*	*31.9*	*29.1*	*31.6*	*31.4*
Comb. Renewables & Wastes	–	–	*2.9*	*3.7*	*3.2*	*3.1*	*2.8*
Electricity	*9.8*	*16.6*	*21.8*	*21.5*	*22.9*	*27.8*	*29.8*
TRANSPORT[7]	**1.406**	**2.031**	**2.704**	**2.904**	**3.024**	**3.745**	**4.824**
TOTAL OTHER SECTORS[8]	**2.090**	**3.377**	**3.663**	**3.750**	**3.766**	**4.206**	**4.664**
Coal[1]	0.476	0.865	0.426	0.406	0.238	0.131	0.074
Peat	0.408	0.427	0.263	0.248	0.250	0.200	0.150
Oil	0.788	1.240	1.605	1.698	1.643	1.886	2.066
Gas	0.078	0.211	0.497	0.492	0.552	0.667	0.805
Comb. Renewables & Wastes[2]	–	–	0.041	0.041	0.044	0.044	0.044
Electricity	0.340	0.634	0.830	0.865	1.019	1.258	1.505
Heat	–	–	–	–	0.020	0.020	0.020
Shares (%)							
Coal	*22.8*	*25.6*	*11.6*	*10.8*	*6.3*	*3.1*	*1.6*
Peat	*19.5*	*12.6*	*7.2*	*6.6*	*6.6*	*4.8*	*3.2*
Oil	*37.7*	*36.7*	*43.8*	*45.3*	*43.6*	*44.8*	*44.3*
Gas	*3.7*	*6.2*	*13.6*	*13.1*	*14.7*	*15.9*	*17.3*
Comb. Renewables & Wastes	–	–	*1.1*	*1.1*	*1.2*	*1.0*	*0.9*
Electricity	*16.3*	*18.8*	*22.7*	*23.1*	*27.1*	*29.9*	*32.3*
Heat	–	–	–	–	*0.5*	*0.5*	*0.4*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**1.766**	**3.145**	**4.172**	**4.348**	**4.812**	**5.584**	**6.081**
OUTPUT (Mtoe)	**0.632**	**1.244**	**1.626**	**1.694**	**1.983**	**2.421**	**2.883**
(TWh gross)	7.348	14.229	18.903	23.057	23.057	28.146	33.526
Output Shares (%)							
Coal	*1.0*	*41.6*	*37.0*	*34.4*	*28.2*	*23.1*	*16.4*
Peat	*23.9*	*15.8*	*11.6*	*10.5*	*10.0*	*10.0*	*9.0*
Oil	*66.3*	*10.0*	*14.2*	*17.6*	*12.7*	*5.4*	*4.8*
Gas	*–*	*27.7*	*33.3*	*33.4*	*43.0*	*53.7*	*61.5*
Comb. Renewables & Wastes	*–*	*–*	*0.1*	*0.5*	*0.6*	*1.3*	*1.1*
Hydro	*8.8*	*4.9*	*3.8*	*3.4*	*3.4*	*2.9*	*2.5*
Solar/Wind/Other	*–*	*–*	*0.1*	*0.3*	*2.1*	*3.6*	*4.7*
TOTAL LOSSES	**1.649**	**2.261**	**2.906**	**3.092**	**3.320**	**3.720**	**3.836**
of which:							
Electricity and Heat Generation[10]	1.134	1.921	2.547	2.654	2.823	3.152	3.183
Other Transformation	0.329	0.042	–0.012	0.048	0.111	0.107	0.107
Own Use and Losses[11]	0.156	0.298	0.371	0.390	0.386	0.461	0.546
Statistical Differences	**0.124**	**0.471**	**0.185**	**0.093**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	23.17	45.53	66.33	73.40	89.66	115.53	141.24
Population (millions)	3.07	3.51	3.62	3.66	3.69	3.81	3.95
TPES/GDP[12]	0.31	0.23	0.18	0.17	0.15	0.13	0.12
Energy Production/TPES	0.16	0.32	0.30	0.23	0.14	0.08	0.06
Per Capita TPES[13]	2.34	2.98	3.29	3.42	3.55	3.85	4.23
Oil Supply/GDP[12]	0.24	0.11	0.09	0.09	0.07	0.06	0.06
TFC/GDP[12]	0.23	0.17	0.13	0.13	0.11	0.09	0.09
Per Capita TFC[13]	1.76	2.21	2.43	2.55	2.65	2.88	3.26
Energy-related CO_2 Emissions (Mt CO_2)[14]	23.2	33.2	36.2	37.6	38.3	41.9	46.7
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	0.1	0.5	0.5	0.1	0.1	0.2

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	3.6	1.5	2.2	4.9	1.6	2.3	2.6
Coal	6.9	9.9	–2.8	–4.9	–0.6	0.7	–1.6
Peat	2.1	1.0	–2.7	–3.8	–8.8	–3.0	–4.7
Oil	2.3	–2.4	3.5	9.2	0.8	1.4	3.4
Gas	–	13.6	6.0	4.6	7.3	5.3	3.9
Comb. Renewables & Wastes	–	–	–	39.7	3.4	9.0	–
Hydro	4.3	–1.5	0.5	–6.5	5.4	0.6	0.3
Solar/Wind/Other	–	–	–	300.0	119.0	15.4	9.6
TFC	4.3	0.9	2.2	5.6	1.6	2.3	3.2
Electricity Consumption	5.8	2.9	4.9	5.3	5.9	4.3	3.6
Energy Production	4.6	7.8	1.2	–20.4	–13.2	–9.6	–1.8
Net Oil Imports	2.9	–2.0	3.0	9.6	0.2	1.4	3.4
GDP	4.9	3.6	6.5	10.6	6.9	5.2	4.1
Growth in the TPES/GDP Ratio	–1.3	–2.0	–4.0	–5.2	–5.0	–2.7	–1.5
Growth in the TFC/GDP Ratio	–0.6	–2.6	–4.0	–4.5	–4.9	–2.7	–0.8

Please note: Rounding may cause totals to differ from the sum of the elements.

ITALY

Italy has 20 regions, 103 provinces and some 8 100 municipalities[1]. The Government has recently undertaken a decentralisation policy. The Legislative Decree of 1998 on decentralisation, which still needs to be implemented, gave new responsibility for energy policy to regions and local authorities. In implementing this Decree, it is important to ensure that respective responsibilities are well defined and that energy policies are well co-ordinated across regions and with the State.

The public sector has a large role in the Italian energy industry. ENI (the oil and natural gas company) retains a dominant position, as does ENEL (the public electricity company), although they do not have legal monopolies. ENI has been partially privatised, with the government's share reduced to 38% by June 1998. No decision has been taken on privatising ENEL, which in mid-1999 remained fully owned by the State.

In line with IEA *Shared Goals*, the Government is implementing numerous measures to liberalise and to increase the efficiency of the energy sector. The National Conference on Environment and Energy, held in November 1998, emphasised the need to increase the role of the market in the energy sector. The Government expects the decentralisation policy to lead to more efficiency in administrative procedures. The Government has moved from a previous "command and control" system, where national companies were in charge of implementing government policy, to a market-based economy and it is now necessary to continue to develop clear arm's length relations between the State and ENEL and ENI.

The Antitrust Authority, which oversees all sectors of the economy, including energy, was created in 1990. A Regulatory Authority for Electricity and Gas was formed in 1995. The well functioning of these authorities is essential for promoting effective competition, and their independence should be safeguarded.

Italy has high energy taxes in comparison with other IEA countries. In December 1998, Parliament voted a CO_2 tax. Multiple tax rates on electricity and natural gas, which are set up to incorporate fiscal, social and regional policies, distort competition between fuels and industries. The Government should devise a long-term strategy to make taxes consistent across different sectors and fuels and to better internalise the externalities associated with energy use.

High energy prices, a mild climate and Italy's small number of energy-intensive industries contribute to the low level of energy consumption and CO_2 emissions in comparison with GDP. The Government has issued a plan to meet the Kyoto target for reducing carbon emissions. Energy efficiency can be improved in many sectors

1. Provinces and municipalities are called "local authorities".

and measures should concentrate on being cost-effective. The regions' responsibilities for energy efficiency improvements should be clearly set, and the Government should ensure that these responsibilities are carried out effectively. Specific measures are needed to increase the use of public transport.

Italy produces oil and natural gas. The removal of unnecessary barriers to oil and gas exploration and production would increase domestic production and enhance security of supply. In the domestic oil sector, competition needs to be developed. The Government has taken some measures to rationalise the downstream oil sector and should continue to ensure the development of effective competition.

Natural gas consumption has increased rapidly, and import sources are being diversified. However, Italy will continue to be dependent on large foreign gas suppliers. The Government should therefore continue to monitor the evolution of the gas market to ensure security of supply. There is no legal monopoly in the Italian gas sector, and Law 9 of 1991 allows third party access in limited circumstances so that some companies have become active in this market. There is a good basis for developing competition, in spite of SNAM's dominant position in gas imports and transport, its important share in distribution, and ENI/AGIP's dominant position in gas storage.

In May 1999, Parliament mandated the Government to implement the EU Directive on Natural Gas within one year. This reform should be based on regulated third party access and should be implemented as soon as possible to complement the reform in the electricity sector. SNAM's take-or-pay contracts are likely to account for a substantial amount of gas consumption; the Government should seek means to reduce their anti-competitive effects.

After the referendum of 1987 which phased out nuclear electricity generation, the rise in electricity demand has been met through an increase in domestic generation from other sources and an increase in imports. ENEL has retained a dominant position in electricity generation, imports, transport and distribution. In February 1999, the Government issued a Legislative Decree to implement the EU Directive on Electricity. This Decree instructs ENEL to divest itself of at least 15 GW of generation capacity and sets up a single purchase system for captive consumers. Together with the reform of prices to end-users, access to the grid and the buy-back tariffs, this reform is expected to lower prices, in particular for small and medium enterprises which play a major role in Italy's economy. The Government should ensure that the Legislative Decree, and in particular ENEL's divestiture of assets, do in fact generate competition. Payments of stranded costs to ENEL should not distort competition between companies.

Energy from renewable sources has increased significantly since 1990, mostly because of the high buy-back tariffs for electricity. The Government has set ambitious targets for energy production from renewable sources as one of its measures to reduce CO_2 emissions. The February 1999 Legislative Decree on electricity also includes provisions to increase electricity production from renewable sources. The Government should ensure that the new system works efficiently and does not distort competition between utilities. It should also ensure

that the promotion of renewable sources leads to a decrease in their generation cost to make them competitive.

Italy's public budget for energy research and development is managed by ENEA, the National Agency for New Technology, Energy and Environment. The budget is the fifth largest among IEA Members, although it has substantially decreased over the past decade. Most of this decrease is due to the rapid reduction in nuclear R&D after the 1987 moratorium. R&D in other energy areas has also decreased substantially since the late 1980s. The Government is reviewing its energy R&D policies with the aim of improving their effectiveness and is considering an increase in their funding. The review should cover the following issues: improving the assessment of energy R&D measures, co-ordinating activities among the different institutions and regions, and redefining the relationship between ENEA and the national enterprises.

RECOMMENDATIONS

The Government should:

General Energy Policy

☐ Continue to increase competition in the oil, natural gas and electricity sectors.

☐ Continue to develop a clear arm's length relationship between the State on the one hand and ENI and ENEL on the other.

☐ Support efficient co-operation between the Regulatory Authority for Electricity and Gas and the Antitrust Authority.

☐ Clearly define the respective responsibilities of the central Government and the regions.

☐ Ensure that energy policies are well co-ordinated across regions and with the State and that regions have adequate staff and financial resources to carry out their tasks.

☐ Set a clear timetable for the implementation of reforms to ensure consistency in energy policy.

Energy Efficiency, Environment and Taxation Policy

☐ Seek the most cost-effective means of reducing CO_2 emissions.

☐ Clearly define the responsibilities of the regions and the local authorities for energy efficiency measures and ensure that they are carried out effectively in co-

operation with ENEA. Ensure that regions focus on the most cost-effective measures.

☐ Increase the share of public transport and ensure that regions effectively co-operate on inter-regional transport issues.

☐ Continue to tighten building codes and to ensure that they are appropriately implemented at the local level, especially in the renovation of buildings.

☐ Implement EU Directives on Energy Labelling and Standards in a timely way and contribute positively to the development of other measures.

☐ Continue to develop Voluntary Agreements with industry, taking account of the experiences in other countries, and monitor their results to ensure that these Voluntary Agreements lead to energy efficiency improvements significantly beyond the business-as-usual trend.

☐ Set a long-term objective of clarifying the fuel tax structure in order to make it consistent across sectors and fuels and to internalise the externalities associated with energy use. In particular, in implementing the CO_2 tax, take into account the need to avoid distortion of competition between the different fuels and between the different electricity generators.

☐ Ensure predictability and transparency as to the time schedule and the conditions for the progressive introduction of the CO_2 tax, so that energy users and producers have a firm basis for their investment decisions.

Oil

☐ Clarify the regions' role in granting licences to ensure that there are no unnecessary obstacles to the production of hydrocarbons. Ensure a consistent approach between regions in granting production licences. Streamline and speed up licensing procedures at the national level.

☐ Implement the 1998 Decree on the rationalisation of fuel distribution and ensure that filling stations can be freely closed or opened, provided that they meet regulations on environment and safety. Ensure that the municipalities' concession procedures do not impede competition.

☐ Closely monitor the evolution of competition, in particular to ensure that there is no cartel activity or abuse of dominant position, including on access to pipelines and storage.

☐ Support the Regulatory Authority in setting buy-back tariffs for electricity from refinery residues in order to avoid distortion of competition at the international level.

Natural Gas

- ☐ Continue to monitor the evolution of the gas market to ensure security of supply.
- ☐ Introduce competition into the natural gas market as soon as possible.
- ☐ Seek means to reduce the effects of take-or-pay contracts which impede competition.
- ☐ Implement regulated third party access to ensure maximum transparency in transmission and distribution tariffs and to prevent any discrimination between users. These tariffs should be designed to allow for additional investment and to prevent any bottlenecks in transport.
- ☐ Ensure effective unbundling between supply, transmission, distribution and non-gas activities to create a level playing field for competition in gas supply. Ensure that all gas companies are effectively corporatised.
- ☐ Promote the largest possible degree of market opening when defining eligible consumers.
- ☐ Ensure the independence of the Regulator. Its role in promoting effective competition in the gas market should be well recognised and respected.

Electricity and Renewable Energy Sources

- ☐ Monitor the electricity market to prevent any abuse of dominant position, taking into account the development of competition in the European electricity market.
- ☐ Consider whether joint ventures involving ENEL will deliver effective competition in the generation sector. Ensure that there is no discrimination against independent generators.
- ☐ Ensure that the dominant position of ENEL in the distribution sector is reduced.
- ☐ Ensure effective unbundling of the different activities of electricity companies.
- ☐ Ensure the independence of the Regulatory Authority. Its role in promoting effective competition in the electricity market should be well recognised and respected.
- ☐ Take a fair view on stranded costs payments.
- ☐ Define clearly the relations between the Regulatory Authority, the Network Operator, the "Single Buyer" and the Market Operator.
- ☐ Ensure effective independence of these newly created institutions to avoid discrimination between users of the system.

- ☐ Ensure that directives to the "Single Buyer" place no unnecessary burden on the captive market, relative to the liberalised market.

- ☐ Support the Regulatory Authority in setting tariffs in a cost-reflective manner, properly allocating costs between different types of customers. Transmission and distribution tariffs should be set to provide an incentive for efficiency improvements, to allow for competition and to ensure security of supply.

- ☐ Continue to seek the most cost-effective ways of promoting renewable sources, make efforts to decrease the cost of their use for generation and avoid distortions of competition between utilities.

Energy Technology, Research and Development

- ☐ Set up a National Research Programme reflecting the conclusions of the National Conference on Environment and Energy.

- ☐ Ensure sufficient funding for energy R&D, consistent with energy policy goals and continue to carry out long-term energy R&D.

- ☐ Take appropriate measures to implement the plan for the co-ordination of energy R&D activities and their evaluation.

- ☐ Encourage collaboration with industry to better secure market deployment of technology.

- ☐ Continue to increase ENEA's expertise in R&D and energy policy issues.

ITALY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**20.1**	**24.8**	**29.3**	**29.3**	**29.2**	**31.3**	**33.3**
Coal[1]		0.3	0.3	0.0	0.0	0.0	0.2	0.2
Oil		1.1	4.8	5.7	6.2	6.0	5.8	5.5
Gas		12.6	14.0	16.4	15.8	14.9	13.6	12.4
Comb. Renewables & Wastes[2]		0.2	0.9	1.2	1.2	1.9	4.5	7.0
Nuclear		0.8	–	–	–	–	–	–
Hydro		3.2	2.7	3.6	3.6	3.6	3.8	3.9
Geothermal		1.8	2.0	2.4	2.5	2.5	2.6	2.8
Solar/Wind/Other[3]		–	0.0	0.0	0.1	0.2	0.9	1.6
TOTAL NET IMPORTS[4]		**109.3**	**130.4**	**133.2**	**133.0**	**136.4**	**142.6**	**152.5**
Coal[1]	Exports	0.4	0.1	0.1	0.1	..	..	..
	Imports	8.2	13.9	11.5	10.8	..	..	..
	Net Imports	7.7	13.7	11.5	10.7	11.2	11.7	12.3
Oil	Exports	29.4	20.1	19.0	21.5	..	..	..
	Imports	136.4	111.1	109.2	110.5	..	..	..
	Bunkers	7.1	2.7	2.3	2.4	2.4	2.4	2.4
	Net Imports	99.9	88.3	87.8	86.6	85.2	82.9	80.6
Gas	Exports	–	0.0	0.0	0.0	..	..	..
	Imports	1.6	25.3	30.5	32.0	..	..	..
	Net Imports	1.6	25.3	30.4	32.0	36.7	48.1	59.6
Electricity	Exports	0.2	0.1	0.1	0.1	..	..	..
	Imports	0.3	3.1	3.3	3.4	3.3	..	..
	Net Imports	0.1	3.0	3.2	3.3	3.3	..	..
TOTAL STOCK CHANGES		**–0.9**	**–1.9**	**–1.3**	**1.0**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**128.6**	**153.3**	**161.1**	**163.3**	**165.6**	**173.9**	**185.8**
Coal[1]		8.1	14.6	11.2	11.3	11.2	11.9	12.5
Oil		100.1	91.0	93.2	93.5	91.2	88.6	86.1
Gas		14.2	39.0	46.1	47.5	51.7	61.7	72.0
Comb. Renewables & Wastes[2]		0.2	1.0	1.4	1.6	1.9	4.5	7.0
Nuclear		0.8	–	–	–	–	–	–
Hydro		3.2	2.7	3.6	3.6	3.6	3.8	3.9
Geothermal		1.8	2.0	2.4	2.5	2.5	2.6	2.8
Solar/Wind/Other[3]		–	0.0	0.0	0.1	0.2	0.9	1.6
Electricity Trade[5]		0.1	3.0	3.2	3.3	3.3	–	–
Shares (%)								
Coal		*6.3*	*9.5*	*7.0*	*6.9*	*6.7*	*6.8*	*6.7*
Oil		*77.9*	*59.3*	*57.8*	*57.3*	*55.1*	*51.0*	*46.4*
Gas		*11.1*	*25.4*	*28.6*	*29.1*	*31.2*	*35.5*	*38.8*
Comb. Renewables & Wastes		*0.2*	*0.6*	*0.9*	*1.0*	*1.2*	*2.6*	*3.8*
Nuclear		*0.6*	–	–	–	–	–	–
Hydro		*2.5*	*1.8*	*2.2*	*2.2*	*2.2*	*2.2*	*2.1*
Geothermal		*1.4*	*1.3*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Solar/Wind/Other		–	–	–	–	*0.1*	*0.5*	*0.8*
Electricity Trade		*0.1*	*1.9*	*2.0*	*2.0*	*2.0*	–	–

0 is negligible; – is nil; .. is not available.

Please note: Data for 2000 and 2005 are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**98.7**	**117.6**	**124.3**	**125.5**	**126.8**	**130.0**	**133.8**
Coal[1]	3.3	3.4	2.7	2.7	2.6	2.5	2.4
Oil	72.1	64.2	63.8	64.6	63.8	63.5	63.0
Gas	12.8	30.6	35.8	35.4	36.1	37.2	38.0
Comb. Renewables & Wastes[2]	–	0.8	1.1	1.2	1.4	1.9	2.4
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.1	0.2
Electricity	10.6	18.5	20.7	21.3	22.6	24.6	27.4
Heat	–	0.2	0.2	0.2	0.3	0.3	0.4
Shares (%)							
Coal	*3.3*	*2.9*	*2.1*	*2.2*	*2.1*	*1.9*	*1.8*
Oil	*73.0*	*54.6*	*51.4*	*51.5*	*50.3*	*48.8*	*47.1*
Gas	*12.9*	*26.0*	*28.8*	*28.2*	*28.5*	*28.6*	*28.4*
Comb. Renewables & Wastes	–	*0.7*	*0.9*	*0.9*	*1.1*	*1.5*	*1.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	*0.1*
Electricity	*10.7*	*15.7*	*16.7*	*17.0*	*17.8*	*18.9*	*20.5*
Heat	–	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.3*
TOTAL INDUSTRY[6]	**47.6**	**44.6**	**43.6**	**44.9**	**44.4**	**44.8**	**45.5**
Coal[1]	2.6	3.3	2.6	2.6	2.5	2.4	2.3
Oil	29.7	16.9	14.7	15.5	14.4	13.7	12.7
Gas	8.7	14.6	15.8	16.0	16.0	15.9	15.9
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.2	0.3	0.6	0.9
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	6.6	9.5	10.2	10.6	11.3	12.3	13.7
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*5.6*	*7.3*	*5.9*	*5.8*	*5.6*	*5.3*	*5.0*
Oil	*62.3*	*37.9*	*33.8*	*34.4*	*32.4*	*30.4*	*27.9*
Gas	*18.2*	*32.9*	*36.3*	*35.6*	*35.9*	*35.5*	*35.0*
Comb. Renewables & Wastes	–	*0.5*	*0.5*	*0.5*	*0.7*	*1.3*	*2.0*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*13.9*	*21.4*	*23.5*	*23.7*	*25.4*	*27.4*	*30.1*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**20.5**	**35.3**	**40.0**	**40.6**	**40.8**	**41.2**	**41.7**
TOTAL OTHER SECTORS[8]	**30.6**	**37.8**	**40.7**	**40.0**	**41.6**	**44.0**	**46.7**
Coal[1]	0.5	0.1	0.1	0.1	0.1	0.1	0.2
Oil	22.5	12.8	10.1	9.5	9.7	10.0	10.3
Gas	4.0	15.7	19.7	19.1	19.8	20.7	21.3
Comb. Renewables & Wastes[2]	–	0.6	0.9	1.0	1.1	1.3	1.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.1	0.2
Electricity	3.6	8.3	9.8	10.0	10.6	11.5	12.8
Heat	–	0.2	0.2	0.2	0.3	0.3	0.4
Shares (%)							
Coal	*1.5*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
Oil	*73.5*	*33.9*	*24.7*	*23.8*	*23.3*	*22.7*	*22.1*
Gas	*13.1*	*41.6*	*48.4*	*47.8*	*47.7*	*47.1*	*45.7*
Comb. Renewables & Wastes	–	*1.6*	*2.1*	*2.4*	*2.5*	*3.0*	*3.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	*0.1*	*0.4*
Electricity	*11.8*	*22.1*	*24.0*	*25.1*	*25.5*	*26.1*	*27.4*
Heat	–	*0.5*	*0.5*	*0.5*	*0.6*	*0.7*	*0.9*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**27.6**	**42.4**	**46.0**	**46.8**	**49.2**	**59.7**	**70.6**
OUTPUT (Mtoe)	**12.4**	**18.3**	**20.6**	**21.2**	**22.7**	**28.0**	**31.6**
(TWh gross)	143.9	213.2	239.4	246.5	263.6	325.0	367.5
Output Shares (%)							
Coal	*3.6*	*16.8*	*10.6*	*10.0*	*10.1*	*9.8*	*9.2*
Oil	*62.4*	*48.2*	*48.9*	*46.0*	*40.6*	*29.2*	*22.0*
Gas	*3.1*	*18.6*	*21.0*	*24.9*	*30.4*	*38.5*	*43.6*
Comb. Renewables & Wastes	*0.9*	*0.1*	*0.3*	*0.3*	*0.8*	*4.6*	*7.6*
Nuclear	*2.2*	–	–	–	–	–	–
Hydro	*26.1*	*14.8*	*17.6*	*16.9*	*16.0*	*13.5*	*12.2*
Geothermal	*1.7*	*1.5*	*1.6*	*1.6*	*1.5*	*1.2*	*1.1*
Solar/Wind/Other	–	*0.0*	*0.2*	*0.3*	*0.6*	*3.1*	*4.3*
TOTAL LOSSES	**29.5**	**35.8**	**36.8**	**37.9**	**38.8**	**43.9**	**52.0**
of which:							
Electricity and Heat Generation[10]	15.3	23.9	25.2	25.4	26.3	31.4	38.6
Other Transformation	6.0	2.7	2.3	2.7	2.5	2.4	2.4
Own Use and Losses[11]	8.3	9.2	9.3	9.8	10.0	10.1	11.0
Statistical Differences	**0.3**	**–0.0**	**0.0**	**0.0**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	688.66	1093.95	1164.36	1181.92	1254.26	1384.80	1528.94
Population (millions)	54.75	56.74	57.38	57.52	57.30	57.15	57.00
TPES/GDP[12]	0.19	0.14	0.14	0.14	0.13	0.13	0.12
Energy Production/TPES	0.16	0.16	0.18	0.18	0.18	0.18	0.18
Per Capita TPES[13]	2.35	2.70	2.81	2.84	2.89	3.04	3.26
Oil Supply/GDP[12]	0.15	0.08	0.08	0.08	0.07	0.06	0.06
TFC/GDP[12]	0.14	0.11	0.11	0.11	0.10	0.09	0.09
Per Capita TFC[13]	1.80	2.07	2.17	2.18	2.21	2.27	2.35
Energy–related CO_2 Emissions (Mt CO_2)[14]	348.2	408.2	419.7	424.3	426.2	444.8	464.0
CO_2 Emissions from Bunkers (Mt CO_2)	22.6	8.4	7.2	7.5	7.5	7.5	7.5

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.5	0.8	0.8	1.4	0.5	1.0	1.3
Coal	4.3	3.1	–4.3	0.7	–0.4	1.2	1.1
Oil	–0.0	–0.8	0.4	0.4	–0.8	–0.6	–0.6
Gas	8.1	5.1	2.8	3.1	2.9	3.6	3.1
Comb. Renewables & Wastes	23.4	1.2	5.9	12.8	6.9	18.4	9.5
Nuclear	–2.9	–	–	–	–	–	–
Hydro	3.4	–3.3	4.9	–1.0	0.6	0.8	0.4
Geothermal	0.1	1.2	2.5	3.5	0.8	0.8	1.1
Solar/Wind/Other	–	–	41.4	92.5	24.9	43.7	11.0
TFC	1.3	0.9	0.9	0.9	0.3	0.5	0.6
Electricity Consumption	4.0	3.0	1.9	3.1	1.9	1.7	2.2
Energy Production	0.2	1.8	2.8	0.2	–0.2	1.4	1.2
Net Oil Imports	–0.4	–0.9	–0.1	–1.4	–0.5	–0.6	–0.6
GDP	3.5	2.3	1.0	1.5	2.0	2.0	2.0
Growth in the TPES/GDP Ratio	–1.9	–1.5	–0.2	–0.1	–1.5	–1.0	–0.7
Growth in the TFC/GDP Ratio	–2.1	–1.4	–0.1	–0.6	–1.6	–1.5	–1.4

Please note: Rounding may cause totals to differ from the sum of the elements.

JAPAN

The principal goals of Japanese energy policy are summarised as the "3 Es": economic growth, energy security and environmental protection. These goals are a short-hand description of the *Shared Goals* of the IEA. The intention of Japan's energy policy is to achieve the three goals simultaneously, and the possibility of trade-offs between the goals is acknowledged by the Government. Because of the possibility of trade-offs, it will be important that the benefits and costs of the goals be quantified wherever possible and decisions based on a clear understanding of the extent to which the goals are achieved by pursuing any particular policy.

Since the last in-depth review in 1994, the two major developments in Japan's energy policy have been: reform of the regulatory framework and measures to respond to climate change. The strengthening of deregulation efforts was decided in May 1997, in the *Action Programme for Economic Structure Reform*. In line with this decision, increased efforts have been undertaken by the energy sector for restructuring the supply side, which does not yet meet international standards in terms of costs and services. Reform in the energy sector is an important component of overall policy on economic recovery and, increasingly, the market will be relied on to achieve a satisfactory outcome.

Electricity regulatory reform is the central issue in this review. Competition in electricity is closely related to developments in the gas market, to energy efficiency policies, and to Japan's commitment to reduce greenhouse gas emissions. These linkages are the key issues discussed in the chapters of the review on these areas.

ENERGY EFFICIENCY

It is commendable that Japan has made energy efficiency one of the priorities for meeting greenhouse gas emission reduction targets in the short and long terms. However, in view of the rising trends in energy consumption in all sectors, the share of the targets to be achieved by energy efficiency measures would require drastic changes in lifestyle, energy infrastructure and the use of efficient technology. This review discusses the cost-effectiveness of energy efficiency measures currently in place. If the measures are not successful, then additional contributions would be required from fuel switching (from coal to nuclear, gas or renewables) or from international flexibility mechanisms. Government direct support for voluntary action and the possibility of improving the analytical basis for energy savings projections are also discussed.

ENERGY AND THE ENVIRONMENT

Approximately 90% of carbon dioxide produced in Japan is energy-related. Japan has agreed to reduce greenhouse gas emissions by 6% compared with 1990 during

the first commitment period between 2008 and 2012. For the energy sector, policy is focused on drastic energy efficiency measures in the industry, residential and commercial, and transportation sectors and, on the supply side, on the promotion of nuclear power and new energies.

The review concludes that Japan's nuclear energy production target is achievable. To achieve it, however, is likely to require attention be given to improving the capacity utilisation factor, which in turn requires that consideration be given to regulatory issues, such as the periodic inspection regime, while, of course, always giving primary consideration to safety as an essential element in public acceptance. Public acceptance of nuclear energy is essential if the planned growth in nuclear power generation is to be achieved.

ELECTRICITY

The Japanese electricity sector has been shaped by the Government's key energy policy goals of energy security, economic growth and environmental protection. The ten vertically integrated utilities that serve virtually all end-users of electricity in Japan have enhanced energy security through diversification away from oil. Investment in nuclear power has contributed to diversification and is expected to reinforce government efforts to limit carbon dioxide emissions from the energy sector.

Government concerns about high electricity prices (the highest in the OECD) have led to reforms of the sector of which the introduction of competition is seen as a key measure. Amendment of the Electric Utility Industries Law has required utilities to conduct tenders for independent power producers to supply short-term thermal power to the utilities. These tenders have been highly successful and demonstrate significant potential for other industrial companies to enter the power business. These tenders will be expanded beginning in 1999 (and overseen by a neutral agency) to allow competition in the supply of all future thermal power needs, unless a remarkable change in the situation occurs.

Further reforms, particularly the introduction of partial liberalisation of retail supply have been considered by an advisory committee to the MITI Minister. The proposed reforms, which will be embodied in a new law in 1999, are expected to liberalise the market for extra high voltage consumers (28% of all supply) and to introduce accounting measures to separate the activities of the incumbent utilities to ensure non-discrimination.

The decision to move forward with partial liberalisation of retail supply is an important, irreversible step for Japan. In particular, the recognition by Japan of the need for equal conditions in competition between the utilities and new entrants, the need for fair and transparent rules on the use of power transmission lines, and the commitment to set a timetable for liberalisation are essential points in any liberalisation effort.

OIL

Oil remains a critically important energy source for Japan, accounting for nearly 55% of primary energy supply. Because of its share of primary energy supply, oil accounts for about 65% of energy-related carbon dioxide emissions. On both energy security and environmental grounds, reducing oil consumption or diversifying supply are logical goals of the Government, but the cost-effectiveness of policies to achieve these ends, such as promotion of Japanese investment in oil production worldwide through the Japan National Oil Corporation, needs to be considered in the context of the current low world oil price and plentiful supply.

Liberalisation of the market for petroleum products in Japan has lowered gasoline prices and promoted a major restructuring of the distribution of petroleum products. Further change is inevitable, because retail margins are too low to support the number of retail outlets. Liberalisation of the electricity sector, and the introduction of cost-reflective electricity tariffs, could contribute to lowering the need for oil to meet peak demand. Energy market liberalisation generally is likely to be an effective means of ensuring the compatible achievement of Japan's energy policy goals.

Japan wishes to maintain domestic refining capacity to ensure that, during emergency periods, stocks of oil can be readily converted to products. The structure of customs duty may offer protection to the refining industry in competition with imports. The different levels of taxation on crude and oil products, as well as the differences between oil products, could generally raise the issue of cross-subsidies leading to economic inefficiency.

GAS

Natural gas is one of Japan's most important energy sources in terms of energy security since dependency on the Middle East is smaller than that for oil, and on environmental grounds because of lower greenhouse gas emissions from gas-fired power than from coal-fired power. Consumption is largely for electricity generation. Electricity and gas issues are consequently closely related since natural gas is imported as liquefied natural gas (LNG) and the gas pipeline network is not highly developed.

Given the uncertainty of achieving the nuclear target, natural gas might be considered as an alternative means of meeting energy demand with an acceptable environmental outcome. To develop gas further would require overcoming two major barriers: developing the network and lowering the cost of supplying LNG. Only 5% of the land area (but 50% of the population) is covered by the gas grid. Some small LPG retailers have a high degree of market power. The review discusses measures, including third party access and better gas load management, which might improve the performance of the gas market, simultaneously enhancing security and environmental objectives.

The ability of individual companies to operate flexibly is limited by the present organisation of the gas market within Japan. Third party access to LNG terminals may be one way of introducing competition and lowering costs but would, of course, require consideration of the terms of access and/or compensation to the owners. The development of the gas market may also be impeded by the way in which gas prices are formed. The efficient functioning of the gas market would be improved substantially if market players could operate with more flexibility, for example by encouraging trade in gas between large consumers.

COAL

Japan is by far the world's largest importer of steam coal for power generation (64.1 Mt in 1997) and of coking coal for steel making (65.3 Mt in 1997). Japan accounts for about 28% of total world coal imports. In Japan, where steam coal is primarily used for baseload power generation, security of physical supplies of steam coal is essential. The question arises whether pressure to reduce fuel costs for electricity generation will conflict with Japan's energy security goal. Over time, the Asia-Pacific coal market may develop along lines seen in the European coal market, with the spot market becoming a more prominent point of reference for determining price, but distinguished from the European market by the demand for coal in baseload power generation. This latter feature of the market could lead to long-term contracts with prices related to the spot price, but with explicit premiums for security of supply, and thus limit the physical size of the spot market.

Japan maintains a small but heavily subsidised coal mining industry, justified in part on security grounds and as a means of supporting the development of coal technology. Production has declined under competitive pressure from imported coal from about 55 Mt in the early 1960s to its present level of 3.97 Mt (1997 financial year). Competition in the electricity market is also placing pressure on subsidies for Japanese coal production. The future of domestic production is currently under review. To date, policies have been very effective in reducing the level of domestic production. The real need of coal mining regions in Japan appears to be creation of employment opportunities for the remaining mining workforce, rather than energy security or supporting the development of coal technology.

RESEARCH, DEVELOPMENT AND TECHNOLOGY

Achieving the *3 Es* in the short and long terms will require continuation of recent trends in research, development and deployment, in the areas of energy efficiency and renewables, while continuing to give attention to nuclear, particularly waste

management and research directed at raising the level of public acceptance of nuclear power. A balance of long-term and short-term research and development is likely to continue to be needed, particularly in light of increased private sector focus on short-term research and development. Consideration could also be given to further research on the effectiveness of market-based mechanisms for achieving the *3 Es* of Japanese energy policy.

RECOMMENDATIONS

The Government should:

General Energy Policy

☐ Give consideration to redefining the role and scope of the Long Term Energy Supply and Demand Outlook, with a view to enhancing its value as an objective analysis of the energy outlook in Japan, with a range of possible outcomes for the future based on plausible, published assumptions.

Efficiency

☐ Through electricity and gas market liberalisation policies, encourage the widespread use of cost-reflective energy pricing, including time-differentiated electricity pricing to encourage energy conservation in summer and also to assist in levelling electricity loads.

☐ Review policies to achieve improved energy efficiency, taking care to distinguish between improvements attributable to government policies and improvements that would have happened otherwise, and utilise the results of reviews undertaken to adjust the package of policies intended to meet Japan's Third Conference of the Parties (COP 3) target, in particular the possible need to adjust the balance between energy demand and energy supply policies.

☐ Evaluate the applicability to Japan of policies used in other IEA Member countries to monitor and enforce voluntary agreements with industry.

☐ Consider strengthening energy conservation standards for buildings, adopting energy conservation information systems for residential buildings and developing a process of energy audits/certification for buildings as part of the documentation prepared when buildings are sold.

Nuclear

- ☐ Give consideration to means by which the Government could improve the overall capacity utilisation factor of nuclear plants, consistent with good safety and reliability by, for example, allowing utilities to increase the length of the power cycle in nuclear plants between two refuelling operations, from 13 to 18 months or more as is the present trend in other OECD countries.

- ☐ Continue efforts to ensure full transparency and accountability for regulating safety of nuclear power reactors.

Electricity

The Government should adopt a comprehensive reform plan for the industry that lays out the timing and criteria for evaluating progress with reform of introducing effective competition for the electricity sector, taking into account its major policy goals (environmental protection, energy security and economic growth).

As part of this reform plan, the Government should define measurable indicators of these reforms so that progress towards their achievement can be monitored. The Government should monitor the progress of these reforms and, if there are problems with this progress, the Government can make a timely adjustment toward other policies.

Competition principles should be strengthened in the overall policy framework.

The following recommendations would apply particularly to the first step of reform:

Regulatory independence from day-to-day political pressures is essential to build confidence of all electricity market participants that government intervention in the electricity market will be neutral and transparent. Further, independence from the regulated companies, including but not limited to utilities, is needed to ensure transparent, fair, and reasonably predictable decisions. Therefore, the regulation of the electricity sector should be independent from policy-making functions and electricity industry promotion functions, with transparent procedures and due process for the review of decisions. Transparency, expertise, independence and adequate legal powers are particularly important. Co-ordination with the Fair Trade Commission should be clearly defined.

Non-discriminatory tariffs and terms of access to the networks and system services are cornerstones of electricity reform. Therefore, the first step of reform should include the requirement for regulated terms and conditions of access to the network and provision of ancillary services. Separate accounts for natural monopoly activities and supply of electricity to captive customers are needed from the potentially competitive activities. Prices should reflect, to the extent possible, underlying costs to encourage efficient development and use of the networks.

Standard customer tariffs do not reflect the high cost of peak power. Cost-reflective pricing of energy would encourage those customers able to manage their load to use less energy on peak, thus reducing total electricity costs. Therefore, standard electricity tariffs for captive customers, and network/ancillary service tariffs for liberalised customers, should reflect costs by time of use. Implementation of the time-of-use tariffs should be phased in, beginning with liberalised customers and the larger (power) captive customers.

The current application of yardstick assessment to economic regulation provides only diffuse incentives for utilities to improve their efficiency. Therefore, the yardstick assessment scheme should be revised to provide a greater incentive for utilities to improve their efficiency by providing a less direct link between prices a utility can charge and the corresponding cost, and providing a more direct link with the cost-efficiency of other electric utilities, making suitable adjustments for utilities' unique physical situations.

Competition law needs to be enforced vigorously where collusive behaviour, abuse of dominant position, or anti-competitive mergers risks frustrating reform. The Anti-monopoly Act should be amended to clarify that it also applies to the electricity sector.

If after a reasonable period, such as by 2003, there continues to be evidence of discriminatory behaviour, and the market is not sufficiently competitive, despite accounting separation, further changes will be necessary:

The Government should expand the set of eligible customers. If possible, make all customers eligible.

If difficulties with accounting separation are found, and if measures to strengthen accounting separation have not eliminated these difficulties, then utilities should be required to functionally separate their regulated activities from unregulated activities and the regulatory regime may need to be strengthened. The Government should consider the full range of feasible separation options to promote competition in the industry.

Increased activity in the trading of electricity will increase the need and the opportunity for a short-term electricity market to deal with imbalances between generation and loads. Therefore, a short-term market for electricity sales should be created to optimise use of generating resources.

Following the second step in the regulatory reform in the electricity sector, consistent with its reform objectives, the Government of Japan should undertake a review of the operation of the competitive electricity market in each utility service area in Japan. Depending on the outcome of such an evaluation, the Government should consider what further practical regulatory and/or structural reforms should be introduced, consistent with Japan's overall energy policy goals and objectives. Among the options to be considered are:

- measures to encourage entry of new generating companies;

- ☐ the expansion of interconnections between regions in a way that supports greater competition as well as reliability of supply;

- ☐ modification of economic regulation applied to the utilities to provide them with greater incentives to operate and invest efficiently in monopoly activities of the sector, as well as to compete for customers in the competitive activities of the sector;

- ☐ measures to encourage the voluntary sale of utilitie' generating capacity to multiple buyers; and

- ☐ the full range of feasible horizontal and vertical separation options to promote further competition in the industry.

Oil

- ☐ In the course of the planned review of the role of the Japan National Oil Corporation (JNOC), seek to quantify the tangible energy security benefits arising from JNOC's activities to date, and evaluate the cost-effectiveness of their achievement.

- ☐ Consistent with its policy of self-responsibility, permit further rationalisation of gasoline retailing, notwithstanding the drastic reduction in the number of service stations that appears likely in the immediate future.

- ☐ Review the structure of customs duty applying to petroleum products, to remove anomalies which may exist between products, and particularly with the higher tariff on heavy oil.

Gas

- ☐ Give consideration to the means by which competition might be introduced into LNG procurement as a means of reducing the cost of gas and enhancing security of supply.

- ☐ Review the basis on which prices are set in the gas market, to determine the extent to which monopolistic price-setting may be impeding the growth of gas consumption and the introduction of new technologies such as trigeneration of electricity, heat and cold.

- ☐ Ensure that large gas consumers are able to exchange gas freely and that the tariff on transport is set at a threshold low enough to encourage small-scale cogeneration and trigeneration; ensure that a protective tariff applies to gas transport for all captive users.

- ☐ Further encourage the introduction of competition in the gas market wherever the gas grid has already been developed, by expanding the range of consumers able to directly negotiate price and conditions of supply, by monitoring price and conditions of supply, and by monitoring prices and trade practices of LPG retailers with a view to preventing any anti-competitive activities.

- ☐ Encourage gas grid expansion wherever economical to do so.

Coal

- ☐ In reviewing the future of the domestic coal industry, and the role of coal generally, acknowledge the operation of the international coal market as a cost-effective means of contributing to Japan's energy security and encourage the development of pricing formulae in long-term contracts to provide the same level of security as the former benchmark pricing system.

- ☐ Clarify the objectives of assistance to the coal industry, particularly those objectives which could be achieved by measures other than continuing coal production.

- ☐ Continue efforts to achieve structural adjustment in the coal mining industry, and the abolition by FY 2001 of existing subsidies for domestic coal production.

Research, Development and Technology

- ☐ Review the share of research and development funding given to developing wind power, in the light of its economic and technical performance in other IEA countries, and with a view to responding to the difficulties encountered in its application in Japan.

- ☐ Review the share of research and development funding for energy conservation, in view of the importance of energy conservation to achieving Japan's greenhouse targets; and give consideration to socio-economic research on consumer motivation and the effectiveness of pricing as an instrument of energy policy.

- ☐ Ensure that industry views are considered in reaching decisions on funding for particular projects, within the Government's overall research and development strategy, so that long-term commercial potential is a criterion for project selection for projects expected to be implemented by 2010, in particular.

- ☐ Continue to pursue a mix of shorter-term and long-term research and development and to encourage industry to do the same; and consider sharing the results of the Electricity Research and Development Review Committee's deliberations on this subject with other IEA Member countries.

JAPAN

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**29.5**	**75.6**	**102.5**	**107.5**	**118.0**	**138.4**	**163.7**
Coal[1]		17.9	4.6	3.6	2.9	2.9	2.9	2.9
Oil		0.8	0.6	0.8	0.7	0.7	0.7	0.7
Gas		2.3	1.8	2.0	2.0	2.0	2.0	2.0
Comb. Renewables & Wastes[2]		–	6.7	7.1	7.1	8.0	9.7	11.9
Nuclear		2.5	52.7	78.8	83.6	91.8	107.2	125.1
Hydro		5.7	7.7	6.9	7.6	7.9	8.5	9.0
Geothermal		0.2	1.5	3.4	3.5	4.6	7.3	11.5
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.1	0.5
TOTAL NET IMPORTS[4]		**300.7**	**364.2**	**411.4**	**406.7**	**398.7**	**386.2**	**376.2**
Coal[1]	Exports	0.4	1.0	1.6	1.8	1.8	1.7	1.7
	Imports	41.3	70.0	83.1	85.0	83.8	80.6	77.6
	Net Imports	40.9	69.0	81.5	83.2	82.1	78.9	75.9
Oil	Exports	2.9	3.8	8.1	15.5	15.2	14.8	14.5
	Imports	276.7	262.6	288.0	290.6	281.0	267.0	255.0
	Bunkers	16.8	5.1	4.2	5.0	5.0	5.0	5.0
	Net Imports	257.0	253.6	275.7	270.1	260.7	247.2	235.5
Gas	Exports	–	–	–	–	–	–	–
	Imports	2.8	41.7	54.3	53.4	55.8	60.1	64.8
	Net Imports	2.8	41.7	54.3	53.4	55.8	60.1	64.8
Electricity	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
TOTAL STOCK CHANGES		**–6.6**	**–1.0**	**–3.5**	**–1.9**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**323.6**	**438.8**	**510.4**	**512.3**	**516.6**	**524.6**	**539.9**
Coal[1]		57.9	74.0	84.6	86.8	85.0	81.8	78.9
Oil		252.2	252.9	273.5	268.3	261.5	247.9	236.2
Gas		5.1	43.3	56.1	55.4	57.9	62.2	66.8
Comb. Renewables & Wastes[2]		–	6.7	7.1	7.1	8.0	9.7	11.9
Nuclear		2.5	52.7	78.8	83.6	91.8	107.2	125.1
Hydro		5.7	7.7	6.9	7.6	7.9	8.5	9.0
Geothermal		0.2	1.5	3.4	3.5	4.6	7.3	11.5
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.1	0.5
Electricity Trade[5]		–	–	–	–	–	–	–
Shares (%)								
Coal		*17.9*	*16.9*	*16.6*	*16.9*	*16.5*	*15.6*	*14.6*
Oil		*77.9*	*57.6*	*53.6*	*52.4*	*50.6*	*47.3*	*43.8*
Gas		*1.6*	*9.9*	*11.0*	*10.8*	*11.2*	*11.9*	*12.4*
Comb. Renewables & Wastes		*–*	*1.5*	*1.4*	*1.4*	*1.5*	*1.9*	*2.2*
Nuclear		*0.8*	*12.0*	*15.4*	*16.3*	*17.8*	*20.4*	*23.2*
Hydro		*1.8*	*1.8*	*1.4*	*1.5*	*1.5*	*1.6*	*1.7*
Geothermal		*0.1*	*0.3*	*0.7*	*0.7*	*0.9*	*1.4*	*2.1*
Solar/Wind/Other		*–*	*–*	*–*	*–*	*–*	*–*	*0.1*
Electricity Trade		*–*	*–*	*–*	*–*	*–*	*–*	*–*

0 is negligible, – is nil, .. is not available.

Please note: Data for 1997 are provisional. Data for 2000 and 2005 are IEA Secretariat estimates. In 2010, data for combustible renewables and wastes, electricity generated, production and imports of coal, oil and gas, and bunkers are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**235.3**	**294.5**	**337.1**	**334.9**	**335.3**	**336.9**	**340.6**
Coal[1]	20.2	22.5	21.4	22.2	21.8	21.5	21.2
Oil	172.4	188.3	214.5	210.3	206.7	198.6	191.4
Gas	7.0	14.7	20.5	20.1	20.8	23.9	27.6
Comb. Renewables & Wastes[2]	–	3.7	3.4	3.4	4.0	5.4	7.1
Geothermal	–	–	0.2	0.3	0.3	0.5	0.7
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	35.7	65.1	76.6	78.2	81.1	86.3	91.7
Heat	0.0	0.2	0.4	0.4	0.5	0.7	0.9
Shares (%)							
Coal	*8.6*	*7.6*	*6.4*	*6.6*	*6.5*	*6.4*	*6.2*
Oil	*73.3*	*63.9*	*63.6*	*62.8*	*61.6*	*59.0*	*56.2*
Gas	*3.0*	*5.0*	*6.1*	*6.0*	*6.2*	*7.1*	*8.1*
Comb. Renewables & Wastes	–	*1.3*	*1.0*	*1.0*	*1.2*	*1.6*	*2.1*
Geothermal	–	–	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*15.2*	*22.1*	*22.7*	*23.4*	*24.2*	*25.6*	*26.9*
Heat	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.3*
TOTAL INDUSTRY[6]	**140.2**	**134.5**	**144.1**	**157.4**	**156.8**	**156.1**	**155.9**
Coal[1]	18.2	21.7	20.4	21.2	20.7	20.4	19.9
Oil	94.9	73.3	78.9	90.5	88.4	84.2	80.6
Gas	2.1	4.6	7.7	7.4	7.8	8.8	9.8
Comb. Renewables & Wastes[2]	–	2.5	2.2	2.2	2.4	2.6	2.9
Geothermal	–	–	0.1	0.1	0.1	0.2	0.4
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	25.1	32.4	34.8	36.0	37.4	39.8	42.4
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*13.0*	*16.2*	*14.1*	*13.5*	*13.2*	*13.0*	*12.7*
Oil	*67.7*	*54.4*	*54.7*	*57.5*	*56.4*	*54.0*	*51.7*
Gas	*1.5*	*3.4*	*5.4*	*4.7*	*5.0*	*5.7*	*6.3*
Comb. Renewables & Wastes	–	*1.8*	*1.5*	*1.4*	*1.5*	*1.7*	*1.8*
Geothermal	–	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.3*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*17.9*	*24.1*	*24.2*	*22.8*	*23.8*	*25.5*	*27.2*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**43.4**	**74.3**	**90.0**	**86.0**	**85.0**	**83.6**	**83.2**
TOTAL OTHER SECTORS[8]	**51.6**	**85.7**	**102.9**	**91.4**	**93.5**	**97.1**	**101.5**
Coal[1]	1.8	0.8	1.1	1.0	1.1	1.2	1.3
Oil	35.4	42.5	47.4	35.6	35.2	34.2	33.3
Gas	5.0	10.1	12.7	12.6	12.9	13.6	14.2
Comb. Renewables & Wastes[2]	–	1.2	1.2	1.2	1.7	2.8	4.2
Geothermal	–	–	0.1	0.1	0.2	0.2	0.3
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	9.5	30.9	39.9	40.4	41.9	44.5	47.2
Heat	0.0	0.2	0.4	0.4	0.5	0.7	0.9
Shares (%)							
Coal	*3.4*	*0.9*	*1.1*	*1.1*	*1.2*	*1.2*	*1.3*
Oil	*68.6*	*49.6*	*46.1*	*39.0*	*37.7*	*35.3*	*32.9*
Gas	*9.6*	*11.8*	*12.4*	*13.8*	*13.8*	*14.0*	*14.0*
Comb. Renewables & Wastes	–	*1.4*	*1.2*	*1.3*	*1.8*	*2.8*	*4.1*
Geothermal	–	–	*0.1*	*0.2*	*0.2*	*0.2*	*0.3*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*18.4*	*36.1*	*38.8*	*44.2*	*44.8*	*45.8*	*46.6*
Heat	*0.1*	*0.2*	*0.4*	*0.4*	*0.6*	*0.7*	*0.9*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**90.5**	**170.6**	**210.4**	**214.9**	**221.1**	**233.8**	**252.0**
OUTPUT (Mtoe)	**40.0**	**73.2**	**86.3**	**88.3**	**90.6**	**95.5**	**101.5**
(TWh gross)	465.4	850.8	1003.2	1027.1	1053.0	1110.0	1180.0
Output Shares (%)							
Coal	*8.0*	*14.7*	*18.2*	*17.7*	*17.2*	*16.2*	*15.2*
Oil	*73.2*	*30.1*	*21.0*	*20.5*	*18.3*	*14.4*	*11.2*
Gas	*2.3*	*19.4*	*20.2*	*19.7*	*19.8*	*20.5*	*20.2*
Comb. Renewables & Wastes	*–*	*1.3*	*2.0*	*2.0*	*2.1*	*2.2*	*2.3*
Nuclear	*2.1*	*23.8*	*30.1*	*31.2*	*33.4*	*37.0*	*40.7*
Hydro	*14.3*	*10.5*	*8.0*	*8.6*	*8.7*	*8.9*	*8.9*
Geothermal	*0.1*	*0.2*	*0.4*	*0.4*	*0.5*	*0.7*	*1.1*
Solar/Wind/Other	*–*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.5*
TOTAL LOSSES	**94.5**	**143.2**	**174.2**	**178.9**	**181.4**	**187.7**	**199.3**
of which:							
Electricity and Heat Generation[10]	50.5	97.2	123.7	127.0	130.0	137.2	149.5
Other Transformation	25.1	23.3	24.6	27.6	27.4	27.1	27.1
Own Use and Losses[11]	19.0	22.7	26.0	24.4	24.0	23.3	22.6
Statistical Differences	**–6.2**	**1.2**	**–0.9**	**–1.5**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997P	2000	2005	2010
GDP (billion 1990 US$)	1590.43	2970.09	3315.66	3332.00	3640.97	4159.77	4706.39
Population (millions)	108.66	123.54	125.86	126.25	127.40	128.89	130.40
TPES/GDP[12]	0.20	0.15	0.15	0.15	0.14	0.13	0.11
Energy Production/TPES	0.09	0.17	0.20	0.21	0.23	0.26	0.30
Per Capita TPES[13]	2.98	3.55	4.05	4.06	4.06	4.07	4.14
Oil Supply/GDP[12]	0.16	0.09	0.08	0.08	0.07	0.06	0.05
TFC/GDP[12]	0.15	0.10	0.10	0.10	0.09	0.08	0.07
Per Capita TFC[13]	2.17	2.38	2.68	2.65	2.63	2.61	2.61
Energy-related CO_2 Emissions (Mt CO_2)[14]	910.2	1061.8	1177.7	..	1147.8	1109.8	1078.4
CO_2 Emissions from Bunkers (Mt CO_2)	53.5	16.3	13.5	..	16.1	16.1	16.1

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.5	2.0	2.5	0.4	0.3	0.3	0.6
Coal	–2.0	3.4	2.3	2.5	–0.7	–0.8	–0.7
Oil	0.4	–0.2	1.3	–1.9	–0.8	–1.1	–1.0
Gas	24.2	8.0	4.4	–1.1	1.5	1.4	1.5
Comb. Renewables & Wastes	–	–	0.8	0.1	4.1	4.1	4.1
Nuclear	39.1	10.1	6.9	6.2	3.1	3.1	3.1
Hydro	3.2	0.9	–1.7	10.0	1.3	1.3	1.3
Geothermal	22.3	6.2	14.6	3.1	9.6	9.6	9.6
Solar/Wind/Other	–	–	–	33.3	44.2	46.1	45.2
TFC	0.9	1.6	2.3	–0.7	0.0	0.1	0.2
Electricity Consumption	3.9	3.4	2.8	2.1	1.2	1.2	1.2
Energy Production	4.9	6.1	5.2	4.9	3.1	3.2	3.4
Net Oil Imports	0.5	–0.4	1.4	–2.0	–1.2	–1.1	–1.0
GDP	3.5	3.9	1.9	0.5	3.0	2.7	2.5
Growth in the TPES/GDP Ratio	–1.9	–1.9	0.7	–0.1	–2.6	–2.3	–1.9
Growth in the TFC/GDP Ratio	–2.5	–2.2	0.4	–1.1	–2.9	–2.5	–2.2

Please note: Rounding may cause totals to differ from the sum of the elements.

SWITZERLAND

Switzerland is a federal country comprising 26 cantons which make their own policy decisions unless the Federal Constitution specifically gives the competence to the Swiss Government. Cantons are also responsible for the implementation of many policy measures decided at federal level. In such a system, close co-operation between the Swiss Government and the cantons is necessary for successful energy policies. Increased co-operation between cantons would also improve policy-making at the local level. Another important feature of the Swiss political system is that citizens can directly take decisions on legislation through referendums. Providing adequate information to the public is vital for such decision-making to function properly.

The "Energy 2000 Action Plan" is the core of Swiss energy policy. It aims to stabilise electricity consumption and to reduce fossil fuel consumption and CO_2 emissions beyond 2000. It also aims at increasing the supply of renewable and nuclear energy by upgrading the capacity of existing nuclear power plants. The Decree of 1991 on Efficient Energy Use followed by the Energy Law of 1998 defined the respective responsibilities of the Swiss Government and the cantons on energy policy.

Between 1990 and 1997, the slowing-down of fossil fuel use and electricity demand and the stabilisation of CO_2 emissions were achieved as a result of economic stagnation and the Energy 2000 Action Plan. One of the main aspects of the current plan is the importance given to assessing the cost-effectiveness of the measures implemented. The results of these studies should be valuable in formulating a new energy plan.

Although energy intensity in Switzerland is already low, progress can be made to improve energy efficiency. In particular, the effectiveness of voluntary measures could be increased, more stringent building codes could be adopted by cantons and the use of public transport could be more strongly encouraged.

The Swiss Government and the cantons have put strong emphasis on promoting non-hydro renewables. The best way to make energy production from renewables sustainable in the long term is to ensure that their overall production cost decreases to a level which makes them competitive. Policy measures should encourage competition among renewables in order to favour the most cost-effective ones.

Energy and CO_2 taxes are being seriously considered. Such taxes could better internalise the external costs of using energy. Improvements in the tax system would send the right price signals to energy consumers and suppliers, allowing them to take the right decisions on fuel choice and investments to increase energy efficiency.

A large number of companies are present in the electricity and natural gas sectors. Suppliers have monopoly rights in their areas and set prices for final consumers.

These sectors are also characterised by strong involvement of local authorities in both ownership and regulation, e.g. price controls. Local authorities levy various taxes and hidden charges on the companies. These, together with the absence of competition, have contributed to high average electricity and gas prices, in particular for industrial customers.

Thus, the initiative by the Swiss Government to introduce competition in the electricity sector is a timely, welcome move. This reform, envisaging regulated third party access, can increase the efficiency of this sector and reduce prices for final consumers if it is well designed and regulated so as to avoid cross-subsidies and discrimination. In addition, harmonising regulations with the EU would be beneficial to Switzerland.

Corporatisation of all utilities would enhance efficient management and allow them to compete on a level playing field. Creating a single national company for transmission would facilitate third party access in a transparent and non-discriminatory manner. It could also lead to increased rationalisation of the operation of the utilities transmission grid and improved dispatching within Switzerland.

The introduction of competition in the electricity sector is expected to oblige local authorities to reduce taxes and charges, but this will lead to a large decrease in the revenue of some municipalities and cantons. Such reductions in revenues need to be compensated. The introduction of competition is also expected to create stranded costs, in particular for some hydro plants. It should be ensured that payments for stranded costs to utilities do not increase their competitiveness artificially.

The Swiss Government is also considering introducing competition in the natural gas sector. Together with the corporatisation of all gas companies and improved management, this would allow the gas market to develop in an efficient manner in which management decisions, including investment decisions, would be taken on an economic basis. As light fuel oil is less taxed than gas, a rationalisation of the overall energy tax system would contribute to gas penetration. Switzerland is becoming a transit country for gas from the North Sea to Italy. This should increase diversity in supply sources, thus contributing to security of supply.

Oil consumption has stabilised since the beginning of the 1990s. Competition in the retail market is increasing although oil supply is still mainly concentrated in the hands of four large suppliers. Competitition has led companies to rationalise distribution in order to cut costs and to invest in the modernisation of refineries.

The Swiss nuclear power plants are efficiently run and contribute significantly to Swiss electricity supply. In addition, by providing 40% of electricity supply, nuclear contributes together with hydroelectricity to 98% carbon-free electricity production, making Switzerland one of the lowest emitters of CO_2 per GDP (calculated in purchasing power parity) among IEA countries. For these reasons the nuclear option should be kept open. The proposed revisions of the Atomic Energy Act address several concerns of the public and of policy-makers. The decision of

October 1998 to start negotiations with all major players regarding the date of the closure of existing nuclear power plants does not actually impede the building of new nuclear power plants in the future. In the process of closing down nuclear power plants, the Government should consider the best timetable, taking into account the costs involved, and the consequences for CO_2 emissions and for the energy supply/demand balance in Switzerland.

Switzerland has a strong, comprehensive and efficiently managed energy R&D programme. In addition, R&D programmes are regularly assessed to increase their efficiency. Priorities are clearly defined. The Swiss Government should continue to ensure that the R&D programmes are effectively in line with Swiss energy policy. This is becoming increasingly important as Switzerland is committed to making large efforts to reduce CO_2 emissions.

RECOMMENDATIONS

The Swiss Government should:

Government Structure and Energy Trends

☐ Further strengthen public information on energy policy measures. Make sure that trade-offs between various policy options are well understood.

☐ Improve the review of the cantons' energy policies. Promote co-operation among cantons.

☐ Further enhance co-operation with the cantons on energy policy, especially on the Energy 2000 Action Plan and on the introduction of competition in the energy markets to ensure successful implementation of energy policy measures.

The Energy 2000 Action Plan and Energy Taxation

The Energy 2000 Action Plan

☐ Strengthen public information on the cost effectiveness of policy measures in the Plan. Cost effectiveness should be assessed, taking into consideration economic trends.

☐ Review the process of setting voluntary measures to identify whether and how it could be improved and consider setting more binding measures where possible.

☐ Establish a new Energy Action Plan Beyond 2000, based on a comprehensive assessment of the Energy 2000 Action Plan. The new plan should be adapted to the development of competition in the energy market.

☐ Further strengthen cooperation between the cantons and the Swiss Government. Promote co-operation among cantons.

Energy Efficiency

☐ Expand labelling for energy efficiency of domestic appliances and office equipment.

☐ Where needed, encourage cantons to adopt more stringent building codes and to make individual metering for heating and hot water compulsory.

☐ Develop public transportation systems and increase their use. Strengthen co-operation between administrations involved in energy policy and those involved in transport policy.

Renewables

☐ Focus on the most cost-effective measures to promote non-hydro renewables and ensure that these measures are designed to increase their competitiveness. Adapt the current system of promoting electricity from non-hydro renewables to make it compatible with the introduction of competition in the electricity sector.

☐ Ensure that the public receives accurate information about renewable energy available on the market.

Energy Taxation

☐ Make local taxes and charges on electricity and natural gas transparent.

☐ Better internalise the external costs of using energy, including environmental costs, through taxation or through more focused approaches, such as road taxes.

Fossil Fuels

☐ Introduce competition in the natural gas sector as soon as possible.

☐ Strongly encourage corporatisation of those gas industries which are not privatised, and the unbundling of accounts in order to allow the companies to compete on a level playing field.

☐ Establish a regulation to control tariffs and settle disputes in an unbiased manner and ensure that the regulator has enough legal competences and resources to carry out its missions.

☐ Introduce third party access to the whole gas grid and make tariffs transparent in order to prevent discrimination between users.

Electricity

- ☐ Seriously consider the future of electricity supply, taking into account probable future developments (i.e. introduction of competition, CO_2 emissions reduction) and the merits of the different production options from the point of view of economy and environment.

- ☐ Continue to work on the introduction of effective competition in the electricity sector, based on regulated third party access, with the eventual aim of ensuring a high level of competition among utilities, and consumer choice.

- ☐ Strongly encourage corporatisation of utilities when they are not privatised.

- ☐ Strongly encourage unbundling of accounts and regulate prices in the non-competitive segments of the electricity sector. Ensure that prices for captive consumers are cost-reflective and that there are no cross-subsidies.

- ☐ Ensure that regulatory authorities have enough legal competence and resources to carry out their mission.

- ☐ Set up a national grid company in order to facilitate third party access and tariff setting in a transparent and non-discriminatory manner.

- ☐ Carefully assess the stranded costs calculated by the electricity companies and take measures to ensure that payments for these costs do not distort competition with the other electricity generators at national or international level.

Nuclear

- ☐ Take measures to ensure the implementation of radioactive waste repositories.

- ☐ Continue actions aimed at strengthening the legal framework for the use of nuclear energy and at enhancing the independence of safety authorities.

- ☐ Ensure that decisions on nuclear issues are reached in a democratic process accepted by the public.

- ☐ Maintain a sufficient level of technological competence to keep nuclear energy as a viable option.

Energy Technology, Research and Development

- ☐ Continue to fund R&D sufficiently to contribute to the objectives of Swiss energy policy.

- ☐ Strengthen the assessment of R&D programmes and fully reflect the results of these assessments to ensure maximum efficiency of future programmes.

- ☐ Further strengthen co-operation with industry in order to better disseminate R&D results into the market.

- ☐ Maintain strong participation in international R&D programmes.

SWITZERLAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**4.28**	**9.72**	**10.48**	**10.99**	**10.24**	**10.29**	**10.28**
Coal[1]		–	–	–	–	–	–	–
Oil		–	–	–	–	–	–	–
Gas		–	0.00	–	–	–	–	–
Comb. Renewables & Wastes[2]		0.24	0.98	1.45	1.41	1.40	1.45	1.49
Nuclear		1.64	6.18	6.57	6.64	5.89	5.84	5.76
Hydro		2.40	2.56	2.44	2.93	2.93	2.97	2.99
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	0.02	0.02	0.02	0.03	0.04
TOTAL NET IMPORTS[4]		**15.23**	**15.16**	**15.15**	**15.02**	**14.20**	**14.34**	**14.37**
Coal[1]	Exports	0.02	0.01	–	–	–	–	–
	Imports	0.24	0.35	0.11	0.07	0.05	0.04	0.02
	Net Imports	0.22	0.34	0.11	0.07	0.05	0.04	0.02
Oil	Exports	0.23	0.16	0.65	0.51	–	–	–
	Imports	15.38	13.54	13.40	13.74	–	–	–
	Bunkers	–	0.02	0.01	0.01	–	–	–
	Net Imports	15.16	13.36	12.74	13.22	12.25	12.03	11.79
Gas	Exports	–	–	–	–	–	–	–
	Imports	0.15	1.63	2.38	2.29	2.39	2.52	2.64
	Net Imports	0.15	1.63	2.38	2.29	2.39	2.52	2.64
Electricity	Exports	0.90	1.97	2.08	2.37	1.98	1.70	1.50
	Imports	0.60	1.79	2.00	1.78	1.49	1.45	1.42
	Net Imports	–0.30	–0.18	–0.08	–0.58	–0.49	–0.25	–0.08
TOTAL STOCK CHANGES		**0.22**	**0.12**	**–0.00**	**0.21**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**19.72**	**25.00**	**25.62**	**26.22**	**24.44**	**24.63**	**24.65**
Coal[1]		0.33	0.36	0.14	0.11	0.05	0.04	0.02
Oil		15.26	13.46	12.70	13.39	12.25	12.03	11.79
Gas		0.15	1.63	2.38	2.29	2.39	2.52	2.64
Comb. Renewables & Wastes[2]		0.24	0.99	1.46	1.41	1.40	1.45	1.49
Nuclear		1.64	6.18	6.57	6.64	5.89	5.84	5.76
Hydro		2.40	2.56	2.44	2.93	2.93	2.97	2.99
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	0.02	0.02	0.02	0.03	0.04
Electricity Trade[5]		–0.30	–0.18	–0.08	–0.58	–0.49	–0.25	–0.08
Shares (%)								
Coal		*1.7*	*1.4*	*0.6*	*0.4*	*0.2*	*0.2*	*0.1*
Oil		*77.4*	*53.8*	*49.6*	*51.1*	*50.1*	*48.8*	*47.8*
Gas		*0.8*	*6.5*	*9.3*	*8.7*	*9.8*	*10.2*	*10.7*
Comb. Renewables & Wastes		*1.2*	*4.0*	*5.7*	*5.4*	*5.7*	*5.9*	*6.0*
Nuclear		*8.3*	*24.7*	*25.6*	*25.3*	*24.1*	*23.7*	*23.4*
Hydro		*12.2*	*10.2*	*9.5*	*11.2*	*12.0*	*12.1*	*12.1*
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*
Electricity Trade		*–1.5*	*–0.7*	*–0.3*	*–2.2*	*–2.0*	*–1.0*	*–0.3*

0 is negligible. – is nil. .. is not available.

Please note: Forecast data for electricity and heat generation are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**17.57**	**19.59**	**20.61**	**20.23**	**19.53**	**19.75**	**19.83**
Coal[1]	0.29	0.35	0.14	0.11	0.05	0.04	0.02
Oil	14.30	12.85	12.97	12.74	11.75	11.54	11.31
Gas	0.24	1.52	2.19	2.10	2.18	2.30	2.40
Comb. Renewables & Wastes[2]	0.24	0.60	0.74	0.73	1.01	1.05	1.07
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	0.02	0.02	0.02	0.02	0.02
Electricity	2.50	4.04	4.21	4.20	4.26	4.52	4.71
Heat	–	0.25	0.33	0.34	0.26	0.28	0.30
Shares (%)							
Coal	*1.6*	*1.8*	*0.7*	*0.5*	*0.3*	*0.2*	*0.1*
Oil	*81.4*	*65.6*	*62.9*	*63.0*	*60.2*	*58.4*	*57.0*
Gas	*1.3*	*7.7*	*10.6*	*10.4*	*11.2*	*11.6*	*12.1*
Comb. Renewables & Wastes	*1.4*	*3.0*	*3.6*	*3.6*	*5.2*	*5.3*	*5.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Electricity	*14.2*	*20.6*	*20.4*	*20.7*	*21.8*	*22.9*	*23.8*
Heat	–	*1.3*	*1.6*	*1.7*	*1.3*	*1.4*	*1.5*
TOTAL INDUSTRY[6]	**4.78**	**3.93**	**4.08**	**4.11**	**4.32**	**4.49**	**4.57**
Coal[1]	0.08	0.33	0.13	0.10	0.04	0.03	0.02
Oil	3.70	1.31	1.29	1.29	1.40	1.41	1.34
Gas	0.05	0.59	0.89	0.91	0.96	1.00	1.03
Comb. Renewables & Wastes[2]	–	0.16	0.32	0.34	0.47	0.50	0.52
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.95	1.48	1.38	1.40	1.40	1.50	1.61
Heat	–	0.05	0.07	0.08	0.05	0.05	0.05
Shares (%)							
Coal	*1.6*	*8.4*	*3.2*	*2.4*	*0.9*	*0.7*	*0.4*
Oil	*77.4*	*33.4*	*31.7*	*31.4*	*32.4*	*31.4*	*29.3*
Gas	*1.1*	*15.1*	*21.8*	*22.1*	*22.2*	*22.3*	*22.5*
Comb. Renewables & Wastes	–	*4.1*	*7.9*	*8.3*	*10.9*	*11.1*	*11.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*19.9*	*37.7*	*33.8*	*33.9*	*32.4*	*33.4*	*35.2*
Heat	–	*1.2*	*1.7*	*1.8*	*1.2*	*1.1*	*1.1*
TRANSPORT[7]	**4.29**	**6.29**	**6.51**	**6.73**	**6.13**	**6.32**	**6.49**
TOTAL OTHER SECTORS[8]	**8.49**	**9.38**	**10.02**	**9.39**	**9.08**	**8.94**	**8.77**
Coal[1]	0.21	0.02	0.01	0.01	0.01	0.01	–
Oil	6.48	5.47	5.38	4.93	4.46	4.11	3.81
Gas	0.19	0.92	1.30	1.19	1.22	1.30	1.37
Comb. Renewables & Wastes[2]	0.24	0.44	0.42	0.39	0.54	0.55	0.55
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	0.02	0.02	0.02	0.02	0.02
Electricity	1.37	2.34	2.63	2.59	2.62	2.72	2.77
Heat	–	0.20	0.26	0.26	0.21	0.23	0.25
Shares (%)							
Coal	*2.5*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	–
Oil	*76.3*	*58.3*	*53.6*	*52.5*	*49.1*	*46.0*	*43.4*
Gas	*2.2*	*9.8*	*13.0*	*12.6*	*13.4*	*14.5*	*15.6*
Comb. Renewables & Wastes	*2.8*	*4.7*	*4.2*	*4.1*	*5.9*	*6.2*	*6.3*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
Electricity	*16.1*	*24.9*	*26.2*	*27.6*	*28.9*	*30.4*	*31.6*
Heat	–	*2.2*	*2.6*	*2.8*	*2.3*	*2.6*	*2.9*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.48**	**9.35**	**9.97**	**10.47**	**9.58**	**9.59**	**9.60**
OUTPUT (Mtoe)	**3.17**	**4.70**	**4.78**	**5.30**	**5.07**	**5.09**	**5.11**
(TWh gross)	36.82	54.62	55.64	61.62	58.95	59.19	59.42
Output Shares (%)							
Coal	–	*0.1*	–	–	–	–	–
Oil	*7.1*	*0.5*	*0.5*	*0.3*	*1.3*	*1.0*	*1.1*
Gas	–	*0.6*	*1.2*	*1.4*	*1.6*	*1.7*	*1.9*
Comb. Renewables & Wastes	–	*1.0*	*2.1*	*1.8*	*1.0*	*1.0*	*1.1*
Nuclear	*17.1*	*43.3*	*45.2*	*41.2*	*38.2*	*37.8*	*37.1*
Hydro	*75.8*	*54.6*	*51.0*	*55.3*	*57.8*	*58.4*	*58.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.0*	*0.0*	*0.0*	*0.2*	*0.3*
TOTAL LOSSES	**2.17**	**5.05**	**5.65**	**5.61**	**4.91**	**4.88**	**4.82**
of which:							
Electricity and Heat Generation[10]	1.32	4.38	4.82	4.81	4.23	4.20	4.17
Other Transformation	0.14	0.01	0.02	–0.02	0.07	0.07	0.04
Own Use and Losses[11]	0.72	0.66	0.81	0.83	0.61	0.61	0.61
Statistical Differences	**–0.02**	**0.36**	**–0.63**	**0.37**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	182.31	228.41	227.57	231.53	237.84	251.21	260.12
Population (millions)	6.44	6.80	7.11	7.11	7.24	7.39	7.44
TPES/GDP[12]	0.11	0.11	0.11	0.11	0.10	0.10	0.09
Energy Production/TPES	0.22	0.39	0.41	0.42	0.42	0.42	0.42
Per Capita TPES[13]	3.06	3.68	3.61	3.69	3.38	3.33	3.31
Oil Supply/GDP[12]	0.08	0.06	0.06	0.06	0.05	0.05	0.05
TFC/GDP[12]	0.10	0.09	0.09	0.09	0.08	0.08	0.08
Per Capita TFC[13]	2.73	2.88	2.90	2.85	2.70	2.67	2.67
Energy-related CO_2 Emissions (Mt CO_2)[14]	45.9	44.2	42.9	44.8	41.4	41.0	40.5
CO_2 Emissions from Bunkers (Mt CO_2)	–	0.1	0.0	0.0	–	–	–

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	0.2	2.1	0.4	2.3	-2.3	0.2	0.0
Coal	–6.3	4.5	–14.1	–23.6	–23.1	–4.4	–12.9
Oil	–2.2	0.1	–1.0	5.5	–2.9	–0.4	–0.4
Gas	31.0	7.2	6.5	–3.5	1.4	1.1	0.9
Comb. Renewables & Wastes	11.2	7.3	6.6	–2.8	–0.3	0.7	0.5
Nuclear	11.0	6.5	1.0	1.1	–3.9	–0.2	–0.3
Hydro	2.1	–0.5	–0.8	19.9	0.0	0.3	0.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	5.6	1.7	8.4	5.9
TFC	–0.6	1.3	0.8	–1.8	–1.2	0.2	0.1
Electricity Consumption	2.6	3.0	0.7	–0.3	0.5	1.2	0.8
Energy Production	6.5	4.1	1.3	4.9	–2.3	0.1	–0.0
Net Oil Imports	–1.6	–0.3	–0.8	3.8	–2.5	–0.4	–0.4
GDP	–0.4	2.3	–0.1	1.7	0.9	1.1	0.7
Growth in the TPES/GDP Ratio	0.6	–0.2	0.5	0.6	–3.2	–0.9	–0.7
Growth in the TFC/GDP Ratio	–0.3	–0.9	0.9	–3.5	–2.1	–0.9	–0.6

Please note: Rounding may cause totals to differ from the sum of the elements.

STANDARD REVIEWS

Australia
Belgium
New Zealand
Norway
Spain
Turkey

AUSTRALIA

GENERAL POLICY

In October 1998, the former Department of Industry, Science and Tourism and the Resources and Energy Group of the former Department of Primary Industries and Energy merged into the Department of Industry, Science and Resources (ISR). The new department is expected to deliver a coherent and integrated approach to industry development issues and the facilitation of major investment projects.

In 1997, total energy supply increased slightly (0.5%) to 101.6 Mtoe. Energy production grew by 5.1% to 199.2 Mtoe. Net energy exports were 95.7 Mtoe, a 7% increase over 1996. Energy efficiency, measured as total primary energy supply divided by GDP, decreased by 2.2%. According to IEA's calculations, energy-related CO_2 emissions were 306.1 million tonnes, a 16.4% increase over 1990.

ENERGY PRODUCTION AND SUPPLY

Oil

In 1997, oil production increased slightly to 27.9 Mtoe and total consumption decreased 4.3% to 35.2 Mtoe.

The development of a Downstream Petroleum Products Action Agenda was announced in June 1998.[1] The announcement was made in the context of the Commonwealth Government's Industry Policy Statement, *Investing for Growth*, as a means for governments (Commonwealth and state) and industry to work together to identify a set of actions to promote industry growth. The Action Agenda process is expected to result in a public document which includes a vision for the future of the industry, a clear statement of the roles of Government and industry and a list of actions to be taken to remove obstacles in the development of industry. It is expected that the Action Agenda will be completed by late 1999.

On 20 July 1998, the Treasurer and the Minister for Industry, Science and Tourism announced a comprehensive reform package for the petroleum retailing industry. The package, *Petroleum Marketing – A New Era of Competition,* seeks to improve the market environment for petroleum retailing through the lifting of legislative restrictions on competition and measures to assist the transition to more efficient retail network structures. Key elements of the package are:

- Lifting of price surveillance as of 1 August 1998;

1. For information on the regulation of the downstrean oil sector, see *Australia 1997 Review*, IEA/OECD Paris, 1997.

- Implementing an open access regime for petroleum terminals, thereby allowing bulk fuel purchasers to source products directly from the terminal gate at wholesale prices. Under the access regime, new customers can obtain access to bulk supply subject to safety requirements;

- Setting an independent retail price monitoring system operated as a joint venture between motoring organisations and the major oil companies. This is complemented by ongoing "hot-spot" monitoring of prices by the Australian Competition and Consumer Commission;

- Prescribing a strengthened Oil Code under Part IVB of the *Trade Practices Act 1974.* The new Oil Code will provide a mandatory code of practice to govern the relationship between service station operators and their suppliers. The primary aim of the code is to improve commercial dealings in the industry through enhanced disclosure and expeditious low-cost dispute resolution; and

- Repealing the *Petroleum Retail Marketing Sites Act 1980* and the *Petroleum Retail Marketing Franchise Act 1980*. The Petroleum Retail Legislation Repeal Bill 1998 was introduced into Parliament on 25 November 1998 and is to come into effect when the Oil Code is prescribed.

Natural Gas

In 1997, natural gas production stabilised at 25.6 Mtoe. Gas supply increased slightly to 16.9 Mtoe. On 25 September 1998, Bass Strait crude oil and gas production was shut down after an explosion at the Longford Gas and Crude Oil Stabilization Plant. The government of the State of Victoria is undertaking a Royal Commission of Inquiry into the incident. The Inquiry is expected to report to the Victorian government by the end of June 1999.

On 7 November 1997, Commonwealth, State and Territory Heads of Government signed the Natural Gas Pipelines Access Agreement committing each jurisdiction to introduce legislation that would bring into effect the national third party access regime[2].

At the beginning of 1999, all states and territories, except Western Australia and Tasmania, had passed their enabling legislation, to give legal effect to the national regulatory regime for third party access to natural gas pipelines. Tasmania introduced legislation which was passed by the Lower House and is awaiting consideration by the Upper House. The Commonwealth's legislation, which is critical in order for the national third party access regime to be put in place, received Royal Assent on 30 July 1998.

Since the Commonwealth legislation received assent, states and territories have progressively commenced the national third party access regime, with South

2. For more detailed information see the chapter on Australia in *Energy Policies of IEA Countries, 1998 Review*, IEA/OECD Paris, 1998.

Australia, New South Wales, the Australian Capital Territory (ACT), the Northern Territory and Western Australia having proclaimed their legislation. It is expected that the remaining jurisdictions will complete the implementation of the national third party access regime by the end of 1999.

The National Gas Pipelines Advisory Committee was established to monitor the operation of the Code and to assess and make recommendations on possible amendments where experience has shown the Gas Pipelines Access Law or Code to be defective. Ministers will ultimately determine whether changes are made to the regime.

LNG

Australia exports approximately 35% of its natural gas production in the form of liquefied natural gas (LNG). LNG is sold under long-term contracts to eight Japanese utilities. Where opportunities have existed, spot sales have also been made. During 1995-1996 spot sales were made to buyers in Turkey, Korea and Spain, and during 1996-1997 they were made to the United States. During 1998-1999 it is envisaged that some sales will also be made to North American markets.

LNG exports in 1995-96 increased by 6.6% to approximately 7.4 Mt and were worth approximately A$ 1.5 billion[3]. Exports of LNG from the North West Shelf (NWS) Project reached a peak in April 1996 of 7.48 Mt per year as a result of refinements to the processing stage. This peak level is expected to be the maximum potential production for the NWS Project in its current configuration until major expansion of the project.

Coal

In 1997, coal production increased by 7% to 139 Mtoe. Exports increased by 5.5% to 94.8 Mtoe. Coal continued to be the major fuel supplied in Australia with 41.7% of the total, mostly because of its share in electricity generation (80.1% in 1997). According to national statistics, in 1998, coal production increased to 144 Mtoe and exports increased to 105 Mtoe.

On 9 July 1997, the Government asked the then Industry Commission (now Productivity Commission) to undertake an inquiry into the Australian black coal industry. The inquiry was created to examine the Australian coal industry's performance against the benchmark of international best practice, and also to examine issues including components of mining costs, safety standards, industrial relations and work practices, and the potential for micro-economic reform. The Commission delivered its final report to the Commonwealth Treasurer on 2 July 1998

3. In 1998, on average A$ 1 = US$ 0.63.

in which it identified work arrangements in black coal mining, transport infrastructure and government regulation as key issues for the industry. The Government is currently formulating its response. The Government announced its full support for the Commission's recommendations and is seeking to implement these in co-operation with the state governments of Queensland and New South Wales.

Electricity

In 1997, electricity generation increased by 3% to 182.6 TWh.

The National Electricity Market (NEM) is being introduced progressively with the aim of achieving full competition by 2002 when all customers are expected to be able to choose their suppliers. The latest stage of the NEM commenced on 13 December 1998 in the States of New South Wales, Victoria, South Australia and the Australian Capital Territory. The same system was concurrently implemented in Queensland. Queensland will not physically join the NEM until the interconnection with NSW is completed in 2001. Tasmania is expected to join the NEM in 2002 following construction of an interconnection with Victoria.

The Australian Competition and Consumer Commission authorised market arrangements in the National Electricity Code in July 1998 and accepted the network access arrangements in September 1998. This action was critical to the implementation of the NEM. In addition, the National Electricity Market Management Company (NEMMCO) took responsibility for the operation of the market and the National Electricity Code Administrator (NECA) for the administration of the market, following the proclamation of the National Electricity Market Legislation and associated regulations in December 1998.

Other reforms include the following:

- NECA is reviewing the network pricing arrangements in the National Electricity Code and issued a draft report recommending changes to the recovery of new network investment costs. A final report is expected to be published by 30 June 1999.

- Since 1 July 1998, customers with electricity consumption greater than 160 MWh per annum can choose their suppliers in Victoria, New South Wales and the ACT. Customers consuming 750 MWh per annum were already contestable. Around 50% of consumption is now under competition in these states and the ACT.

- Tasmania has desegregated the vertically integrated Hydro-Electric Corporation (HEC) into three companies: the HEC continues to be responsible for generation and system control; Transend Networks will provide transmission services; and Aurora Energy will provide distribution and retail services.

- Victoria sold its last government-owned generation company in 1999.

- In July 1999, the six regional distribution companies in Queensland are to be merged into one corporation called Ergon Energy.

- The South Australian government has announced its intention to proceed with long-term leasing arrangements for its electricity supply industry assets, in lieu of their sale.

GREENHOUSE GAS EMISSIONS

A revised National Greenhouse Strategy (NGS) was released in November 1998[4]. It included the substantial package of measures announced by the Prime Minister in November 1997, which form the core of new measures in the NGS, and are complemented by a range of state-based measures. The National Greenhouse Strategy will build on the range of effective greenhouse abatement measures that Australia already has in place: for example, the expanded Greenhouse Challenge industry agreements programme, the introduction of a national energy market to facilitate the wider use of low emission energy supplies, the refocused national energy end-use efficiency programme to achieve more cost-effective and greenhouse-friendly outcomes, and an increase of 2% in electricity from renewables.

4. For detailed information on the Greenhouse Strategy of November 1997, see the Chapter on Australia in *Energy Policies of IEA Countries, 1998 Review*, IEA/OECD Paris, 1998.

AUSTRALIA

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**68.0**	**157.2**	**189.5**	**199.2**	**227.4**	**260.2**	**273.1**
Coal[1]		40.3	106.3	129.9	139.0	153.4	167.9	183.0
Oil		19.8	28.5	27.5	27.9	34.8	28.1	22.4
Gas		3.4	17.1	25.6	25.6	32.7	57.4	60.6
Comb. Renewables & Wastes[2]		3.5	4.0	5.0	5.2	4.9	5.2	5.5
Nuclear		–	–	–	–	–	–	–
Hydro		1.0	1.2	1.3	1.4	1.5	1.5	1.5
Geothermal		–	..	–	–	–	–	–
Solar/Wind/Other[3]		–	0.1	0.1	0.1	0.1	0.1	0.1
TOTAL NET IMPORTS[4]		**–10.3**	**–65.5**	**–89.4**	**–95.7**	**–116.0**	**–135.9**	**–140.0**
Coal[1]	Exports	17.6	67.7	89.9	94.8	111.1	124.7	138.0
	Imports	–	–	–	–	–	–	–
	Net Imports	–17.6	–67.7	–89.9	–94.8	–111.1	–124.7	–138.0
Oil	Exports	3.4	9.2	13.3	16.0	19.7	16.8	13.6
	Imports	12.5	14.3	23.5	24.5	24.5	31.5	37.6
	Bunkers	1.8	0.6	0.9	0.8	0.8	0.8	0.8
	Net Imports	7.4	4.5	9.4	7.7	4.0	13.9	23.2
Gas	Exports	–	2.3	8.8	8.6	8.9	25.1	25.1
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–2.3	–8.8	–8.6	–8.9	–25.1	–25.1
Electricity	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
TOTAL STOCK CHANGES		**–0.1**	**–4.5**	**1.0**	**–1.9**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**57.6**	**87.2**	**101.1**	**101.6**	**111.4**	**124.2**	**133.1**
Coal[1]		22.6	35.0	40.7	42.3	42.3	43.2	45.0
Oil		27.1	32.1	37.2	35.6	38.8	42.0	45.5
Gas		3.4	14.8	16.8	16.9	23.9	32.2	35.4
Comb. Renewables & Wastes[2]		3.5	4.0	5.0	5.2	4.9	5.2	5.5
Nuclear		–	–	–	–	–	–	–
Hydro		1.0	1.2	1.3	1.4	1.5	1.5	1.5
Geothermal		–	..	–	–	–	–	–
Solar/Wind/Other[3]		–	0.1	0.1	0.1	0.1	0.1	0.1
Electricity Trade[5]		–	–	–	–	–	–	–
Shares (%)								
Coal		*39.2*	*40.1*	*40.3*	*41.7*	*37.9*	*34.8*	*33.8*
Oil		*47.1*	*36.9*	*36.7*	*35.0*	*34.8*	*33.8*	*34.2*
Gas		*5.9*	*17.0*	*16.6*	*16.6*	*21.4*	*26.0*	*26.6*
Comb. Renewables & Wastes		*6.1*	*4.5*	*5.0*	*5.2*	*4.4*	*4.1*	*4.1*
Nuclear		–	–	–	–	–	–	–
Hydro		*1.7*	*1.4*	*1.3*	*1.4*	*1.3*	*1.2*	*1.2*
Geothermal		–	..	–	–	–	–	–
Solar/Wind/Other		–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Electricity Trade		–	–	–	–	–	–	–

0 is negligible. – is nil. .. is not available.

Please note: All data except GDP and population refer to the fiscal year July to June. All forecast data are based on the 1997 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**40.0**	**58.1**	**66.3**	**67.6**	**73.0**	**80.8**	**87.9**
Coal[1]	4.9	4.3	4.2	4.2	4.5	4.5	4.5
Oil	24.7	30.5	34.7	35.2	35.5	38.3	41.7
Gas	2.4	8.8	10.2	10.4	13.7	17.3	19.8
Comb. Renewables & Wastes[2]	3.5	3.3	4.2	4.4	4.5	4.6	4.7
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.1	0.1	0.1	0.1	0.1	0.1
Electricity	4.5	11.1	12.8	13.2	14.6	16.1	17.1
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*12.3*	*7.4*	*6.4*	*6.3*	*6.2*	*5.5*	*5.2*
Oil	*61.7*	*52.6*	*52.4*	*52.1*	*48.7*	*47.4*	*47.5*
Gas	*5.9*	*15.2*	*15.5*	*15.4*	*18.8*	*21.4*	*22.5*
Comb. Renewables & Wastes	*8.7*	*5.6*	*6.4*	*6.5*	*6.2*	*5.7*	*5.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Electricity	*11.3*	*19.1*	*19.3*	*19.6*	*20.0*	*19.9*	*19.4*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**17.6**	**23.1**	**25.8**	**26.2**	**29.7**	**32.9**	**35.8**
Coal[1]	4.6	4.1	4.1	4.1	4.3	4.3	4.3
Oil	7.7	6.3	7.1	7.0	6.1	6.0	6.4
Gas	1.8	6.1	6.7	6.8	9.9	12.5	14.3
Comb. Renewables & Wastes[2]	1.5	1.5	2.3	2.5	2.7	2.9	3.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	2.0	5.1	5.6	5.8	6.7	7.3	7.7
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*26.4*	*17.6*	*15.7*	*15.6*	*14.6*	*13.0*	*12.1*
Oil	*43.8*	*27.4*	*27.5*	*26.9*	*20.5*	*18.2*	*17.8*
Gas	*10.0*	*26.5*	*25.8*	*25.8*	*33.2*	*38.0*	*40.0*
Comb. Renewables & Wastes	*8.5*	*6.4*	*9.1*	*9.6*	*9.0*	*8.8*	*8.7*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.3*	*22.0*	*21.9*	*22.2*	*22.6*	*22.1*	*21.4*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**13.5**	**22.7**	**26.2**	**26.7**	**27.9**	**31.0**	**34.1**
TOTAL OTHER SECTORS[8]	**8.9**	**12.3**	**14.3**	**14.7**	**15.4**	**16.9**	**18.0**
Coal[1]	0.3	0.1	0.1	0.1	0.1	0.1	0.1
Oil	3.5	1.8	1.9	2.0	2.0	2.1	2.3
Gas	0.6	2.7	3.4	3.4	3.7	4.3	4.8
Comb. Renewables & Wastes[2]	2.0	1.8	1.9	1.9	1.8	1.7	1.6
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.1	0.1	0.1	0.1	0.1	0.1
Electricity	2.5	5.9	7.0	7.3	7.7	8.6	9.1
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*3.2*	*1.1*	*0.5*	*0.5*	*0.5*	*0.5*	*0.4*
Oil	*39.7*	*14.2*	*13.3*	*13.3*	*12.8*	*12.6*	*12.9*
Gas	*7.0*	*21.8*	*23.7*	*23.4*	*24.0*	*25.4*	*26.4*
Comb. Renewables & Wastes	*22.5*	*14.4*	*13.1*	*12.9*	*11.9*	*10.2*	*8.9*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.7*	*0.6*	*0.6*	*0.6*	*0.6*	*0.6*
Electricity	*27.7*	*47.7*	*48.8*	*49.4*	*50.2*	*50.7*	*50.8*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**16.0**	**35.1**	**40.2**	**41.4**	**44.5**	**48.3**	**50.8**
OUTPUT (Mtoe)	**5.5**	**13.3**	**15.2**	**15.7**	**17.4**	**19.2**	**20.4**
(TWh gross)	64.4	154.3	177.2	182.6	201.9	222.7	236.8
Output Shares (%)							
Coal	*74.9*	*77.1*	*79.1*	*80.1*	*77.6*	*73.7*	*72.9*
Oil	*2.6*	*2.7*	*1.7*	*1.3*	*1.4*	*1.8*	*1.7*
Gas	*4.3*	*10.6*	*8.6*	*7.6*	*11.7*	*15.7*	*16.7*
Comb. Renewables & Wastes	*0.5*	*0.4*	*1.8*	*1.8*	*0.8*	*0.9*	*1.3*
Nuclear	–	–	–	–	–	–	–
Hydro	*17.7*	*9.2*	*8.8*	*9.2*	*8.5*	*7.9*	*7.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.0*	*0.0*	..	..	..
TOTAL LOSSES	**17.8**	**29.0**	**33.4**	**35.1**	**38.4**	**43.4**	**45.2**
of which:							
Electricity and Heat Generation[10]	10.5	21.7	25.0	25.7	27.1	29.1	30.4
Other Transformation	5.5	0.3	0.3	1.3	2.7	2.9	3.0
Own Use and Losses[11]	1.7	7.0	8.1	8.1	8.7	11.4	11.7
Statistical Differences	**–0.1**	**0.1**	**1.4**	**–1.0**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	179.64	295.61	354.33	364.10	400.18	475.29	564.49
Population (millions)	13.51	17.07	18.31	18.53	19.10	20.00	20.90
TPES/GDP[12]	0.32	0.29	0.29	0.28	0.28	0.26	0.24
Energy Production/TPES	1.18	1.80	1.87	1.96	2.04	2.09	2.05
Per Capita TPES[13]	4.27	5.11	5.52	5.48	5.83	6.21	6.37
Oil Supply/GDP[12]	0.15	0.11	0.10	0.10	0.10	0.09	0.08
TFC/GDP[12]	0.22	0.20	0.19	0.19	0.18	0.17	0.16
Per Capita TFC[13]	2.96	3.40	3.62	3.65	3.82	4.04	4.21
Energy-related CO_2 Emissions (Mt CO_2)[14]	175.6	263.0	303.8	306.1	330.2	362.2	386.5
CO_2 Emissions from Bunkers (Mt CO_2)	5.7	2.0	2.7	2.5	2.5	2.6	2.6

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	3.0	2.2	2.5	0.5	3.1	2.2	1.4
Coal	1.5	3.2	2.6	4.0	–0.1	0.5	0.8
Oil	2.9	–0.0	2.4	–4.2	2.9	1.6	1.6
Gas	12.7	7.1	2.2	0.6	12.2	6.2	1.9
Comb. Renewables & Wastes	0.1	1.0	4.0	4.3	–2.1	1.0	1.3
Nuclear	–	–	–	–	–	–	–
Hydro	5.1	–0.7	1.6	7.2	0.9	0.5	0.3
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	17.3	1.2	3.4	–	2.1	1.9
TFC	2.5	2.1	2.2	1.9	2.6	2.0	1.7
Electricity Consumption	6.3	5.0	2.4	3.3	3.4	1.9	1.2
Energy Production	3.9	5.7	3.2	5.1	4.5	2.7	1.0
Net Oil Imports	4.2	–6.6	13.1	–17.5	–19.6	28.2	10.8
GDP	2.8	3.1	3.1	2.8	3.2	3.5	3.5
Growth in the TPES/GDP Ratio	0.2	–0.9	–0.5	–2.2	–0.1	–1.3	–2.0
Growth in the TFC/GDP Ratio	–0.3	–1.0	–0.8	–0.8	–0.6	–1.4	–1.7

Please note: Rounding may cause totals to differ from the sum of the elements.

BELGIUM

ENERGY DEMAND

Belgium's primary energy supply in 1997 increased by 1.2% from its 1996 level, to 57.1 million tonnes of oil equivalent, with solid fuel demand decreasing by 2.3%, oil demand increasing by 2.1%, nuclear energy growing by 9.4%, and gas consumption decreasing by 4.2%. The main elements driving these evolutions are:

- reduced demand for coal from power plants;
- increased demand for oil products in transport and industry, especially for non-energy use;
- higher availability of nuclear power plants, now at 90.7%; and
- lower gas demand from the residential sector explained by favourable climate conditions (a 15.7% reduction in the number of degree-days from 1996).

Growth in energy demand remained below GDP growth (2.9% in 1997). Dependency on energy imports for overall supply went down from 78.9% in 1996 to 76.7% in 1997, mostly because of the increased contribution of nuclear power to total primary energy supply.

ELECTRICITY

Electricity demand grew by 3.8% to 78.1 TWh between 1996 and 1997. Nuclear contributed to 60.1% of total output; thermal plants, 38.3% (coal: 18.6%, natural gas: 18.1%, and oil: 1.6%), and renewables, including hydro, 1.6%.

Final electricity demand grew by 2.8% in 1997, with industry and services accounting for most of the growth. Increases were noted in industrial sectors such as steel-making, chemicals, paper and pulp, and food products. The residential sector reduced its demand for electricity by 1.3%, again thanks to favourable climate conditions, but also to improved efficiency in appliances.

Electricity trade grew by 10.6%, to 16.7 TWh in 1997. This represents 21% of the country's total electricity output for 1997.

On 8 October 1998, the Belgian Government approved the transposition of the EU Directive on Electricity (96/92/EC) into Belgian Law, which became effective on 29 April 1999. The principle guidelines of the law include:

- 65% of the Belgian electricity market will be open by 31 December 2006, when all final consumers directly connected to the transmission grid become eligible,

regardless of their consumption level. The proposal stipulates that the Belgian market should be entirely liberalised by 2010 at the latest.

- Specific pricing will be established for small and medium enterprises which are not eligible, to bring them in line with neighbouring countries.

- Regulated third party access (TPA) will be introduced, completed by negotiated TPA for transits and high volume transmissions.

- Each transmission company will need to identify a system operator, subject to a series of conditions to be further elaborated in a regulation (*arrêté royal*), to guarantee its independence, to avoid conflict and to protect confidential commercial information.

- The new law creates a "Commission de régulation de l'électricité" (Commission for electricity regulation), in charge of regulations pertaining to the liberalised part of the sector.[1] The Commission has a governing board and a general council. It is composed of four directorates: market dispute; technical market operations; prices and accounts monitoring; and an administrative directorate. The law also contains a set of rules aimed at assuring the independence of the Commission. During the period preceding full market liberalisation, the Commission will coexist with the "Comité de contrôle de l'électricité et du gaz" (control committee for electricity and gas), which remains in charge of the regulated part of the sector.

NATURAL GAS

The UK-Continental Interconnector gas pipeline has been fully operational since 14 October 1998. The 255 km undersea pipeline can carry up to 20 billion cubic metres (bcm) per year between Bacton and Zeebrugge. Initially, most of the gas will flow from the United Kingdom to the continent, but 9 bcm per year will flow in the other direction. Distrigaz, the Belgian gas company, as a shareholder of the Interconnector, is entitled to a fixed amount of gas. New short-term contracts will be concluded with other suppliers to cover peak demand. The operation of the Interconnector is likely to have consequences for the pattern of gas supply in Belgium.

The gas network has been strengthened between Zeebrugge, Eynatten (Germany) and Zelzate (the Netherlands).

OIL

New measures have been implemented to meet the 90-day stock commitment under the International Energy Programme of the IEA: companies must hold stocks for jet fuel, and more on-site inspections have been planned.

1. Its role has also been extended by the law on gas markets, also passed on 29 April 1999.

NUCLEAR

Nuclear energy supplied 60.1% of the country's total electricity production, 3% higher than its 1996 share, and reaching a record level of 45.1 TWh. No major refurbishment and no need for refuelling at units 1 and 3 of Tihange explain the high availability of nuclear plants in 1999 (90.2%).

The Government has taken a number of decisions based on the report by Ondraf/Niras[2] (published in June 1997) which looked into the options for long-term management of short-lived low-level nuclear waste:

- the option of long-term storage has been given up;
- technical and economic choices must be made between deep geological disposal and near-surface disposal;
- Ondraf/Niras has been given the following instructions and missions: to limit its prospecting to the existing nuclear zones and to sites where interest is shown by local authorities; to improve understanding of near-surface disposal issues, from the viewpoint of reversibility and monitoring; to finalise feasibility and cost studies of deep geological disposal of low radioactivity waste; and to develop consultation and management structures to integrate disposal projects at the local level.

Ondraf/Niras elaborated a three-year programme (1998-2001) that should enable the Government to take a decision on deep and/or near-surface disposal facilities in 2001. Projects should be integrated with the broader economic development of identified regions, through co-management with local authorities.

Ondraf/Niras, together with the Belgian State and the most important waste producers have agreed on a new programme about the geological disposal of high-level, medium-level and long-lived waste and its financing, for the period 1998-2003. The programme includes:

- drafting of a safety and feasibility report, reviewing the last 10 years of R&D efforts, to be submitted to an *ad-hoc* national scientific committee as well as to international review by the Nuclear Energy Agency; and
- preparing the Praclay project, the purpose of which is to test and demonstrate the technical feasibility of the geological disposal of vitrified high-level waste from reprocessing plants.

Ondraf/Niras must elaborate an inventory of all nuclear installations and sites containing radioactive material, including an evaluation of dismantling and cleaning-up costs, and an assessment of whether sufficient provisions have been collected to cover these costs.

2. Organisme National des Déchets Radioactifs et des Matières Fissiles Enrichies / Nationale Instelling voor Radioactief Afval en Verrijkte Splijststoffen.

RESEARCH AND DEVELOPMENT

Total Belgian RD&D budget amounts to BF 2 200.5 million of which 1 511.4 million is spent on nuclear fission and fusion (federal competence). In Wallonia, RD&D expenditures on energy technology represent an important share of total energy policy expenditures (BF 332.7 million out of 648.5, in 1997). RD&D on fossil fuels is rapidly growing. Financial support to renewable energy sources has not grown significantly. Favoured options include: biomass and waste, climate-oriented architecture and passive solar, thermal solar and small hydro plants. In the Flemish region, energy RD&D is financed through VLIET and VLIETbis (Flemish programme to boost energy technology). Priority areas are energy conservation in the industrial, residential and transport sectors and demonstration in the field of photovoltaics. Annually, VITO, the Flemish Institute for Technological Research, receives some BF 300 million for energy-related projects. The moderate RD&D budget of the Brussels region is entirely spent on energy efficiency projects.

RENEWABLES

Starting 1 July 1998, the Control Committee for Electricity and Gas has doubled its support to renewable electricity, to BF 2 per kWh, for hydro and wind plants with a maximum 10 MW capacity per site. Conditions for connection to the grid have been improved, including for small photovoltaics installations with a capacity of more than 3 kW.

On 4 December 1998, the Federal Government approved the inclusion of a paragraph on offshore wind farms in the law proposal for the transposition of the European Directive on the liberalisation of the electricity market (see Electricity, above). The paragraph will create a legal framework for the development of offshore wind turbines in the North Sea. The conditions and procedure for granting the construction permits are to be defined by ministerial decree.

Flanders

In the Flemish Plan for Sustainable Energy, the following targets have been set for the share of renewable energy in total energy supply:

- doubling of current level by 2000 (about 2%);
- 2012: 3%;
- 2020: 5%.

The budget for the photovoltaics programme will be almost doubled between 1998 and 1999, to BF 20 million. A subsidy is given to the installation of photovoltaic panels on rooftops and to the application of solar boilers for hot water production

and heating. A good practice code for solar boilers will be circulated and could be made a legal standard. A wind plan for Flanders will be elaborated to identify concrete rules for siting and installation of wind turbines.

Wallonia

The target of a 3 to 4% penetration of renewable energy sources in total primary supply by 2010 is unlikely to be reached without additional regulatory and financial support. Wallonia has suspended its activity on biofuels for cost, land-use as well as environmental reasons.

ENERGY CONSERVATION

In March 1998, Enover/Concere[3], the concertation group between the Federal Government and the regional authorities, agreed upon a next phase towards the introduction of a system of energy certification of buildings. The new phase, which should last one year, aims at the practical application of the chosen methodology to some 15 dwellings.

Flanders

As of September 1997, VIREG[4] has been fully operational. This body constitutes a concertation platform between the Flemish Government, the energy production and distribution companies, and the industrial and residential energy users. VIREG has elaborated a plan to reduce electricity demand by 3.1 TWh from a business-as-usual scenario over the 1996-2005 period. Strategic actions for energy efficiency investments in government buildings, schools, hospitals and horticulture sector are included in the plan. In September 1998, VIREG and the Flemish Government organised the "Month of Rational Use of Energy", with seminars, workshops and a media campaign for end users.

In the context of the thermal insulation standard, 30 residential buildings are checked every month for compliance. Insulation regulations will be restructured soon, with the introduction of an energy performance standard.

Five energy consultants have been hired to provide advice on the rational use of energy to industry.

In 1997, a Flemish body for the promotion of combined heat and power (CHP), Belcogen, was established. It is supported 50% by the Flemish Government and 50% by the private sector (Distrigaz and Electrabel, mostly). An action plan has

3. Energy and Environmental Technology Information Centres.
4. Formal body for discussions on all energy matters between the central government and the three regions (Concertation État-Régions / Energie-Overleg).

been elaborated between VIREG and Distrigaz to encourage energy savings. Distrigaz has made available BF 400 million over a five-year period for the financing of CHP projects.

Wallonia

In fall 1998, a new body, Cogensud, was created to promote CHP. Its task is to promote interaction between all actors in the field of CHP (energy users, equipment suppliers, electricity producers and distributors) and to stimulate actions towards potential CHP users. A seminar on CHP was organised in September 1998.

ENERGY AND ENVIRONMENT

In spite of a 1.6% reduction between 1996 and 1997, Belgium's CO_2 emissions remain 12.4% higher than their 1990 level.

Under the burden-sharing agreement of the European Council of Environment Ministers in June 1998, following the Kyoto Protocol of the United Framework Convention on Climate Change, Belgium is committed to reduce its total emissions of CO_2, CH_4, N_2O, PFCs, HFCs, and SF_6, expressed in CO_2 equivalent, by 7.5% from 1990 levels between 2008 and 2012. The Government will elaborate a new action plan to this aim before the end of 1999. Actions should focus on energy conservation, combined heat and power and renewable energy.

The Federal Secretary for the Environment has requested the elaboration and analysis of different policy scenarios to meet the Kyoto target. Emphasis should be on domestic measures which can be taken unilaterally. The Federal Ministry of Economic Affairs has issued a study on additional measures in the field of energy production and energy tariffs. Flanders is currently examining the reduction potential and possible measures in the field of energy efficiency, transportation and renewable energy sources.

The Federal Council for Sustainable Development issued its first advice to the Belgian authorities on further implementation of the Kyoto Protocol, including:

- re-enforcement of the political will of Belgian authorities;
- organisation of a parliamentary debate on the integration of climate policies with other goals;
- rapid ratification of the Protocol;
- efforts to focus on the domestic level, with further examination of international flexibility mechanisms; and
- specific actions in the energy, transport and residential sectors.

BELGIUM

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**6.5**	**12.8**	**12.1**	**13.2**	**12.7**	**12.5**	**12.9**
Coal[1]		6.4	1.2	0.2	0.2	0.2	–	–
Oil		–	–	–	–	–	–	–
Gas		0.0	0.0	0.0	–	–	–	–
Comb. Renewables & Wastes[2]		0.0	0.4	0.6	0.5	0.2	0.2	0.6
Nuclear		0.0	11.1	11.3	12.4	12.3	12.3	12.3
Hydro		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	0.0	0.0	0.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL NET IMPORTS[4]		**39.8**	**35.5**	**44.5**	**43.8**	**40.7**	**41.9**	**44.4**
Coal[1]	Exports	0.8	1.1	1.1	1.3	1.0	0.9	0.9
	Imports	5.3	10.3	9.6	9.4	8.7	8.6	8.6
	Net Imports	4.6	9.2	8.5	8.2	7.8	7.7	7.7
Oil	Exports	15.1	19.2	20.9	20.8	15.4	16.0	16.4
	Imports	46.4	41.7	49.2	50.0	40.4	41.8	42.9
	Bunkers	3.1	4.1	4.5	5.1	4.0	4.0	4.0
	Net Imports	28.2	18.4	23.8	24.0	21.0	21.8	22.5
Gas	Exports	–	–	–	–	–	–	–
	Imports	7.1	8.2	11.9	11.3	12.0	12.4	14.2
	Net Imports	7.1	8.2	11.9	11.3	12.0	12.4	14.2
Electricity	Exports	0.2	0.7	0.5	0.6	..	..	..
	Imports	0.1	0.4	0.8	0.9	..	..	..
	Net Imports	–0.1	–0.3	0.4	0.3	–	–	–
TOTAL STOCK CHANGES		**–0.0**	**0.1**	**–0.3**	**0.2**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**46.3**	**48.4**	**56.4**	**57.1**	**53.4**	**54.4**	**57.3**
Coal[1]		11.2	10.2	8.7	8.5	8.0	7.7	7.7
Oil		28.0	18.7	23.7	24.2	21.0	21.8	22.5
Gas		7.1	8.2	11.8	11.3	12.0	12.4	14.2
Comb. Renewables & Wastes[2]		0.0	0.4	0.6	0.5	0.2	0.2	0.6
Nuclear		0.0	11.1	11.3	12.4	12.3	12.3	12.3
Hydro		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	0.0	0.0	0.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.0	0.0	0.0
Electricity Trade[5]		–0.1	–0.3	0.4	0.3	–	–	–
Shares (%)								
Coal		*24.1*	*21.1*	*15.4*	*14.8*	*14.9*	*14.2*	*13.4*
Oil		*60.5*	*38.7*	*42.0*	*42.3*	*39.3*	*40.1*	*39.3*
Gas		*15.4*	*16.9*	*20.9*	*19.7*	*22.5*	*22.8*	*24.7*
Comb. Renewables & Wastes		*–*	*0.9*	*1.0*	*1.0*	*0.3*	*0.3*	*1.0*
Nuclear		*–*	*23.0*	*20.0*	*21.6*	*23.0*	*22.6*	*21.4*
Hydro		*–*	*–*	*–*	*–*	*0.1*	*0.1*	*0.1*
Geothermal		*–*	*–*	*–*	*–*	*..*	*..*	*..*
Solar/Wind/Other		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Electricity Trade		*–0.1*	*–0.7*	*0.6*	*0.5*	*–*	*–*	*–*

0 is negligible. – is nil. .. is not available.

Please note: All forecast data are based on the 1996 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**35.6**	**32.9**	**40.2**	**40.4**	**38.3**	**39.5**	**41.0**
Coal[1]	5.7	3.4	2.6	2.7	3.6	3.7	3.7
Oil	21.0	17.3	21.6	22.1	19.5	20.1	20.8
Gas	4.6	6.8	9.6	9.0	9.0	8.8	9.0
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.2	..	..	..
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	2.9	5.0	6.0	6.2	5.7	6.0	6.4
Heat	0.3	0.2	0.3	0.3	0.5	0.9	1.1
Shares (%)							
Coal	*16.5*	*10.2*	*6.4*	*6.6*	*9.4*	*9.4*	*9.0*
Oil	*60.7*	*52.6*	*53.8*	*54.8*	*50.9*	*50.8*	*50.7*
Gas	*13.3*	*20.7*	*23.8*	*22.2*	*23.5*	*22.3*	*22.0*
Comb. Renewables & Wastes	–	*0.6*	*0.5*	*0.5*	..	..	..
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.5*	*15.1*	*14.9*	*15.3*	*14.8*	*15.1*	*15.7*
Heat	*0.9*	*0.7*	*0.6*	*0.7*	*1.4*	*2.3*	*2.6*
TOTAL INDUSTRY[6]	**16.8**	**13.4**	**15.2**	**16.2**	**15.3**	**15.7**	**16.1**
Coal[1]	3.5	2.9	2.2	2.4	3.3	3.4	3.4
Oil	7.9	4.3	5.5	6.1	4.2	4.1	4.1
Gas	3.2	3.3	4.3	4.3	4.2	3.9	3.9
Comb. Renewables & Wastes[2]	–	0.0	0.0	0.0	..	..	..
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.9	2.6	3.0	3.1	3.2	3.4	3.7
Heat	0.3	0.2	0.2	0.2	0.5	0.8	0.9
Shares (%)							
Coal	*21.1*	*21.7*	*14.5*	*14.6*	*21.4*	*21.8*	*21.3*
Oil	*46.8*	*32.4*	*36.2*	*37.9*	*27.3*	*26.4*	*25.6*
Gas	*18.7*	*24.7*	*28.3*	*26.6*	*27.2*	*25.1*	*24.5*
Comb. Renewables & Wastes	–	*0.1*	*0.1*	*0.1*	..	..	..
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.5*	*19.7*	*19.5*	*19.4*	*21.1*	*21.8*	*23.0*
Heat	*1.9*	*1.4*	*1.4*	*1.5*	*3.0*	*4.8*	*5.5*
TRANSPORT[7]	**5.0**	**7.9**	**9.1**	**9.4**	**9.0**	**9.4**	**9.7**
TOTAL OTHER SECTORS[8]	**12.7**	**11.7**	**15.9**	**14.8**	**13.9**	**14.4**	**15.2**
Coal[1]	2.2	0.5	0.4	0.3	0.3	0.3	0.3
Oil	8.1	5.2	7.1	6.7	6.4	6.6	7.2
Gas	1.5	3.5	5.3	4.7	4.8	4.9	5.1
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.2	..	..	..
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.9	2.3	2.9	2.9	2.3	2.4	2.6
Heat	–	0.0	0.0	0.0	0.1	0.2	0.2
Shares (%)							
Coal	*17.0*	*4.1*	*2.3*	*2.1*	*2.3*	*2.1*	*1.6*
Oil	*64.2*	*44.6*	*44.8*	*45.2*	*46.0*	*46.1*	*47.0*
Gas	*11.4*	*30.1*	*33.1*	*31.4*	*34.7*	*34.0*	*33.2*
Comb. Renewables & Wastes	–	*1.6*	*1.1*	*1.3*	..	..	..
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.4*	*19.3*	*18.5*	*19.8*	*16.4*	*16.7*	*16.9*
Heat	–	*0.3*	*0.2*	*0.2*	*0.6*	*1.2*	*1.2*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**10.0**	**17.5**	**18.4**	**19.1**	**19.5**	**20.0**	**22.0**
OUTPUT (Mtoe)	**3.5**	**6.0**	**6.5**	**6.7**	**6.4**	**6.7**	**7.3**
(TWh gross)	40.6	70.2	75.2	78.1	74.6	78.3	84.9
Output Shares (%)							
Coal	*21.7*	*28.3*	*24.2*	*20.9*	*9.8*	*11.5*	*8.7*
Oil	*53.7*	*1.9*	*1.7*	*1.8*	*1.1*	*2.3*	*2.3*
Gas	*23.7*	*7.7*	*14.6*	*14.8*	*24.5*	*24.7*	*29.6*
Comb. Renewables & Wastes	*0.3*	*0.9*	*1.5*	*1.4*	*1.0*	*1.0*	*3.5*
Nuclear	*0.2*	*60.8*	*57.6*	*60.7*	*63.1*	*60.1*	*55.5*
Hydro	*0.4*	*0.4*	*0.3*	*0.4*	*0.5*	*0.4*	*0.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
TOTAL LOSSES	**11.8**	**16.0**	**16.2**	**16.4**	**15.1**	**14.9**	**16.3**
of which:							
Electricity and Heat Generation[10]	6.2	11.3	11.6	12.1	12.6	12.3	13.6
Other Transformation	4.2	2.1	1.7	1.6	1.3	1.3	1.3
Own Use and Losses[11]	1.4	2.7	2.9	2.8	1.3	1.3	1.5
Statistical Differences	**–0.1**	**–0.5**	**0.0**	**0.3**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	135.59	196.13	211.89	218.25	233.66	261.80	293.32
Population (millions)	9.74	9.96	10.16	10.18	10.00	10.00	10.00
TPES/GDP[12]	0.34	0.25	0.27	0.26	0.23	0.21	0.20
Energy Production/TPES	0.14	0.26	0.22	0.23	0.24	0.23	0.23
Per Capita TPES[13]	4.76	4.86	5.55	5.61	5.34	5.44	5.73
Oil Supply/GDP[12]	0.21	0.10	0.11	0.11	0.09	0.08	0.08
TFC/GDP[12]	0.25	0.17	0.19	0.19	0.16	0.15	0.14
Per Capita TFC[13]	3.55	3.30	3.96	3.97	3.83	3.95	4.10
Energy-related CO_2 Emissions (Mt CO_2)[14]	138.5	109.1	124.6	122.6	111.5	113.7	119.7
CO_2 Emissions from Bunkers (Mt CO_2)	9.7	13.1	14.4	16.2	12.6	12.6	12.6

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	0.7	0.0	2.6	1.3	–2.2	0.4	1.0
Coal	–1.0	–0.3	–2.7	–2.3	–2.1	–0.6	–
Oil	–1.5	–2.8	4.0	2.1	–4.6	0.8	0.6
Gas	4.5	–1.2	6.3	–4.7	2.1	0.6	2.7
Comb. Renewables & Wastes	41.7	17.8	4.0	–2.0	–35.1	–	31.5
Nuclear	130.2	12.8	0.2	9.4	–0.2	–	–
Hydro	4.9	1.3	–1.5	23.8	4.9	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–20.6	–	–
TFC	0.3	–0.6	3.4	0.5	–1.8	0.6	0.7
Electricity Consumption	4.2	2.6	3.2	2.8	–2.9	1.1	1.5
Energy Production	2.4	5.0	–0.9	8.5	–1.3	–0.3	0.7
Net Oil Imports	–0.8	–3.4	4.4	1.0	–4.4	0.8	0.6
GDP	2.4	2.1	1.3	3.0	2.3	2.3	2.3
Growth in the TPES/GDP Ratio	–1.6	–2.1	1.3	–1.7	–4.4	–1.9	–1.2
Growth in the TFC/GDP Ratio	–2.0	–2.7	2.1	–2.4	–4.0	–1.6	–1.5

Please note: Rounding may cause totals to differ from the sum of the elements.

NEW ZEALAND

ELECTRICITY

In 1998, the Government announced a comprehensive reform programme intended to increase competition and efficiency in the power industry. An important feature of this reform was the split of the Electricity Corporation of New Zealand (ECNZ) into three competing generators. Also, with the introduction of the Electricity Industry Reform Act 1998, the Government forced major structural changes on the electricity distribution and retail industry.

Earlier, in 1996, the state-owned generator ECNZ was split into two separate state-owned companies. ECNZ retained the majority of the generation capacity (mostly hydro, but also some thermal) and the corporate name, and another, smaller company (Contact Energy) was formed to manage the thermal and geothermal generation, and the Clyde and Roxborough hydro stations. The residual ECNZ generated some 70% of all electricity sold in New Zealand, Contact Energy generated about 25%, and 5% came from private sector generators, overall resulting in lower wholesale prices for electricity.

Despite the 1996 split and a construction cap, ECNZ remained dominant both in the contracts market and the spot market. This dominance was expected to remain unless further action was taken. Thus, the Government decided in April 1998 to split ECNZ into three smaller state-owned competitors. The four state-owned generators will still represent the bulk of New Zealand's generation capacity. The three new companies formed from ECNZ will remain in public ownership. The Government expects this move to result in lower wholesale prices and to lead to a better balance between supply and demand in the generation market.

In September 1998, the Government announced its decision to privatise the state-owned generator Contact Energy, and it began scoping the sale of the company. The company was sold in early 1999. A block of shares (40%) went to Mission Edison Ltd. The remaining shares were floated on the sharemarket to smaller investors.

The Electricity Industry Reform Act 1998 focuses on the distribution and supply market. The Government had concerns regarding the performance of the roughly 40 electricity distributors and retailers in the country for a number of years. There were fears that the benefits of the generation market reforms might not be passed on to consumers, because of low competitive pressure on costs and prices in distribution and retailing. Moreover, some of the retailers were maintaining local, often uneconomic generation plants, which did not come under competitive pressure. This created incentives to deter competition in retailing and generation using cross-subsidies from monopoly distribution. For these reasons, the Government decided to require corporate separation of distribution and supply activities by 1 April 1999, and complete ownership separation by 31 December 2003.

The core objective of these reforms was to increase competition in the generation and retail markets. Further objectives were to allow horizontal mergers between retail businesses, horizontal mergers among distribution businesses, and vertical integration between the competitive parts of the market, i.e. generation and retail supply.

Soon after the Act entered into effect, most of the local power companies began procedures to separate. In most cases, they sold their retailing businesses and kept their lines businesses. As anticipated, both ECNZ and Contact Energy have entered the retailing market. Transalta, a large distribution company owned by Canadian investors, sold its lines business and entered the supply market. The Government expects the adaptation and consolidation period in the industry to take until the end of 1999, resulting in four or five larger retailing companies and less than 12 retailers overall.

The Electricity Industry Reform Act contains provisions enabling the Government to mandate a system that allows consumers to take part in the competitive power market without having to buy an expensive meter. The power industry developed and had in place from April a "deemed profiling" (load profiling) system for smaller consumers. Deemed profiling involves estimating the consumption pattern of consumers rather than requiring them all to have time-of-use meters.

The economic regulation of the electricity industry relies on general legislation, in particular the Commerce Act. This Act contains provisions barring anti-competitive activities and provides for price control to be introduced in cases where competition is limited (such as with electricity line services). The Commerce Act provisions are supported by regulations requiring extensive public disclosure of information relating to the performance of line businesses. Another aspect of the reform has been to tighten these regulations in order to enhance the transparency of these businesses. These changes to the regulations were implemented in March 1999.

In February 1998, a major power outage occurred in Auckland's Central Business District. In some quarters, questions were raised about the ability of a fully competitive market to provide adequate security of energy supplies. The Government initiated a Ministerial Inquiry to investigate the issue; and this committee reported in July 1998. The report concluded that the outage was caused by the absence of adequate maintenance procedures for distribution equipment and an inadequate risk management plan by the concerned supplier, Mercury Energy. It was also established that the lack of appropriate management procedures dated back to before the market reforms, when the responsible supplier was the Auckland Electric Power Board. The problems were exacerbated, but not caused, by the fact that Mercury Energy was fully owned by a consumer trust. The Ministerial Inquiry issued a number of recommendations, which were quickly implemented by Mercury Energy, including adoption of a standard commercial constitution.

NATURAL GAS

In recognition of the strong natural monopoly characteristics of the gas pipeline business in New Zealand, the Government enacted wide-ranging Gas Information

Disclosure Requirements in August 1997. The regulations were intended to increase transparency and performance in the gas business. In 1998, gas companies had made their second annual public disclosures. There have been a number of gas price rises and a number of upward revaluations of gas pipeline assets, and the disclosures have shown a large amount of unexplained variability in the performance of different pipeline businesses. The Government will be reviewing the matters further.

A voluntary natural gas pipeline access code, setting out the framework for negotiating and contracting access to pipeline capacity, was issued in July 1998. This code was developed by an industry consultative body, Gas House, in a lengthy process. The code is now active, despite some outstanding issues between pipeline owners and gas users. Gas House claims it has contributed to the growth of competition in contestable gas markets. The industry is now developing a reconciliation code, including protocols for deemed profiling (similar to that introduced in the electricity industry to help consumers wishing to switch between retailers).

The electricity sector reforms have affected the gas business in New Zealand. Notably, they have led to the corporate integration of the pipeline business of Enerco, the main gas distributor, with the distribution network of South Power, the electricity distributor for Christchurch and environs in the South Island. In the same move, Enerco sold its residential gas retail business to electricity generators. Contact Energy has also acquired electricity retail businesses.

OIL

In 1997, consultants were engaged by the Ministry of Commerce to undertake an investigation into the openness of the downstream oil business in New Zealand. This study showed that there were no barriers to entry into this business.

Subsequently, Challenge! (a subsidiary of Fletcher Challenge Energy Ltd) entered the market, establishing storage facilities, a distribution network and eight retail sites in April 1998. Challenge! now has 49 North Island retail sites (17 company-owned service stations, 17 company-owned truck-stocks and 15 independent stations). Challenge! is targeting independent station owners for its South Island expansion, with two currently operating. Gull, an Australian-based company, entered the retail market in early 1999, and now has 6 service stations in the North Island.

In May 1998, the taxation system for transportation fuel was changed slightly. The National Roads Fund Tax on premium petrol, used for motorway construction and maintenance, was raised from 9.4 cents per litre[1] to 13.6 cents per litre, whereas the Consolidated Fund Tax was reduced from 20.8 cents to 18.7 cents per litre, resulting in an overall tax increase on petrol of 2.1 cents per litre.

1. On average in 1998, NZ$ 1 = US$ 0.534.

COAL

In 1998, the state-owned coal company, Solid Energy, was put up for sale. This was motivated by the company's strong capital expenditure requirement of over NZ$ 300 million over the following five years. However, coal export prices began to decline at the end of 1998, and this suppressed the bid price for Solid Energy. As it did not consider that the received bids reflected an adequate return on the taxpayers' investment, the Government withdrew the company from sale.

ENERGY EFFICIENCY AND CLIMATE CHANGE

New Zealand signed the Kyoto Protocol in May 1998 but has yet to ratify it. Work is currently being undertaken on a domestic policy package, which would enable New Zealand to meet its climate change commitments at least cost. A *Policy Options Statement* (POS), released in January 1999, set out the Government's preferred long-term policy – domestic emissions trading, fully interfacing with the Protocol's international trading system – and three policy options for the period prior to 2008, all economic instruments in some form. The POS also signalled that complementary measures (e.g. information dissemination and selected energy efficiency initiatives) would likely be required to achieve New Zealand's target at least cost.

In 1998, the Government reviewed the activities of the Energy Efficiency and Conservation Authority (EECA), founded in 1992. The review of activities concluded that EECA was performing well in its core activities, such as commercial and industrial partnerships (voluntary agreements), information programmes and the NZ$ 2 million Energy Saver Fund: four key programmes yielded a present value of savings of NZ$ 44 million net of programme costs. However, the benefits of smaller programmes were considered questionable.

The governance structure of EECA is also under review, as the Government strives to increase funding from non-government sources and to focus the authority's activities on strategies to combat climate change. Regular government funding for EECA declined from NZ$ 5.1 million in 1997/98 to NZ$ 4.6 million in 1998/99, but the Government has allocated NZ$ 3.9 million over three years in order to allow a smooth transition towards more third party funding.

NEW ZEALAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**4.05**	**12.18**	**13.66**	**14.16**	**16.09**	**15.53**	**16.76**
Coal[1]		1.29	1.39	2.19	1.97	3.73	4.90	5.27
Oil		0.18	2.09	2.41	3.15	2.15	2.15	2.15
Gas		0.28	3.87	4.40	4.70	5.06	2.81	2.17
Comb. Renewables & Wastes[2]		–	0.66	0.70	0.69	0.98	1.28	1.49
Nuclear		–	–	–	–	–	–	–
Hydro		1.23	2.01	2.23	2.00	2.14	2.25	2.28
Geothermal		1.07	2.17	1.73	1.65	2.03	2.13	3.36
Solar/Wind/Other[3]		–	–	0.00	0.00	0.00	0.01	0.04
TOTAL NET IMPORTS[4]		**4.27**	**2.03**	**2.55**	**2.39**	**0.69**	**2.05**	**2.95**
Coal[1]	Exports	0.02	0.23	1.17	0.84	2.31	2.31	2.31
	Imports	–	0.01	–	–	–	–	–
	Net Imports	–0.02	–0.22	–1.17	–0.84	–2.31	–2.31	–2.31
Oil	Exports	–	1.47	1.49	2.07	–	–	–
	Imports	4.60	4.04	5.53	5.64	3.32	4.70	5.60
	Bunkers	0.31	0.32	0.33	0.34	0.31	0.33	0.34
	Net Imports	4.29	2.25	3.72	3.23	3.01	4.37	5.26
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
Electricity	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
TOTAL STOCK CHANGES		**–0.05**	**–0.05**	**0.16**	**0.13**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**8.27**	**14.16**	**16.37**	**16.68**	**16.78**	**17.58**	**19.71**
Coal[1]		1.26	1.13	1.25	1.36	1.42	2.59	2.96
Oil		4.42	4.32	6.06	6.29	5.16	6.52	7.41
Gas		0.28	3.87	4.40	4.71	5.06	2.81	2.17
Comb. Renewables & Wastes[2]		–	0.66	0.70	0.69	0.98	1.28	1.49
Nuclear		–	–	–	–	–	–	–
Hydro		1.23	2.01	2.23	2.00	2.14	2.25	2.28
Geothermal		1.07	2.17	1.73	1.65	2.03	2.13	3.36
Solar/Wind/Other[3]		–	–	0.00	0.00	0.00	0.01	0.04
Electricity Trade[5]		–	–	–	–	–	–	–
Shares (%)								
Coal		*15.3*	*8.0*	*7.6*	*8.1*	*8.4*	*14.7*	*15.0*
Oil		*53.5*	*30.5*	*37.0*	*37.7*	*30.7*	*37.1*	*37.6*
Gas		*3.4*	*27.4*	*26.8*	*28.2*	*30.1*	*16.0*	*11.0*
Comb. Renewables & Wastes		*–*	*4.6*	*4.3*	*4.1*	*5.8*	*7.3*	*7.6*
Nuclear		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Hydro		*14.9*	*14.2*	*13.6*	*12.0*	*12.7*	*12.8*	*11.6*
Geothermal		*12.9*	*15.3*	*10.6*	*9.9*	*12.1*	*12.1*	*17.0*
Solar/Wind/Other		*–*	*–*	*–*	*–*	*–*	*0.1*	*0.2*
Electricity Trade		*–*	*–*	*–*	*–*	*–*	*–*	*–*

0 is negligible. – is nil. .. is not available.

Please note: Forecast data refer to the fiscal year.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**6.05**	**9.91**	**12.15**	**12.43**	**14.03**	**13.70**	**14.22**
Coal[1]	0.87	1.01	0.93	0.87	1.24	1.31	1.35
Oil	3.67	4.43	5.32	5.40	5.79	6.35	6.97
Gas	0.14	1.30	2.40	2.62	3.10	1.77	1.26
Comb. Renewables & Wastes[2]	–	0.51	0.52	0.52	0.72	0.78	0.84
Geothermal	–	0.27	0.32	0.32	0.35	0.38	0.40
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.37	2.39	2.67	2.71	2.85	3.12	3.40
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*14.4*	*10.2*	*7.6*	*7.0*	*8.8*	*9.5*	*9.5*
Oil	*60.6*	*44.7*	*43.8*	*43.5*	*41.2*	*46.4*	*49.0*
Gas	*2.4*	*13.1*	*19.8*	*21.0*	*22.1*	*12.9*	*8.8*
Comb. Renewables & Wastes	–	*5.1*	*4.3*	*4.2*	*5.1*	*5.7*	*5.9*
Geothermal	–	*2.7*	*2.6*	*2.6*	*2.5*	*2.7*	*2.8*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*22.6*	*24.1*	*21.9*	*21.8*	*20.3*	*22.8*	*23.9*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**2.18**	**4.07**	**5.33**	**5.44**	**6.50**	**5.44**	**5.22**
Coal[1]	0.69	0.86	0.75	0.72	0.98	1.04	1.08
Oil	0.96	0.59	0.62	0.55	0.59	0.63	0.67
Gas	0.05	1.06	2.17	2.38	2.78	1.44	0.94
Comb. Renewables & Wastes[2]	–	0.39	0.41	0.40	0.58	0.62	0.67
Geothermal	–	0.22	0.25	0.26	0.28	0.30	0.32
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.48	0.96	1.14	1.14	1.30	1.41	1.54
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*31.5*	*21.1*	*14.1*	*13.3*	*15.0*	*19.1*	*20.7*
Oil	*43.9*	*14.4*	*11.6*	*10.2*	*9.1*	*11.6*	*12.8*
Gas	*2.4*	*25.9*	*40.7*	*43.7*	*42.8*	*26.4*	*17.9*
Comb. Renewables & Wastes	–	*9.6*	*7.6*	*7.3*	*8.8*	*11.4*	*12.8*
Geothermal	–	*5.4*	*4.7*	*4.7*	*4.3*	*5.5*	*6.2*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*22.2*	*23.6*	*21.3*	*20.9*	*19.9*	*26.0*	*29.6*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**2.15**	**3.54**	**4.39**	**4.53**	**4.78**	**5.26**	**5.80**
TOTAL OTHER SECTORS[8]	**1.72**	**2.30**	**2.44**	**2.46**	**2.75**	**2.99**	**3.21**
Coal[1]	0.19	0.15	0.18	0.15	0.26	0.26	0.27
Oil	0.57	0.37	0.34	0.34	0.46	0.50	0.54
Gas	0.09	0.18	0.21	0.22	0.27	0.29	0.29
Comb. Renewables & Wastes[2]	–	0.12	0.12	0.12	0.14	0.16	0.17
Geothermal	–	0.05	0.06	0.06	0.07	0.08	0.08
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.88	1.42	1.53	1.57	1.54	1.70	1.85
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*10.7*	*6.6*	*7.3*	*6.0*	*9.3*	*8.8*	*8.5*
Oil	*32.8*	*16.0*	*13.9*	*13.9*	*16.9*	*16.7*	*16.8*
Gas	*5.3*	*7.8*	*8.7*	*9.0*	*10.0*	*9.8*	*9.1*
Comb. Renewables & Wastes	–	*5.2*	*4.9*	*4.8*	*5.2*	*5.2*	*5.2*
Geothermal	–	*2.3*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*51.2*	*62.0*	*62.6*	*63.7*	*56.1*	*56.9*	*57.8*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.16**	**5.41**	**5.56**	**5.84**	**5.92**	**6.52**	**8.12**
OUTPUT (Mtoe)	**1.59**	**2.78**	**3.17**	**3.16**	**3.12**	**3.42**	**3.72**
(TWh gross)	18.53	32.27	36.84	36.75	36.22	39.73	43.31
Output Shares (%)							
Coal	*8.5*	*1.2*	*2.8*	*5.5*	*1.4*	*11.9*	*13.8*
Oil	*6.1*	*0.0*	*0.0*	*–*	*–*	*0.0*	*0.1*
Gas	*1.4*	*17.6*	*18.5*	*23.7*	*21.1*	*11.5*	*8.8*
Comb. Renewables & Wastes	*–*	*2.0*	*2.3*	*2.2*	*2.5*	*4.4*	*5.3*
Nuclear	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Hydro	*77.3*	*72.3*	*70.5*	*63.2*	*68.6*	*65.7*	*61.3*
Geothermal	*6.7*	*6.8*	*5.8*	*5.5*	*6.4*	*6.0*	*9.7*
Solar/Wind/Other	*–*	*–*	*0.0*	*0.0*	*0.0*	*0.3*	*1.0*
TOTAL LOSSES	**2.35**	**4.22**	**3.75**	**4.02**	**2.75**	**3.89**	**5.48**
of which:							
Electricity and Heat Generation[10]	1.57	2.63	2.39	2.68	2.80	3.10	4.39
Other Transformation	0.36	0.86	0.45	0.43	–0.63	0.16	0.43
Own Use and Losses[11]	0.43	0.73	0.91	0.91	0.58	0.62	0.66
Statistical Differences	**–0.13**	**0.03**	**0.47**	**0.23**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	34.46	43.10	51.38	52.56	57.43	66.58	77.19
Population (millions)	2.97	3.36	3.71	3.76	3.81	4.00	4.15
TPES/GDP[12]	0.24	0.33	0.32	0.32	0.29	0.26	0.26
Energy Production/TPES	0.49	0.86	0.83	0.85	0.96	0.88	0.85
Per Capita TPES[13]	2.78	4.21	4.41	4.43	4.40	4.40	4.75
Oil Supply/GDP[12]	0.13	0.10	0.12	0.12	0.09	0.10	0.10
TFC/GDP[12]	0.18	0.23	0.24	0.24	0.24	0.21	0.18
Per Capita TFC[13]	2.04	2.95	3.27	3.31	3.68	3.42	3.43
Energy-related CO_2 Emissions (Mt CO_2)[14]	18.3	25.4	31.3	33.1	30.6	35.0	38.0
CO_2 Emissions from Bunkers (Mt CO_2)	1.0	1.0	1.0	1.1	1.0	1.1	1.1

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.6	4.1	2.5	1.9	0.2	0.9	2.3
Coal	–4.5	1.5	1.7	8.6	1.4	12.8	2.7
Oil	–0.7	0.2	5.8	3.7	–6.4	4.8	2.6
Gas	20.0	14.8	2.1	7.1	2.4	–11.1	–5.1
Comb. Renewables & Wastes	–	2.7	1.1	–2.0	12.5	5.4	3.2
Nuclear	–	–	–	–	–	–	–
Hydro	4.6	2.0	1.8	–10.5	2.3	1.0	0.3
Geothermal	–2.2	8.0	–3.7	–4.9	7.3	0.9	9.5
Solar/Wind/Other	–	–	–	–	–	61.5	28.1
TFC	2.1	3.4	3.5	2.3	4.1	–0.5	0.8
Electricity Consumption	3.0	3.5	1.8	1.6	1.6	1.9	1.7
Energy Production	4.5	7.9	1.9	3.6	4.4	–0.7	1.5
Net Oil Imports	–2.3	–4.5	8.8	–13.3	–2.3	7.7	3.8
GDP	0.7	1.6	3.0	2.3	3.0	3.0	3.0
Growth in the TPES/GDP Ratio	0.8	2.4	–0.5	–0.4	–2.7	–2.0	–0.7
Growth in the TFC/GDP Ratio	1.3	1.8	0.5	–0.0	1.1	–3.4	–2.2

Please note: Rounding may cause totals to differ from the sum of the elements.

NORWAY

GENERAL POLICY

In March 1998, the Government issued a "White Paper on Energy Policy". The paper gives high priority to energy efficiency, renewable energy sources and waterborne energy systems. The objectives were:

- To increase the use of waterborne energy as well as heat based on bioenergy, heat-pumps and waste to 4 TWh by 2010; and
- To increase wind power production to 3 TWh by 2010.

In order to achieve these goals, the Government proposed an "energy package" which includes an increase in electricity taxation to raise NKr 5 billion[1] to support renewable energy sources.

In May 1998, the Government presented a "White Paper on Oil and Gas Activity".

In 1997, total energy supply increased 2.6% to 24.2 Mtoe, and energy production increased 1.9% to 212.7 Mtoe.

In October 1998, the Norwegian Water Resources and Energy Administration changed its name to the Norwegian Water Resources and Energy Directorate (NVE).

ENERGY MARKET DEVELOPMENTS

Oil and Natural Gas

In 1997, oil production decreased slightly to 160.8 Mtoe, and net exports amounted to 156.8 Mtoe, slightly below the level of 1996. Natural gas production increased to 41 Mtoe, and net exports increased to 37.1 Mtoe.

In April 1998, the Government decided to reduce oil production by around 100 000 barrels per day from the beginning of May 1998 until the end of the year, in order to reduce oversupply and to support oil prices. In December 1998, the reduction was maintained until the end of June 1999. In March 1999, the production curtailment was raised to 200 000 barrels per day for the remainder of the year.

1. On average, in 1998, US$ 1 = NKr 0.14.

Electricity

In 1997, electricity generation increased 6% to 110.5 TWh. Net electricity imports were reduced by 58%. Electricity taxation of non-industrial consumers increased from 5.75 ore/kWh to 5.94 ore/kWh in 1999.

The National State Pollution Control Authority gave Naturkraft permission to build two gas-fired power plants on the west coast of Norway, provided that CO_2 and NO_x emissions are significantly reduced in comparison with the former estimated emissions level. As an alternative solution, Naturkraft will be allowed to compensate for its CO_2 emissions by buying emissions rights when the system is implemented in Norway. Naturkraft has appealed against the decision on the reduction of CO_2 and NO_x emissions to the Ministry of Environment, and several environmental organisations have appealed against the decision allowing Naturkraft to buy emissions rights.

Renewable Energy Sources

In 1997, hydropower accounted for close to 99% of electricity generation and provided more than 50% of energy use in the industry sector and more than 70% in the residential/commercial sector. Biofuels are the second most important renewable energy source and accounted for approximately 1.2 Mtoe in 1997, or about 5% of total energy supply.

The Ministry of Petroleum and Energy delegated to the Water Resources and Energy Directorate (NVE) the responsibility for funding renewables and for carrying out different support schemes. NVE is responsible for providing information and education on energy efficiency and the use of non-hydro renewables. These information and education activities aim to ensure the effective use of government funds and to promote effective use of energy resources in the long term.

Funding to renewables amounted to NKr 157 million in 1998, twice the level of 1996. Funding is expected to increase to NKr 190 million in 1999 with the aim of promoting technology and securing the market share of renewable energy sources. Biofuels, heat pumps, solar energy, waste heat and wind power are given the highest priority. Two support schemes were set up and implemented as of January 1999:

- Investments in biomass plants, wind energy, heat pumps, district heating, tidal power and small-scale hydro plants (with a capacity lower than 1 000 kW) are exempted from the general investment tax which amounts to 7%; and

- A subsidy is granted for electricity generation from wind power, corresponding to reimbursement of half of the tax rate on electric power.

Public funds also subsidise 20 to 25% of the investment cost of biofuels, heat pumps and solar energy plants producing on base load, as well as district heating, energy recovery from waste heat and wind mills with a total capacity above 1.5 MW.

ENERGY EFFICIENCY

In 1997, energy intensity, as measured by total primary energy supply divided by GDP, decreased 0.8%. Government spending on energy efficiency measures is expected to be NKr 57 million in 1999. In the past, energy efficiency measures have been redirected away from subsidies towards public information and educational activities. Eighteen regional energy efficiency centres have been established in order to support public authorities and electricity utilities in developing energy efficiency policy.

From January 1999 all electricity utilities are required to provide customers with a simplified and more informative electricity bill. The bill is sent more frequently to customers. The aim of this measure is to increase customer awareness of their electricity consumption. Information regarding energy efficiency measures, the possibility of changing suppliers and the tariff structure are included in the bill.

In 1999, the Government decided to increase the role of municipalities in energy efficiency activities, since local authorities have an important role in infrastructure development, which could affect the demand and supply of energy. Measures will be redirected towards strengthening the energy competence of important decision-makers at the local level.

In 1999, a small subsidy programme was introduced in the residential sector. Older dwellings with the potential for energy efficiency improvements and households with limited ability to undertake important investments in energy efficiency will be given priority.

ENERGY AND THE ENVIRONMENT

At Kyoto, Norway agreed to maintain the increase in CO_2 emissions and five other gases to 1% between 1990 and 2008-2012. According to IEA calculations, in 1997, energy-related CO_2 emissions increased 3.6% to 34.3 Mt. Between 1990 and 1997, energy-related CO_2 emissions increased 15.1%.

A White Paper on "Norwegian Implementation of the Kyoto Protocol" and a bill on "Green Taxes" were presented to the Parliament in 1998. The Storting decided:

- to request the Government to appoint a broad-based commission of experts to draw up a proposal for a system of greenhouse gas emissions trading;
- to introduce a tax of NKr 300 per tonne on final waste disposal, in order to increase energy recovery and to reduce emissions of methane from landfills. A tax rebate is implemented when energy from waste disposal is recovered; and
- to exempt the building of wind turbines, biofuels, heat pumps, district heating and micro and mini hydropower plants from the investment tax. Support to

electricity from windmills in the form of a reimbursement of half the tax on electric power was also introduced.

The $C0_2$ tax on oil and gas produced from the continental shelf was increased from NKr 89 per litre (89 per cubic metre for gas) to NKr 107 per litre (107 per cubic metre for gas) from July 1998. The tax was subsequently reduced to its level from 1 January 1999.

ENERGY RESEARCH AND DEVELOPMENT

In 1998, public energy R&D expenditure was around NKr 277 million, the same level as in 1997. Estimated spending for 1999 is NKr 272 million. R&D has decreased while the development of more efficient technologies and cleaner methods for oil and gas recovery is receiving more money. R&D funding to renewable energy sources has increased its share.

In the future, funding is expected to concentrate on the following:

- electricity transmission and distribution, power exchange and network efficiency;
- biofuels, wind energy, solar heating, photovoltaics and wave power; and
- research on social conditions for the development of energy and environmental policy.

NORWAY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**8.19**	**120.12**	**208.62**	**212.65**	**134.38**	**..**	**..**
Coal[1]		0.29	0.20	0.15	0.26	0.20	..	..
Oil		1.64	84.35	161.10	160.79	85.20	..	..
Gas		–	24.14	37.36	41.01	37.55	..	..
Comb. Renewables & Wastes[2]		–	1.00	1.09	1.16	1.30	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		6.27	10.42	8.91	9.44	9.83	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	0.00	0.00	0.00	0.00	..	..
TOTAL NET IMPORTS[4]		**6.48**	**–96.80**	**–183.36**	**–188.48**	**–110.68**	**..**	**..**
Coal[1]	Exports	0.09	0.17	0.11	0.13	0.20	..	..
	Imports	0.67	0.84	0.97	0.92	0.80	..	..
	Net Imports	0.58	0.67	0.85	0.79	0.60	..	..
Oil	Exports	3.69	77.95	154.97	156.78	..	..	..
	Imports	10.68	4.47	4.51	5.22	..	..	..
	Bunkers	0.64	0.45	0.77	0.96	..	..	..
	Net Imports	6.35	–73.93	–151.22	–152.52	–76.75	..	..
Gas	Exports	–	22.17	33.77	37.09	34.48	..	..
	Imports	–	–	–	–	–	..	..
	Net Imports	–	–22.17	–33.77	–37.09	–34.48	..	..
Electricity	Exports	0.45	1.40	0.36	0.42	0.05	..	–
	Imports	0.01	0.03	1.14	0.75	–	..	–
	Net Imports	–0.45	–1.37	0.77	0.33	–0.05	..	–
TOTAL STOCK CHANGES		**0.44**	**–1.87**	**–1.63**	**0.06**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**15.11**	**21.46**	**23.62**	**24.23**	**23.70**	**..**	**..**
Coal[1]		0.91	0.86	1.01	1.03	0.80	..	..
Oil		8.38	8.56	8.25	8.35	8.75	..	..
Gas		–	1.98	3.59	3.92	3.07	..	..
Comb. Renewables & Wastes[2]		–	1.00	1.10	1.16	1.30	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		6.27	10.42	8.91	9.44	9.83	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	0.00	0.00	0.00	0.00	..	..
Electricity Trade[5]		–0.45	–1.37	0.77	0.33	–0.05	..	..
Shares (%)								
Coal		*6.0*	*4.0*	*4.3*	*4.2*	*3.4*	..	..
Oil		*55.5*	*39.9*	*34.9*	*34.4*	*36.9*	..	..
Gas		–	*9.2*	*15.2*	*16.2*	*13.0*	..	..
Comb. Renewables & Wastes		–	*4.7*	*4.6*	*4.8*	*5.5*	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		*41.5*	*48.6*	*37.7*	*39.0*	*41.5*	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other		–	–	–	–	–	..	..
Electricity Trade		*–3.0*	*–6.4*	*3.3*	*1.4*	*–0.2*	..	..

0 is negligible. – is nil. .. is not available.

Please note: Most forecast data are based on the 1992 submission. Forecast data for natural gas own use and losses are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**13.73**	**18.01**	**19.44**	**19.34**	**19.59**	**..**	**..**
Coal[1]	0.81	0.78	0.95	0.95	0.72	..	..
Oil	7.68	7.96	8.57	8.38	8.25	..	..
Gas	0.01	–	–	–	0.45	..	..
Comb. Renewables & Wastes[2]	–	0.88	0.94	1.00	1.20	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	5.23	8.33	8.87	8.90	8.88	..	..
Heat	–	0.07	0.12	0.11	0.09	..	..
Shares (%)							
Coal	*5.9*	*4.3*	*4.9*	*4.9*	*3.7*	..	..
Oil	*55.9*	*44.2*	*44.1*	*43.3*	*42.1*	..	..
Gas	*0.1*	–	–	–	*2.3*	..	..
Comb. Renewables & Wastes	–	*4.9*	*4.8*	*5.2*	*6.1*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*38.1*	*46.2*	*45.6*	*46.0*	*45.3*	..	..
Heat	–	*0.4*	*0.6*	*0.6*	*0.5*	..	..
TOTAL INDUSTRY[6]	**6.96**	**7.91**	**7.92**	**7.99**	**8.90**	**..**	**..**
Coal[1]	0.76	0.77	0.95	0.95	0.70	..	..
Oil	3.01	2.79	2.71	2.56	3.00	..	..
Gas	0.00	–	–	–	0.45	..	..
Comb. Renewables & Wastes[2]	–	0.39	0.39	0.46	0.50	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	3.20	3.94	3.84	4.01	4.23	..	..
Heat	–	0.02	0.03	0.02	0.02	..	..
Shares (%)							
Coal	*10.9*	*9.7*	*11.9*	*11.8*	*7.9*	..	..
Oil	*43.2*	*35.3*	*34.2*	*32.0*	*33.7*	..	..
Gas	–	–	–	–	*5.1*	..	..
Comb. Renewables & Wastes	–	*4.9*	*5.0*	*5.7*	*5.6*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*45.9*	*49.8*	*48.5*	*50.2*	*47.5*	..	..
Heat	–	*0.2*	*0.4*	*0.3*	*0.2*	..	..
TRANSPORT[7]	**2.62**	**4.22**	**4.62**	**4.69**	**4.58**	**..**	**..**
TOTAL OTHER SECTORS[8]	**4.15**	**5.89**	**6.90**	**6.66**	**6.11**	**..**	**..**
Coal[1]	0.06	0.01	0.00	0.00	0.02	..	..
Oil	2.10	1.02	1.39	1.28	0.75	..	..
Gas	0.01	–	–	–	–	..	..
Comb. Renewables & Wastes[2]	–	0.49	0.54	0.55	0.70	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	1.98	4.31	4.87	4.74	4.57	..	..
Heat	–	0.06	0.09	0.09	0.07	..	..
Shares (%)							
Coal	*1.3*	*0.2*	*0.1*	–	*0.3*	..	..
Oil	*50.6*	*17.3*	*20.2*	*19.2*	*12.3*	..	..
Gas	*0.2*	–	–	–	–	..	..
Comb. Renewables & Wastes	–	*8.3*	*7.9*	*8.2*	*11.5*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*47.8*	*73.3*	*70.6*	*71.2*	*74.8*	..	..
Heat	–	*1.0*	*1.3*	*1.4*	*1.1*	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**6.31**	**10.59**	**9.18**	**9.69**	**10.00**	**..**	**..**
OUTPUT (Mtoe)	**6.28**	**10.46**	**8.98**	**9.50**	**9.87**	**..**	**..**
(TWh gross)	73.03	121.61	104.43	110.48	114.73	..	..
Output Shares (%)							
Coal	*0.0*	*0.2*	*0.2*	*0.2*	*0.2*	..	..
Oil	*0.2*	*0.0*	–	–	–	..	..
Gas	–	–	*0.3*	*0.2*	–	..	..
Comb. Renewables & Wastes	–	*0.2*	*0.3*	*0.2*	*0.2*	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	*99.8*	*99.6*	*99.2*	*99.4*	*99.6*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	*0.0*	*0.0*	*0.0*	..	..
TOTAL LOSSES	**1.34**	**3.65**	**5.27**	**5.60**	**4.11**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	0.03	0.04	0.05	0.04	–0.01	..	..
Other Transformation	0.57	–0.05	–0.19	–0.29	0.34	..	..
Own Use and Losses[11]	0.73	3.66	5.41	5.85	3.78	..	..
Statistical Differences	**0.05**	**–0.21**	**–1.09**	**–0.71**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	65.65	115.45	145.94	150.96	161.14	..	..
Population (millions)	3.96	4.24	4.38	4.41	4.50	..	..
TPES/GDP[12]	0.23	0.19	0.16	0.16	0.15	..	..
Energy Production/TPES	0.54	5.60	8.83	8.78	5.67	..	..
Per Capita TPES[13]	3.82	5.06	5.39	5.50	5.27	..	..
Oil Supply/GDP[12]	0.13	0.07	0.06	0.06	0.05	..	..
TFC/GDP[12]	0.21	0.16	0.13	0.13	0.12	..	..
Per Capita TFC[13]	3.47	4.25	4.44	4.39	4.35	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	26.5	29.8	33.1	34.3	32.4	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	2.0	1.4	2.4	3.0	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	3.7	1.2	1.6	2.6	–0.7	–	–
Coal	1.4	–1.3	2.6	2.4	–8.0	–	–
Oil	1.8	–0.8	–0.6	1.2	1.6	–	–
Gas	–	9.8	10.5	9.3	–7.8	–	–
Comb. Renewables & Wastes	–	5.4	1.5	5.8	3.9	–	–
Nuclear	–	–	–	–	–	–	–
Hydro	3.3	2.9	–2.6	5.9	1.4	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	26.0	–	–
TFC	3.5	0.6	1.3	–0.5	0.4	–	–
Electricity Consumption	3.6	2.3	1.1	0.3	–0.1	–	–
Energy Production	33.7	8.9	9.6	1.9	–14.2	–	–
Net Oil Imports	–	19.9	12.7	0.9	–20.5	–	–
GDP	4.8	2.6	4.0	3.4	2.2	–	–
Growth in the TPES/GDP Ratio	–1.0	–1.4	–2.3	–0.8	–2.9	–	–
Growth in the TFC/GDP Ratio	–1.2	–2.0	–2.6	–3.8	–1.7	–	–

Please note: Rounding may cause totals to differ from the sum of the elements.

SPAIN

GENERAL POLICY AND MARKET DEVELOPMENTS

The Spanish Government continued to introduce more competition in the energy sector with the 1998 law on oil and natural gas and with several measures in the electricity sector.

In 1997, total energy supply was 107.3 Mtoe; it continued to increase at a fast pace, i.e. 5.1% from the 1996 level. Natural gas supply showed the sharpest growth (31.4%). Energy production decreased by 4% to 31.4 Mtoe in 1997.

ENERGY PRODUCTION AND SUPPLY

Oil and Natural Gas

In 1997, total oil supply increased 2.9% to 57.1 Mtoe, mostly due to the increase in industry consumption. The share of unleaded gasoline increased to 40.6% of total gasoline consumption in the same year.

Natural gas supply increased 31.4% reaching 11.3 Mtoe in 1997. Most of the increase was in the electricity sector where the share of gas in electricity generation more than doubled from less than 4% in 1996 to 8.8% in 1997. Around 40% of the gas used in power generation came from co-generation. In 1997, Algeria was the most important gas supplier with 67.4% of total gas supply, followed by Norway (13.4%), the United Arab Emirates (9.3%) and Libya (8.6%).

In September 1998, Parliament passed a law on oil and gas that increased competition in the oil sector and implemented the EU Directive on the introduction of competition in the gas sector. The main elements of the law are as follows:

Oil

- The ceiling on gasoline prices was abolished. The price ceiling on LPG was maintained and will be lifted when conditions for effective competition are met.

- Freedom of activity in refining, storage and distribution of oil products was introduced.

Natural Gas

- Consumers of more than 20 mcm per year became eligible to choose their own supplier. Consumers of less than 20 mcm can join to become eligible. Electricity

generators that are competitive in the electricity market became eligible regardless of their consumption. Distributors did not become eligible. The threshold will be reduced to 15 mcm in 2000 and 5 mcm in 2003. In 2013 all consumers will be eligible.

- Gas traders have to hold 35 days of gas stocks.

- Construction of new natural gas facilities became subject to authorisation procedures and no longer to concessions. However, in existing concession areas, the operator can still maintain its concession rights for 15 years.

- The Ministry of Industry was made responsible for fixing and publishing maximum tariffs for third party access.

- The law provided for unbundling of accounts between gas activities and legal unbundling between gas and non-gas activities.

- In October 1998, Gas Natural, the Spanish gas distribution company, and ENDESA, the public utility, signed an agreement under which both companies would build gas-fired power plants for a total capacity of 3 000 MW. Gas Natural would supply most of ENDESA's gas requirements.

Coal

In 1997, coal production decreased 2% to 9.8 Mtoe, following a reduction in brown coal production. Steam coal production increased slightly. In 1998, the Government agreed with the main unions on the "1998-2002 Plan for Coal Mining and Alternative Development in the Mining Districts". The plan envisages a reduction in hard coal production from 18 Mt in 1997 to 14.7 Mt in 2001.

Coal subsidies in 1997 are shown in Table 1.

Electricity

In 1997, electricity generation increased 7.2% to 185.8 TWh. Consumption increased about 4% to 176.4 TWh and Spain became a net exporter of electricity.

The main developments after the enactment of the December 1997 law on the introduction of competition in the electricity sector[1] were as follows:

- The Government and the electricity sector agreed on the payment of an electricity tariff of around Ptas[2] 1 500 billion of stranded costs, of which around Ptas 1 000 billion will be transformed into securities held by banks.

1. See *Energy Policies of IEA Countries, 1998 Review*.
2. On average, in 1998, Ptas 100 = US$ 0.67.

Table 1

IEA Secretariat Estimates of Assistance to Spanish Coal Producers

(in million Ptas or Ptas per tonne)

Assistance Category [a]	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998p*
I. ASSISTANCE INCLUDED IN PRODUCER SUBSIDY EQUIVALENT										
1. Direct aid to current production										
a) Investment grants	834	963	2,642	2,683	2,688	0	0	0	0	0
b) Aid to clean up spoil heaps and purify water	0	0	0	0	0	0	100	100	0	0
c) Grants to promote innovation	615	350	123	165	147	0	50	50	0	0
d) Aid to cover operating losses	51 080	48 572	47 461	43 416	62 565	65 826	66 665	58 748	50 295	126 855
e) Aid to promote sales of coal and coke	2 583	1 400	0	0	0	0	0	0	0	0
Subtotal	**55 112**	**51 285**	**50 226**	**46 264**	**65 400**	**65 826**	**66 815**	**58 898**	**50 295**	**126 855**
2. f) Grant associated with write-down of assets	0	0	0	0	0	9 473	8 239	7 686	9 113	11 995
3. Indirect aid to current production										
g) Excess deficit payments on miners' social charges	0	0	0	0	0	0	0	0	0	0
4. Price support										
h) Reconversion funds and compensation OFICO[b]	17 527	12 447	23 506	29 021	10 200	53 192	63 424	65 523	80 443	0
Subtotal (2+3+4)	**17 527**	**12 447**	**23 506**	**29 021**	**10 200**	**62 665**	**71 663**	**73 209**	**89 556**	**11 995**
Total PSE (million Ptas)	**72 639**	**63 732**	**73 732**	**75 285**	**75 600**	**128 491**	**138 478**	**132 107**	**139 851**	**138 850**
Total PSE (million US$)	**614**	**625**	**710**	**735**	**594**	**959**	**1 110**	**1 043**	**955**	**929**
Ptas per tonne produced	**3 788**	**3 255**	**4 087**	**4 028**	**4 146**	**7 032**	**7 828**	**7 443**	**7 801**	**8 468**
US$ per tonne produced	**32**	**32**	**39**	**39**	**33**	**52**	**63**	**59**	**53**	**57**
Hard coal and sub-bituminous coal production (million tonnes)	19.176	19.579	18.039	18.692	18.236	18.273	17.689	17.749	17.928	16.397
US$/Pta exchange rate (OECD figures)	118.4	101.9	103.9	102.4	127.2	134	124.7	126.7	146.4	149.4
II. ASSISTANCE NOT BENEFITING CURRENT PRODUCTION										
1. Assistance to help offset social security costs	..	..	..	..	..	23 156	33 407	33 339	51 244	54 967
Total aid not benefiting current production (million PTA)	**..**	**..**	**..**	**..**	**..**	**23 156**	**33 407**	**33 339**	**51 244**	**54 967**

p Preliminary data, subject to revision.

[a] Definitions of categories are in Appendix D of *Coal Prospects and Policies in IEA Countries: 1987 Review*, IEA/OECD Paris, 1988.

[b] The OFICO system was abolished in January 1998. All aid is now paid from the budget in conformity with the requirements of the European Commission's state aid framework decision.

.. Not available.

Note: Hard coal production includes sub-bituminous coal for PSE purposes.

Source: Dirección de Planificatión Energética. Adapted and updated from *Energy Policies of IEA Countries: 1998 Review*, IEA/OECD Paris, 1988.

- The threshold of eligibility for electricity consumers would be reduced to 1 GWh in October 1999, five years earlier than 2004 as envisaged by the law.

- The Market Operator, responsible for the management of the spot market, and the System Operator (Red Electrica), responsible for the management of the transmission system, started operations in 1998.

- Electricity tariffs for end-use consumers were reduced by 2.5% on average for the year 1999. In 1998 access tariffs were cut by 25%.

Renewable Energy Sources

In 1997, energy generation from non-hydro renewables was 3.6 Mtoe, i.e. 3.4% of total energy supply. Non-hydro renewables accounted for 1.3% of total electricity generation.

Electricity generation from wind power was 742 GWh in 1997, more than double the 1996 level. Wind power capacity was 455 MW in 1997 and was estimated to be 834 MW in 1998. At end 1998, a Royal Decree was issued to revise the buy-back tariff system for electricity from renewables. This tariff is no longer a fixed amount set by decree. According to the new decree, the tariff is comprised of the price of electricity in the market plus an extra sum that constitutes the subsidy.

ENERGY EFFICIENCY AND ENVIRONMENT

In 1997, energy intensity, measured as total primary energy supply divided by GDP, increased 1.5%. According to IEA data, energy-related CO_2 emissions increased 6.7% to 253.8 Mt in 1997. Between 1990 and 1997, energy-related CO_2 emissions increased more than 18%. Under the Kyoto Protocol, Spain is committed to maintaining the increase in greenhouse gas emissions to 15% between 1990 and 2008-2012.

According to the Institute for Energy Diversification and Savings (IDAE), measures undertaken through the Plan for Energy Savings and Efficiency (PAEE) led to a reduction of 3.7 Mt in CO_2 emissions and to 584 ktoe of energy conservation in 1997. In November 1997, an incentive programme was set up to promote the efficient use of electricity. The programme earmarked Ptas 5 billion in 1998 to allow some distribution companies to establish electricity savings programmes for end-use consumers and to reduce fluctuations in the load curve. The other distribution companies have to earmark 0.25% of their income from the sale of electricity to energy savings programmes for end-use consumption.

ENERGY TECHNOLOGY, RESEARCH AND DEVELOPMENT

According to provisional data, public expenditure on energy R&D was Ptas 9.9 billion in 1998, a 13.7% decrease over 1996. R&D expenditure on energy conservation decreased 40% to Ptas 2.7 billion and expenditure on renewables increased slightly to Ptas 1.4 billion.

SPAIN

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**11.3**	**34.1**	**32.7**	**31.4**	**29.6**	**..**	**..**
Coal[1]		6.5	11.9	10.0	9.8	9.3	..	..
Oil		0.7	1.2	0.5	0.4	0.9	..	..
Gas		0.0	1.3	0.4	0.2	0.3	..	..
Comb. Renewables & Wastes[2]		0.0	3.4	3.5	3.5	3.5	..	..
Nuclear		1.7	14.1	14.7	14.4	12.5	..	..
Hydro		2.5	2.2	3.4	3.0	3.1	..	..
Geothermal		–	–	0.0	0.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.1	0.1	..	..	..
TOTAL NET IMPORTS[4]		**42.5**	**56.6**	**70.1**	**75.3**	**81.3**	**..**	**..**
Coal[1]	Exports	0.0	0.0	0.1	0.1	..	..	..
	Imports	2.2	7.1	7.7	6.9	12.2	..	..
	Net Imports	2.2	7.1	7.6	6.7	12.2	..	..
Oil	Exports	4.3	12.3	8.2	8.0	..	..	..
	Imports	45.3	61.8	67.0	71.0	..	..	..
	Bunkers	1.4	3.7	4.6	5.7	..	..	..
	Net Imports	39.6	45.9	54.1	57.3	55.4	..	..
Gas	Exports	–	–	–	–	–	..	..
	Imports	0.9	3.7	8.3	11.5	13.2	..	..
	Net Imports	0.9	3.7	8.3	11.5	13.2	..	..
Electricity	Exports	0.2	0.3	0.5	0.7	–	..	..
	Imports	0.0	0.3	0.6	0.4	0.5	..	..
	Net Imports	–0.2	–0.0	0.1	–0.3	0.5	..	..
TOTAL STOCK CHANGES		**–0.9**	**–0.1**	**–0.7**	**0.7**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**53.0**	**90.6**	**102.1**	**107.3**	**110.8**	**..**	**..**
Coal[1]		9.0	19.4	16.3	18.2	21.5	..	..
Oil		38.9	46.5	55.5	57.1	56.3	..	..
Gas		0.9	5.0	8.6	11.3	13.5	..	..
Comb. Renewables & Wastes[2]		0.0	3.4	3.5	3.5	3.5	..	..
Nuclear		1.7	14.1	14.7	14.4	12.5	..	..
Hydro		2.5	2.2	3.4	3.0	3.1	..	..
Geothermal		–	–	0.0	0.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.1	0.1	..	..	..
Electricity Trade[5]		–0.2	–0.0	0.1	–0.3	0.5	..	..
Shares (%)								
Coal		*17.1*	*21.5*	*15.9*	*16.9*	*19.4*	..	..
Oil		*73.6*	*51.3*	*54.3*	*53.2*	*50.8*	..	..
Gas		*1.8*	*5.5*	*8.5*	*10.5*	*12.2*	..	..
Comb. Renewables & Wastes		*–*	*3.7*	*3.4*	*3.3*	*3.2*	..	..
Nuclear		*3.2*	*15.6*	*14.4*	*13.4*	*11.3*	..	..
Hydro		*4.7*	*2.4*	*3.4*	*2.8*	*2.8*	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other		–	–	*0.1*	*0.1*	..	..	..
Electricity Trade		*–0.3*	–	*0.1*	*–0.2*	*0.5*	..	..

0 is negligible. – is nil. .. is not available.

Please note: All forecast data are based on the 1995 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**39.9**	**61.4**	**71.6**	**74.9**	**79.5**	**..**	**..**
Coal[1]	4.0	3.2	1.8	1.7	3.7	..	..
Oil	30.1	39.9	47.1	49.2	50.3	..	..
Gas	0.7	4.6	7.4	8.1	7.2	..	..
Comb. Renewables & Wastes[2]	–	2.8	2.6	2.7	2.7	..	..
Geothermal	–	–	0.0	0.0	..	..	..
Solar/Wind/Other	–	–	0.0	0.0	..	..	..
Electricity	5.1	10.8	12.7	13.2	15.6	..	..
Heat	–	0.0	0.0	0.1	..	..	..
Shares (%)							
Coal	*9.9*	*5.3*	*2.5*	*2.3*	*4.7*	..	..
Oil	*75.6*	*65.0*	*65.7*	*65.6*	*63.3*	..	..
Gas	*1.8*	*7.5*	*10.4*	*10.8*	*9.1*	..	..
Comb. Renewables & Wastes	–	*4.5*	*3.7*	*3.5*	*3.4*	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*12.7*	*17.6*	*17.7*	*17.6*	*19.6*	..	..
Heat	–	–	–	*0.1*	..	..	..
TOTAL INDUSTRY[6]	**20.7**	**24.4**	**25.5**	**28.3**	**32.0**	**..**	**..**
Coal[1]	3.6	2.9	1.6	1.5	3.6	..	..
Oil	13.4	11.3	11.7	13.9	12.9	..	..
Gas	0.4	3.8	5.9	6.5	6.1	..	..
Comb. Renewables & Wastes[2]	–	0.9	0.8	0.8	2.4	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	0.0	0.0	..	..	..
Electricity	3.3	5.4	5.5	5.6	7.0	..	..
Heat	–	–	–	0.1	..	..	..
Shares (%)							
Coal	*17.5*	*12.1*	*6.2*	*5.4*	*11.3*	..	..
Oil	*64.7*	*46.4*	*46.0*	*48.9*	*40.3*	..	..
Gas	*2.0*	*15.5*	*23.2*	*22.8*	*19.1*	..	..
Comb. Renewables & Wastes	–	*3.7*	*3.2*	*2.9*	*7.5*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*15.8*	*22.3*	*21.5*	*19.8*	*21.9*	..	..
Heat	–	–	–	*0.2*	..	..	..
TRANSPORT[7]	**11.9**	**22.8**	**28.4**	**28.6**	**29.6**	**..**	**..**
TOTAL OTHER SECTORS[8]	**7.2**	**14.2**	**17.7**	**18.1**	**17.9**	**..**	**..**
Coal[1]	0.3	0.3	0.2	0.2	0.1	..	..
Oil	4.9	6.1	7.3	7.1	8.2	..	..
Gas	0.3	0.8	1.5	1.6	1.1	..	..
Comb. Renewables & Wastes[2]	–	1.9	1.8	1.8	0.3	..	..
Geothermal	–	–	0.0	0.0	..	..	..
Solar/Wind/Other	–	–	0.0	0.0	..	..	..
Electricity	1.7	5.1	6.9	7.3	8.2	..	..
Heat	–	0.0	0.0	–	..	..	..
Shares (%)							
Coal	*4.3*	*2.1*	*1.2*	*1.2*	*0.6*	..	..
Oil	*68.2*	*43.0*	*40.9*	*39.3*	*45.8*	..	..
Gas	*4.1*	*5.9*	*8.6*	*8.9*	*6.1*	..	..
Comb. Renewables & Wastes	–	*13.3*	*10.3*	*10.1*	*1.7*	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	..	..	..
Electricity	*23.4*	*35.7*	*38.7*	*40.3*	*45.8*	..	..
Heat	–	–	*0.1*	–	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**12.6**	**33.4**	**35.5**	**38.4**	**41.6**	**..**	**..**
OUTPUT (Mtoe)	**6.5**	**13.0**	**14.9**	**16.0**	**17.5**	**..**	**..**
(TWh gross)	*75.7*	151.2	173.4	185.8	204.0	..	..
Output Shares (%)							
Coal	*18.9*	*40.1*	*31.5*	*34.3*	*35.7*	..	..
Oil	*33.2*	*5.7*	*8.0*	*7.2*	*6.0*	..	..
Gas	*1.0*	*1.0*	*3.9*	*8.8*	*15.3*	..	..
Comb. Renewables & Wastes	*0.1*	*0.5*	*0.9*	*0.9*	*1.2*	..	..
Nuclear	*8.7*	*35.9*	*32.5*	*29.8*	*23.5*	..	..
Hydro	*38.2*	*16.8*	*23.0*	*18.6*	*17.9*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.0*	*0.2*	*0.4*	*0.2*	..	..
TOTAL LOSSES	**–31.4**	**28.9**	**30.3**	**31.5**	**31.1**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	6.1	20.4	20.5	22.4	24.0	..	..
Other Transformation	–41.2	2.3	2.6	1.8	–	..	..
Own Use and Losses[11]	3.7	6.1	7.1	7.4	7.1	..	..
Statistical Differences	**44.5**	**0.3**	**0.2**	**0.9**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	315.49	491.94	538.55	557.57	618.19	..	..
Population (millions)	34.81	38.85	39.27	39.32	39.50	..	..
TPES/GDP[12]	0.17	0.18	0.19	0.19	0.18	..	..
Energy Production/TPES	0.21	0.38	0.32	0.29	0.27	..	..
Per Capita TPES[13]	1.52	2.33	2.60	2.73	2.81	..	..
Oil Supply/GDP[12]	0.12	0.09	0.10	0.10	0.09	..	..
TFC/GDP[12]	0.13	0.12	0.13	0.13	0.13	..	..
Per Capita TFC[13]	1.15	1.58	1.82	1.91	2.01	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	148.8	215.0	237.8	253.8	269.8	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	4.3	11.6	14.7	18.2	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	3.9	2.8	2.0	5.1	1.1	..	..
Coal	3.0	5.5	–2.9	11.7	5.8	..	..
Oil	3.9	–0.5	3.0	3.0	–0.5	..	..
Gas	6.7	12.3	9.7	30.8	6.1	..	..
Comb. Renewables & Wastes	24.8	47.0	0.6	0.5	–0.4	..	..
Nuclear	0.4	20.9	0.6	–1.8	–4.6	..	..
Hydro	8.2	–5.3	7.8	–13.1	1.4	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	75.3	56.9	–	..	..
TFC	4.1	1.7	2.6	4.6	2.0	..	..
Electricity Consumption	6.4	3.6	2.7	4.2	5.8	..	..
Energy Production	5.5	7.3	–0.7	–4.0	–1.9	..	..
Net Oil Imports	3.2	–0.4	2.8	5.9	–1.1	..	..
GDP	2.3	2.8	1.5	3.5	3.5	..	..
Growth in the TPES/GDP Ratio	1.6	–0.0	0.5	1.5	–2.4	..	..
Growth in the TFC/GDP Ratio	1.8	–1.1	1.1	1.0	–1.5	..	..

Please note: Rounding may cause totals to differ from the sum of the elements.

TURKEY

GENERAL POLICY

According to the Turkish Government, a general consensus is growing which would allow international arbitration in joint ventures in order to encourage the involvement of foreign capital in the energy sector. The Government is working on new regulations to this effect.

Due to rapid economic and population growth, energy demand continued to increase at a rapid pace. In 1997, total energy supply was 71.3 Mtoe, a 5.4% increase over 1996. Energy production increased slightly to 27.6 Mtoe and energy net imports increased 4.3% to 43.2 Mtoe.

ENERGY MARKET DEVELOPMENTS

Oil

In 1997, oil consumption decreased slightly to 26.65 Mtoe, because of a reduction in demand in the residential/commercial sector. TPAO, the public upstream oil company, produces most of the crude oil in Turkey. In 1997, oil production decreased only slightly to 3.5 Mtoe.

The March 1998 Decree created an "Automatic Price System" to set domestic oil prices and to modify the tax system on oil products. This system was applied on 1 July 1998 and is administered in the following way:

- The system sets a ceiling on the ex-refinery product prices according to the CIF Mediterranean product prices. The ceiling is changed when the price of oil products (calculated as a rolling average over five days) rises or falls by more than 3%.

- Ex-refinery prices and distributor and dealer margins are indexed to the US$.

The new tax system includes four components:

- Oil products used in electricity generation are exempt from the Petroleum Fuel Price Stabilisation Fund (AFIF) which applies to the ex-refinery prices.

- Since January 1996, in accordance with the Custom Union Agreement with the European Union (EU), custom duties are applied only to oil products from non-EU countries and on domestic production. A decree of May 1998 exempted domestic products from this tax.

- The Petroleum Consumption Tax (an *ad valorem* tax based on the ex-refinery ceiling price of oil products plus the AFIF) is still applied.

- A VAT of 15% on the domestic price of oil products also continues to be applied.

In 1998, the Privatisation High Council (PHC) auctioned the sale of 51% of Petrol Ofisi, the Turkish public oil distribution company. Ten groups entered the auction, and the shares were sold to a Turkish consortium, including Is Bankasi-Bayindir Holding-Park Holding and PUAS, at a total price of US$ 1.16 billion. However, in 1999 the Administrative Court of Ankara cancelled the tender and as a consequence the PHC cancelled the sale. A new tender is planned for 1999.

In 1999, the Government also plans to sell 10 to 15% of Tupras, the public refiner, to "strategic investors".

According to official data, around 17.9 million tonnes of crude oil was transported in 1997 through the Iraq-Turkey Crude Oil Pipeline. In 1998, an equivalent amount of oil was transported through this pipeline.

Natural Gas

In 1997, natural gas supply increased by 19.5% to 8.3 Mtoe. Final gas consumption increased 20% to 4.1 Mtoe, and the share of gas in electricity generation increased from 18.1% in 1996 to 21.4% in 1997. The gas suppliers are Russia (66.5%) and Algeria (33.5%).

In March 1999, Turkey signed a "Head of Agreement" with Turkmenistan for the import of natural gas reaching 16 bcm per year.

The first section of the Eastern Anatolia Natural Gas Transmission Line, which will carry natural gas from Iran, is under construction. Tenders for the construction of the other four sections (Erzurum-Sivas, Sivas-Kayseri, Kayseri-Ankara, Kayseri-Konya-Seydisehir) have been completed. Gas imports are expected to start in 2000.

In 1999, ENI, the Italian oil and natural gas company, signed with Gazprom, the Russian gas company, a Memorandum of Understanding to build a US$ 3 billion gas pipeline through the Black Sea to transport natural gas from Dzhubga in Russia to Samsun in Turkey. This project, called the "Blue Stream" project, is a 50/50 joint venture between the two companies. 0.5 bcm would be delivered in 2000, rising gradually to 16 bcm in 2007.

Coal

In 1997, coal production (mainly lignite) increased slightly to 13.1 Mtoe. Both hard coal and lignite production increased.

Hard coal is produced in the Zonguldak Coal Basin which is a very complex geological structure. Thus, production has been continually subsidised as shown in Table 1. According to provisional data, assistance to coal producers amounted to TL 4 920 million[1] in 1998. The 1990 restructuring plan of TTK, the public hard coal enterprise, led to a reduction in employment of 26 246 between 1990 and 1998. Underground workers accounted for about two-thirds of the reduction.

Electricity

In 1997, electricity generation increased by 8.9% to 103.3 TWh, and electricity consumption increased by 11.2% to 105.5 TWh. In 1997, Turkey became a net importer of electricity, mostly from Bulgaria.

Because of the expected increase in electricity consumption, electricity generation capacity is expected to increase from 21.9 GW in 1997 to 28.1 GW in 2000 and 45.6 GW in 2005, mostly from natural gas and hydro plants.

Renewable Energy Sources

In 1997, energy supply from renewables was 10.8 Mtoe, of which 5.5 Mtoe was wood. Geothermal energy production increased by 10.5% from its 1996 level to 0.18 Mtoe.

ENERGY EFFICIENCY, ENVIRONMENT, RESEARCH AND DEVELOPMENT

In 1997, energy intensity, measured as total primary energy supply divided by GDP, decreased by 2%. Energy-related CO_2 emissions increased by more than 6% in 1997. Between 1990 and 1997, these emissions increased by more than one-third.

The Government considers that energy policy should be fully integrated into the policy to promote the economic development of the country. Thus, it is necessary to ensure the supply of competitive and environmentally-friendly energy through a sustainable energy policy. The Government has therefore emphasised the development and use of new technologies for energy production, transformation and final consumption. In 1997, public funding for energy R&D was increased threefold in real terms and amounted to TL 1 609 billion. The largest increase in funding was for R&D spending on fossil fuels.

In May 1998, the Energy Technology Policy Study Group issued a report on the "National Energy Technology Policy". This study group is comprised of experts

1. On average in 1998, TL 10 000 = US$ 0.04.

Table 1

IEA Secretariat Estimates of Assistance to Turkish Coal Producers*

(in million TL or TL per tonne)

Assistance Category [a]	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998p*
I. ASSISTANCE INCLUDED IN PRODUCER SUBSIDY EQUIVALENT											
1. Direct aid to current production											
a) Investment grants	22 776	37 565	43 983	158 365	213 853	12 983	0	0	0	0	0
b) Aid to maintain a qualified workforce	1 085	2 344	3 506	6 070	0	0	0	0	0	0	0
c) Aid to promote the sales of coal and coke	3 321	11 445	20 560	47 932	0	0	0	0	0	0	0
d) Deficit grant to help cover operating losses	30 670	60 477	41 578	1 353 013	3 317 011	2 826 924	2 081 582	10 136 023	12 579 735	15 653 709	33 218 151
Subtotal	**57 852**	**111 831**	**109 627**	**1 565 380**	**3 530 864**	**2 839 907**	**2 081 582**	**10 136 023**	**12 579 735**	**15 653 709**	**33 218 151**
2. Indirect aid to current production											
e) Excess deficit payments to miners pension funds	7 110	3 549	4 989	6 260	566 311	708 638	1 670 766	611 843	1 090 750	4 169 396	4 349 112
f) Grants to supplement miners holiday and sickness benefits	14 420	29 901	63 514	139 985	129 884	781 680	1 168 407	1 480 137	2 186 772	4 206 384	7 002 560
g) Excess payments by public electricity producers for domestic coal	..	..	..	..	..	..	..	..	..	..	..
Subtotal	**21 530**	**33 450**	**68 503**	**146 245**	**696 195**	**1 490 318**	**2 839 173**	**2 091 980**	**3 277 522**	**8 375 780**	**11 351 672**
Total PSE (million TL)	**79 382**	**145 281**	**178 130**	**1 711 625**	**4 227 059**	**4 330 225**	**4 920 755**	**12 228 003**	**15 857 257**	**24 029 489**	**44 569 823**
Total PSE (million US$)	**56**	**69**	**69**	**408**	**613**	**394**	**165**	**268**	**195**	**159**	**171**
TL per tonne produced	**24 350**	**47 790**	**64 893**	**620 154**	**1 493 660**	**1 552 608**	**1 733 881**	**5 439 503**	**6 496 213**	**9 562 073**	**20 672 460**
US$ per tonne produced	**17**	**23**	**25**	**148**	**216**	**141**	**58**	**119**	**80**	**63**	**79**
Hard coal production (million tonnes)	3.256	3.038	2.745	2.762	2.830	2.789	2.838	2.248	2.441	2.513	2.156
US$/TL exchange rate (OECD figures)		2 100	2 600	4 200	6 900	11 000	29 800	45 700	81 300	151 600	260 500
II. ASSISTANCE NOT BENEFITING CURRENT PRODUCTION											
1. Deficit payments to finance social security benefits with respect to:											
h) Old-age pension and survivors pension insurance	134 635	305 975	269 649	550 144	0	0	0	0	0	0	0
i) Disability pension insurance	883	1 552	3 247	3 836	7 813	11 550	9 661	99 908	89 875	269 250	139 907
j) Occupational disease payments	6 806	7 667	15 223	21 906	9 982	12 160	30 202	136 603	293 555	341 647	631 981
k) Social aid to retired miners	0	0	0	0	405 112	875 176	1 505 292	3 863 102	3 650 310	3 922 633	4 026 827
Total aid not benefiting current production (million TL)	**142 324**	**315 194**	**288 119**	**575 886**	**422 907**	**898 886**	**1 545 155**	**4 099 613**	**4 033 740**	**4 533 530**	**4 798 715**

* Aid received from the Treasury arising from the differences between TKK's actual costs and market prices.
p Preliminary.
.. Not available.
[a] Definitions of categories are in Appendix D of *Coal Prospects and Policies in IEA Countries: 1987 Review*, IEA/OECD Paris, 1988.
Source: Updated from *Energy Policies of IEA Countries: 1998 Review*, IEA/OECD Paris, 1988.

from the Ministry of Energy and Natural Resources, energy specialists from the public and private sectors, and academics. The report deals with energy technologies as well as the legal and institutional framework, and emphasises the need to strengthen R&D efforts. The main recommendations of the report are as follows:

- To enhance energy conservation and the promotion of efficient end-use technologies.
- To discuss and vote in Parliament the Energy Efficiency Law as soon as possible.
- To establish a committee acting as an advisory body to select the most convenient energy efficiency technologies for Turkey and to facilitate the introduction of those technologies into the market. The National Energy Conservation Centre will act as the secretariat of this committee.
- To favour environmentally-friendly technologies for energy production.
- To promote and facilitate the use of renewable energy sources through increased R&D efforts and to adapt existing subsidies to this purpose.

TURKEY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**15.48**	**25.68**	**26.77**	**27.56**	**31.09**	**35.89**	**52.84**
Coal[1]		5.21	12.41	12.27	13.12	16.15	19.07	28.23
Oil		3.59	3.79	3.58	3.53	2.85	1.91	1.19
Gas		–	0.18	0.17	0.21	0.56	0.22	0.12
Comb. Renewables & Wastes[2]		6.45	7.21	7.04	7.02	6.97	7.06	7.16
Nuclear		–	–	–	–	–	–	3.66
Hydro		0.22	1.99	3.48	3.42	3.76	5.39	7.32
Geothermal		–	0.09	0.16	0.18	0.69	2.04	4.81
Solar/Wind/Other[3]		–	0.02	0.06	0.08	0.12	0.20	0.36
TOTAL NET IMPORTS[4]		**8.74**	**27.64**	**41.41**	**43.18**	**62.00**	**94.98**	**126.53**
Coal[1]	Exports	–	–	–	–	–	–	–
	Imports	0.01	4.21	6.18	7.51	8.57	12.23	28.26
	Net Imports	0.01	4.21	6.18	7.51	8.57	12.23	28.26
Oil	Exports	0.86	1.90	1.60	1.31	..	..	..
	Imports	9.68	22.83	30.12	28.78	..	..	..
	Bunkers	0.09	0.12	0.13	0.16	..	..	..
	Net Imports	8.73	20.81	28.39	27.31	35.39	41.07	49.47
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	2.68	6.84	8.17	18.04	41.67	48.80
	Net Imports	–	2.68	6.84	8.17	18.04	41.67	48.80
Electricity	Exports	–	0.08	0.03	0.02	..	..	..
	Imports	–	0.02	0.02	0.21	..	..	..
	Net Imports	–	–0.06	–0.01	0.19	–	–	–
TOTAL STOCK CHANGES		**0.11**	**–0.82**	**–0.52**	**0.54**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**24.32**	**52.50**	**67.65**	**71.27**	**93.09**	**130.86**	**179.37**
Coal[1]		5.15	16.94	18.90	21.18	24.72	31.30	56.48
Oil		12.50	23.46	31.02	30.86	38.24	42.98	50.66
Gas		–	2.86	6.98	8.34	18.59	41.89	48.93
Comb. Renewables & Wastes[2]		6.45	7.21	7.04	7.02	6.97	7.06	7.16
Nuclear		–	–	–	–	–	–	3.66
Hydro		0.22	1.99	3.48	3.42	3.76	5.39	7.32
Geothermal		–	0.09	0.16	0.18	0.69	2.04	4.81
Solar/Wind/Other[3]		–	0.02	0.06	0.08	0.12	0.20	0.36
Electricity Trade[5]		–	–0.06	–0.01	0.19	–	–	–
Shares (%)								
Coal		*21.2*	*32.3*	*27.9*	*29.7*	*26.6*	*23.9*	*31.5*
Oil		*51.4*	*44.7*	*45.9*	*43.3*	*41.1*	*32.8*	*28.2*
Gas		*–*	*5.4*	*10.3*	*11.7*	*20.0*	*32.0*	*27.3*
Comb. Renewables & Wastes		*26.5*	*13.7*	*10.4*	*9.9*	*7.5*	*5.4*	*4.0*
Nuclear		*–*	*–*	*–*	*–*	*–*	*–*	*2.0*
Hydro		*0.9*	*3.8*	*5.1*	*4.8*	*4.0*	*4.1*	*4.1*
Geothermal		*–*	*0.2*	*0.2*	*0.3*	*0.7*	*1.6*	*2.7*
Solar/Wind/Other		*–*	*–*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*
Electricity Trade		*–*	*–0.1*	*–*	*0.3*	*–*	*–*	*–*

0 is negligible. – is nil. .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**19.99**	**40.20**	**51.77**	**53.62**	**70.51**	**91.82**	**124.45**
Coal[1]	2.94	7.57	7.92	9.01	13.87	16.47	28.31
Oil	9.70	20.80	27.31	26.65	32.87	37.27	44.50
Gas	0.04	0.72	3.39	4.07	6.33	14.15	17.55
Comb. Renewables & Wastes[2]	6.45	7.21	6.84	6.85	6.96	7.06	7.16
Geothermal	–	0.02	0.09	0.11	0.61	1.80	4.57
Solar/Wind/Other	–	0.02	0.06	0.08	0.12	0.20	0.36
Electricity	0.85	3.87	6.14	6.85	9.75	14.87	22.01
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*14.7*	*18.8*	*15.3*	*16.8*	*19.7*	*17.9*	*22.7*
Oil	*48.5*	*51.7*	*52.8*	*49.7*	*46.6*	*40.6*	*35.8*
Gas	*0.2*	*1.8*	*6.6*	*7.6*	*9.0*	*15.4*	*14.1*
Comb. Renewables & Wastes	*32.3*	*17.9*	*13.2*	*12.8*	*9.9*	*7.7*	*5.8*
Geothermal	–	–	*0.2*	*0.2*	*0.9*	*2.0*	*3.7*
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.3*
Electricity	*4.3*	*9.6*	*11.9*	*12.8*	*13.8*	*16.2*	*17.7*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**4.30**	**13.71**	**18.75**	**20.25**	**27.02**	**39.04**	**58.90**
Coal[1]	1.14	4.52	5.71	6.38	9.17	12.81	25.03
Oil	2.60	6.16	7.77	8.10	8.59	9.25	9.98
Gas	0.00	0.67	1.95	2.20	3.47	7.95	9.89
Comb. Renewables & Wastes[2]	–	–	–	–	–	–	–
Geothermal	–	–	–	–	0.21	0.37	0.66
Solar/Wind/Other	–	0.01	0.02	0.02	0.06	0.13	0.26
Electricity	0.55	2.35	3.30	3.55	5.53	8.53	13.08
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*26.5*	*33.0*	*30.4*	*31.5*	*33.9*	*32.8*	*42.5*
Oil	*60.5*	*44.9*	*41.4*	*40.0*	*31.8*	*23.7*	*16.9*
Gas	*0.1*	*4.9*	*10.4*	*10.9*	*12.8*	*20.4*	*16.8*
Comb. Renewables & Wastes	–	–	–	–	–	–	–
Geothermal	–	–	–	–	*0.8*	*1.0*	*1.1*
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.3*	*0.4*
Electricity	*12.9*	*17.2*	*17.6*	*17.5*	*20.5*	*21.8*	*22.2*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**4.49**	**9.58**	**12.89**	**12.21**	**17.61**	**20.83**	**26.38**
TOTAL OTHER SECTORS[8]	**11.21**	**16.91**	**20.13**	**21.16**	**25.89**	**31.95**	**39.17**
Coal[1]	1.28	3.03	2.21	2.62	4.71	3.65	3.27
Oil	3.15	5.11	6.74	6.42	6.78	7.37	8.41
Gas	0.04	0.05	1.41	1.84	2.86	6.19	7.65
Comb. Renewables & Wastes[2]	6.45	7.21	6.84	6.85	6.96	7.06	7.16
Geothermal	–	0.02	0.09	0.11	0.40	1.42	3.91
Solar/Wind/Other	–	0.01	0.04	0.06	0.06	0.07	0.10
Electricity	0.29	1.49	2.80	3.27	4.12	6.18	8.68
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*11.4*	*17.9*	*11.0*	*12.4*	*18.2*	*11.4*	*8.4*
Oil	*28.1*	*30.2*	*33.5*	*30.3*	*26.2*	*23.1*	*21.5*
Gas	*0.3*	*0.3*	*7.0*	*8.7*	*11.1*	*19.4*	*19.5*
Comb. Renewables & Wastes	*57.5*	*42.6*	*34.0*	*32.4*	*26.9*	*22.1*	*18.3*
Geothermal	–	*0.1*	*0.4*	*0.5*	*1.6*	*4.5*	*10.0*
Solar/Wind/Other	–	*0.1*	*0.2*	*0.3*	*0.2*	*0.2*	*0.3*
Electricity	*2.6*	*8.8*	*13.9*	*15.4*	*15.9*	*19.3*	*22.1*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**2.77**	**11.08**	**17.73**	**19.31**	**28.57**	**49.39**	**71.70**
OUTPUT (Mtoe)	**1.07**	**4.95**	**8.16**	**8.88**	**11.55**	**17.16**	**24.92**
(TWh gross)	12.43	57.54	94.86	103.30	134.31	199.56	289.82
Output Shares (%)							
Coal	*26.1*	*35.1*	*32.1*	*32.8*	*28.6*	*26.9*	*27.7*
Oil	*51.4*	*6.9*	*6.9*	*6.9*	*3.6*	*2.3*	*1.6*
Gas	*–*	*17.7*	*18.1*	*21.4*	*35.1*	*39.3*	*36.4*
Comb. Renewables & Wastes	*1.6*	*–*	*0.2*	*0.3*	*0.0*	*0.0*	*0.0*
Nuclear	*–*	*–*	*–*	*–*	*–*	*–*	*4.8*
Hydro	*20.9*	*40.2*	*42.7*	*38.5*	*32.5*	*31.4*	*29.4*
Geothermal	*–*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Solar/Wind/Other	*–*	*–*	*–*	*–*	*0.0*	*0.0*	*0.0*
TOTAL LOSSES	**4.03**	**11.18**	**15.45**	**16.87**	**22.57**	**39.05**	**54.92**
of which:							
Electricity and Heat Generation[10]	1.70	6.13	9.57	10.42	17.02	32.22	46.77
Other Transformation	1.32	2.49	1.96	2.14	1.41	1.61	1.96
Own Use and Losses[11]	1.00	2.56	3.93	4.30	4.14	5.21	6.19
Statistical Differences	**0.30**	**1.13**	**0.44**	**0.79**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	71.29	150.68	188.84	203.05	229.73	293.20	374.20
Population (millions)	38.45	56.20	62.70	63.75	67.33	72.54	78.14
TPES/GDP[12]	0.34	0.35	0.36	0.35	0.41	0.45	0.48
Energy Production/TPES	0.64	0.49	0.40	0.39	0.33	0.27	0.29
Per Capita TPES[13]	0.63	0.93	1.08	1.12	1.38	1.80	2.30
Oil Supply/GDP[12]	0.18	0.16	0.16	0.15	0.17	0.15	0.14
TFC/GDP[12]	0.28	0.27	0.27	0.26	0.31	0.31	0.33
Per Capita TFC[13]	0.52	0.72	0.83	0.84	1.05	1.27	1.59
Energy-related CO_2 Emissions (Mt CO_2)[14]	56.9	138.4	176.8	187.5	244.9	337.5	473.8
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	0.4	0.4	0.5	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	3.7	5.1	4.3	5.4	9.3	7.0	6.5
Coal	4.1	9.0	1.8	12.0	5.3	4.8	12.5
Oil	3.1	4.1	4.8	–0.5	7.4	2.4	3.3
Gas	–	–	16.1	19.4	30.6	17.6	3.2
Comb. Renewables & Wastes	3.1	–0.7	–0.4	–0.3	–0.3	0.3	0.3
Nuclear	–	–	–	–	–	–	–
Hydro	25.7	7.6	9.8	–1.6	3.2	7.5	6.3
Geothermal	–	–	11.3	10.5	56.4	24.3	18.7
Solar/Wind/Other	–	–	20.4	25.0	15.1	10.6	12.0
TFC	4.1	4.2	4.3	3.6	9.6	5.4	6.3
Electricity Consumption	11.3	8.2	8.0	11.6	12.5	8.8	8.2
Energy Production	1.9	3.6	0.7	2.9	4.1	2.9	8.0
Net Oil Imports	5.1	5.3	5.3	–3.8	9.0	3.0	3.8
GDP	4.5	4.5	3.8	7.5	4.2	5.0	5.0
Growth in the TPES/GDP Ratio	–0.8	0.6	0.5	–2.0	4.9	2.0	1.4
Growth in the TFC/GDP Ratio	–0.4	–0.3	0.5	–3.7	5.1	0.4	1.2

Please note: Rounding may cause totals to differ from the sum of the elements.

STANDARD REVIEWS

Energy Balances and Key Statistical Data

Austria
Canada
Denmark
France
Germany
Greece
Luxembourg
Netherlands
Portugal
Sweden
United Kingdom
United States

AUSTRIA

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**8.0**	**8.4**	**7.9**	**8.0**	**9.7**	**9.7**	**9.9**
Coal[1]		1.1	0.6	0.3	0.3	0.2	0.1	0.1
Oil		2.7	1.2	1.0	1.0	1.0	0.7	0.6
Gas		2.0	1.1	1.3	1.2	1.4	1.3	1.0
Comb. Renewables & Wastes[2]		0.7	2.7	2.3	2.4	3.6	3.9	4.4
Nuclear		–	–	–	–	–	–	–
Hydro		1.6	2.7	2.9	3.1	3.4	3.5	3.6
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	0.2	0.2	0.3
TOTAL NET IMPORTS[4]		**14.0**	**17.7**	**19.6**	**19.3**	**19.3**	**21.1**	**22.9**
Coal[1]	Exports	0.1	0.0	–	0.0	–	–	–
	Imports	3.1	3.1	3.1	3.1	2.3	2.0	1.8
	Net Imports	3.0	3.1	3.1	3.1	2.3	2.0	1.8
Oil	Exports	0.1	0.4	1.1	1.4	0.9	0.9	0.9
	Imports	9.9	10.4	11.9	12.4	11.0	11.4	11.6
	Bunkers	–	–	–	–	–	–	–
	Net Imports	9.7	10.0	10.8	11.0	10.1	10.5	10.7
Gas	Exports	–	–	–	–	0.0	0.0	0.0
	Imports	1.3	4.5	5.6	5.1	7.0	8.7	10.5
	Net Imports	1.3	4.5	5.6	5.1	7.0	8.7	10.4
Electricity	Exports	0.4	0.6	0.7	0.8	0.8	0.8	0.8
	Imports	0.3	0.6	0.8	0.8	0.7	0.7	0.8
	Net Imports	–0.1	–0.0	0.1	–0.1	–0.2	–0.1	–0.0
TOTAL STOCK CHANGES		**–0.2**	**–0.3**	**–0.2**	**0.5**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**21.8**	**25.7**	**27.3**	**27.8**	**29.1**	**30.8**	**32.8**
Coal[1]		4.0	4.1	3.4	3.6	2.5	2.1	1.9
Oil		12.3	10.9	11.7	12.1	11.1	11.1	11.2
Gas		3.3	5.2	6.8	6.5	8.4	10.0	11.5
Comb. Renewables & Wastes[2]		0.7	2.8	2.4	2.5	3.6	4.0	4.5
Nuclear		–	–	–	–	–	–	–
Hydro		1.6	2.7	2.9	3.1	3.4	3.5	3.6
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	0.2	0.2	0.3
Electricity Trade[5]		–0.1	–0.0	0.1	–0.1	–0.2	–0.1	–0.0
Shares (%)								
Coal		*18.3*	*16.1*	*12.5*	*13.1*	*8.6*	*6.8*	*5.6*
Oil		*56.4*	*42.4*	*42.8*	*43.5*	*38.2*	*36.2*	*34.2*
Gas		*15.3*	*20.4*	*24.9*	*23.5*	*29.0*	*32.3*	*34.9*
Comb. Renewables & Wastes		*3.3*	*10.7*	*8.7*	*8.9*	*12.4*	*12.9*	*13.7*
Nuclear		–	–	–	–	–	–	–
Hydro		*7.4*	*10.5*	*10.8*	*11.1*	*11.7*	*11.3*	*11.0*
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other		–	–	–	–	*0.7*	*0.7*	*0.8*
Electricity Trade		*–0.6*	*–0.2*	*0.3*	*–0.2*	*–0.6*	*–0.3*	*–0.1*

0 is negligible, – is nil, .. is not available.

Please note: Forecasts are based on the 1996 submission. Forecasts for final consumption by sector are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**17.0**	**21.1**	**22.2**	**22.5**	**25.1**	**26.6**	**28.4**
Coal[1]	2.1	1.5	1.2	1.3	1.6	1.5	1.4
Oil	10.2	9.6	10.4	10.7	10.2	10.3	10.4
Gas	1.8	3.1	3.8	3.6	5.1	6.1	6.9
Comb. Renewables & Wastes[2]	0.7	2.5	1.8	1.7	2.8	2.7	2.9
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	0.1	0.1	0.1
Electricity	2.2	3.7	4.1	4.2	4.3	4.7	5.3
Heat	–	0.6	0.9	1.0	1.1	1.3	1.4
Shares (%)							
Coal	*12.5*	*7.3*	*5.5*	*5.6*	*6.3*	*5.6*	*5.0*
Oil	*59.9*	*45.6*	*46.6*	*47.6*	*40.7*	*38.8*	*36.7*
Gas	*10.7*	*14.6*	*17.1*	*16.1*	*20.5*	*22.8*	*24.4*
Comb. Renewables & Wastes	*4.1*	*12.1*	*8.3*	*7.5*	*11.0*	*10.1*	*10.0*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.2*	*0.2*	*0.2*
Electricity	*12.8*	*17.6*	*18.6*	*18.6*	*17.1*	*17.8*	*18.7*
Heat	–	*2.9*	*4.0*	*4.5*	*4.3*	*4.7*	*4.9*
TOTAL INDUSTRY[6]	**6.4**	**6.9**	**6.3**	**6.7**	**8.2**	**8.8**	**9.4**
Coal[1]	0.7	0.9	0.8	0.9	1.1	1.1	1.0
Oil	3.3	2.2	1.8	2.0	2.4	2.5	2.5
Gas	1.2	1.8	1.7	1.8	2.4	2.8	3.2
Comb. Renewables & Wastes[2]	0.0	0.4	0.3	0.3	0.5	0.5	0.6
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.0	1.6	1.5	1.6	1.7	1.8	2.1
Heat	–	0.1	0.2	0.1	0.1	0.1	0.1
Shares (%)							
Coal	11.4	12.5	12.5	12.7	13.5	11.9	10.6
Oil	52.4	31.7	29.0	30.4	29.6	28.0	26.2
Gas	19.2	26.8	27.0	27.1	28.8	31.9	33.9
Comb. Renewables & Wastes	0.5	5.4	4.7	3.9	6.4	5.9	5.8
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	16.3	22.6	24.3	23.8	20.4	20.9	22.0
Heat	–	1.0	2.5	2.0	1.2	1.4	1.5
TRANSPORT[7]	**4.0**	**5.5**	**6.5**	**6.5**	**6.1**	**6.2**	**6.3**
TOTAL OTHER SECTORS[8]	**6.6**	**8.7**	**9.4**	**9.3**	**10.8**	**11.6**	**12.7**
Coal[1]	1.3	0.7	0.4	0.4	0.4	0.4	0.4
Oil	3.1	2.2	2.3	2.4	2.0	2.1	2.1
Gas	0.6	1.2	2.1	1.8	2.7	3.2	3.7
Comb. Renewables & Wastes[2]	0.7	2.2	1.5	1.4	2.2	2.2	2.3
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	0.1	0.1	0.1
Electricity	1.0	1.9	2.3	2.4	2.3	2.6	2.9
Heat	–	0.5	0.7	0.9	1.0	1.1	1.3
Shares (%)							
Coal	*19.4*	*7.7*	*4.4*	*4.4*	*4.1*	*3.6*	*3.2*
Oil	*46.8*	*24.9*	*24.7*	*26.1*	*18.8*	*17.6*	*16.4*
Gas	*9.0*	*14.1*	*21.9*	*19.3*	*25.3*	*27.7*	*29.2*
Comb. Renewables & Wastes	*9.9*	*25.0*	*16.5*	*15.4*	*20.6*	*18.6*	*18.1*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.5*	*0.5*	*0.6*
Electricity	*15.0*	*22.2*	*24.7*	*25.3*	*21.6*	*22.1*	*22.8*
Heat	–	*6.2*	*7.8*	*9.4*	*9.0*	*9.8*	*9.9*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.8**	**7.1**	**8.1**	**8.2**	**8.5**	**9.2**	**10.1**
OUTPUT (Mtoe)	**2.7**	**4.2**	**4.6**	**4.8**	**4.8**	**5.1**	**5.6**
(TWh gross)	30.9	49.4	53.5	55.5	55.8	59.8	64.9
Output Shares (%)							
Coal	*10.3*	*14.8*	*11.5*	*11.8*	*4.3*	*2.3*	*1.4*
Oil	*14.1*	*4.4*	*3.7*	*5.0*	*2.0*	*1.5*	*1.2*
Gas	*14.3*	*14.8*	*17.5*	*15.5*	*18.1*	*20.9*	*23.3*
Comb. Renewables & Wastes	*0.7*	*2.3*	*3.3*	*2.9*	*4.8*	*7.0*	*8.3*
Nuclear	–	–	–	–	–	–	–
Hydro	*60.6*	*63.7*	*64.0*	*64.8*	*70.6*	*68.2*	*65.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
TOTAL LOSSES	**4.7**	**4.5**	**5.1**	**5.1**	**3.9**	**4.1**	**4.5**
of which:							
Electricity and Heat Generation[10]	2.2	2.2	2.5	2.2	2.4	2.6	2.9
Other Transformation	1.4	0.8	0.6	0.6	0.3	0.3	0.3
Own Use and Losses[11]	1.2	1.5	2.0	2.2	1.2	1.2	1.2
Statistical Differences	**0.1**	**0.1**	**–0.1**	**0.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	104.19	159.50	178.73	183.27	198.23	218.87	241.65
Population (millions)	7.59	7.73	8.06	8.07	8.11	8.15	8.20
TPES/GDP[12]	0.21	0.16	0.15	0.15	0.15	0.14	0.14
Energy Production/TPES	0.37	0.33	0.29	0.29	0.33	0.31	0.30
Per Capita TPES[13]	2.87	3.33	3.38	3.44	3.58	3.77	4.00
Oil Supply/GDP[12]	0.12	0.07	0.07	0.07	0.06	0.05	0.05
TFC/GDP[12]	0.16	0.13	0.12	0.12	0.13	0.12	0.12
Per Capita TFC[13]	2.24	2.73	2.76	2.79	3.10	3.27	3.46
Energy–related CO_2 Emissions (Mt CO_2)[14]	58.4	59.4	62.7	64.1	61.1	63.1	65.8
CO_2 Emissions from Bunkers (Mt CO_2)	–	–	–	–	–	–	–

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.5	0.7	1.0	1.9	1.5	1.1	1.3
Coal	–1.5	1.2	–3.3	6.6	–11.6	–3.5	–2.4
Oil	0.7	–1.5	1.1	3.7	–2.8	0.1	0.1
Gas	4.6	1.7	4.4	–3.6	8.8	3.4	2.8
Comb. Renewables & Wastes	6.3	9.3	–2.4	4.2	13.3	2.0	2.4
Nuclear	–	–	–	–	–	–	–
Hydro	6.7	1.2	1.4	5.2	3.1	0.5	0.7
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	3.7	3.1
TFC	2.1	0.9	0.9	1.4	3.7	1.2	1.3
Electricity Consumption	3.9	2.8	1.8	1.8	0.8	1.9	2.3
Energy Production	0.0	0.4	–1.1	2.0	6.7	–0.1	0.5
Net Oil Imports	2.7	–1.2	1.2	2.4	–2.9	0.7	0.4
GDP	3.0	2.3	1.9	2.5	2.7	2.0	2.0
Growth in the TPES/GDP Ratio	–1.4	–1.6	–0.9	–0.7	–1.1	–0.8	–0.7
Growth in the TFC/GDP Ratio	–0.8	–1.4	–1.0	–1.1	1.0	–0.8	–0.7

Please note: Rounding may cause totals to differ from the sum of the elements.

CANADA

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**198.0**	**274.1**	**355.8**	**362.7**	**389.9**	**409.5**	**420.3**
Coal[1]		11.7	37.9	41.6	43.0	39.9	40.7	41.9
Oil		96.3	94.7	114.6	120.2	128.3	136.4	138.8
Gas		61.4	88.1	135.0	137.4	146.4	154.9	161.8
Comb. Renewables & Wastes[2]		7.8	8.5	9.7	10.4	17.1	18.7	19.9
Nuclear		4.1	19.4	24.2	21.5	27.7	27.8	26.9
Hydro		16.7	25.5	30.6	30.2	30.0	30.5	30.5
Geothermal		–	–	–	–	0.4	0.4	0.4
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.1	0.1	0.1
TOTAL NET IMPORTS[4]		**–35.4**	**–60.4**	**–121.1**	**–122.2**	**–136.4**	**–143.3**	**–143.9**
Coal[1]	Exports	7.6	21.4	23.9	25.3	21.8	21.8	23.1
	Imports	10.5	9.7	8.4	9.7	5.6	6.9	8.3
	Net Imports	2.8	–11.7	–15.6	–15.6	–16.2	–15.0	–14.8
Oil	Exports	63.1	49.7	79.0	84.6	89.9	97.2	96.1
	Imports	48.8	34.2	41.9	47.5	45.1	48.5	50.1
	Bunkers	–	0.6	0.6	0.5	0.7	0.7	0.8
	Net Imports	–14.3	–16.2	–37.7	–37.6	–45.4	–49.5	–46.8
Gas	Exports	23.1	33.0	65.5	67.0	71.8	76.4	81.0
	Imports	0.3	0.5	1.0	1.0	0.6	0.6	0.6
	Net Imports	–22.8	–32.5	–64.5	–65.9	–71.1	–75.7	–80.4
Electricity	Exports	1.4	1.6	3.8	3.9	7.2	6.8	5.4
	Imports	0.2	1.5	0.5	0.8	3.6	3.6	3.4
	Net Imports	–1.2	–0.0	–3.2	–3.1	–3.6	–3.2	–2.0
TOTAL STOCK CHANGES		**–1.6**	**–4.0**	**0.2**	**–2.5**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**161.0**	**209.7**	**234.9**	**238.0**	**253.5**	**266.1**	**276.4**
Coal[1]		15.3	24.5	25.9	27.4	23.7	25.7	27.2
Oil		81.0	77.6	77.5	80.8	82.9	87.0	92.0
Gas		37.3	54.3	70.3	70.7	75.3	79.2	81.5
Comb. Renewables & Wastes[2]		7.8	8.5	9.7	10.4	17.1	18.7	19.9
Nuclear		4.1	19.4	24.2	21.5	27.7	27.8	26.9
Hydro		16.7	25.5	30.6	30.2	30.0	30.5	30.5
Geothermal		–	–	–	–	0.4	0.4	0.4
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.1	0.1	0.1
Electricity Trade[5]		–1.2	–0.0	–3.2	–3.1	–3.6	–3.2	–2.0
Shares (%)								
Coal		*9.5*	*11.7*	*11.0*	*11.5*	*9.3*	*9.7*	*9.8*
Oil		*50.3*	*37.0*	*33.0*	*34.0*	*32.7*	*32.7*	*33.3*
Gas		*23.2*	*25.9*	*29.9*	*29.7*	*29.7*	*29.8*	*29.5*
Comb. Renewables & Wastes		*4.9*	*4.0*	*4.1*	*4.4*	*6.8*	*7.0*	*7.2*
Nuclear		*2.5*	*9.2*	*10.3*	*9.0*	*10.9*	*10.4*	*9.7*
Hydro		*10.4*	*12.2*	*13.0*	*12.7*	*11.8*	*11.5*	*11.0*
Geothermal		–	–	–	–	*0.2*	*0.2*	*0.2*
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		*–0.7*	–	*–1.4*	*–1.3*	*–1.4*	*–1.2*	*–0.7*

0 is negligible, – is nil, .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**133.2**	**161.0**	**184.3**	**187.5**	**193.1**	**202.2**	**210.4**
Coal[1]	5.2	3.2	3.3	3.4	4.5	4.7	4.8
Oil	77.6	70.2	76.9	79.5	73.9	76.9	80.9
Gas	23.7	43.2	53.8	53.0	57.2	59.3	59.9
Comb. Renewables & Wastes[2]	7.6	8.1	9.3	10.0	15.5	16.7	17.8
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	18.9	35.8	40.4	40.9	41.6	44.1	46.5
Heat	0.1	0.5	0.5	0.8	0.5	0.6	0.6
Shares (%)							
Coal	*3.9*	*2.0*	*1.8*	*1.8*	*2.3*	*2.3*	*2.3*
Oil	*58.3*	*43.6*	*41.7*	*42.4*	*38.2*	*38.0*	*38.4*
Gas	*17.8*	*26.8*	*29.2*	*28.3*	*29.6*	*29.3*	*28.5*
Comb. Renewables & Wastes	*5.7*	*5.1*	*5.1*	*5.3*	*8.0*	*8.3*	*8.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*14.2*	*22.2*	*21.9*	*21.8*	*21.5*	*21.8*	*22.1*
Heat	*0.1*	*0.3*	*0.3*	*0.4*	*0.3*	*0.3*	*0.3*
TOTAL INDUSTRY[6]	**52.8**	**62.4**	**72.5**	**74.7**	**85.0**	**91.0**	**96.2**
Coal[1]	4.7	3.2	3.3	3.3	4.5	4.7	4.8
Oil	21.4	18.2	20.6	21.2	20.4	21.0	22.2
Gas	11.9	20.1	23.2	23.6	27.7	29.8	31.2
Comb. Renewables & Wastes[2]	5.7	6.1	7.6	8.2	13.6	14.9	16.0
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	9.1	14.4	17.3	17.6	18.3	20.2	21.6
Heat	0.1	0.5	0.5	0.7	0.5	0.6	0.6
Shares (%)							
Coal	*8.9*	*5.0*	*4.5*	*4.4*	*5.3*	*5.1*	*5.0*
Oil	*40.4*	*29.2*	*28.4*	*28.4*	*23.9*	*23.0*	*23.0*
Gas	*22.5*	*32.1*	*32.0*	*31.5*	*32.6*	*32.7*	*32.4*
Comb. Renewables & Wastes	*10.8*	*9.8*	*10.5*	*11.0*	*16.0*	*16.3*	*16.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*17.2*	*23.0*	*23.9*	*23.6*	*21.5*	*22.2*	*22.4*
Heat	*0.2*	*0.8*	*0.7*	*1.0*	*0.6*	*0.6*	*0.6*
TRANSPORT[7]	**35.3**	**44.3**	**50.6**	**52.2**	**53.5**	**56.3**	**59.1**
TOTAL OTHER SECTORS[8]	**45.1**	**54.3**	**61.1**	**60.6**	**54.7**	**54.9**	**55.1**
Coal[1]	0.4	0.1	0.0	0.1	0.0	0.1	0.1
Oil	21.3	10.9	11.3	11.8	6.3	6.1	6.3
Gas	11.9	20.2	25.2	24.1	24.2	24.0	23.0
Comb. Renewables & Wastes[2]	1.9	2.0	1.7	1.8	1.8	1.9	1.9
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	9.5	21.1	22.8	22.8	22.3	22.9	23.9
Heat	–	0.0	0.0	0.0	–	–	–
Shares (%)							
Coal	*0.9*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*
Oil	*47.4*	*20.1*	*18.5*	*19.5*	*11.4*	*11.2*	*11.5*
Gas	*26.3*	*37.2*	*41.3*	*39.7*	*44.3*	*43.7*	*41.7*
Comb. Renewables & Wastes	*4.2*	*3.7*	*2.9*	*2.9*	*3.3*	*3.4*	*3.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*21.2*	*38.9*	*37.2*	*37.7*	*40.8*	*41.7*	*43.3*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**36.1**	**70.2**	**82.2**	**82.4**	**83.4**	**87.3**	**90.9**
OUTPUT (Mtoe)	**23.2**	**41.5**	**49.6**	**49.5**	**49.5**	**51.8**	**53.4**
(TWh gross)	270.1	482.0	577.0	575.0	575.1	602.2	621.0
Output Shares (%)							
Coal	*12.9*	*17.2*	*16.4*	*17.4*	*13.2*	*13.8*	*15.2*
Oil	*3.4*	*3.3*	*1.8*	*2.4*	*1.0*	*1.5*	*1.9*
Gas	*6.0*	*2.2*	*3.4*	*4.1*	*4.5*	*5.8*	*6.7*
Comb. Renewables & Wastes	*–*	*0.5*	*0.6*	*0.7*	*2.0*	*2.2*	*2.3*
Nuclear	*5.6*	*15.1*	*16.1*	*14.4*	*18.5*	*17.7*	*16.6*
Hydro	*72.1*	*61.6*	*61.7*	*61.1*	*60.6*	*58.9*	*57.1*
Geothermal	*–*	*–*	*–*	*–*	*0.1*	*0.1*	*0.1*
Solar/Wind/Other	*–*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*
TOTAL LOSSES	**31.2**	**51.1**	**56.4**	**54.2**	**60.3**	**63.9**	**66.0**
of which:							
Electricity and Heat Generation[10]	12.8	28.3	32.0	32.2	33.4	35.0	36.9
Other Transformation	1.9	1.2	0.0	–2.1	7.0	7.5	7.6
Own Use and Losses[11]	16.5	21.6	24.3	24.0	19.9	21.4	21.5
Statistical Differences	**–3.5**	**–2.4**	**–5.7**	**–3.7**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	340.86	572.67	624.32	647.38	680.96	757.76	843.21
Population (millions)	22.56	27.79	29.97	30.29	31.00	32.40	33.80
TPES/GDP[12]	0.47	0.37	0.38	0.37	0.37	0.35	0.33
Energy Production/TPES	1.23	1.31	1.51	1.52	1.54	1.54	1.52
Per Capita TPES[13]	7.14	7.55	7.84	7.86	8.18	8.21	8.18
Oil Supply/GDP[12]	0.24	0.14	0.12	0.12	0.12	0.11	0.11
TFC/GDP[12]	0.39	0.28	0.30	0.29	0.28	0.27	0.25
Per Capita TFC[13]	5.91	5.79	6.15	6.19	6.23	6.24	6.22
Energy–related CO_2 Emissions (Mt CO_2)[14]	374.0	427.5	462.4	477.4	477.3	504.0	527.6
CO_2 Emissions from Bunkers (Mt CO_2)	–	2.0	2.0	1.7	2.2	2.4	2.4

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	2.9	0.9	1.9	1.3	2.1	1.0	0.8
Coal	4.4	1.9	0.9	5.8	–4.7	1.6	1.1
Oil	2.1	–1.5	–0.0	4.3	0.8	1.0	1.1
Gas	2.7	2.0	4.4	0.6	2.1	1.0	0.6
Comb. Renewables & Wastes	–1.6	1.6	2.2	7.4	18.2	1.7	1.3
Nuclear	15.7	6.4	3.8	–11.1	8.7	0.1	–0.6
Hydro	3.8	1.8	3.1	–1.4	–0.3	0.4	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	26.0	–	95.7	–	–
TFC	2.4	0.4	2.3	1.8	1.0	0.9	0.8
Electricity Consumption	4.7	3.4	2.0	1.1	0.6	1.2	1.1
Energy Production	1.0	2.4	4.4	1.9	2.4	1.0	0.5
Net Oil Imports	–	–	15.2	–0.2	6.5	1.7	–1.1
GDP	3.9	2.7	1.4	3.7	1.7	2.2	2.2
Growth in the TPES/GDP Ratio	–1.0	–1.8	0.5	–2.3	0.4	–1.2	–1.4
Growth in the TFC/GDP Ratio	–1.4	–2.2	0.8	–1.9	–0.7	–1.2	–1.3

Please note: Rounding may cause totals to differ from the sum of the elements.

DENMARK

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		0.40	9.98	17.59	20.27	24.07	19.28	12.37
Coal[1]		–	–	0.04	0.01	–	–	–
Oil		0.07	6.11	10.32	11.59	14.56	9.36	5.39
Gas		–	2.74	5.64	6.96	7.44	7.49	4.05
Comb. Renewables & Wastes[2]		0.33	1.08	1.47	1.54	1.83	2.02	2.28
Nuclear		–	–	–	–	–	–	–
Hydro		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Geothermal		–	0.00	0.00	0.00	–	0.03	0.03
Solar/Wind/Other[3]		–	0.06	0.11	0.18	0.23	0.37	0.61
TOTAL NET IMPORTS[4]		**19.85**	**8.14**	**4.14**	**2.21**	**–4.48**	**0.10**	**6.06**
Coal[1]	Exports	0.04	0.03	0.10	0.06	–	–	–
	Imports	1.91	6.23	7.74	7.95	4.56	3.54	2.64
	Net Imports	1.87	6.20	7.64	7.88	4.56	3.54	2.64
Oil	Exports	2.89	5.51	10.05	11.47	7.05	3.50	3.89
	Imports	21.58	8.73	11.07	10.70	2.50	3.71	7.83
	Bunkers	0.69	0.96	1.51	1.50	1.61	1.61	1.61
	Net Imports	18.00	2.26	–0.48	–2.27	–6.16	–1.39	2.34
Gas	Exports	–	0.93	1.70	2.78	2.65	1.71	–
	Imports	–	–	–	–	–	–	1.27
	Net Imports	–	–0.93	–1.70	–2.78	–2.65	–1.71	1.27
Electricity	Exports	0.11	0.42	1.65	0.95	0.23	0.33	0.19
	Imports	0.09	1.03	0.33	0.33	–	–	–
	Net Imports	–0.02	0.61	–1.33	–0.62	–0.23	–0.33	–0.19
TOTAL STOCK CHANGES		**–0.44**	**0.16**	**1.14**	**–1.37**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**19.81**	**18.28**	**22.87**	**21.11**	**19.59**	**19.38**	**18.43**
Coal[1]		1.93	6.07	8.88	6.58	4.56	3.54	2.64
Oil		17.57	8.68	10.06	9.57	8.41	7.97	7.73
Gas		–	1.79	3.67	3.86	4.79	5.78	5.32
Comb. Renewables & Wastes[2]		0.33	1.08	1.47	1.54	1.83	2.02	2.28
Nuclear		–	–	–	–	–	–	–
Hydro		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Geothermal		–	0.00	0.00	0.00	–	0.03	0.03
Solar/Wind/Other[3]		–	0.06	0.12	0.18	0.23	0.37	0.61
Electricity Trade[5]		–0.02	0.61	–1.32	–0.62	–0.23	–0.33	–0.19
Shares (%)								
Coal		*9.7*	*33.2*	*38.8*	*31.2*	*23.3*	*18.2*	*14.3*
Oil		*88.7*	*47.5*	*44.0*	*45.3*	*42.9*	*41.1*	*42.0*
Gas		*–*	*9.8*	*16.1*	*18.3*	*24.5*	*29.8*	*28.9*
Comb. Renewables & Wastes		*1.7*	*5.9*	*6.4*	*7.3*	*9.3*	*10.4*	*12.4*
Nuclear		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Hydro		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Geothermal		*–*	*–*	*–*	*–*	*–*	*0.1*	*0.2*
Solar/Wind/Other		*–*	*0.3*	*0.5*	*0.8*	*1.2*	*1.9*	*3.3*
Electricity Trade		*–0.1*	*3.3*	*–5.8*	*–3.0*	*–1.2*	*–1.7*	*–1.0*

0 is negligible, – is nil, .. is not available.

Please note: TPES for a given year strongly depends on the amount of net import of electricity, which may vary substantially from year to year. All forecast data are based on the 1996 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**16.15**	**14.07**	**16.28**	**15.81**	**14.88**	**15.06**	**14.81**
Coal[1]	0.34	0.39	0.37	0.37	0.45	0.42	0.38
Oil	14.26	8.02	8.35	8.03	7.00	6.70	6.47
Gas	0.12	1.13	1.87	1.84	1.94	2.29	2.17
Comb. Renewables & Wastes[2]	0.05	0.20	0.53	0.55	0.50	0.53	0.62
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.00	0.01	0.01	0.01	0.02	0.02
Electricity	1.39	2.50	2.74	2.74	2.70	2.70	2.71
Heat	–	1.84	2.42	2.27	2.28	2.40	2.44
Shares (%)							
Coal	*2.1*	*2.8*	*2.3*	*2.4*	*3.0*	*2.8*	*2.6*
Oil	*88.3*	*57.0*	*51.3*	*50.8*	*47.1*	*44.5*	*43.7*
Gas	*0.7*	*8.0*	*11.5*	*11.7*	*13.0*	*15.2*	*14.6*
Comb. Renewables & Wastes	*0.3*	*1.4*	*3.3*	*3.5*	*3.3*	*3.5*	*4.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.1*	*0.1*	*0.1*
Electricity	*8.6*	*17.7*	*16.8*	*17.3*	*18.1*	*17.9*	*18.3*
Heat	–	*13.1*	*14.8*	*14.3*	*15.3*	*16.0*	*16.5*
TOTAL INDUSTRY[6]	**4.04**	**3.00**	**3.52**	**3.50**	**3.04**	**3.18**	**3.09**
Coal[1]	0.21	0.31	0.33	0.34	0.35	0.32	0.29
Oil	3.41	1.32	1.31	1.18	0.69	0.54	0.52
Gas	0.02	0.53	0.84	0.87	0.91	1.16	1.09
Comb. Renewables & Wastes[2]	–	0.02	0.09	0.12	0.10	0.10	0.11
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.40	0.75	0.83	0.85	0.90	0.95	0.97
Heat	–	0.07	0.12	0.14	0.10	0.10	0.10
Shares (%)							
Coal	*5.2*	*10.4*	*9.4*	*9.7*	*11.6*	*10.0*	*9.3*
Oil	*84.5*	*44.0*	*37.0*	*33.7*	*22.6*	*17.0*	*16.9*
Gas	*0.4*	*17.6*	*23.8*	*24.9*	*29.8*	*36.6*	*35.4*
Comb. Renewables & Wastes	–	*0.6*	*2.7*	*3.3*	*3.4*	*3.1*	*3.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*9.8*	*25.0*	*23.6*	*24.4*	*29.5*	*30.0*	*31.5*
Heat	–	*2.5*	*3.4*	*4.0*	*3.1*	*3.2*	*3.3*
TRANSPORT[7]	**3.52**	**4.58**	**4.87**	**4.90**	**4.36**	**4.34**	**4.41**
TOTAL OTHER SECTORS[8]	**8.59**	**6.50**	**7.89**	**7.42**	**7.47**	**7.54**	**7.31**
Coal[1]	0.13	0.08	0.04	0.03	0.10	0.10	0.10
Oil	7.34	2.14	2.20	1.98	1.97	1.85	1.66
Gas	0.10	0.60	1.03	0.97	1.03	1.13	1.06
Comb. Renewables & Wastes[2]	0.05	0.18	0.44	0.44	0.39	0.43	0.44
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.00	0.01	0.01	0.01	0.02	0.02
Electricity	0.98	1.73	1.89	1.86	1.78	1.72	1.71
Heat	–	1.76	2.29	2.13	2.18	2.30	2.34
Shares (%)							
Coal	*1.5*	*1.2*	*0.5*	*0.4*	*1.3*	*1.3*	*1.3*
Oil	*85.4*	*33.0*	*27.8*	*26.7*	*26.4*	*24.5*	*22.7*
Gas	*1.2*	*9.3*	*13.1*	*13.1*	*13.8*	*15.0*	*14.4*
Comb. Renewables & Wastes	*0.6*	*2.8*	*5.6*	*5.9*	*5.3*	*5.6*	*6.0*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.3*
Electricity	*11.4*	*26.6*	*23.9*	*25.1*	*23.8*	*22.8*	*23.3*
Heat	–	*27.2*	*29.1*	*28.7*	*29.2*	*30.5*	*32.0*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.69**	**7.35**	**12.34**	**10.16**	**8.66**	**8.43**	**7.77**
OUTPUT (Mtoe)	**1.64**	**2.21**	**4.61**	**3.81**	**3.33**	**3.43**	**3.28**
(TWh gross)	19.12	25.74	53.55	44.29	38.69	39.89	38.18
Output Shares (%)							
Coal	*35.8*	*90.6*	*74.0*	*64.9*	*47.4*	*34.4*	*25.2*
Oil	*64.1*	*4.1*	*10.8*	*12.2*	*10.5*	*7.7*	*6.9*
Gas	*–*	*2.6*	*10.7*	*15.4*	*25.9*	*36.5*	*38.0*
Comb. Renewables & Wastes	*–*	*0.2*	*2.2*	*3.0*	*10.1*	*11.7*	*13.3*
Nuclear	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Hydro	*0.1*	*0.1*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other	*–*	*2.4*	*2.3*	*4.4*	*6.1*	*9.6*	*16.4*
TOTAL LOSSES	**3.74**	**4.18**	**6.64**	**5.11**	**4.71**	**4.32**	**3.62**
of which:							
Electricity and Heat Generation[10]	3.04	2.84	4.62	3.39	2.50	2.02	1.49
Other Transformation	0.44	–0.01	–0.09	–0.27	–	–	–
Own Use and Losses[11]	0.26	1.34	2.11	2.00	2.21	2.30	2.13
Statistical Differences	**–0.08**	**0.03**	**–0.05**	**0.18**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	98.45	133.36	155.53	160.69	171.53	191.25	206.03
Population (millions)	5.02	5.14	5.26	5.28	5.31	5.39	5.43
TPES/GDP[12]	0.20	0.14	0.15	0.13	0.11	0.10	0.09
Energy Production/TPES	0.02	0.55	0.77	0.96	1.23	0.99	0.67
Per Capita TPES[13]	3.94	3.56	4.35	3.99	3.69	3.60	3.40
Oil Supply/GDP[12]	0.18	0.07	0.06	0.06	0.05	0.04	0.04
TFC/GDP[12]	0.16	0.11	0.10	0.10	0.09	0.08	0.07
Per Capita TFC[13]	3.22	2.74	3.09	2.99	2.80	2.79	2.73
Energy–related CO_2 Emissions (Mt CO_2)[14]	59.4	52.9	72.3	62.4	53.0	50.0	44.8
CO_2 Emissions from Bunkers (Mt CO_2)	2.2	3.1	4.7	4.7	5.0	5.0	5.0

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.2	–1.4	3.8	–7.7	–2.5	–0.2	–1.0
Coal	14.4	3.1	6.5	–25.9	–11.5	–4.9	–5.7
Oil	–1.4	–5.5	2.5	–4.9	–4.2	–1.1	–0.6
Gas	–	–	12.8	5.1	7.5	3.8	–1.6
Comb. Renewables & Wastes	6.5	7.6	5.3	4.8	5.9	2.0	2.4
Nuclear	–	–	–	–	–	–	–
Hydro	–	–	–	–	14.5	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	44.0	12.4	57.7	7.4	10.2	10.2
TFC	0.6	–1.6	2.5	–2.9	–2.0	0.2	–0.3
Electricity Consumption	4.9	2.8	1.5	–	–0.5	0.0	0.1
Energy Production	15.0	24.2	9.9	15.3	5.9	–4.3	–8.5
Net Oil Imports	–2.6	–16.0	–	369.8	39.4	–25.7	–
GDP	1.9	1.8	2.6	3.3	2.2	2.2	1.5
Growth in the TPES/GDP Ratio	–0.7	–3.1	1.2	–10.7	–4.6	–2.4	–2.5
Growth in the TFC/GDP Ratio	–1.3	–3.3	–0.1	–6.0	–4.1	–1.9	–1.8

Please note: Rounding may cause totals to differ from the sum of the elements.

FRANCE

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**36.1**	**110.8**	**130.1**	**127.8**	**123.3**	**133.1**	**139.5**
Coal[1]		18.0	8.2	5.3	4.4	4.9	3.8	0.7
Oil		2.1	3.6	2.6	2.2	1.0	1.0	1.0
Gas		6.3	2.5	2.4	2.1	1.1	0.7	–
Comb. Renewables & Wastes[2]		1.7	9.8	10.5	10.5	4.7	5.0	5.1
Nuclear		3.8	81.9	103.5	103.1	105.8	116.9	127.0
Hydro		4.1	4.6	5.6	5.4	5.8	5.8	5.8
Geothermal		–	0.1	0.1	0.1	..	..	..
Solar/Wind/Other[3]		0.0	0.1	0.1	0.1	..	..	..
TOTAL NET IMPORTS[4]		**142.8**	**118.6**	**122.5**	**120.1**	**135.1**	**138.2**	**141.5**
Coal1	Exports	1.3	0.6	0.4	0.4	0.8	0.8	0.8
	Imports	10.8	13.7	11.1	10.1	20.2	17.6	16.6
	Net Imports	9.5	13.0	10.7	9.7	19.4	16.8	15.8
Oil	Exports	13.7	14.8	18.8	20.1	1.0	1.5	1.5
	Imports	145.1	102.4	109.6	109.7	95.7	98.2	98.9
	Bunkers	5.3	2.5	2.7	3.0	2.4	2.3	2.4
	Net Imports	126.0	85.1	88.1	86.6	92.3	94.4	95.0
Gas	Exports	0.1	0.3	0.7	1.2	–	–	–
	Imports	7.6	24.7	30.3	30.5	30.7	33.7	36.7
	Net Imports	7.6	24.4	29.6	29.3	30.7	33.7	36.7
Electricity	Exports	0.6	4.5	6.2	6.0	7.3	6.7	6.1
	Imports	0.4	0.6	0.3	0.4	–	–	–
	Net Imports	–0.2	–3.9	–5.9	–5.6	–7.3	–6.7	–6.1
TOTAL STOCK CHANGES		**–2.4**	**–1.7**	**1.7**	**–0.5**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**176.6**	**227.6**	**254.3**	**247.5**	**258.4**	**271.3**	**281.0**
Coal[1]		29.2	20.2	16.6	14.6	24.3	20.6	16.5
Oil		124.3	88.8	91.1	88.0	93.3	95.4	96.0
Gas		13.6	26.0	32.7	31.3	31.8	34.4	36.7
Comb. Renewables & Wastes[2]		1.7	9.8	10.6	10.6	4.7	5.0	5.1
Nuclear		3.8	81.9	103.5	103.1	105.8	116.9	127.0
Hydro		4.1	4.6	5.6	5.4	5.8	5.8	5.8
Geothermal		–	0.1	0.1	0.1	..	..	..
Solar/Wind/Other[3]		0.0	0.1	0.1	0.1	..	..	..
Electricity Trade[5]		–0.2	–3.9	–5.9	–5.6	–7.3	–6.7	–6.1
Shares (%)								
Coal		*16.6*	*8.9*	*6.5*	*5.9*	*9.4*	*7.6*	*5.9*
Oil		*70.4*	*39.0*	*35.8*	*35.6*	*36.1*	*35.2*	*34.2*
Gas		*7.7*	*11.4*	*12.8*	*12.7*	*12.3*	*12.7*	*13.1*
Comb. Renewables & Wastes		*1.0*	*4.3*	*4.2*	*4.3*	*1.8*	*1.8*	*1.8*
Nuclear		*2.2*	*36.0*	*40.7*	*41.6*	*40.9*	*43.1*	*45.2*
Hydro		*2.3*	*2.0*	*2.2*	*2.2*	*2.2*	*2.1*	*2.1*
Geothermal		–	*0.1*	–	–	..	..	..
Solar/Wind/Other		–	–	–	–	..	..	..
Electricity Trade		*–0.1*	*–1.7*	*–2.3*	*–2.3*	*–2.8*	*–2.5*	*–2.2*

0 is negligible, – is nil, .. is not available.

Please note: All forecast data are based on the 1991 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**138.1**	**145.4**	**161.5**	**161.1**	**161.4**	**168.6**	**173.7**
Coal[1]	13.1	7.5	5.6	5.2	10.0	9.6	9.6
Oil	99.4	79.5	85.5	85.9	85.1	87.0	87.5
Gas	11.2	23.9	31.0	30.6	29.6	32.0	33.9
Comb. Renewables & Wastes[2]	1.7	7.6	7.5	7.5	4.5	4.8	4.9
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	..	..	..
Electricity	12.8	26.0	30.6	30.5	32.3	35.4	37.9
Heat	–	0.9	1.4	1.3	..	..	..
Shares (%)							
Coal	*9.5*	*5.2*	*3.4*	*3.2*	*6.2*	*5.7*	*5.5*
Oil	*72.0*	*54.7*	*53.0*	*53.3*	*52.7*	*51.6*	*50.3*
Gas	*8.1*	*16.5*	*19.2*	*19.0*	*18.3*	*19.0*	*19.5*
Comb. Renewables & Wastes	*1.2*	*5.2*	*4.6*	*4.7*	*2.8*	*2.8*	*2.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*9.3*	*17.9*	*18.9*	*19.0*	*20.0*	*21.0*	*21.8*
Heat	–	*0.6*	*0.8*	*0.8*	..	..	..
TOTAL INDUSTRY[6]	**55.7**	**45.3**	**49.3**	**50.0**	**52.9**	**55.2**	**58.0**
Coal[1]	7.2	5.9	4.6	4.2	8.4	8.1	8.1
Oil	35.3	18.0	20.5	21.0	18.7	18.9	19.6
Gas	5.8	11.1	13.1	13.5	12.5	13.6	14.6
Comb. Renewables & Wastes[2]	0.2	0.5	0.4	0.4	1.1	1.4	1.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	7.2	9.9	10.7	11.0	12.3	13.4	14.4
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*12.9*	*12.9*	*9.4*	*8.5*	*15.8*	*14.6*	*13.9*
Oil	*63.4*	*39.7*	*41.7*	*41.9*	*35.3*	*34.2*	*33.7*
Gas	*10.4*	*24.6*	*26.5*	*26.9*	*23.6*	*24.6*	*25.2*
Comb. Renewables & Wastes	*0.4*	*1.0*	*0.7*	*0.7*	*2.1*	*2.4*	*2.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*13.0*	*21.8*	*21.7*	*21.9*	*23.2*	*24.2*	*24.7*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**27.1**	**42.8**	**46.9**	**47.9**	**51.0**	**55.1**	**56.7**
TOTAL OTHER SECTORS[8]	**55.4**	**57.3**	**65.3**	**63.2**	**57.5**	**58.4**	**59.1**
Coal[1]	5.8	1.7	0.9	1.0	1.7	1.6	1.6
Oil	37.6	19.5	19.0	17.9	16.2	13.9	12.1
Gas	5.4	12.8	17.9	17.1	17.1	18.4	19.3
Comb. Renewables & Wastes[2]	1.5	7.1	7.2	7.2	3.4	3.4	3.4
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	..	..	..
Electricity	5.0	15.3	18.9	18.6	19.3	21.2	22.7
Heat	–	0.9	1.4	1.3	..	..	..
Shares (%)							
Coal	*10.5*	*2.9*	*1.4*	*1.5*	*2.9*	*2.7*	*2.6*
Oil	*68.0*	*34.0*	*29.1*	*28.4*	*28.1*	*23.7*	*20.5*
Gas	*9.7*	*22.4*	*27.4*	*27.1*	*29.7*	*31.5*	*32.7*
Comb. Renewables & Wastes	*2.7*	*12.4*	*11.0*	*11.3*	*5.9*	*5.8*	*5.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*9.0*	*26.8*	*29.0*	*29.5*	*33.5*	*36.2*	*38.4*
Heat	–	*1.6*	*2.1*	*2.1*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**35.9**	**99.4**	**121.4**	**119.5**	**128.7**	**136.7**	**143.4**
OUTPUT (Mtoe)	**15.7**	**35.8**	**43.7**	**42.9**	**47.5**	**50.3**	**52.6**
(TWh gross)	182.5	416.8	508.1	498.9	552.2	584.9	612.1
Output Shares (%)							
Coal	*19.4*	*8.5*	*6.1*	*5.2*	*9.4*	*6.8*	*3.8*
Oil	*40.2*	*2.1*	*1.5*	*1.5*	*1.7*	*1.5*	*1.7*
Gas	*5.5*	*0.7*	*0.8*	*1.0*	*3.1*	*3.3*	*3.7*
Comb. Renewables & Wastes	*0.4*	*0.4*	*0.4*	*0.4*	*0.2*	*0.2*	*0.2*
Nuclear	*8.1*	*75.4*	*78.2*	*79.3*	*73.5*	*76.7*	*79.6*
Hydro	*26.1*	*12.8*	*12.8*	*12.5*	*12.1*	*11.5*	*11.0*
Geothermal	–	*0.0*	–	–	–	–	–
Solar/Wind/Other	*0.3*	*0.1*	*0.1*	*0.1*	..	..	..
TOTAL LOSSES	**37.6**	**77.6**	**92.5**	**90.5**	**97.0**	**102.7**	**107.3**
of which:							
Electricity and Heat Generation[10]	20.2	62.7	76.3	75.2	81.2	86.4	90.8
Other Transformation	*5.4*	3.2	2.5	2.0	4.9	5.0	*5.0*
Own Use and Losses[11]	12.0	11.8	13.7	13.3	10.9	11.4	11.6
Statistical Differences	**0.9**	**4.6**	**0.3**	**–4.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	811.43	1195.43	1278.26	1307.35	1411.99	1605.35	1825.18
Population (millions)	52.12	56.74	58.37	58.60	59.50	60.80	61.80
TPES/GDP[12]	0.22	0.19	0.20	0.19	0.18	0.17	0.15
Energy Production/TPES	0.20	0.49	0.51	0.52	0.48	0.49	0.50
Per Capita TPES[13]	3.39	4.01	4.36	4.22	4.34	4.46	4.55
Oil Supply/GDP[12]	0.15	0.07	0.07	0.07	0.07	0.06	0.05
TFC/GDP[12]	0.17	0.12	0.13	0.12	0.11	0.11	0.10
Per Capita TFC[13]	2.65	2.56	2.77	2.75	2.71	2.77	2.81
Energy–related CO_2 Emissions (Mt CO_2)[14]	496.1	378.3	384.7	362.9	414.5	411.8	403.2
CO_2 Emissions from Bunkers (Mt CO_2)	17.0	8.0	8.6	9.4	*7.5*	*7.3*	*7.5*

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.2	1.7	1.9	–2.7	1.4	1.0	0.7
Coal	1.7	–4.2	–3.2	–11.8	18.4	–3.2	–4.3
Oil	–1.0	–2.5	0.4	–3.3	2.0	0.4	0.1
Gas	7.4	2.0	3.9	–4.1	0.4	1.6	1.3
Comb. Renewables & Wastes	7.6	12.7	1.3	0.1	–23.7	1.0	0.4
Nuclear	18.1	20.6	4.0	–0.5	0.9	2.0	1.7
Hydro	5.7	–2.0	3.4	–4.5	2.7	–	–
Geothermal	–	–	–0.9	–4.1	–	–	–
Solar/Wind/Other	–1.8	3.2	0.5	6.3	–	–	–
TFC	0.7	0.1	1.8	–0.2	0.1	0.9	0.6
Electricity Consumption	5.4	3.7	2.8	–0.1	1.8	1.9	1.4
Energy Production	2.2	9.4	2.7	–1.7	–1.2	1.5	0.9
Net Oil Imports	–1.0	–3.0	0.6	–1.7	2.1	0.5	0.1
GDP	2.7	2.1	1.1	2.3	2.6	2.6	2.6
Growth in the TPES/GDP Ratio	–1.4	–0.4	0.7	–4.8	–1.1	–1.6	–1.9
Growth in the TFC/GDP Ratio	–1.9	–2.0	0.6	–2.4	–2.5	–1.7	–2.0

Please note: Rounding may cause totals to differ from the sum of the elements.

GERMANY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**171.7**	**185.7**	**140.7**	**139.7**	**128.4**	**119.8**	**114.7**
Coal[1]		141.4	121.8	73.4	70.2	69.0	62.9	57.6
Oil		6.8	4.9	3.5	3.5	1.0	–	–
Gas		16.4	13.5	16.3	16.1	12.3	11.6	11.0
Comb. Renewables & Wastes[2]		2.5	4.1	3.7	3.8	3.9	4.5	5.2
Nuclear		3.2	39.8	41.7	44.4	40.5	38.7	38.7
Hydro		1.3	1.5	1.9	1.5	1.6	1.7	1.7
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.2	0.3	0.3	0.5	0.6
TOTAL NET IMPORTS[4]		**167.3**	**165.3**	**207.3**	**208.0**	**222.4**	**231.4**	**236.0**
Coal[1]	Exports	18.3	8.2	1.2	0.9	..	..	..
	Imports	15.2	11.5	13.6	15.8	..	..	..
	Net Imports	–3.1	3.3	12.4	14.9	20.9	25.0	28.6
Oil	Exports	9.9	10.2	16.0	16.4	..	..	..
	Imports	171.1	132.9	153.5	153.8	..	..	..
	Bunkers	4.1	2.5	2.0	2.2	2.0	2.0	2.0
	Net Imports	157.1	120.2	135.4	135.2	143.7	142.6	138.7
Gas	Exports	0.1	0.9	2.8	3.0	..	..	..
	Imports	12.4	42.7	62.8	61.1	..	..	..
	Net Imports	12.3	41.7	60.0	58.1	57.4	61.6	65.0
Electricity	Exports	0.7	2.7	3.7	3.5	..	..	..
	Imports	1.7	2.7	3.2	3.3	..	..	..
	Net Imports	1.0	0.1	–0.5	–0.2	0.5	2.3	3.7
TOTAL STOCK CHANGES		**–1.1**	**4.7**	**3.2**	**–0.5**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**337.9**	**355.7**	**351.3**	**347.3**	**350.9**	**351.2**	**350.7**
Coal[1]		139.4	128.5	90.1	86.3	89.9	87.9	86.2
Oil		161.9	126.7	138.9	139.3	144.6	142.6	138.7
Gas		28.7	55.0	75.2	71.9	69.7	73.2	76.0
Comb. Renewables & Wastes[2]		2.5	4.1	3.7	3.8	3.8	4.5	5.1
Nuclear		3.2	39.8	41.7	44.4	40.5	38.7	38.7
Hydro		1.3	1.5	1.9	1.5	1.6	1.7	1.7
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.2	0.3	0.3	0.5	0.6
Electricity Trade[5]		1.0	0.1	–0.5	–0.2	0.5	2.3	3.7
Shares (%)								
Coal		*41.2*	*36.1*	*25.6*	*24.8*	*25.6*	*25.0*	*24.6*
Oil		*47.9*	*35.6*	*39.5*	*40.1*	*41.2*	*40.6*	*39.6*
Gas		*8.5*	*15.5*	*21.4*	*20.7*	*19.9*	*20.8*	*21.7*
Comb. Renewables & Wastes		*0.7*	*1.2*	*1.1*	*1.1*	*1.1*	*1.3*	*1.5*
Nuclear		*0.9*	*11.2*	*11.9*	*12.8*	*11.5*	*11.0*	*11.0*
Hydro		*0.4*	*0.4*	*0.5*	*0.4*	*0.5*	*0.5*	*0.5*
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other		–	–	–	*0.1*	*0.1*	*0.1*	*0.2*
Electricity Trade		*0.3*	–	*–0.1*	*–0.1*	*0.1*	*0.6*	*1.1*

0 is negligible, – is nil, .. is not available.

Please note: All data include the new Laender of Germany. Forecast data are from the 1996 German submission based on Prognos forecasts. For 2000 to 2010, losses from electricity and heat generation are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**246.6**	**247.3**	**247.6**	**244.3**	**250.5**	**252.1**	**251.9**
Coal[1]	53.1	37.3	13.7	13.3	15.8	13.5	12.0
Oil	138.2	118.4	129.6	129.0	132.7	131.7	128.8
Gas	21.1	41.0	54.6	52.0	51.7	54.4	56.2
Comb. Renewables & Wastes[2]	1.7	2.3	1.3	1.3	1.2	1.3	1.4
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	26.9	39.1	39.4	39.7	40.3	42.4	44.5
Heat	5.5	9.1	9.0	9.0	8.8	8.9	9.0
Shares (%)							
Coal	*21.5*	*15.1*	*5.5*	*5.4*	*6.3*	*5.4*	*4.8*
Oil	*56.0*	*47.9*	*52.3*	*52.8*	*53.0*	*52.2*	*51.2*
Gas	*8.6*	*16.6*	*22.0*	*21.3*	*20.6*	*21.6*	*22.3*
Comb. Renewables & Wastes	*0.7*	*0.9*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*10.9*	*15.8*	*15.9*	*16.3*	*16.1*	*16.8*	*17.7*
Heat	*2.2*	*3.7*	*3.6*	*3.7*	*3.5*	*3.5*	*3.6*
TOTAL INDUSTRY[6]	**105.9**	**89.4**	**76.6**	**78.8**	**81.0**	**82.9**	**84.5**
Coal[1]	28.7	20.7	10.1	10.5	13.4	12.1	11.2
Oil	46.9	28.0	27.8	28.6	28.1	28.1	27.6
Gas	13.3	19.7	19.6	19.9	20.4	22.1	23.7
Comb. Renewables & Wastes[2]	0.0	–	0.1	0.1	0.2	0.2	0.2
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	15.3	18.6	17.3	17.7	17.5	18.8	20.0
Heat	1.6	2.4	1.7	2.0	1.5	1.6	1.7
Shares (%)							
Coal	*27.1*	*23.1*	*13.2*	*13.3*	*16.5*	*14.6*	*13.3*
Oil	*44.3*	*31.3*	*36.2*	*36.3*	*34.7*	*33.9*	*32.7*
Gas	*12.6*	*22.0*	*25.6*	*25.2*	*25.2*	*26.7*	*28.0*
Comb. Renewables & Wastes	–	–	*0.2*	*0.2*	*0.2*	*0.2*	*0.3*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*14.5*	*20.8*	*22.6*	*22.5*	*21.6*	*22.6*	*23.7*
Heat	*1.5*	*2.7*	*2.2*	*2.5*	*1.9*	*2.0*	*2.0*
TRANSPORT[7]	**39.7**	**60.0**	**64.6**	**65.1**	**70.9**	**71.7**	**71.3**
TOTAL OTHER SECTORS[8]	**101.0**	**97.9**	**106.4**	**100.4**	**98.5**	**97.5**	**96.1**
Coal[1]	22.7	16.6	3.6	2.7	2.5	1.5	0.8
Oil	54.2	31.6	38.7	36.8	35.2	33.9	32.5
Gas	7.8	21.3	35.0	32.1	31.3	32.0	31.9
Comb. Renewables & Wastes[2]	1.7	2.3	1.2	1.2	1.0	1.1	1.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	10.7	19.3	20.7	20.5	21.3	21.9	22.5
Heat	3.9	6.7	7.3	7.1	7.2	7.2	7.2
Shares (%)							
Coal	*22.5*	*16.9*	*3.3*	*2.7*	*2.5*	*1.5*	*0.8*
Oil	*53.6*	*32.3*	*36.3*	*36.7*	*35.8*	*34.7*	*33.8*
Gas	*7.7*	*21.8*	*32.9*	*31.9*	*31.7*	*32.8*	*33.2*
Comb. Renewables & Wastes	*1.7*	*2.3*	*1.1*	*1.2*	*1.0*	*1.1*	*1.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*10.6*	*19.8*	*19.5*	*20.4*	*21.6*	*22.4*	*23.5*
Heat	*3.9*	*6.9*	*6.9*	*7.0*	*7.3*	*7.4*	*75*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**98.6**	**141.2**	**138.5**	**139.0**	**138.7**	**138.5**	**139.7**
OUTPUT (Mtoe)	**32.2**	**47.1**	**47.4**	**47.1**	**47.4**	**48.7**	**50.2**
(TWh gross)	374.4	547.6	550.6	548.0	550.9	566.0	583.6
Output Shares (%)							
Coal	*69.0*	*58.8*	*55.0*	*53.4*	*53.9*	*54.8*	*54.3*
Oil	*12.0*	*1.9*	*1.4*	*1.3*	*1.9*	*1.5*	*1.3*
Gas	*10.9*	*7.4*	*8.7*	*9.2*	*10.2*	*10.9*	*11.7*
Comb. Renewables & Wastes	*0.8*	*0.9*	*1.4*	*1.3*	*1.6*	*2.0*	*2.4*
Nuclear	*3.2*	*27.8*	*29.1*	*31.1*	*28.2*	*26.2*	*25.4*
Hydro	*4.1*	*3.2*	*4.0*	*3.2*	*3.4*	*3.4*	*3.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.0*	*0.4*	*0.6*	*0.8*	*1.2*	*1.4*
TOTAL LOSSES	**92.2**	**110.0**	**105.1**	**105.4**	**100.4**	**99.1**	**98.8**
of which:							
Electricity and Heat Generation[10]	60.0	83.4	81.1	81.8	81.5	80.0	79.5
Other Transformation	8.5	6.0	5.3	5.5	0.6	0.5	0.4
Own Use and Losses[11]	23.7	20.5	18.7	18.1	18.3	18.6	18.8
Statistical Differences	**–1.0**	**–1.5**	**–1.4**	**–2.5**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$) *	1137.14	1640.06	1793.63	1833.12	2032.41	2344.70	2639.90
Population (millions)	78.96	79.36	81.90	82.05	79.10	79.70	78.60
TPES/GDP[12] *	0.30	0.22	0.20	0.19	0.17	0.15	0.13
Energy Production/TPES	0.51	0.52	0.40	0.40	0.37	0.34	0.33
Per Capita TPES[13]	4.28	4.48	4.29	4.23	4.44	4.41	4.46
Oil Supply/GDP[12] *	0.14	0.08	0.08	0.08	0.07	0.06	0.05
TFC/GDP[12]	0.22	0.15	0.14	0.13	0.12	0.11	0.10
Per Capita TFC[13]	3.12	3.12	3.02	2.98	3.17	3.16	3.20
Energy–related CO_2 Emissions (Mt CO_2)[14]	1073.5	981.4	909.1	884.0	906.8	902.1	891.9
CO_2 Emissions from Bunkers (Mt CO_2)	13.0	7.9	6.4	6.8	6.2	6.3	6.3

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.5	–0.3	–0.2	–1.1	0.3	0.0	–0.0
Coal	–0.2	–0.6	–5.8	–4.2	1.4	–0.4	–0.4
Oil	–0.1	–2.2	1.5	0.3	1.3	–0.3	–0.6
Gas	10.2	0.6	5.4	–4.4	–1.1	1.0	0.8
Comb. Renewables & Wastes	6.2	1.2	–1.5	1.9	0.1	3.2	2.7
Nuclear	27.5	10.3	0.8	6.4	–3.1	–0.9	–
Hydro	3.2	–0.5	3.9	–20.9	2.3	0.7	0.7
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	87.9	48.3	9.2	6.7	3.6
TFC	1.2	–0.6	0.0	–1.3	0.8	0.1	–0.0
Electricity Consumption	3.8	1.4	0.1	0.7	0.5	1.0	1.0
Energy Production	1.0	0.2	–4.5	–0.7	–2.8	–1.4	–0.9
Net Oil Imports	0.2	–2.5	2.0	–0.2	2.0	–0.1	–0.6
GDP	2.4	2.1	1.5	2.2	3.5	2.9	2.4
Growth in the TPES/GDP Ratio	–0.8	–2.4	–1.7	–3.3	–3.0	–2.8	–2.4
Growth in the TFC/GDP Ratio	–1.1	–2.7	–1.5	–3.5	–2.6	–2.7	–2.4

Please note: Rounding may cause totals to differ from the sum of the elements.

* The GDP figures prior to 1991 have been based on conversions made by the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung) and the former statistical office of the GDR (Statistisches Amt der DDR). These conversions are calculations which are highly dependent on specific hypotheses and do not necessarily reflect economic realities.

GREECE

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**2.33**	**8.80**	**9.21**	**9.65**	**9.86**	**11.00**	**11.61**
Coal[1]		1.69	7.12	7.19	7.71	8.30	9.50	10.00
Oil		..	0.85	0.53	0.48	0.10	–	–
Gas		–	0.14	0.05	0.05	0.03	0.03	0.03
Comb. Renewables & Wastes[2]		0.45	0.46	0.95	0.95	0.95	0.95	0.95
Nuclear		–	–	–	–	–	–	–
Hydro		0.19	0.15	0.37	0.33	0.37	0.38	0.42
Geothermal		–	0.00	0.00	0.00	0.00	0.00	0.07
Solar/Wind/Other[3]		–	0.08	0.12	0.13	0.11	0.14	0.14
TOTAL NET IMPORTS[4]		**11.12**	**13.01**	**15.90**	**16.33**	**20.21**	**25.57**	**31.82**
Coal[1]	Exports	0.02	–	0.03	0.04	–	–	–
	Imports	0.47	0.92	1.09	0.80	1.20	1.74	2.44
	Net Imports	0.45	0.92	1.06	0.76	1.20	1.74	2.44
Oil	Exports	4.95	7.59	4.72	3.88	6.00	6.00	6.00
	Imports	16.51	22.16	22.58	22.27	26.64	30.77	36.17
	Bunkers	0.89	2.55	3.14	3.15	3.40	3.40	3.40
	Net Imports	10.67	12.03	14.72	15.24	17.24	21.37	26.77
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	–	0.01	0.13	1.68	2.41	2.61
	Net Imports	–	–	0.01	0.13	1.68	2.41	2.61
Electricity	Exports	0.00	0.05	0.11	0.06	–	–	–
	Imports	0.01	0.11	0.23	0.26	0.09	0.05	–
	Net Imports	0.00	0.06	0.12	0.20	0.09	0.05	–
TOTAL STOCK CHANGES		**–1.10**	**0.25**	**–0.34**	**–0.42**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**12.36**	**22.06**	**24.77**	**25.56**	**30.07**	**36.57**	**43.43**
Coal[1]		2.10	8.07	7.95	8.45	9.50	11.24	12.44
Oil		9.61	13.10	15.21	15.32	17.34	21.37	26.77
Gas		–	0.14	0.05	0.17	1.71	2.44	2.64
Comb. Renewables & Wastes[2]		0.45	0.46	0.95	0.95	0.95	0.95	0.95
Nuclear		–	–	–	–	–	–	–
Hydro		0.19	0.15	0.37	0.33	0.37	0.38	0.42
Geothermal		–	0.00	0.00	0.00	0.00	0.00	0.07
Solar/Wind/Other[3]		–	0.08	0.12	0.13	0.11	0.14	0.14
Electricity Trade[5]		0.00	0.06	0.12	0.20	0.09	0.05	–
Shares (%)								
Coal		*17.0*	*36.6*	*32.1*	*33.1*	*31.6*	*30.7*	*28.6*
Oil		*77.7*	*59.4*	*61.4*	*60.0*	*57.7*	*58.4*	*61.6*
Gas		*–*	*0.6*	*0.2*	*0.7*	*5.7*	*6.7*	*6.1*
Comb. Renewables & Wastes		*3.6*	*2.1*	*3.8*	*3.7*	*3.2*	*2.6*	*2.2*
Nuclear		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Hydro		*1.5*	*0.7*	*1.5*	*1.3*	*1.2*	*1.0*	*1.0*
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	*0.2*
Solar/Wind/Other		*–*	*0.3*	*0.5*	*0.5*	*0.4*	*0.4*	*0.3*
Electricity Trade		*–*	*0.3*	*0.5*	*0.8*	*0.3*	*0.1*	*–*

0 is negligible, – is nil, .. is not available.

Please note: Most forecast data are based on the 1997 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**9.21**	**15.05**	**17.55**	**17.96**	**20.82**	**25.51**	**31.02**
Coal[1]	0.52	1.20	1.01	0.94	1.30	1.36	1.48
Oil	7.15	10.75	12.44	12.74	14.29	17.77	22.61
Gas	0.00	0.11	0.02	0.09	0.71	1.20	1.40
Comb. Renewables & Wastes[2]	0.45	0.46	0.91	0.91	0.91	0.91	0.91
Geothermal	–	0.00	0.00	0.00	0.00	0.00	–
Solar/Wind/Other	–	0.08	0.11	0.12	0.10	0.12	0.12
Electricity	1.09	2.45	3.06	3.15	3.51	4.15	4.50
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*5.6*	*8.0*	*5.8*	*5.3*	*6.2*	*5.3*	*4.8*
Oil	*77.6*	*71.4*	*70.9*	*70.9*	*68.6*	*69.6*	*72.9*
Gas	*–*	*0.7*	*0.1*	*0.5*	*3.4*	*4.7*	*4.5*
Comb. Renewables & Wastes	*4.9*	*3.1*	*5.2*	*5.1*	*4.4*	*3.6*	*2.9*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other	*–*	*0.5*	*0.6*	*0.7*	*0.5*	*0.5*	*0.4*
Electricity	*11.9*	*16.3*	*17.4*	*17.6*	*16.9*	*16.3*	*14.5*
Heat	*–*	*–*	*–*	*–*	*–*	*–*	*–*
TOTAL INDUSTRY[6]	**3.49**	**4.62**	**4.77**	**4.83**	**5.48**	**6.58**	**7.95**
Coal[1]	0.46	1.18	0.98	0.91	1.26	1.32	1.43
Oil	2.39	2.18	2.53	2.58	2.20	2.63	3.77
Gas	–	0.10	0.01	0.08	0.61	1.00	1.00
Comb. Renewables & Wastes[2]	–	0.12	0.21	0.21	0.21	0.21	0.21
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.63	1.04	1.04	1.06	1.20	1.42	1.54
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*13.1*	*25.4*	*20.5*	*18.8*	*23.0*	*20.1*	*18.0*
Oil	*68.7*	*47.2*	*53.0*	*53.3*	*40.1*	*40.0*	*47.4*
Gas	*–*	*2.3*	*0.3*	*1.6*	*11.1*	*15.2*	*12.6*
Comb. Renewables & Wastes	*–*	*2.6*	*4.3*	*4.3*	*3.8*	*3.2*	*2.6*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Electricity	*18.2*	*22.5*	*21.9*	*21.9*	*21.9*	*21.6*	*19.4*
Heat	*–*	*–*	*–*	*–*	*–*	*–*	*–*
TRANSPORT[7]	**2.70**	**5.95**	**6.71**	**6.88**	**8.10**	**10.03**	**12.32**
TOTAL OTHER SECTORS[8]	**3.03**	**4.48**	**6.07**	**6.25**	**7.24**	**8.90**	**10.75**
Coal[1]	0.04	0.03	0.03	0.03	0.04	0.04	0.05
Oil	2.08	2.63	3.21	3.30	4.00	5.12	6.54
Gas	0.00	0.01	0.01	0.01	0.10	0.20	0.40
Comb. Renewables & Wastes[2]	0.45	0.35	0.70	0.70	0.70	0.70	0.70
Geothermal	–	0.00	0.00	0.00	0.00	0.00	–
Solar/Wind/Other	–	0.08	0.11	0.12	0.10	0.12	0.12
Electricity	0.46	1.40	2.00	2.08	2.30	2.72	2.94
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*1.4*	*0.6*	*0.5*	*0.5*	*0.6*	*0.4*	*0.5*
Oil	*68.6*	*58.6*	*52.9*	*52.8*	*55.2*	*57.5*	*60.8*
Gas	*0.1*	*0.2*	*0.1*	*0.1*	*1.4*	*2.2*	*3.7*
Comb. Renewables & Wastes	*14.9*	*7.7*	*11.6*	*11.2*	*9.7*	*7.9*	*6.5*
Geothermal	*–*	*0.1*	*0.1*	*0.1*	*0.1*	*–*	*–*
Solar/Wind/Other	*–*	*1.7*	*1.8*	*2.0*	*1.4*	*1.3*	*1.1*
Electricity	*15.0*	*31.2*	*33.0*	*33.3*	*31.8*	*30.5*	*27.3*
Heat	*–*	*–*	*–*	*–*	*–*	*–*	*–*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.34**	**8.90**	**9.33**	**9.97**	**11.65**	**13.98**	**15.46**
OUTPUT (Mtoe)	**1.27**	**2.99**	**3.65**	**3.72**	**4.26**	**5.09**	**5.59**
(TWh gross)	14.82	34.77	42.41	43.29	49.55	59.16	65.03
Output Shares (%)							
Coal	*35.5*	*72.4*	*69.1*	*70.7*	*63.8*	*64.7*	*65.4*
Oil	*49.5*	*22.3*	*20.1*	*19.2*	*16.9*	*16.6*	*16.8*
Gas	*–*	*0.3*	*0.2*	*0.8*	*10.1*	*10.7*	*9.7*
Comb. Renewables & Wastes	*–*	*–*	*0.3*	*0.3*	*0.2*	*0.2*	*0.2*
Nuclear	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Hydro	*15.0*	*5.1*	*10.3*	*9.0*	*8.8*	*7.5*	*7.5*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*0.1*
Solar/Wind/Other	*–*	*–*	*0.1*	*0.1*	*0.3*	*0.3*	*0.3*
TOTAL LOSSES	**3.14**	**7.26**	**7.40**	**7.94**	**9.25**	**11.06**	**12.41**
of which:							
Electricity and Heat Generation[10]	2.07	5.91	5.68	6.25	7.39	8.89	9.87
Other Transformation	0.44	0.04	0.10	0.02	0.19	0.20	0.22
Own Use and Losses[11]	0.64	1.31	1.61	1.68	1.67	1.97	2.32
Statistical Differences	**0.00**	**–0.26**	**–0.19**	**–0.34**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	55.87	82.91	90.31	93.17	103.90	125.19	152.32
Population (millions)	8.93	10.16	10.48	10.49	10.50	10.80	11.00
TPES/GDP[12]	0.22	0.27	0.27	0.27	0.29	0.29	0.29
Energy Production/TPES	0.19	0.40	0.37	0.38	0.33	0.30	0.27
Per Capita TPES[13]	1.38	2.17	2.36	2.44	2.86	3.39	3.95
Oil Supply/GDP[12]	0.17	0.16	0.17	0.16	0.17	0.17	0.18
TFC/GDP[12]	0.16	0.18	0.19	0.19	0.20	0.20	0.20
Per Capita TFC[13]	1.03	1.48	1.68	1.71	1.98	2.36	2.82
Energy–related CO_2 Emissions (Mt CO_2)[14]	36.3	72.3	77.5	80.6	93.8	114.5	135.8
CO_2 Emissions from Bunkers (Mt CO_2)	2.7	8.0	9.9	9.9	10.7	10.7	10.7

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	4.4	2.9	2.0	3.2	5.6	4.0	3.5
Coal	8.7	8.0	–0.2	6.3	4.0	3.4	2.0
Oil	3.5	0.9	2.5	0.7	4.2	4.3	4.6
Gas	–	–	–15.9	249.0	115.4	7.4	1.6
Comb. Renewables & Wastes	–	0.3	12.7	0.4	–0.1	–	–
Nuclear	–	–	–	–	–	–	–
Hydro	8.2	–6.2	16.2	–10.7	3.5	0.5	2.0
Geothermal	–	–	4.9	–	–	–	77.3
Solar/Wind/Other	–	–	7.4	9.6	–4.4	4.9	–
TFC	4.0	2.4	2.6	2.3	5.1	4.1	4.0
Electricity Consumption	7.0	3.7	3.8	3.1	3.6	3.4	1.6
Energy Production	8.3	8.0	0.7	4.8	0.8	2.2	1.1
Net Oil Imports	2.5	–0.2	3.4	3.6	4.2	4.4	4.6
GDP	3.7	1.6	1.4	3.2	3.7	3.8	4.0
Growth in the TPES/GDP Ratio	0.7	1.3	0.5	0.0	1.8	0.2	–0.5
Growth in the TFC/GDP Ratio	0.2	0.7	1.1	–0.8	1.3	0.3	–0.0

Please note: Rounding may cause totals to differ from the sum of the elements.

LUXEMBOURG

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**0.00**	**0.03**	**0.04**	**0.05**	**0.03**	**0.03**	**0.03**
Coal[1]		–	–	–	–	–	–	–
Oil		–	–	–	–	–	–	–
Gas		–	–	–	–	–	–	–
Comb. Renewables & Wastes[2]		–	0.03	0.03	0.04	0.02	0.02	0.02
Nuclear		–	–	–	–	–	–	–
Hydro		0.00	0.01	0.01	0.01	0.01	0.01	0.01
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	0.00	0.00	–	–	–
TOTAL NET IMPORTS[4]		**4.51**	**3.55**	**3.42**	**3.34**	**3.18**	**3.20**	**3.23**
Coal[1]	Exports	–	–	–	–	–	–	–
	Imports	2.44	1.13	0.49	0.31	0.10	0.10	0.10
	Net Imports	2.44	1.13	0.49	0.31	0.10	0.10	0.10
Oil	Exports	0.01	0.01	0.00	0.01	–	–	–
	Imports	1.69	1.67	1.91	1.96	1.80	1.75	1.70
	Bunkers	–	–	–	–	–	–	–
	Net Imports	1.67	1.65	1.91	1.96	1.80	1.75	1.70
Gas	Exports	–	–	–	–	–	–	–
	Imports	0.22	0.43	0.61	0.63	0.90	0.95	1.00
	Net Imports	0.22	0.43	0.61	0.63	0.90	0.95	1.00
Electricity	Exports	0.07	0.06	0.07	0.07	0.04	0.04	0.04
	Imports	0.24	0.40	0.49	0.52	0.42	0.44	0.47
	Net Imports	0.18	0.34	0.42	0.45	0.38	0.40	0.43
TOTAL STOCK CHANGES		**–0.01**	**–0.01**	**–0.02**	**0.01**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**4.51**	**3.57**	**3.45**	**3.39**	**3.21**	**3.23**	**3.26**
Coal[1]		2.44	1.13	0.49	0.31	0.10	0.10	0.10
Oil		1.67	1.64	1.89	1.97	1.80	1.75	1.70
Gas		0.22	0.43	0.61	0.63	0.90	0.95	1.00
Comb. Renewables & Wastes[2]		–	0.03	0.03	0.04	0.02	0.02	0.02
Nuclear		–	–	–	–	–	–	–
Hydro		0.00	0.01	0.01	0.01	0.01	0.01	0.01
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	0.00	0.00	–	–	–
Electricity Trade[5]		0.18	0.34	0.42	0.45	0.38	0.40	0.43
Shares (%)								
Coal		*54.1*	*31.7*	*14.1*	*9.2*	*3.1*	*3.1*	*3.1*
Oil		*37.1*	*46.0*	*54.8*	*57.9*	*56.1*	*54.2*	*52.1*
Gas		*4.9*	*12.0*	*17.7*	*18.4*	*28.0*	*29.4*	*30.7*
Comb. Renewables & Wastes		*–*	*0.7*	*1.0*	*1.1*	*0.6*	*0.6*	*0.6*
Nuclear		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Hydro		*0.1*	*0.2*	*0.1*	*0.2*	*0.3*	*0.3*	*0.3*
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Electricity Trade		*3.9*	*9.5*	*12.2*	*13.1*	*11.8*	*12.4*	*13.2*

0 is negligible, – is nil, .. is not available.

Please note: For forecast years, Luxembourg is planning to replace electricity generation from coal with imported electricity. Forecast data for electricity generation and own use and losses are IEA Secretariat estimates. Data for 2000 and 2010 are based on the 1994 submission, while data for 2005 are IEA Secretariat estimates. Forecast GDP figures are based on the 1993 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**2.94**	**2.96**	**3.15**	**3.21**	**3.00**	**3.00**	**3.00**
Coal[1]	0.98	0.55	0.26	0.19	0.10	0.10	0.10
Oil	1.54	1.64	1.88	1.96	1.80	1.75	1.70
Gas	0.18	0.42	0.56	0.58	0.55	0.57	0.60
Comb. Renewables & Wastes[2]	–	–	0.02	0.02	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.26	0.36	0.42	0.44	0.55	0.57	0.60
Heat	–	–	0.01	0.01	–	–	–
Shares (%)							
Coal	*33.2*	*18.5*	*8.2*	*6.0*	*3.3*	*3.3*	*3.3*
Oil	*52.1*	*55.3*	*59.7*	*61.2*	*60.0*	*58.3*	*56.7*
Gas	*6.0*	*14.2*	*17.9*	*18.2*	*18.3*	*19.0*	*20.0*
Comb. Renewables & Wastes	–	–	*0.5*	*0.5*	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.7*	*12.0*	*13.4*	*13.8*	*18.3*	*19.0*	*20.0*
Heat	–	–	*0.4*	*0.4*	–	–	–
TOTAL INDUSTRY[6]	**2.09**	**1.34**	**1.02**	**0.97**	**1.09**	**1.12**	**1.15**
Coal[1]	0.94	0.54	0.25	0.19	0.09	0.09	0.09
Oil	0.81	0.30	0.15	0.12	0.30	0.30	0.30
Gas	0.14	0.28	0.35	0.38	0.33	0.34	0.36
Comb. Renewables & Wastes[2]	–	–	–	–	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.20	0.23	0.26	0.27	0.37	0.38	0.40
Heat	–	–	0.01	0.01	–	–	–
Shares (%)							
Coal	*45.1*	*40.4*	*24.9*	*19.5*	*8.3*	*8.0*	*7.8*
Oil	*38.6*	*22.0*	*14.7*	*12.0*	*27.5*	*26.8*	*26.1*
Gas	*6.6*	*20.8*	*34.1*	*39.4*	*30.3*	*30.4*	*31.3*
Comb. Renewables & Wastes	–	–	–	–	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*9.7*	*16.8*	*25.1*	*28.1*	*33.9*	*33.9*	*34.8*
Heat	–	–	*1.1*	*1.0*	–	–	–
TRANSPORT[7]	**0.29**	**1.03**	**1.39**	**1.50**	**1.27**	**1.22**	**1.18**
TOTAL OTHER SECTORS[8]	**0.56**	**0.59**	**0.74**	**0.74**	**0.65**	**0.66**	**0.68**
Coal[1]	0.03	0.01	0.00	0.00	0.01	0.01	0.01
Oil	0.44	0.31	0.35	0.35	0.24	0.23	0.23
Gas	0.04	0.14	0.22	0.20	0.22	0.23	0.24
Comb. Renewables & Wastes[2]	–	–	0.02	0.02	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.05	0.13	0.16	0.16	0.18	0.19	0.20
Heat	–	–	0.00	0.00	–	–	–
Shares (%)							
Coal	*6.1*	*1.0*	*0.4*	*0.3*	*1.5*	*1.5*	*1.5*
Oil	*78.4*	*53.6*	*47.4*	*47.8*	*36.9*	*34.8*	*33.8*
Gas	*6.8*	*24.1*	*28.9*	*27.3*	*33.8*	*34.8*	*35.3*
Comb. Renewables & Wastes	–	–	*2.0*	*2.0*	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.8*	*21.3*	*21.1*	*22.1*	*27.7*	*28.8*	*29.4*
Heat	–	–	*0.3*	*0.4*	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**0.44**	**0.20**	**0.13**	**0.10**	**0.38**	**0.40**	**0.43**
OUTPUT (Mtoe)	**0.12**	**0.05**	**0.04**	**0.04**	**0.17**	**0.17**	**0.17**
(TWh gross)	1.39	0.62	0.45	0.41	1.98	1.98	1.98
Output Shares (%)							
Coal	*58.8*	*76.4*	*29.8*	*21.2*	–	–	–
Oil	*27.6*	*1.4*	*3.8*	*3.2*	–	–	–
Gas	*10.2*	*5.4*	*42.1*	*43.2*	*91.4*	*91.4*	*91.9*
Comb. Renewables & Wastes	–	*5.4*	*9.6*	*11.5*	*2.0*	*2.0*	*2.0*
Nuclear	–	–	–	–	–	–	–
Hydro	*3.4*	*11.2*	*13.4*	*19.5*	*6.1*	*6.1*	*6.1*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*1.3*	*1.5*	–	–	–
TOTAL LOSSES	**1.54**	**0.61**	**0.30**	**0.19**	**0.21**	**0.23**	**0.26**
of which:							
Electricity and Heat Generation[10]	0.32	0.14	0.08	0.05	0.21	0.23	0.26
Other Transformation	1.08	0.41	0.16	0.09	–	–	–
Own Use and Losses[11]	0.14	0.06	0.06	0.05	–	–	–
Statistical Differences	**0.02**	**0.00**	**–**	**–0.00**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	6.14	10.35	13.90	14.41	15.43	17.29	19.37
Population (millions)	0.35	0.38	0.42	0.42	0.40	0.40	0.40
TPES/GDP[12]	0.73	0.35	0.25	0.24	0.21	0.19	0.17
Energy Production/TPES	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Per Capita TPES[13]	12.83	9.35	8.28	8.04	8.03	8.08	8.15
Oil Supply/GDP[12]	0.27	0.16	0.14	0.14	0.12	0.10	0.09
TFC/GDP[12]	0.48	0.29	0.23	0.22	0.19	0.17	0.15
Per Capita TFC[13]	8.39	7.74	7.57	7.60	7.50	7.50	7.50
Energy–related CO_2 Emissions (Mt CO_2)[14]	16.3	10.9	9.1	8.6	7.9	7.8	7.8
CO_2 Emissions from Bunkers (Mt CO_2)	–	–	–	–	–	–	–

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	–2.5	–0.8	–0.6	–1.5	–1.8	0.1	0.2
Coal	–4.6	–4.3	–13.2	–35.7	–31.6	–	–
Oil	–4.0	2.1	2.4	4.1	–2.9	–0.6	–0.6
Gas	13.6	–0.8	6.1	2.5	12.9	1.1	1.0
Comb. Renewables & Wastes	–	3.0	5.3	8.8	–18.5	–	–
Nuclear	–	–	–	–	–	–	–
Hydro	12.2	–2.6	–3.0	40.0	12.6	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
TFC	–0.1	0.1	1.1	1.8	–2.2	–	–
Electricity Consumption	2.7	1.6	2.9	5.0	7.6	0.7	1.0
Energy Production	36.6	1.6	3.9	15.4	–12.6	–	–
Net Oil Imports	–3.5	1.8	2.4	2.8	–2.8	–0.6	–0.6
GDP	1.3	4.1	5.0	3.7	2.3	2.3	2.3
Growth in the TPES/GDP Ratio	–3.7	–4.7	–5.4	–5.0	–4.0	–2.1	–2.1
Growth in the TFC/GDP Ratio	–1.3	–3.9	–3.8	–1.8	–4.4	–2.2	–2.2

Please note: Rounding may cause totals to differ from the sum of the elements.

NETHERLANDS

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**56.8**	**60.0**	**73.4**	**65.3**	**71.6**	**68.6**	**69.3**
Coal[1]		1.1	–	–	–	–	–	–
Oil		1.6	4.1	3.2	3.0	2.3	1.7	1.1
Gas		53.7	54.6	68.3	60.6	66.6	64.3	65.6
Comb. Renewables & Wastes[2]		–	0.4	0.7	1.0	1.9	2.1	2.4
Nuclear		0.3	0.9	1.1	0.6	0.8	0.4	–
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.1	0.2	0.2
TOTAL NET IMPORTS[4]		**6.0**	**6.8**	**2.8**	**11.0**	**9.6**	**18.0**	**22.9**
Coal[1]	Exports	1.4	2.2	2.1	2.9	2.6	1.7	0.7
	Imports	2.9	11.6	11.1	13.4	10.2	9.1	8.0
	Net Imports	1.5	9.4	9.0	10.5	7.6	7.4	7.3
Oil	Exports	42.4	59.8	60.6	63.0	37.7	40.8	43.9
	Imports	83.8	91.1	95.9	99.8	78.9	87.0	95.2
	Bunkers	11.6	10.9	11.5	12.2	13.4	15.5	17.7
	Net Imports	29.8	20.4	23.8	24.6	27.8	30.7	33.7
Gas	Exports	25.3	25.8	35.0	30.4	31.1	29.9	29.9
	Imports	–	2.0	4.1	5.2	4.5	9.1	11.3
	Net Imports	–25.3	–23.8	–30.9	–25.2	–26.6	–20.8	–18.6
Electricity	Exports	0.1	0.0	0.1	0.0	0.0	0.0	–
	Imports	0.0	0.8	1.0	1.1	0.9	0.7	0.6
	Net Imports	–0.1	0.8	0.9	1.1	0.8	0.7	0.6
TOTAL STOCK CHANGES		**–0.3**	**–0.2**	**–0.2**	**–1.4**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**62.4**	**66.6**	**76.0**	**74.9**	**81.3**	**86.7**	**92.2**
Coal[1]		2.9	8.9	9.2	9.2	7.6	7.4	7.3
Oil		30.9	24.8	26.5	27.6	30.1	32.4	34.7
Gas		28.5	30.8	37.5	35.3	40.0	43.5	47.0
Comb. Renewables & Wastes[2]		–	0.4	0.7	1.0	1.9	2.1	2.4
Nuclear		0.3	0.9	1.1	0.6	0.8	0.4	–
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.1	0.2	0.2
Electricity Trade[5]		–0.1	0.8	0.9	1.1	0.8	0.7	0.6
Shares (%)								
Coal		*4.6*	*13.4*	*12.2*	*12.3*	*9.3*	*8.6*	*7.9*
Oil		*49.5*	*37.2*	*34.9*	*36.8*	*37.0*	*37.4*	*37.7*
Gas		*45.6*	*46.3*	*49.3*	*47.2*	*49.2*	*50.2*	*51.0*
Comb. Renewables & Wastes		*–*	*0.6*	*0.9*	*1.3*	*2.3*	*2.5*	*2.6*
Nuclear		*0.5*	*1.4*	*1.4*	*0.8*	*0.9*	*0.4*	*–*
Hydro		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other		*–*	*–*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*
Electricity Trade		*–0.2*	*1.2*	*1.2*	*1.4*	*1.0*	*0.8*	*0.6*

0 is negligible, – is nil, .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**48.8**	**52.0**	**59.3**	**58.1**	**67.5**	**72.3**	**77.0**
Coal[1]	1.1	1.7	1.4	1.6	2.5	2.5	2.5
Oil	24.7	20.5	21.5	22.7	25.9	27.5	29.2
Gas	19.3	23.0	27.1	24.1	29.6	31.1	32.6
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.2	0.5	0.6	0.6
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	3.8	6.3	7.4	7.7	8.0	9.3	10.5
Heat	–	0.2	1.7	1.8	1.1	1.3	1.5
Shares (%)							
Coal	*2.2*	*3.3*	*2.3*	*2.7*	*3.6*	*3.4*	*3.2*
Oil	*50.5*	*39.5*	*36.3*	*39.1*	*38.3*	*38.1*	*38.0*
Gas	*39.5*	*44.2*	*45.7*	*41.5*	*43.8*	*43.1*	*42.4*
Comb. Renewables & Wastes	–	*0.3*	*0.4*	*0.4*	*0.7*	*0.8*	*0.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.8*	*12.2*	*12.5*	*13.3*	*11.9*	*12.8*	*13.7*
Heat	–	*0.5*	*2.9*	*3.0*	*1.6*	*1.8*	*1.9*
TOTAL INDUSTRY[6]	**21.2**	**21.7**	**20.7**	**21.8**	**29.8**	**31.7**	**33.6**
Coal[1]	0.8	1.7	1.3	1.6	2.5	2.5	2.5
Oil	10.4	8.4	6.7	7.5	11.7	12.1	12.6
Gas	8.1	8.8	8.6	8.6	11.4	12.3	13.2
Comb. Renewables & Wastes[2]	–	0.0	0.0	0.0	0.0	0.1	0.2
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	0.0	0.0	0.0
Electricity	2.0	2.9	3.2	3.3	3.6	4.0	4.5
Heat	–	–	0.8	0.8	0.6	0.6	0.6
Shares (%)							
Coal	*3.6*	*7.7*	*6.5*	*7.1*	*8.2*	*7.8*	*7.3*
Oil	*48.8*	*38.6*	*32.4*	*34.5*	*39.2*	*38.3*	*37.5*
Gas	*38.4*	*40.4*	*41.7*	*39.2*	*38.2*	*38.8*	*39.4*
Comb. Renewables & Wastes	–	*0.1*	*0.2*	*0.1*	*0.1*	*0.3*	*0.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*9.2*	*13.1*	*15.5*	*15.2*	*12.1*	*12.8*	*13.3*
Heat	–	–	*3.8*	*3.8*	*2.1*	*2.0*	*1.9*
TRANSPORT[7]	**7.5**	**10.6**	**13.4**	**13.8**	**13.7**	**14.9**	**16.2**
TOTAL OTHER SECTORS[8]	**20.2**	**19.6**	**25.1**	**22.4**	**24.0**	**25.7**	**27.3**
Coal[1]	0.3	0.1	0.0	0.0	–	–	–
Oil	6.9	1.6	1.5	1.5	0.6	0.6	0.6
Gas	11.1	14.2	18.4	15.6	18.2	18.8	19.4
Comb. Renewables & Wastes[2]	–	0.1	0.2	0.2	0.4	0.4	0.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	1.8	3.4	4.1	4.2	4.3	5.1	5.9
Heat	–	0.2	0.9	0.9	0.5	0.7	0.9
Shares (%)							
Coal	*1.6*	*0.3*	*0.1*	*0.1*	–	–	–
Oil	*34.2*	*8.3*	*5.9*	*6.6*	*2.5*	*2.4*	*2.3*
Gas	*55.3*	*72.4*	*73.4*	*69.4*	*75.7*	*73.3*	*71.1*
Comb. Renewables & Wastes	–	*0.7*	*0.7*	*0.8*	*1.8*	*1.7*	*1.7*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.1*	*0.1*	*0.1*
Electricity	*8.8*	*17.1*	*16.2*	*18.9*	*17.9*	*19.9*	*21.6*
Heat	–	*1.2*	*3.6*	*4.1*	*2.0*	*2.6*	*3.2*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**12.0**	**15.0**	**18.5**	**18.7**	**16.2**	**17.9**	**19.7**
OUTPUT (Mtoe)	**4.5**	**6.2**	**7.3**	**7.5**	**7.8**	**9.2**	**10.7**
(TWh gross)	52.6	71.9	85.0	86.7	90.2	107.1	124.0
Output Shares (%)							
Coal	*6.0*	*38.3*	*31.6*	*30.0*	*22.1*	*17.9*	*14.9*
Oil	*12.3*	*4.3*	*4.6*	*4.2*	*6.9*	*7.6*	*8.1*
Gas	*79.5*	*51.0*	*55.6*	*58.3*	*61.6*	*66.8*	*70.5*
Comb. Renewables & Wastes	*–*	*1.3*	*2.4*	*3.9*	*4.8*	*4.7*	*4.6*
Nuclear	*2.1*	*4.9*	*4.9*	*2.8*	*3.4*	*1.4*	*–*
Hydro	*–*	*0.2*	*0.1*	*0.1*	*0.3*	*0.2*	*0.2*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other	*–*	*0.1*	*0.8*	*0.8*	*0.9*	*1.3*	*1.7*
TOTAL LOSSES	**14.3**	**15.3**	**17.3**	**17.5**	**13.7**	**14.4**	**15.2**
of which:							
Electricity and Heat Generation[10]	7.5	8.6	9.2	9.2	7.5	7.5	7.4
Other Transformation	1.6	1.0	1.2	1.5	0.6	1.2	1.8
Own Use and Losses[11]	5.2	5.7	7.0	6.8	5.6	5.7	5.9
Statistical Differences	**–0.7**	**–0.7**	**–0.7**	**–0.7**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	193.21	283.67	324.63	336.46	364.45	416.38	475.71
Population (millions)	13.44	14.95	15.52	15.61	15.90	15.99	16.09
TPES/GDP[12]	0.32	0.23	0.23	0.22	0.22	0.21	0.19
Energy Production/TPES	0.91	0.90	0.97	0.87	0.88	0.79	0.75
Per Capita TPES[13]	4.65	4.46	4.89	4.80	5.11	5.42	5.73
Oil Supply/GDP[12]	0.16	0.09	0.08	0.08	0.08	0.08	0.07
TFC/GDP[12]	0.25	0.18	0.18	0.17	0.19	0.17	0.16
Per Capita TFC[13]	3.64	3.48	3.82	3.72	4.25	4.52	4.79
Energy–related CO_2 Emissions (Mt CO_2)[14]	151.0	161.3	186.7	184.3	186.2	198.1	210.1
CO_2 Emissions from Bunkers (Mt CO_2)	36.9	34.5	36.4	38.6	42.3	49.3	56.1

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.7	–0.3	2.2	–1.4	2.7	1.3	1.2
Coal	2.4	9.4	0.6	–0.2	–6.4	–0.4	–0.4
Oil	0.4	–2.2	1.1	4.0	2.9	1.5	1.4
Gas	2.4	–0.6	3.3	–5.7	4.2	1.7	1.6
Comb. Renewables & Wastes	–	4.0	10.5	43.3	24.9	2.3	2.0
Nuclear	21.0	0.0	2.9	–42.1	6.9	–12.9	–
Hydro	–	–	–5.8	14.3	37.9	–2.0	–1.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	49.5	3.0	9.7	10.8	7.1
TFC	2.0	–0.5	2.2	–2.0	5.2	1.4	1.3
Electricity Consumption	4.4	2.3	2.7	3.8	1.5	2.9	2.5
Energy Production	4.4	–1.8	3.4	–11.0	3.1	–0.9	0.2
Net Oil Imports	1.0	–3.9	2.6	3.4	4.2	2.0	1.8
GDP	2.6	2.1	2.3	3.6	2.7	2.7	2.7
Growth in the TPES/GDP Ratio	–0.9	–2.4	–0.1	–4.9	0.0	–1.4	–1.4
Growth in the TFC/GDP Ratio	–0.6	–2.6	–0.1	–5.5	2.4	–1.3	–1.4

Please note: Rounding may cause totals to differ from the sum of the elements.

PORTUGAL

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**1.40**	**2.07**	**2.43**	**2.32**	**2.36**	**2.52**	**2.66**
Coal[1]		0.13	0.12	–	–	–	–	–
Oil		..	–	–	–	–	–	–
Gas		–	–	–	–	–	–	–
Comb. Renewables & Wastes[2]		0.64	1.15	1.10	1.13	1.27	1.34	1.42
Nuclear		–	–	–	–	–	–	–
Hydro		0.63	0.79	1.27	1.13	0.99	1.04	1.07
Geothermal		–	0.00	0.04	0.05	0.04	0.04	0.04
Solar/Wind/Other[3]		–	0.01	0.02	0.02	0.05	0.10	0.12
TOTAL NET IMPORTS[4]		**5.69**	**14.82**	**16.46**	**18.32**	**19.31**	**21.22**	**22.58**
Coal[1]	Exports	0.01	0.01	0.03	0.04	..	..	..
	Imports	0.28	3.00	3.39	3.73	..	..	..
	Net Imports	0.27	2.99	3.36	3.69	3.60	3.59	3.32
Oil	Exports	0.23	2.50	2.47	2.18	..	..	..
	Imports	6.44	14.93	15.98	16.97	..	..	..
	Bunkers	0.80	0.61	0.50	0.50	0.85	1.08	1.36
	Net Imports	5.42	11.83	13.00	14.29	13.88	13.88	13.87
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	0.10	1.83	3.75	5.40
	Net Imports	–	–	–	0.10	1.83	3.75	5.40
Electricity	Exports	0.01	0.15	0.26	0.21	..	..	..
	Imports	0.01	0.15	0.35	0.46	..	..	..
	Net Imports	–0.00	0.00	0.10	0.25	–	–	–
TOTAL STOCK CHANGES		**0.14**	**–0.47**	**0.26**	**–0.24**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**7.23**	**16.42**	**19.15**	**20.40**	**21.67**	**23.73**	**25.24**
Coal[1]		0.51	2.76	3.43	3.53	3.60	3.59	3.32
Oil		5.45	11.71	13.19	14.22	13.88	13.88	13.87
Gas		–	–	–	0.09	1.83	3.75	5.40
Comb. Renewables & Wastes[2]		0.64	1.15	1.10	1.13	1.27	1.34	1.42
Nuclear		–	–	–	–	–	–	–
Hydro		0.63	0.79	1.27	1.13	0.99	1.04	1.07
Geothermal		–	0.00	0.04	0.05	0.04	0.04	0.04
Solar/Wind/Other[3]		–	0.01	0.02	0.02	0.05	0.10	0.12
Electricity Trade[5]		–0.00	0.00	0.10	0.25	–	–	–
Shares (%)								
Coal		*7.0*	*16.8*	*17.9*	*17.3*	*16.6*	*15.1*	*13.1*
Oil		*75.4*	*71.3*	*68.9*	*69.7*	*64.1*	*58.5*	*54.9*
Gas		–	–	–	*0.4*	*8.5*	*15.8*	*21.4*
Comb. Renewables & Wastes		*8.8*	*7.0*	*5.8*	*5.5*	*5.9*	*5.6*	*5.6*
Nuclear		–	–	–	–	–	–	–
Hydro		*8.7*	*4.8*	*6.6*	*5.5*	*4.6*	*4.4*	*4.2*
Geothermal		–	–	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
Solar/Wind/Other		–	*0.1*	*0.1*	*0.1*	*0.2*	*0.4*	*0.5*
Electricity Trade		–	–	*0.5*	*1.2*	–	–	–

0 is negligible, – is nil, .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**6.11**	**12.68**	**15.13**	**15.91**	**16.58**	**18.38**	**19.81**
Coal[1]	0.19	0.59	0.57	0.44	0.62	0.61	0.60
Oil	4.59	8.97	10.87	11.58	11.14	11.89	12.33
Gas	0.05	0.05	0.06	0.11	0.67	1.30	1.74
Comb. Renewables & Wastes[2]	0.58	1.00	0.96	0.96	0.91	0.95	1.03
Geothermal	–	–	0.00	0.00	0.00	0.00	0.00
Solar/Wind/Other	–	0.01	0.02	0.02	0.03	0.03	0.04
Electricity	0.70	2.03	2.60	2.74	3.15	3.52	3.96
Heat	–	0.03	0.05	0.07	0.07	0.08	0.10
Shares (%)							
Coal	*3.1*	*4.7*	*3.8*	*2.8*	*3.7*	*3.3*	*3.0*
Oil	*75.1*	*70.7*	*71.9*	*72.8*	*67.2*	*64.7*	*62.3*
Gas	*0.8*	*0.4*	*0.4*	*0.7*	*4.0*	*7.1*	*8.8*
Comb. Renewables & Wastes	*9.5*	*7.9*	*6.3*	*6.0*	*5.5*	*5.1*	*5.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*
Electricity	*11.5*	*16.0*	*17.2*	*17.2*	*19.0*	*19.2*	*20.0*
Heat	–	*0.2*	*0.3*	*0.4*	*0.4*	*0.4*	*0.5*
TOTAL INDUSTRY[6]	**2.71**	**6.22**	**6.23**	**6.85**	**6.07**	**6.46**	**6.96**
Coal[1]	0.14	0.59	0.57	0.44	0.62	0.61	0.60
Oil	1.81	3.96	3.91	4.53	3.21	3.04	3.05
Gas	0.00	–	0.00	0.04	0.48	0.95	1.26
Comb. Renewables & Wastes[2]	0.32	0.59	0.54	0.54	0.47	0.48	0.50
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.44	1.05	1.17	1.23	1.22	1.30	1.45
Heat	–	0.03	0.05	0.07	0.07	0.08	0.10
Shares (%)							
Coal	*5.1*	*9.5*	*9.1*	*6.4*	*10.2*	*9.5*	*8.6*
Oil	*66.9*	*63.7*	*62.7*	*66.2*	*52.9*	*47.0*	*43.8*
Gas	*0.1*	–	–	*0.6*	*7.9*	*14.7*	*18.1*
Comb. Renewables & Wastes	*11.8*	*9.5*	*8.6*	*7.8*	*7.7*	*7.5*	*7.1*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*16.2*	*16.9*	*18.7*	*17.9*	*20.2*	*20.1*	*20.9*
Heat	–	*0.5*	*0.8*	*1.0*	*1.2*	*1.2*	*1.4*
TRANSPORT[7]	**1.95**	**3.82**	**5.23**	**5.39**	**6.18**	**7.00**	**7.38**
TOTAL OTHER SECTORS[8]	**1.46**	**2.63**	**3.67**	**3.68**	**4.33**	**4.92**	**5.47**
Coal[1]	0.04	0.00	–	–	–	–	–
Oil	0.87	1.21	1.76	1.69	1.78	1.90	1.97
Gas	0.05	0.05	0.06	0.06	0.19	0.35	0.48
Comb. Renewables & Wastes[2]	0.26	0.41	0.42	0.42	0.44	0.46	0.54
Geothermal	–	–	0.00	0.00	0.00	0.00	0.00
Solar/Wind/Other	–	0.01	0.02	0.02	0.03	0.03	0.04
Electricity	0.25	0.95	1.41	1.49	1.89	2.18	2.44
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*2.4*	–	–	–	–	–	–
Oil	*59.7*	*46.0*	*48.0*	*45.9*	*41.2*	*38.6*	*36.1*
Gas	*3.2*	*2.0*	*1.6*	*1.7*	*4.3*	*7.1*	*8.8*
Comb. Renewables & Wastes	*17.9*	*15.6*	*11.6*	*11.5*	*10.2*	*9.4*	*9.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.4*	*0.4*	*0.4*	*0.7*	*0.6*	*0.7*
Electricity	*16.8*	*36.0*	*38.3*	*40.5*	*43.6*	*44.2*	*44.6*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**1.33**	**5.10**	**5.55**	**5.77**	**7.64**	**8.29**	**8.83**
OUTPUT (Mtoe)	**0.84**	**2.44**	**2.96**	**2.93**	**3.68**	**4.19**	**4.62**
(TWh gross)	9.79	28.36	34.43	34.12	42.76	48.73	53.73
Output Shares (%)							
Coal	*3.9*	*32.1*	*36.6*	*38.2*	*30.7*	*26.9*	*22.2*
Oil	*19.2*	*33.1*	*17.5*	*19.8*	*21.1*	*11.8*	*7.1*
Gas	–	–	–	*0.3*	*16.9*	*31.4*	*42.6*
Comb. Renewables & Wastes	*2.0*	*2.4*	*2.8*	*3.0*	*3.6*	*3.4*	*3.0*
Nuclear	–	–	–	–	–	–	–
Hydro	*74.8*	*32.3*	*42.9*	*38.4*	*27.0*	*24.7*	*23.1*
Geothermal	–	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Solar/Wind/Other	–	*0.0*	*0.1*	*0.1*	*0.5*	*1.6*	*1.8*
TOTAL LOSSES	**1.23**	**3.21**	**3.92**	**4.16**	**5.09**	**5.35**	**5.43**
of which:							
Electricity and Heat Generation[10]	0.49	2.63	2.54	2.77	3.90	4.02	4.10
Other Transformation	0.23	–0.38	0.15	0.12	0.04	0.04	0.04
Own Use and Losses[11]	0.51	0.97	1.24	1.27	1.15	1.29	1.28
Statistical Differences	**–0.11**	**0.53**	**0.10**	**0.33**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	40.80	69.13	77.82	80.68	89.71	107.58	128.39
Population (millions)	8.63	9.90	9.93	9.95	10.02	10.11	10.17
TPES/GDP[12]	0.18	0.24	0.25	0.25	0.24	0.22	0.20
Energy Production/TPES	0.19	0.13	0.13	0.11	0.11	0.11	0.11
Per Capita TPES[13]	0.84	1.66	1.93	2.05	2.16	2.35	2.48
Oil Supply/GDP[12]	0.13	0.17	0.17	0.18	0.15	0.13	0.11
TFC/GDP[12]	0.15	0.18	0.19	0.20	0.18	0.17	0.15
Per Capita TFC[13]	0.71	1.28	1.52	1.60	1.65	1.82	1.95
Energy–related CO_2 Emissions (Mt CO_2)[14]	17.5	41.5	49.1	52.0	55.1	59.4	62.0
CO_2 Emissions from Bunkers (Mt CO_2)	2.5	1.9	1.6	1.6	2.7	3.4	4.3

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	5.5	4.6	2.6	6.5	2.0	1.8	1.2
Coal	–2.4	18.2	3.7	2.9	0.6	–0.0	–1.6
Oil	6.1	3.8	2.0	7.8	–0.8	–0.0	–0.0
Gas	–	–	–	–	176.2	15.4	7.6
Comb. Renewables & Wastes	3.2	3.7	–0.7	2.2	4.1	1.0	1.2
Nuclear	–	–	–	–	–	–	–
Hydro	7.3	–1.8	8.3	–11.2	–4.1	0.9	0.6
Geothermal	–	–	55.9	4.7	–0.7	–	–
Solar/Wind/Other	–	–	7.5	17.6	34.8	15.1	4.3
TFC	4.7	4.2	3.0	5.2	1.4	2.1	1.5
Electricity Consumption	8.5	5.3	4.3	5.5	4.7	2.3	2.4
Energy Production	4.4	1.2	2.8	–4.7	0.6	1.3	1.1
Net Oil Imports	8.1	2.9	1.6	9.9	–0.9	–0.0	–0.0
GDP	2.9	3.3	2.0	3.7	3.6	3.7	3.6
Growth in the TPES/GDP Ratio	2.5	1.3	0.6	2.8	–1.5	–1.8	–2.3
Growth in the TFC/GDP Ratio	1.8	0.9	1.0	1.5	–2.1	–1.6	–2.0

Please note: Rounding may cause totals to differ from the sum of the elements.

SWEDEN

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**9.3**	**29.8**	**32.0**	**33.1**	**32.4**	**31.6**	**32.0**
Coal[1]		0.0	0.0	–	–	–	–	–
Peat		–	0.2	0.3	0.3	0.3	0.4	0.4
Oil		–	0.0	–	–	–	–	–
Comb. Renewables & Wastes[2]		3.5	5.5	7.6	8.3	8.0	8.1	8.4
Nuclear		0.6	17.8	19.4	18.2	18.5	17.4	17.4
Hydro		5.1	6.2	4.5	5.9	5.5	5.7	5.8
Solar/Wind/Other[3]		–	0.0	0.3	0.3	0.0	0.0	0.1
TOTAL NET IMPORTS[4]		**29.6**	**17.8**	**20.3**	**19.1**	**19.7**	**21.0**	**21.9**
Coal[1]	Exports	0.0	0.0	0.1	0.0	0.1	0.1	0.1
	Imports	1.7	2.6	2.5	2.5	2.2	2.3	2.4
	Net Imports	1.7	2.6	2.4	2.5	2.2	2.3	2.4
Oil	Exports	1.4	8.7	9.9	9.9	9.2	9.6	9.9
	Imports	30.4	24.2	27.7	27.2	27.0	28.3	29.2
	Bunkers	1.1	0.7	1.1	1.3	1.1	1.2	1.3
	Net Imports	27.8	14.9	16.7	16.1	16.7	17.5	18.0
Gas	Imports	–	0.5	0.7	0.7	0.8	1.0	1.2
	Net Imports	–	0.5	0.7	0.7	0.8	1.0	1.2
Electricity	Exports	0.4	1.3	0.8	1.1	–	–	–
	Imports	0.5	1.1	1.4	0.9	0.0	0.3	0.3
	Net Imports	0.1	–0.2	0.5	–0.2	0.0	0.3	0.3
TOTAL STOCK CHANGES		**0.5**	**0.2**	**0.5**	**–0.2**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**39.3**	**47.7**	**52.9**	**51.9**	**52.2**	**52.6**	**53.9**
Coal[1]		1.6	2.7	2.8	2.2	2.2	2.3	2.4
Peat		–	0.2	0.3	0.3	0.3	0.4	0.4
Oil		28.4	14.9	16.8	16.1	16.7	17.5	18.0
Gas		–	0.5	0.7	0.7	0.8	1.0	1.2
Comb. Renewables & Wastes[2]		3.5	5.5	7.6	8.3	8.0	8.1	8.4
Nuclear		0.6	17.8	19.4	18.2	18.5	17.4	17.4
Hydro		5.1	6.2	4.5	5.9	5.5	5.7	5.8
Solar/Wind/Other[3]		–	0.0	0.3	0.3	0.0	0.0	0.1
Electricity Trade[5]		0.1	–0.2	0.5	–0.2	0.0	0.3	0.3
Shares (%)								
Coal		*4.1*	*5.7*	*5.3*	*4.3*	*4.1*	*4.3*	*4.4*
Peat		*–*	*0.5*	*0.6*	*0.5*	*0.6*	*0.7*	*0.7*
Oil		*72.2*	*31.2*	*31.7*	*31.1*	*32.1*	*33.3*	*33.4*
Gas		*–*	*1.1*	*1.4*	*1.4*	*1.6*	*1.9*	*2.1*
Comb. Renewables & Wastes		*9.0*	*11.5*	*14.4*	*16.0*	*15.3*	*15.5*	*15.6*
Nuclear		*1.4*	*37.2*	*36.6*	*35.1*	*35.5*	*33.0*	*32.2*
Hydro		*13.1*	*13.1*	*8.4*	*11.4*	*10.6*	*10.8*	*10.7*
Solar/Wind/Other		*–*	*–*	*0.6*	*0.7*	*0.1*	*0.1*	*0.2*
Electricity Trade		*0.2*	*–0.3*	*1.0*	*–0.4*	*0.1*	*0.5*	*0.6*

0 is negligible, – is nil, .. is not available.

Please note: All forecast data are based on the 1997 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**35.3**	**32.1**	**36.3**	**35.7**	**37.0**	**37.9**	**39.0**
Coal[1]	0.9	1.0	0.9	0.7	1.6	1.7	1.8
Peat	–	0.0	0.0	0.0	–	–	–
Oil	24.8	14.0	15.0	14.7	14.4	14.9	15.3
Gas	0.1	0.4	0.4	0.4	0.4	0.5	0.6
Comb. Renewables & Wastes[2]	3.5	4.6	5.2	5.4	5.6	5.5	5.5
Solar/Wind/Other	–	–	0.0	0.0	–	–	–
Electricity	6.0	10.4	10.8	10.7	11.3	11.5	11.8
Heat	–	1.7	3.9	3.7	3.7	3.8	3.9
Shares (%)							
Coal	*2.6*	*3.3*	*2.4*	*2.0*	*4.2*	*4.4*	*4.6*
Oil	*70.4*	*43.7*	*41.4*	*41.3*	*38.9*	*39.5*	*39.3*
Gas	*0.3*	*1.1*	*1.2*	*1.2*	*1.2*	*1.3*	*1.5*
Comb. Renewables & Wastes	*9.8*	*14.4*	*14.3*	*15.0*	*15.2*	*14.4*	*14.2*
Electricity	*16.9*	*32.2*	*29.9*	*30.0*	*30.5*	*30.3*	*30.4*
Heat	–	*5.3*	*10.8*	*10.5*	*10.1*	*10.1*	*10.1*
TOTAL INDUSTRY[6]	**15.5**	**13.3**	**14.3**	**14.3**	**15.1**	**15.5**	**16.3**
Coal[1]	0.9	1.0	0.9	0.7	1.6	1.7	1.8
Peat	–	0.0	0.0	0.0	–	–	–
Oil	8.3	3.5	4.1	4.0	3.6	3.8	4.0
Gas	0.0	0.3	0.3	0.3	0.3	0.3	0.4
Comb. Renewables & Wastes[2]	2.9	3.7	4.2	4.4	4.5	4.5	4.6
Electricity	3.4	4.6	4.5	4.6	4.8	4.9	5.2
Heat	–	0.2	0.4	0.4	0.4	0.4	0.4
Shares (%)							
Coal	*5.7*	*7.6*	*6.1*	*4.9*	*10.3*	*10.7*	*10.9*
Peat	–	–	*0.1*	*0.1*	–	–	–
Oil	*53.4*	*26.5*	*28.6*	*27.9*	*23.9*	*24.5*	*24.3*
Gas	*0.1*	*1.9*	*2.0*	*2.0*	*1.9*	*2.1*	*2.2*
Comb. Renewables & Wastes	*18.9*	*27.7*	*29.3*	*30.6*	*30.0*	*28.7*	*28.2*
Electricity	*21.9*	*35.0*	*31.4*	*32.0*	*31.5*	*31.5*	*31.7*
Heat	–	*1.3*	*2.6*	*2.6*	*2.3*	*2.5*	*2.7*
TRANSPORT[7]	**5.5**	**7.4**	**7.8**	**7.8**	**8.1**	**8.6**	**9.0**
TOTAL OTHER SECTORS[8]	**14.3**	**11.5**	**14.2**	**13.5**	**13.8**	**13.7**	**13.7**
Coal[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	11.2	3.3	3.4	3.1	2.9	2.8	2.6
Gas	0.1	0.1	0.2	0.2	0.1	0.2	0.2
Comb. Renewables & Wastes[2]	0.5	1.0	1.0	1.0	1.1	1.0	1.0
Solar/Wind/Other	–	–	0.0	0.0	–	–	–
Electricity	2.4	5.5	6.1	5.9	6.3	6.3	6.4
Heat	–	1.5	3.5	3.4	3.4	3.4	3.5
Shares (%)							
Coal	*0.3*	*0.4*	–	–	–	–	–
Oil	*78.7*	*28.9*	*24.2*	*23.1*	*21.1*	*20.3*	*19.3*
Gas	*0.7*	*1.0*	*1.1*	*1.1*	*1.1*	*1.3*	*1.6*
Comb. Renewables & Wastes	*3.6*	*8.4*	*7.0*	*7.3*	*7.8*	*7.4*	*7.0*
Electricity	*16.6*	*47.9*	*42.8*	*43.5*	*45.5*	*46.0*	*46.6*
Heat	–	*13.4*	*24.8*	*25.0*	*24.5*	*25.0*	*25.5*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**8.2**	**26.7**	**29.7**	**29.2**	**28.9**	**28.5**	**29.1**
OUTPUT (Mtoe)	**6.7**	**12.6**	**12.1**	**12.9**	**13.0**	**12.9**	**13.3**
(TWh gross)	78.1	146.0	140.6	149.4	150.7	150.0	154.1
Output Shares (%)							
Coal	*0.6*	*1.2*	*3.0*	*1.8*	*3.1*	*3.3*	*3.6*
Peat	*–*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Oil	*19.4*	*0.8*	*5.1*	*2.1*	*3.1*	*4.1*	*3.8*
Gas	*–*	*0.3*	*0.4*	*0.5*	*0.8*	*0.9*	*1.7*
Comb. Renewables & Wastes	*0.5*	*1.3*	*1.6*	*2.3*	*2.7*	*3.1*	*3.0*
Nuclear	*2.7*	*46.7*	*52.8*	*46.8*	*47.2*	*44.4*	*43.2*
Hydro	*76.7*	*49.7*	*36.8*	*46.2*	*42.8*	*43.9*	*43.7*
Solar/Wind/Other	*–*	*0.0*	*0.1*	*0.1*	*0.3*	*0.3*	*1.0*
TOTAL LOSSES	**3.4**	**16.3**	**17.5**	**16.6**	**15.2**	**14.7**	**14.9**
of which:							
Electricity and Heat Generation[10]	1.5	12.2	14.0	13.0	11.5	11.0	11.1
Other Transformation	1.0	1.3	1.1	1.1	1.2	1.2	1.2
Own Use and Losses[11]	1.0	2.8	2.4	2.5	2.5	2.5	2.6
Statistical Differences	**0.6**	**–0.7**	**–1.0**	**–0.3**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	166.56	229.76	238.20	242.39	254.21	283.43	312.93
Population (millions)	8.14	8.57	8.84	8.85	8.90	8.97	9.04
TPES/GDP[12]	0.24	0.21	0.22	0.21	0.21	0.19	0.17
Energy Production/TPES	0.24	0.62	0.61	0.64	0.62	0.60	0.59
Per Capita TPES[13]	4.83	5.57	5.98	5.87	5.86	5.86	5.96
Oil Supply/GDP[12]	0.17	0.06	0.07	0.07	0.07	0.06	0.06
TFC/GDP[12]	0.21	0.14	0.15	0.15	0.15	0.13	0.12
Per Capita TFC[13]	4.34	3.75	4.10	4.03	4.16	4.22	4.31
Energy–related CO_2 Emissions (Mt CO_2)[14]	88.7	52.7	59.3	52.9	54.0	56.8	58.9
CO_2 Emissions from Bunkers (Mt CO_2)	3.5	2.1	3.5	4.2	3.6	3.9	4.2

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.9	0.8	1.7	–1.7	0.1	0.2	0.5
Coal	1.6	3.9	0.4	–19.6	–1.3	0.8	1.0
Peat	–	–	4.1	–15.2	10.1	0.8	0.3
Oil	–0.6	–5.4	2.0	–3.7	1.2	0.9	0.6
Gas	–	–	5.5	–1.2	4.3	4.1	2.9
Comb. Renewables & Wastes	1.8	3.1	5.5	9.2	–1.3	0.4	0.6
Nuclear	46.7	11.3	1.4	–5.8	0.5	–1.3	–
Hydro	0.3	1.6	–5.5	33.4	–2.2	0.4	0.5
Solar/Wind/Other	–	–	58.7	37.5	15.6	4.8	24.6
TFC	0.4	–1.1	2.0	–1.8	1.2	0.5	0.6
Electricity Consumption	3.5	3.2	0.8	–1.4	1.8	0.3	0.6
Energy Production	8.0	6.6	1.2	3.2	–0.6	–0.5	0.3
Net Oil Imports	0.4	–5.8	1.9	–3.6	1.3	0.9	0.6
GDP	1.8	2.0	0.6	1.8	1.6	2.2	2.0
Growth in the TPES/GDP Ratio	0.1	–1.2	1.1	–3.4	–1.4	–2.0	–1.5
Growth in the TFC/GDP Ratio	–1.3	–3.0	1.4	–3.5	–0.4	–1.7	–1.4

Please note: Rounding may cause totals to differ from the sum of the elements.

UNITED KINGDOM

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**108.5**	**208.9**	**268.8**	**269.0**	**312.2**	**290.4**	**273.9**
Coal[1]		75.9	54.6	30.3	29.6	20.7	18.0	17.0
Oil		0.6	95.3	136.1	134.2	176.0	150.0	126.0
Gas		24.4	40.9	75.9	77.5	88.8	101.0	114.4
Comb. Renewables & Wastes[2]		–	0.6	1.6	1.7	0.9	1.3	1.3
Nuclear		7.3	17.1	24.7	25.6	25.4	19.7	14.8
Hydro		0.3	0.4	0.3	0.4	0.4	0.4	0.4
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.0	0.1	0.0	0.0	0.0
TOTAL NET IMPORTS[4]		**110.4**	**2.1**	**–37.6**	**–38.4**	**–79.8**	**–45.1**	**–24.5**
Coal[1]	Exports	2.0	1.8	0.8	0.9	–	–	–
	Imports	1.1	10.3	12.6	13.8	12.0	17.7	10.5
	Net Imports	–0.9	8.5	11.8	12.9	12.0	17.7	10.5
Oil	Exports	20.9	76.5	109.4	109.8	152.9	123.3	95.5
	Imports	136.9	65.4	60.9	60.7	66.0	70.0	70.0
	Bunkers	5.4	2.5	2.6	2.9	2.0	2.0	2.0
	Net Imports	110.6	–13.6	–51.1	–52.1	–88.9	–55.3	–27.5
Gas	Exports	–	–	1.2	1.7	9.4	19.0	19.0
	Imports	0.7	6.2	1.5	1.1	5.0	10.0	10.0
	Net Imports	0.7	6.2	0.4	–0.6	–4.4	–9.0	–9.0
Electricity	Exports	0.0	0.0	0.0	0.0	–	–	–
	Imports	0.0	1.0	1.4	1.4	1.5	1.5	1.5
	Net Imports	0.0	1.0	1.4	1.4	1.5	1.5	1.5
TOTAL STOCK CHANGES		**1.8**	**2.0**	**1.8**	**–2.6**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**220.8**	**213.1**	**233.1**	**228.0**	**232.4**	**245.3**	**249.4**
Coal[1]		76.4	64.0	44.4	40.0	32.7	35.7	27.5
Oil		111.6	82.6	84.7	82.5	87.1	94.7	98.5
Gas		25.1	47.2	75.9	76.4	84.4	92.0	105.4
Comb. Renewables & Wastes[2]		–	0.6	1.6	1.7	0.9	1.3	1.3
Nuclear		7.3	17.1	24.7	25.6	25.4	19.7	14.8
Hydro		0.3	0.4	0.3	0.4	0.4	0.4	0.4
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.0	0.1	0.0	0.0	0.0
Electricity Trade[5]		0.0	1.0	1.4	1.4	1.5	1.5	1.5
Shares (%)								
Coal		*34.6*	*30.0*	*19.1*	*17.6*	*14.1*	*14.6*	*11.0*
Oil		*50.5*	*38.8*	*36.3*	*36.2*	*37.5*	*38.6*	*39.5*
Gas		*11.4*	*22.1*	*32.6*	*33.5*	*36.3*	*37.5*	*42.3*
Comb. Renewables & Wastes		–	*0.3*	*0.7*	*0.7*	*0.4*	*0.5*	*0.5*
Nuclear		*3.3*	*8.0*	*10.6*	*11.2*	*10.9*	*8.0*	*5.9*
Hydro		*0.2*	*0.2*	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		–	*0.5*	*0.6*	*0.6*	*0.6*	*0.6*	*0.6*

0 is negligible, – is nil, .. is not available.

Please note: Forecast data are based on the 1995 submission. Forecast data for production, imports, exports and bunkers of coal, oil and natural gas and forecast data for electricity generated are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**147.7**	**145.3**	**161.3**	**157.2**	**165.9**	**175.0**	**182.6**
Coal[1]	26.7	10.7	7.1	6.6	10.5	9.6	8.4
Oil	77.3	68.8	74.3	73.3	75.0	77.9	81.9
Gas	23.6	42.0	52.8	49.9	52.1	56.7	59.9
Comb. Renewables & Wastes[2]	–	0.2	0.8	0.8	0.1	0.2	0.2
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	20.0	23.6	26.3	26.6	28.2	30.6	32.2
Heat	–	0.0	–	–	–	–	–
Shares (%)							
Coal	*18.1*	*7.3*	*4.4*	*4.2*	*6.3*	*5.5*	*4.6*
Oil	*52.3*	*47.4*	*46.1*	*46.7*	*45.2*	*44.5*	*44.9*
Gas	*16.0*	*28.9*	*32.7*	*31.7*	*31.4*	*32.4*	*32.8*
Comb. Renewables & Wastes	–	*0.1*	*0.5*	*0.5*	*0.1*	*0.1*	*0.1*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*13.6*	*16.2*	*16.3*	*16.9*	*17.0*	*17.5*	*17.6*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**65.5**	**42.7**	**46.3**	**44.7**	**48.7**	**51.5**	**52.4**
Coal[1]	13.6	6.3	4.5	4.2	6.8	6.8	6.2
Oil	34.0	15.8	18.0	17.0	17.1	16.8	16.0
Gas	10.1	12.0	14.4	14.1	14.1	15.7	16.9
Comb. Renewables & Wastes[2]	–	0.0	0.4	0.4	0.1	0.1	0.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	7.8	8.7	8.9	9.0	10.7	12.2	13.2
Heat	–	0.0	–	–	–	–	–
Shares (%)							
Coal	*20.7*	*14.7*	*9.7*	*9.4*	*14.0*	*13.2*	*11.8*
Oil	*51.9*	*36.9*	*39.0*	*38.0*	*35.1*	*32.6*	*30.5*
Gas	*15.5*	*28.0*	*31.2*	*31.5*	*29.0*	*30.5*	*32.3*
Comb. Renewables & Wastes	–	–	*0.9*	*1.0*	*0.2*	*0.2*	*0.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*12.0*	*20.3*	*19.2*	*20.2*	*22.0*	*23.7*	*25.2*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**31.0**	**46.5**	**49.9**	**50.6**	**54.2**	**58.6**	**63.9**
TOTAL OTHER SECTORS[8]	**51.2**	**56.2**	**65.1**	**61.9**	**62.8**	**64.8**	**66.2**
Coal[1]	13.1	4.4	2.6	2.5	3.7	2.8	2.2
Oil	12.6	7.0	7.0	6.4	4.0	2.9	2.4
Gas	13.5	30.0	38.4	35.8	38.0	41.0	43.0
Comb. Renewables & Wastes[2]	–	0.2	0.4	0.3	–	0.1	0.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	12.0	14.5	16.8	16.9	17.1	18.0	18.6
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*25.5*	*7.8*	*4.0*	*4.0*	*5.9*	*4.3*	*3.3*
Oil	*24.7*	*12.5*	*10.8*	*10.4*	*6.4*	*4.5*	*3.6*
Gas	*26.4*	*53.5*	*58.9*	*57.8*	*60.5*	*63.3*	*65.0*
Comb. Renewables & Wastes	–	*0.4*	*0.5*	*0.5*	–	*0.2*	*0.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*23.4*	*25.8*	*25.8*	*27.3*	*27.2*	*27.8*	*28.1*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**72.5**	**74.6**	**75.4**	**74.7**	**76.3**	**81.9**	**78.8**
OUTPUT (Mtoe)	**24.2**	**27.3**	**29.7**	**29.6**	**31.5**	**34.0**	**35.5**
(TWh gross)	281.4	317.0	345.8	343.9	366.3	395.3	412.8
Output Shares (%)							
Coal	*62.1*	*65.3*	*42.2*	*34.8*	*23.9*	*25.8*	*19.7*
Oil	*25.6*	*10.8*	*4.0*	*2.3*	*10.6*	*18.0*	*15.2*
Gas	*1.0*	*1.1*	*23.7*	*31.3*	*36.6*	*34.9*	*49.3*
Comb. Renewables & Wastes	*–*	*0.4*	*1.6*	*1.6*	*0.9*	*0.9*	*0.9*
Nuclear	*10.0*	*20.7*	*27.4*	*28.5*	*26.6*	*19.1*	*13.7*
Hydro	*1.4*	*1.6*	*1.0*	*1.2*	*1.3*	*1.2*	*1.1*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other	*–*	*0.0*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*
TOTAL LOSSES	**72.2**	**68.5**	**69.4**	**68.0**	**66.5**	**70.4**	**66.9**
of which:							
Electricity and Heat Generation[10]	48.3	47.3	45.7	45.2	44.8	47.9	43.4
Other Transformation	7.2	5.1	4.1	4.2	1.3	1.0	0.8
Own Use and Losses[11]	16.7	16.1	19.6	18.7	20.4	21.5	22.7
Statistical Differences	**0.9**	**–0.8**	**2.4**	**2.8**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	698.05	975.51	1064.57	1100.51	1178.20	1320.07	1479.03
Population (millions)	56.22	57.56	58.80	59.01	59.54	60.35	61.00
TPES/GDP[12]	0.32	0.22	0.22	0.21	0.20	0.19	0.17
Energy Production/TPES	0.49	0.98	1.15	1.18	1.34	1.18	1.10
Per Capita TPES[13]	3.93	3.70	3.96	3.86	3.90	4.07	4.09
Oil Supply/GDP[12]	0.16	0.08	0.08	0.07	0.07	0.07	0.07
TFC/GDP[12]	0.21	0.15	0.15	0.14	0.14	0.13	0.12
Per Capita TFC[13]	2.63	2.52	2.74	2.66	2.79	2.90	2.99
Energy–related CO_2 Emissions (Mt CO_2)[14]	*665.5*	*585.3*	*577.4*	*554.7*	*555.9*	*605.8*	*615.6*
CO_2 Emissions from Bunkers (Mt CO_2)	17.0	7.9	8.3	9.2	6.3	6.3	6.3

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	–0.1	–0.3	1.5	–2.2	0.6	1.1	0.3
Coal	–0.5	–1.3	–5.9	–9.9	–6.5	1.8	–5.1
Oil	–2.7	–1.3	0.4	–2.6	1.8	1.7	0.8
Gas	8.3	1.4	8.3	0.6	3.4	1.7	2.8
Comb. Renewables & Wastes	–	–	16.3	7.7	–18.9	7.6	–
Nuclear	5.4	5.0	6.3	3.7	–0.2	–5.0	–5.6
Hydro	1.6	1.8	–6.9	22.8	4.1	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	86.4	35.7	–11.1	–	–
TFC	0.1	–0.2	1.8	–2.5	1.8	1.1	0.9
Electricity Consumption	0.9	1.0	1.8	1.2	2.0	1.6	1.0
Energy Production	10.1	0.7	4.3	0.1	5.1	–1.4	–1.2
Net Oil Imports	–27.1	–	24.7	1.9	19.5	–9.1	–13.0
GDP	1.5	2.2	1.5	3.4	2.3	2.3	2.3
Growth in the TPES/GDP Ratio	–1.6	–2.5	0.0	–5.4	–1.6	–1.2	–1.9
Growth in the TFC/GDP Ratio	–1.4	–2.4	0.3	–5.7	–0.5	–1.2	–1.4

Please note: Rounding may cause totals to differ from the sum of the elements.

UNITED STATES

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**1455**	**1649**	**1689**	**1684**	**1732**	**1779**	**1831**
Coal[1]		333	539	547	562	596	609	626
Oil		534	431	399	397	377	359	354
Gas		503	419	440	442	461	515	566
Comb. Renewables & Wastes[2]		37	62	72	68	74	79	86
Nuclear		23	159	186	174	182	174	153
Hydro		23	23	30	28	28	28	28
Geothermal		2	14	14	13	13	15	16
Solar/Wind/Other[3]		–	0	0	0	1	1	1
TOTAL NET IMPORTS[4]		**289**	**316**	**443**	**486**	**582**	**668**	**764**
Coal[1]	Exports	31	67	56	52	51	53	55
	Imports	1	2	5	5	7	9	9
	Net Imports	–30	–65	–51	–47	–44	–45	–45
Oil	Exports	11	39	45	49	47	47	48
	Imports	316	415	499	536	609	690	776
	Bunkers	9	29	27	23	17	20	24
	Net Imports	296	347	427	464	545	623	703
Gas	Exports	2	2	4	4	4	5	5
	Imports	24	35	68	69	82	92	108
	Net Imports	22	33	65	66	78	87	103
Electricity	Exports	0	2	1	1	1	2	2
	Imports	1	2	4	4	5	5	4
	Net Imports	1	0	3	3	4	3	3
TOTAL STOCK CHANGES		**–8**	**–39**	**8**	**–8**	**0**	**–0**	**2**
TOTAL SUPPLY (TPES)		**1736**	**1926**	**2140**	**2162**	**2314**	**2447**	**2596**
Coal[1]		311	457	498	513	552	563	583
Oil		824	770	833	855	921	982	1058
Gas		515	439	504	508	538	602	669
Comb. Renewables & Wastes[2]		37	62	72	68	74	79	86
Nuclear		23	159	186	174	182	174	153
Hydro		23	23	30	28	28	28	28
Geothermal		2	14	14	13	13	15	16
Solar/Wind/Other[3]		–	0	0	0	1	1	1
Electricity Trade[5]		1	0	3	3	4	3	3
Shares (%)								
Coal		*17.9*	*23.7*	*23.2*	*23.7*	*23.9*	*23.0*	*22.4*
Oil		*47.5*	*40.0*	*38.9*	*39.5*	*39.8*	*40.1*	*40.7*
Gas		*29.6*	*22.8*	*23.6*	*23.5*	*23.3*	*24.6*	*25.8*
Comb. Renewables & Wastes		*2.2*	*3.2*	*3.4*	*3.1*	*3.2*	*3.2*	*3.3*
Nuclear		*1.3*	*8.3*	*8.7*	*8.0*	*7.9*	*7.1*	*5.9*
Hydro		*1.3*	*1.2*	*1.4*	*1.3*	*1.2*	*1.2*	*1.1*
Geothermal		*0.1*	*0.7*	*0.6*	*0.6*	*0.6*	*0.6*	*0.6*
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		*0.1*	–	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*

0 is negligible, – is nil, .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**1246**	**1290**	**1436**	**1445**	**1558**	**1670**	**1789**
Coal[1]	44	33	26	26	45	46	47
Oil	701	703	765	779	833	910	985
Gas	341	303	341	336	344	355	373
Comb. Renewables & Wastes[2]	16	23	28	24	46	48	51
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	143	226	269	272	283	304	326
Heat	–	2	8	8	7	8	8
Shares (%)							
Coal	*3.5*	*2.6*	*1.8*	*1.8*	*2.9*	*2.7*	*2.6*
Oil	*56.3*	*54.5*	*53.3*	*53.9*	*53.5*	*54.5*	*55.1*
Gas	*27.4*	*23.5*	*23.7*	*23.3*	*22.1*	*21.2*	*20.8*
Comb. Renewables & Wastes	*1.3*	*1.8*	*1.9*	*1.6*	*2.9*	*2.9*	*2.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.5*	*17.6*	*18.7*	*18.8*	*18.2*	*18.2*	*18.2*
Heat	–	*0.1*	*0.5*	*0.5*	*0.5*	*0.5*	*0.4*
TOTAL INDUSTRY[6]	**406**	**386**	**421**	**428**	**469**	**496**	**528**
Coal[1]	31	24	24	24	43	44	45
Oil	161	154	161	166	173	191	207
Gas	151	124	129	128	132	133	140
Comb. Renewables & Wastes[2]	7	9	11	11	27	29	30
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	56	75	91	93	87	93	99
Heat	–	–	5	5	6	6	7
Shares (%)							
Coal	*7.5*	*6.3*	*5.7*	*5.6*	*9.2*	*8.9*	*8.6*
Oil	*39.7*	*40.0*	*38.1*	*38.9*	*36.9*	*38.5*	*39.3*
Gas	*37.3*	*32.1*	*30.5*	*29.9*	*28.2*	*26.8*	*26.5*
Comb. Renewables & Wastes	*1.8*	*2.3*	*2.7*	*2.6*	*5.7*	*5.8*	*5.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*13.7*	*19.3*	*21.7*	*21.8*	*18.6*	*18.7*	*18.8*
Heat	–	–	*1.3*	*1.3*	*1.3*	*1.3*	*1.2*
TRANSPORT[7]	**420**	**502**	**558**	**570**	**637**	**704**	**771**
TOTAL OTHER SECTORS[8]	**420**	**402**	**456**	**447**	**452**	**469**	**490**
Coal[1]	14	9	2	2	1	1	1
Oil	137	63	64	62	47	45	43
Gas	173	164	196	191	193	198	206
Comb. Renewables & Wastes[2]	9	14	15	11	15	15	16
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	87	152	177	179	194	208	223
Heat	–	2	2	2	1	1	1
Shares (%)							
Coal	*3.2*	*2.2*	*0.4*	*0.4*	*0.3*	*0.3*	*0.3*
Oil	*32.6*	*15.6*	*14.0*	*13.9*	*10.4*	*9.5*	*8.8*
Gas	*41.2*	*40.7*	*42.9*	*42.7*	*42.7*	*42.2*	*42.1*
Comb. Renewables & Wastes	*2.1*	*3.4*	*3.4*	*2.6*	*3.4*	*3.3*	*3.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*20.8*	*37.7*	*38.9*	*40.0*	*42.9*	*44.4*	*45.4*
Heat	–	*0.4*	*0.5*	*0.5*	*0.3*	*0.3*	*0.3*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**507**	**765**	**876**	**878**	**935**	**969**	**1014**
OUTPUT (Mtoe)	**169**	**274**	**314**	**316**	**342**	**367**	**392**
(TWh gross)	1966	3182	3651	3671	3979	4272	4564
Output Shares (%)							
Coal	*46.2*	*53.4*	*52.7*	*53.8*	*53.5*	*50.9*	*49.3*
Oil	*17.1*	*4.1*	*2.6*	*2.9*	*2.9*	*1.1*	*0.8*
Gas	*18.6*	*12.0*	*13.1*	*13.8*	*14.9*	*21.7*	*26.8*
Comb. Renewables & Wastes	*0.0*	*2.1*	*1.8*	*1.7*	*2.3*	*2.3*	*2.3*
Nuclear	*4.5*	*19.2*	*19.6*	*18.2*	*17.6*	*15.6*	*12.9*
Hydro	*13.5*	*8.6*	*9.6*	*9.0*	*8.3*	*7.7*	*7.2*
Geothermal	*0.1*	*0.5*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*
TOTAL LOSSES	**498**	**648**	**712**	**711**	**756**	**777**	**807**
of which:							
Electricity and Heat Generation[10]	338	489	552	553	581	590	609
Other Transformation	–1	12	8	9	0	1	1
Own Use and Losses[11]	160	147	151	149	174	187	196
Statistical Differences	**–7**	**–13**	**–7**	**6**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	3701.40	5554.10	6378.70	6629.50	7141.34	7997.34	9026.21
Population (millions)	211.91	249.91	265.56	266.79	275.00	287.00	298.00
TPES/GDP[12]	0.47	0.35	0.34	0.33	0.32	0.31	0.29
Energy Production/TPES	0.84	0.86	0.79	0.78	0.75	0.73	0.71
Per Capita TPES[13]	8.19	7.71	8.06	8.10	8.41	8.53	8.71
Oil Supply/GDP[12]	0.22	0.14	0.13	0.13	0.13	0.12	0.12
TFC/GDP[12]	0.34	0.23	0.23	0.22	0.22	0.21	0.20
Per Capita TFC[13]	5.88	5.16	5.41	5.42	5.67	5.82	6.00
Energy–related CO_2 Emissions (Mt CO_2)[14]	4696.4	4873.4	5338.8	5470.5	5865.0	6217.8	6649.1
CO_2 Emissions from Bunkers (Mt CO_2)	29.4	91.1	86.0	74.1	53.6	63.8	76.2

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	1.3	0.2	1.8	1.0	2.3	1.1	1.2
Coal	2.8	2.0	1.4	3.2	2.5	0.4	0.7
Oil	1.2	–1.2	1.3	2.6	2.5	1.3	1.5
Gas	–1.3	–0.7	2.3	0.7	2.0	2.3	2.1
Comb. Renewables & Wastes	5.9	1.5	2.5	–5.8	2.9	1.4	1.6
Nuclear	20.3	7.7	2.6	–6.8	1.6	–0.9	–2.6
Hydro	1.1	–0.3	4.3	–5.9	–0.1	0.1	0.0
Geothermal	9.0	13.2	–0.3	–5.3	1.5	2.0	1.9
Solar/Wind/Other	–	–	6.4	–0.5	18.9	4.0	2.0
TFC	0.8	–0.1	1.8	0.7	2.5	1.4	1.4
Electricity Consumption	3.1	2.5	2.9	1.2	1.3	1.5	1.4
Energy Production	0.8	0.7	0.4	–0.3	0.9	0.5	0.6
Net Oil Imports	5.1	–1.3	3.5	8.6	5.5	2.7	2.5
GDP	2.6	2.3	2.3	3.9	2.5	2.3	2.5
Growth in the TPES/GDP Ratio	–1.2	–2.1	–0.5	–2.8	–0.2	–1.1	–1.2
Growth in the TFC/GDP Ratio	–1.8	–2.4	–0.5	–3.2	0.0	–0.9	–1.0

Please note: Rounding may cause totals to differ from the sum of the elements.

A

ANNEX

ENERGY BALANCES AND KEY STATISTICAL DATA TABLES

Table A1

GDP Growth Rates for IEA Countries[1]

(annual average percentage change)

	1973-79	1993	1994	1995	1996	1997	1998
Canada	3.9	2.5	3.9	2.1	1.2	3.7	3.0
United States	2.6	2.4	3.7	2.6	3.6	3.9	3.5
North America	**2.7**	**2.4**	**3.7**	**2.5**	**3.4**	**3.9**	**3.5**
Australia	2.8	4.0	5.3	4.1	3.7	2.8	3.6
Japan	3.5	0.3	0.6	1.5	3.9	0.8	–2.6
New Zealand	0.7	6.3	5.4	3.6	2.7	2.3	0.3
Pacific	**3.4**	**0.7**	**1.1**	**1.7**	**3.9**	**1.0**	**–2.0**
Austria	3.0	0.5	2.5	2.1	1.6	2.5	3.1
Belgium	2.4	–1.5	2.6	2.3	1.3	3.0	2.9
Denmark	1.9	0.8	5.8	3.2	3.2	3.3	2.4
Finland	2.1	–1.2	4.5	5.1	3.6	6.0	5.0
France	2.7	–1.3	2.7	2.2	1.4	2.3	3.1
Germany	2.4	–1.2	2.7	1.2	1.3	2.2	2.7
Greece	3.7	–1.6	2.0	2.1	2.4	3.2	3.0
Hungary	4.3	–0.6	2.9	1.5	1.3	4.6	5.2
Ireland	4.9	3.7	8.1	11.8	8.3	10.6	9.0
Italy	3.5	–1.2	2.2	2.9	0.7	1.5	1.5
Luxembourg	1.3	8.7	4.2	3.8	3.0	3.7	4.8
Netherlands	2.6	0.8	3.2	2.3	3.1	3.6	3.8
Norway	4.8	2.7	5.5	3.8	5.5	3.4	2.3
Portugal	2.9	–1.1	2.2	2.9	3.2	3.7	4.0
Spain	2.3	–1.2	2.3	2.7	2.4	3.5	3.8
Sweden	1.8	–2.2	3.3	3.9	1.3	1.8	2.8
Switzerland	–0.4	–0.5	0.5	0.6	–0.0	1.7	1.7
Turkey	4.5	8.0	–5.5	7.2	7.0	7.5	4.7
United Kingdom	1.5	2.1	4.3	2.8	2.3	3.4	2.7
IEA Europe	**2.5**	**–0.3**	**2.7**	**2.5**	**1.8**	**2.8**	**2.9**
IEA Total	**2.7**	**0.9**	**2.8**	**2.3**	**2.8**	**2.9**	**2.1**

1. Data are in 1990 dollars at 1990 prices.

Source: *OECD Economic Outlook*, OECD Paris, 1998.

Table A2

TPES/GDP Ratios for IEA Countries[1]

	1973	1979	1996	1997	1998[2]	Average Annual Growth Rates (%) 1986-91	1992-97
Canada	0.47	0.45	0.38	0.37	0.35	–0.6	–0.6
United States	0.47	0.44	0.34	0.33	0.32	–0.3	–1.4
North America	**0.47**	**0.44**	**0.34**	**0.33**	**0.32**	**–0.3**	**–1.3**
Australia	0.32	0.32	0.29	0.28	0.28	0.5	–1.0
Japan	0.20	0.18	0.15	0.15	0.16	–0.9	1.0
New Zealand	0.24	0.25	0.32	0.32	0.31	4.6	–1.9
Pacific	**0.22**	**0.20**	**0.17**	**0.17**	**0.17**	**–0.8**	**0.8**
Austria	0.21	0.19	0.15	0.15	0.15	–0.6	–0.2
Belgium	0.34	0.31	0.27	0.26	0.26	–0.9	0.3
Denmark	0.20	0.19	0.15	0.13	0.13	–0.6	–1.5
Finland	0.26	0.26	0.24	0.23	0.22	–0.2	0.1
France	0.22	0.20	0.20	0.19	0.19	0.6	–0.5
Germany	0.30	0.28	0.20	0.19	0.18	–3.6	–0.9
Greece	0.22	0.23	0.27	0.27	0.28	2.7	0.6
Hungary	0.88	0.92	0.80	0.75	0.68	0.1	–1.5
Ireland	0.31	0.29	0.18	0.17	0.17	–2.9	–4.3
Italy	0.19	0.17	0.14	0.14	0.14	0.1	–0.4
Luxembourg	0.73	0.58	0.25	0.24	0.22	–1.8	–6.8
Netherlands	0.32	0.31	0.23	0.22	0.21	–1.1	–1.0
Norway	0.23	0.22	0.16	0.16	0.16	–1.3	–2.5
Portugal	0.18	0.21	0.25	0.25	0.27	0.5	0.5
Spain	0.17	0.18	0.19	0.19	0.19	0.9	0.2
Sweden	0.24	0.24	0.22	0.21	0.21	–1.7	0.4
Switzerland	0.11	0.11	0.11	0.11	0.11	–1.2	0.1
Turkey	0.34	0.33	0.36	0.35	0.33	0.7	0.6
United Kingdom	0.32	0.29	0.22	0.21	0.21	–0.9	–2.0
IEA Europe	**0.25**	**0.24**	**0.20**	**0.19**	**0.19**	**–1.1**	**–0.6**
IEA Total	**0.33**	**0.31**	**0.25**	**0.24**	**0.24**	**–0.9**	**–0.6**

1. Measured in toe per $1 000 of GDP at 1990 prices and exchange rates; changes in energy intensity reflect the combined effects of efficiency improvements, structural changes, fuel substitution and exchange rates.
2. IEA Secretariat estimates.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *OECD Economic Outlook*, OECD Paris, 1998.

Table A3

TPES per Inhabitant for IEA Countries

(toe per capita)

	1973	1979	1996	1997	1998[1]	Average Annual Growth Rates (%) 1986-91	1992-97
Canada	7.14	7.86	7.84	7.86	7.66	–0.2	0.9
United States	8.19	8.36	8.06	8.10	8.12	0.7	0.9
North America	**8.09**	**8.31**	**8.04**	**8.08**	**8.08**	**0.6**	**0.9**
Australia	4.27	4.73	5.52	5.48	5.65	1.4	1.8
Japan	2.98	3.06	4.05	4.08	4.02	3.4	2.1
New Zealand	2.78	2.89	4.41	4.43	4.39	3.2	0.7
Pacific	**3.11**	**3.24**	**4.25**	**4.27**	**4.23**	**3.1**	**2.1**
Austria	2.87	3.16	3.38	3.44	3.48	2.2	1.2
Belgium	4.76	4.92	5.55	5.61	5.76	1.9	1.6
Denmark	3.94	4.15	4.35	3.99	3.93	0.1	1.3
Finland	4.57	5.12	6.25	6.43	6.46	0.8	3.3
France	3.39	3.54	4.36	4.22	4.27	2.8	0.5
Germany	4.28	4.73	4.29	4.23	4.24	–1.3	–0.0
Greece	1.38	1.68	2.36	2.44	2.54	4.3	1.9
Hungary	2.04	2.66	2.53	2.49	2.38	–1.4	0.8
Ireland	2.34	2.63	3.29	3.42	3.60	2.3	3.1
Italy	2.35	2.50	2.81	2.84	2.92	2.7	0.5
Luxembourg	12.83	10.69	8.28	8.04	7.98	3.1	–3.8
Netherlands	4.65	4.91	4.89	4.80	4.77	1.2	1.0
Norway	3.82	4.62	5.39	5.50	5.73	–0.2	1.0
Portugal	0.84	1.03	1.93	2.05	2.24	6.0	2.5
Spain	1.52	1.80	2.60	2.73	2.86	5.0	2.0
Sweden	4.83	5.30	5.98	5.87	5.78	–0.7	1.6
Switzerland	3.06	3.15	3.61	3.69	3.71	0.0	0.1
Turkey	0.63	0.70	1.08	1.12	1.09	2.8	3.5
United Kingdom	3.93	3.91	3.96	3.86	4.00	0.7	0.5
IEA Europe	**3.06**	**3.23**	**3.43**	**3.41**	**3.46**	**1.0**	**0.7**
IEA Total	**4.61**	**4.81**	**5.08**	**5.08**	**5.11**	**1.2**	**1.1**

1. IEA Secretariat estimates.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *OECD Economic Outlook*, OECD Paris, 1998.

Table A4

TFC/GDP Ratios for IEA Countries[1]

	1973	1979	1995	1996	1997	Average Annual Growth Rates (%) 1986-91	1992-97
Canada	0.39	0.36	0.29	0.30	0.29	–0.9	0.1
United States	0.34	0.30	0.23	0.23	0.22	–0.7	–1.2
North America	**0.34**	**0.31**	**0.23**	**0.23**	**0.22**	**–0.7**	**–1.1**
Australia	0.22	0.22	0.19	0.19	0.19	0.3	–0.9
Japan	0.15	0.13	0.10	0.10	0.10	–0.9	0.6
New Zealand	0.18	0.19	0.23	0.24	0.24	3.9	–0.2
Pacific	**0.16**	**0.14**	**0.11**	**0.11**	**0.11**	**–0.8**	**0.6**
Austria	0.16	0.15	0.12	0.12	0.12	–0.8	–1.0
Belgium	0.25	0.23	0.18	0.19	0.19	–1.3	1.0
Denmark	0.16	0.15	0.10	0.10	0.10	0.2	–1.8
Finland	0.23	0.21	0.17	0.17	0.17	0.8	–2.2
France	0.17	0.15	0.12	0.13	0.12	0.1	–0.9
Germany	0.22	0.20	0.14	0.14	0.13	–3.9	–0.7
Greece	0.16	0.17	0.18	0.19	0.19	1.7	1.6
Hungary	0.73	0.72	0.55	0.55	0.51	–0.7	–1.9
Ireland	0.23	0.23	0.14	0.13	0.13	–3.3	–4.4
Italy	0.14	0.13	0.11	0.11	0.11	0.3	–0.3
Luxembourg	0.48	0.44	0.23	0.23	0.22	–1.0	–4.6
Netherlands	0.25	0.24	0.18	0.18	0.17	–1.1	–1.2
Norway	0.21	0.19	0.14	0.13	0.13	–1.7	–2.3
Portugal	0.15	0.17	0.19	0.19	0.20	–0.1	1.4
Spain	0.13	0.14	0.14	0.13	0.13	1.2	0.7
Sweden	0.21	0.20	0.15	0.15	0.15	–2.6	–0.2
Switzerland	0.10	0.09	0.09	0.09	0.09	–0.8	–0.8
Turkey	0.28	0.27	0.27	0.27	0.26	0.4	0.1
United Kingdom	0.21	0.19	0.15	0.15	0.14	–0.8	–1.9
IEA Europe	**0.19**	**0.18**	**0.14**	**0.14**	**0.14**	**–1.2**	**–0.6**
IEA Total	**0.24**	**0.22**	**0.17**	**0.17**	**0.17**	**–1.2**	**–0.5**

1. Measured in toe per $1 000 of GDP at 1990 prices and exchange rates.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *OECD Economic Outlook*, OECD Paris, 1998.

Table A5

Total Energy Demand in IEA Countries

(Mtoe and %)

	1973						1979					
	TPES	Shares of TPES					TPES	Shares of TPES				
	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[1] %	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[1] %
Canada	161.0	9.5	50.3	23.2	2.5	14.5	190.8	10.4	48.2	22.9	5.1	13.4
United States	1736.4	17.9	47.5	29.6	1.3	3.7	1881.2	19.5	47.0	25.4	3.7	4.4
North America	**1897.4**	**17.2**	**47.7**	**29.1**	**1.4**	**4.6**	**2072.0**	**18.7**	**47.1**	**25.1**	**3.9**	**5.2**
Australia	57.6	39.2	47.1	5.9	–	7.8	68.7	36.0	46.8	10.1	–	7.1
Japan	323.6	17.9	77.9	1.6	0.8	1.8	354.6	14.4	73.0	5.2	5.2	2.2
New Zealand	8.3	15.3	53.5	3.4	–	27.8	9.1	10.6	46.7	9.3	–	33.4
Pacific	**389.5**	**21.0**	**72.8**	**2.2**	**0.6**	**3.3**	**432.4**	**17.8**	**68.3**	**6.1**	**4.2**	**3.6**
Austria	21.8	18.3	56.4	15.3	–	10.1	23.9	15.2	53.6	18.3	–	12.9
Belgium	46.3	24.1	60.5	15.4	0.0	–0.1	48.4	21.7	52.9	19.2	6.1	–0.0
Denmark	19.8	9.7	88.7	–	–	1.6	21.2	20.4	76.1	..	–	3.5
Finland	21.3	12.0	63.6	–	–	24.4	24.4	17.4	54.0	3.3	7.2	18.0
France	176.6	16.6	70.4	7.7	2.2	3.2	189.8	17.1	61.8	11.0	5.5	4.7
Germany	337.9	41.2	47.9	8.5	0.9	1.4	369.6	37.4	43.6	13.9	3.7	1.4
Greece	12.4	17.0	77.7	–	–	5.2	16.0	21.6	73.6	..	–	4.8
Hungary	21.3	37.1	38.5	19.6	–	4.8	28.4	29.9	40.1	25.9	–	4.0
Ireland	7.2	22.0	77.1	–	–	0.8	8.9	22.5	71.5	5.2	–	0.8
Italy	128.6	6.3	77.9	11.1	0.6	4.1	140.7	7.4	71.0	16.1	0.5	5.0
Luxembourg	4.5	54.1	37.1	4.9	–	4.0	3.9	47.4	33.8	12.1	–	6.6
Netherlands	62.4	4.6	49.5	45.6	0.5	–0.2	69.0	4.8	46.0	47.6	1.3	0.4
Norway	15.1	6.0	55.5	–	–	38.5	18.8	5.3	49.5	3.8	–	41.4
Portugal	7.2	7.0	75.4	–	–	17.5	10.0	4.4	78.3	–	–	17.3
Spain	53.0	17.1	73.6	1.8	3.2	4.4	66.8	16.1	73.3	2.1	2.6	5.9
Sweden	39.3	4.1	72.2	–	1.4	22.3	43.9	4.1	62.3	–	12.5	21.2
Switzerland	19.7	1.7	77.4	0.8	8.3	11.9	20.0	1.1	66.9	3.8	15.4	12.8
Turkey	24.3	21.2	51.4	–	–	27.4	30.3	21.6	49.6	–	–	28.8
United Kingdom	220.8	34.6	50.5	11.4	3.3	0.2	220.0	33.7	43.2	18.4	4.5	0.2
IEA Europe	**1239.5**	**24.8**	**59.2**	**10.2**	**1.6**	**4.3**	**1354.0**	**23.5**	**53.6**	**14.3**	**3.7**	**4.9**
IEA Total	**3526.4**	**20.3**	**54.5**	**19.5**	**1.4**	**4.3**	**3858.3**	**20.3**	**51.7**	**19.2**	**3.9**	**4.9**

1. Includes hydro, geothermal, combustible renewables, wastes, solar, wind, tide, wave, ambient heat used in heat pumps and electricity trade.

Source: *Energy Balances of OECD Countries* , IEA/OECD Paris, 1999.

Table A5 (continued)

Total Energy Demand in IEA Countries

(Mtoe and %)

	1997						1998[2]						1997-98
	TPES	Shares of TPES					TPES	Shares of TPES					Change
	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[2] %	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[1]	in TPES %
Canada	238.0	11.5	34.0	29.7	9.0	15.8	233.9	12.6	34.6	29.1	8.0	15.7	–1.7
United States	2162.2	23.7	39.5	23.5	8.0	5.2	2189.5	24.7	39.1	22.8	8.5	5.0	1.3
North America	**2400.2**	**22.5**	**39.0**	**24.1**	**8.1**	**6.3**	**2423.4**	**23.5**	**38.6**	**23.4**	**8.4**	**6.0**	**1.0**
Australia	101.6	41.7	35.0	16.6	–	6.7	105.8	42.9	34.0	16.8	–	6.4	4.1
Japan	514.9	16.8	52.7	10.7	16.1	3.6	508.3	16.6	51.2	11.3	17.2	3.7	–1.3
New Zealand	16.7	8.1	37.7	28.2	–	26.0	16.6	7.3	39.6	25.0	–	28.2	–0.6
Pacific	**633.2**	**20.6**	**49.5**	**12.1**	**13.1**	**4.7**	**630.8**	**20.8**	**48.0**	**12.6**	**13.8**	**4.8**	**–0.4**
Austria	27.8	13.1	43.5	23.5	–	19.9	28.1	11.5	44.4	23.9	–	20.2	1.4
Belgium	57.1	14.8	42.3	19.7	21.6	1.5	58.3	14.6	42.1	21.4	20.6	1.3	2.1
Denmark	21.1	31.2	45.3	18.3	–	5.2	20.8	26.4	46.5	20.3	–	6.8	–1.5
Finland	33.1	20.7	31.1	8.8	16.5	22.9	33.3	16.6	31.6	10.0	17.1	24.6	0.5
France	247.5	5.9	35.6	12.7	41.6	4.2	251.2	5.6	36.7	13.3	40.0	4.4	1.5
Germany	347.3	24.8	40.1	20.7	12.8	1.5	343.4	24.4	40.7	21.1	12.2	1.6	–1.1
Greece	25.6	33.1	60.0	0.7	–	6.3	26.7	32.7	58.8	2.7	–	5.8	4.4
Hungary	25.3	17.2	27.6	38.3	14.4	2.6	24.1	13.9	28.3	40.6	15.1	2.2	–4.8
Ireland	12.5	23.7	52.4	22.2	–	1.8	13.2	21.5	55.3	21.2	–	2.0	5.7
Italy	163.3	6.9	57.3	29.1	–	6.7	167.6	7.0	55.7	30.5	–	6.8	2.6
Luxembourg	3.4	9.2	57.9	18.4	–	14.5	3.3	3.4	62.0	19.1	–	15.5	–2.4
Netherlands	74.9	12.3	36.8	47.2	0.8	2.9	74.8	12.4	36.8	46.7	1.3	2.8	–0.1
Norway	24.2	4.2	34.4	16.2	–	45.1	25.4	4.4	28.8	17.7	–	49.1	4.9
Portugal	20.4	17.3	69.7	0.4	–	12.6	22.3	14.5	71.3	3.1	–	11.1	9.3
Spain	107.3	16.9	53.2	10.5	13.4	5.9	112.7	15.4	54.5	10.3	13.6	6.1	5.0
Sweden	51.9	4.8	31.1	1.4	35.1	27.6	51.3	5.1	29.8	1.4	37.9	25.8	–1.3
Switzerland	26.2	0.4	51.1	8.7	25.3	14.4	26.6	0.3	50.8	8.9	25.4	14.6	1.4
Turkey	71.3	29.7	43.3	11.7	–	15.3	71.0	29.0	42.6	12.6	–	15.8	–0.4
United Kingdom	228.0	17.6	36.2	33.5	11.2	1.5	236.6	17.3	36.4	33.5	11.3	1.5	3.8
IEA Europe	**1568.2**	**15.9**	**42.0**	**20.8**	**14.9**	**6.3**	**1590.7**	**15.3**	**42.2**	**21.4**	**14.7**	**6.4**	**1.4**
IEA Total	**4601.6**	**20.0**	**41.4**	**21.3**	**11.1**	**6.1**	**4644.8**	**20.3**	**41.1**	**21.3**	**11.3**	**6.0**	**0.9**

1. IEA Secretariat estimates.

2. Includes hydro, geothermal, combustible renewables, wastes, solar, wind, tide, wave, ambient heat used in heat pumps and electricity trade.

Source: *Energy Balances of OECD Countries* , IEA/OECD Paris, 1999.

Table A5 (continued)

Total Energy Demand in IEA Countries

(Mtoe and %)

	2000						2005						2000-05
	TPES	Shares of TPES					TPES	Shares of TPES					Change
	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[1] %	Mtoe	Solid Fuels %	Oil %	Natural Gas %	Nuclear %	Other[1] %	in TPES %
Canada	253.5	9.3	32.7	29.7	10.9	17.3	266.1	9.7	32.7	29.8	10.4	17.5	5.0
United States	2314.0	23.9	39.8	23.3	7.9	5.2	2447.1	23.0	40.1	24.6	7.1	5.1	5.8
North America	**2567.4**	**22.4**	**39.1**	**23.9**	**8.2**	**6.4**	**2713.3**	**21.7**	**39.4**	**25.1**	**7.4**	**6.4**	**5.7**
Australia	111.4	37.9	34.8	21.4	–	5.8	124.2	34.8	33.8	26.0	–	5.5	11.5
Japan	516.6	16.5	50.6	11.2	17.8	4.0	524.6	15.6	47.3	11.9	20.4	4.9	1.5
New Zealand	16.8	8.4	30.7	30.1	–	30.7	17.6	14.7	37.1	16.0	–	32.2	4.7
Pacific	**644.8**	**20.0**	**47.4**	**13.5**	**14.2**	**5.0**	**666.4**	**19.2**	**44.5**	**14.6**	**16.1**	**5.7**	**3.3**
Austria	29.1	8.6	38.2	29.0	–	24.2	30.8	6.8	36.2	32.3	–	24.6	5.8
Belgium	53.4	14.9	39.3	22.5	23.0	0.3	54.4	14.2	40.1	22.8	22.6	0.3	1.8
Denmark	19.6	23.3	42.9	24.5	–	9.4	19.4	18.2	41.1	29.8	–	10.8	–1.1
Finland	32.5	22.6	28.5	10.8	16.0	22.1	34.7	21.6	26.8	15.0	15.0	21.6	6.7
France	258.4	9.4	36.1	12.3	40.9	1.3	271.3	7.6	35.2	12.7	43.1	1.5	5.0
Germany	350.9	25.6	41.2	19.9	11.5	1.8	351.2	25.0	40.6	20.8	11.0	2.5	0.1
Greece	30.1	31.6	57.7	5.7	–	5.1	36.6	30.7	58.4	6.7	–	4.2	21.6
Hungary	26.1	15.4	27.4	38.6	14.0	4.6	27.3	17.0	27.6	37.5	13.4	4.6	4.6
Ireland	13.1	20.4	51.1	26.2	–	2.3	14.7	17.8	48.9	30.3	–	3.0	12.2
Italy	165.6	6.7	55.1	31.2	–	7.0	173.9	6.8	51.0	35.5	–	6.8	5.0
Luxembourg	3.2	3.1	56.1	28.0	–	12.8	3.2	3.1	54.2	29.4	–	13.3	0.6
Netherlands	81.3	9.3	37.0	49.2	0.9	3.5	86.7	8.6	37.4	50.2	0.4	3.5	6.7
Norway	23.7	3.4	36.9	13.0	–	46.8	..	..	..	..	..	..	..
Portugal	21.7	16.6	64.1	8.5	–	10.9	23.7	15.1	58.5	15.8	–	10.6	9.5
Spain	110.8	19.4	50.8	12.2	11.3	6.4	..	..	..	..	..	..	..
Sweden	52.2	4.8	32.1	1.6	35.5	26.1	52.6	4.9	33.3	1.9	33.0	26.9	0.8
Switzerland	24.4	0.2	50.1	9.8	24.1	15.8	24.6	0.2	48.8	10.2	23.7	17.1	0.8
Turkey	93.1	26.6	41.1	20.0	–	12.4	130.9	23.9	32.8	32.0	–	11.2	40.6
United Kingdom	232.4	14.1	37.5	36.3	10.9	1.2	245.3	14.6	38.6	37.5	8.0	1.3	5.5
IEA Europe	**1621.4**	**15.9**	**41.6**	**22.4**	**14.2**	**5.9**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
IEA Total	**4833.6**	**19.9**	**41.1**	**22.0**	**11.0**	**6.0**	**..**	**..**	**..**	**..**	**..**	**..**	**..**

1. Includes hydro, geothermal, combustible renewables, wastes, solar, wind, tide, wave, ambient heat used in heat pumps and electricity trade.

Note: The IEA Secretariat has estimated data for certain countries. For details, please see Energy Balances and Key Statistical Data after each country review.

Source: Country submissions.

Table A6

Development of IEA Energy Self–Sufficiency by Product

(Mtoe and %)

	1973			1979			1996			1997			1998[1]		
	TPES	Production	%	TPES	Production	%	TPES	Production	%	TPES	Production	%	TPES	Production	%
North America															
Coal	326.3	345.1	105.7	386.8	443.6	114.7	523.4	588.7	112.5	540.7	605.0	111.9	570.2	610.4	107.0
Oil	905.0	630.2	69.6	975.6	581.7	59.6	910.0	513.3	56.4	935.3	516.8	55.3	936.1	511.3	54.6
Natural Gas	551.8	564.0	102.2	520.6	521.8	100.2	574.6	575.2	100.1	578.7	579.5	100.1	567.1	584.0	103.0
Total	**1897.4**	**1653.5**	**87.1**	**2072.0**	**1736.1**	**83.8**	**2375.1**	**2044.3**	**86.1**	**2400.2**	**2046.5**	**85.3**	**2423.4**	**2055.4**	**84.8**
Pacific															
Coal	81.7	59.4	72.7	76.9	62.3	81.1	126.6	135.7	107.2	130.2	143.3	110.0	131.2	151.8	115.7
Oil	283.7	20.8	7.3	295.1	23.7	8.0	316.7	30.7	9.7	313.5	31.8	10.2	302.8	34.0	11.2
Natural Gas	8.7	6.0	68.1	26.4	9.9	37.6	77.3	32.0	41.4	76.6	32.3	42.1	79.3	32.8	41.3
Total	**389.5**	**101.5**	**26.1**	**432.4**	**129.9**	**30.1**	**627.8**	**305.7**	**48.7**	**633.2**	**320.3**	**50.6**	**630.8**	**335.9**	**53.3**
IEA Europe															
Coal	307.2	265.3	86.3	317.8	254.3	80.0	258.9	146.1	56.4	249.5	142.6	57.1	242.8	127.6	52.6
Oil	734.2	22.9	3.1	725.5	118.6	16.3	657.0	330.4	50.3	657.9	328.9	50.0	671.5	326.9	48.7
Natural Gas	126.0	119.6	94.9	193.7	166.7	86.1	328.4	229.9	70.0	326.9	226.9	69.4	340.7	226.6	66.5
Total	**1239.5**	**479.1**	**38.7**	**1354.0**	**655.6**	**48.4**	**1571.2**	**1032.2**	**65.7**	**1568.2**	**1030.9**	**65.7**	**1590.7**	**1015.1**	**63.8**
IEA Total															
Coal	715.3	669.8	93.6	781.5	760.2	97.3	908.9	870.5	95.8	920.5	890.9	96.8	944.2	889.8	94.2
Oil	1923.0	673.8	35.0	1996.2	724.0	36.3	1883.8	874.4	46.4	1906.8	877.6	46.0	1910.4	872.1	45.7
Natural Gas	686.5	689.5	100.4	740.7	698.4	94.3	980.3	837.2	85.4	982.2	838.6	85.4	987.2	843.3	85.4
Total	**3526.4**	**2234.1**	**63.4**	**3858.3**	**2521.7**	**65.4**	**4574.1**	**3382.2**	**73.9**	**4601.6**	**3397.7**	**73.8**	**4644.8**	**3406.3**	**73.3**

1. IEA Secretariat estimates.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

Table A7

Indigenous Production/Primary Energy Supply in IEA Countries, 1997

	Total Energy[1]	Coal[1]	Oil[1]	Gas[1]	Electricity[2]
Canada	1.524	1.572	1.487	1.942	1.066
United States	0.779	1.095	0.464	0.870	0.990
North America	**0.853**	**1.119**	**0.553**	**1.001**	**0.999**
Australia	1.960	3.282	0.783	1.511	1.000
Japan	0.208	0.027	0.003	0.037	1.000
New Zealand	0.849	1.453	0.501	1.000	1.000
Pacific	**0.506**	**1.100**	**0.102**	**0.421**	**1.000**
Austria	0.288	0.081	0.084	0.186	1.014
Belgium	0.230	0.026	–	–	0.960
Denmark	0.961	0.002	1.211	1.802	1.196
Finland	0.455	0.383	0.006	–	0.900
France	0.516	0.303	0.025	0.068	1.151
Germany	0.402	0.814	0.025	0.223	1.004
Greece	0.377	0.912	0.031	0.263	0.950
Hungary	0.504	0.758	0.286	0.346	0.943
Ireland	0.230	0.250	–	0.688	1.001
Italy	0.179	0.001	0.066	0.332	0.864
Luxembourg	0.013	–	–	–	0.073
Netherlands	0.872	–	0.110	1.715	0.873
Norway	8.778	0.252	19.268	10.458	0.967
Portugal	0.114	–	–	–	0.922
Spain	0.292	0.540	0.007	0.014	1.017
Sweden	0.637	0.101	–	–	1.019
Switzerland	0.419	–	–	–	1.123
Turkey	0.387	0.619	0.114	0.025	0.979
United Kingdom	1.180	0.740	1.627	1.014	0.954
IEA Europe	**0.657**	**0.571**	**0.500**	**0.694**	**0.997**
IEA Total	**0.738**	**0.968**	**0.460**	**0.854**	**0.999**

1. Calculated as production divided by primary energy supply.
2. Calculated as the ratio between domestic generation and total apparent consumption, or TFC plus own use in the energy sector and distribution losses. Includes CHP units.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

Table A8

Recent Energy and Oil Supply Trends for IEA Countries

(Mtoe and %)

	TPES					Oil Supply					Net Oil Imports[1]				
	1996	1997	% Chg.	1998[2]	% Chg.	1996	1997	% Chg.	1998[2]	% Chg.	1996	1997	% Chg.	1998[2]	% Chg.
Canada	234.9	238.0	1.3	233.9	–1.7	77.5	80.8	4.3	81.0	0.2	–37.1	–37.1	0.1	–41.6	12.1
United States	2140.1	2162.2	1.0	2189.5	1.3	832.5	854.5	2.6	855.1	0.1	453.8	486.9	7.3	499.4	2.6
North America	**2375.1**	**2400.2**	**1.1**	**2423.4**	**1.0**	**910.0**	**935.3**	**2.8**	**936.1**	**0.1**	**416.8**	**449.8**	**7.9**	**457.8**	**1.8**
Australia	101.1	101.6	0.5	105.8	4.1	37.2	35.6	–4.2	35.9	0.9	10.2	8.5	–16.7	6.0	–29.9
Japan	510.4	514.9	0.9	508.3	–1.3	273.5	271.6	–0.7	260.3	–4.2	279.9	280.3	0.1	260.3	–7.1
New Zealand	16.4	16.7	1.9	16.6	–0.6	6.1	6.3	3.7	6.6	4.4	4.0	3.6	–11.8	4.3	21.5
Pacific	**627.8**	**633.2**	**0.9**	**630.8**	**–0.4**	**316.7**	**313.5**	**–1.0**	**302.8**	**–3.4**	**294.2**	**292.4**	**–0.6**	**270.6**	**–7.4**
Austria	27.3	27.8	1.9	28.1	1.4	11.7	12.1	3.7	12.5	3.4	10.8	11.0	2.4	11.7	6.0
Belgium	56.4	57.1	1.3	58.3	2.1	23.7	24.2	2.1	24.5	1.6	28.3	29.1	2.8	30.5	4.8
Denmark	22.9	21.1	–7.7	20.8	–1.5	10.1	9.6	–4.9	9.7	1.1	1.0	–0.8	–175.4	–0.5	–33.5
Finland	32.0	33.1	3.2	33.3	0.5	9.9	10.3	3.5	10.5	2.2	10.0	10.6	5.1	10.6	0.2
France	254.3	247.5	–2.7	251.2	1.5	91.1	88.0	–3.3	92.1	4.6	90.8	89.6	–1.4	92.3	3.1
Germany	351.3	347.3	–1.1	343.4	–1.1	138.9	139.3	0.3	139.7	0.3	137.5	137.4	–0.1	141.4	2.9
Greece	24.8	25.6	3.2	26.7	4.4	15.2	15.3	0.7	15.7	2.4	17.9	18.4	3.0	19.6	6.8
Hungary	25.8	25.3	–1.9	24.1	–4.8	6.8	7.0	1.9	6.8	–2.4	4.7	5.3	11.7	5.6	5.0
Ireland	11.9	12.5	4.9	13.2	5.7	6.0	6.5	9.2	7.3	11.6	6.2	6.8	9.3	7.6	11.1
Italy	161.1	163.3	1.4	167.6	2.6	93.2	93.5	0.4	93.3	–0.2	90.1	89.0	–1.2	91.1	2.3
Luxembourg	3.4	3.4	–1.5	3.3	–2.4	1.9	2.0	4.1	2.1	4.4	1.9	2.0	2.8	2.1	6.7
Netherlands	76.0	74.9	–1.4	74.8	–0.1	26.5	27.6	4.0	27.5	–0.3	35.3	36.8	4.3	36.9	0.3
Norway	23.6	24.2	2.6	25.4	4.9	8.2	8.3	1.2	7.3	–12.3	–150.5	–151.6	0.7	–145.2	–4.2
Portugal	19.1	20.4	6.5	22.3	9.3	13.2	14.2	7.8	15.9	11.7	13.5	14.8	9.5	16.3	10.2
Spain	102.1	107.3	5.1	112.7	5.0	55.5	57.1	3.0	61.5	7.7	58.8	63.0	7.3	68.1	8.0
Sweden	52.9	51.9	–1.7	51.3	–1.3	16.8	16.1	–3.7	15.3	–5.2	17.8	17.4	–2.2	18.2	4.4
Switzerland	25.6	26.2	2.3	26.6	1.4	12.7	13.4	5.5	13.5	0.8	12.8	13.2	3.8	13.7	3.3
Turkey	67.7	71.3	5.4	71.0	–0.4	31.0	30.9	–0.5	30.2	–2.1	28.5	27.5	–3.7	27.2	–1.1
United Kingdom	233.1	228.0	–2.2	236.6	3.8	84.7	82.5	–2.6	86.0	4.3	–48.5	–49.1	1.4	–49.3	0.4
IEA Europe	**1571.2**	**1568.2**	**–0.2**	**1590.7**	**1.4**	**657.0**	**657.9**	**0.1**	**671.5**	**2.1**	**367.0**	**370.4**	**0.9**	**397.7**	**7.4**
IEA Total	**4574.1**	**4601.6**	**0.6**	**4644.8**	**0.9**	**1883.8**	**1906.8**	**1.2**	**1910.4**	**0.2**	**1078.0**	**1112.5**	**3.2**	**1126.1**	**1.2**

1. Includes requirements for marine bunkers.
2. IEA Secretariat estimates.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

Table A9

Share of Oil Use by Sector in IEA Countries

(%)

	TFC				Industry[1]				Residential/Commercial[2]				Transport			
	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997
Canada	58.3	53.3	41.7	42.4	40.4	37.3	28.4	28.4	47.4	35.4	18.5	19.5	98.9	95.2	88.8	89.0
United States	56.3	57.7	53.3	53.9	39.7	48.3	38.1	38.9	32.6	25.0	14.0	13.9	95.9	96.9	96.8	96.6
North America	**56.5**	**57.2**	**52.0**	**52.6**	**39.8**	**47.0**	**36.7**	**37.3**	**34.0**	**26.1**	**14.5**	**14.6**	**96.1**	**96.7**	**96.1**	**96.0**
Australia	61.7	59.7	52.4	52.1	43.8	40.6	27.5	26.9	39.7	26.7	13.3	13.3	99.4	99.6	98.2	98.2
Japan	73.2	70.3	63.6	63.2	67.7	62.2	54.6	54.3	68.5	63.6	46.1	44.6	96.9	97.6	98.0	98.0
New Zealand	60.6	55.2	43.8	43.5	43.9	35.1	11.6	10.2	32.8	22.8	13.9	13.9	99.9	99.9	99.4	99.5
Pacific	**71.3**	**68.4**	**61.2**	**60.8**	**64.7**	**59.1**	**49.3**	**48.9**	**63.4**	**57.7**	**41.5**	**40.1**	**97.6**	**98.1**	**98.1**	**98.1**
Austria	59.9	54.6	46.6	47.6	52.4	41.0	29.0	30.4	46.8	43.2	24.7	26.1	93.1	94.7	95.2	95.7
Belgium	60.7	56.9	53.8	54.8	46.8	38.6	36.2	37.9	64.2	58.3	44.8	45.2	98.4	98.6	98.8	98.8
Denmark	88.3	81.2	51.3	50.8	84.5	72.0	37.0	33.7	85.4	77.3	27.8	26.7	99.7	99.7	99.5	99.5
Finland	59.2	54.8	36.4	35.4	66.2	54.3	18.1	16.7	42.3	41.1	29.1	28.0	99.3	99.5	98.7	98.6
France	72.0	66.8	53.0	53.3	63.4	59.2	41.7	41.9	68.0	56.1	29.1	28.4	97.7	98.1	98.0	98.0
Germany	56.0	53.2	52.3	52.8	44.3	39.5	36.2	36.3	53.6	47.8	36.3	36.7	93.5	97.1	97.8	97.8
Greece	77.6	77.4	70.9	70.9	68.7	69.4	53.0	53.3	68.6	61.6	52.9	52.8	99.2	99.7	99.8	99.8
Hungary	38.1	42.0	29.4	29.9	28.1	32.1	28.8	29.1	35.5	36.8	10.6	9.4	81.2	90.6	96.7	96.8
Ireland	71.2	64.3	59.6	60.7	86.6	73.8	38.6	39.5	37.7	30.5	43.8	45.3	100.0	100.0	100.0	99.9
Italy	73.0	65.1	51.4	51.5	62.3	52.1	33.8	34.4	73.5	58.5	24.7	23.8	97.1	97.3	97.6	97.6
Luxembourg	52.1	43.8	59.7	61.2	38.6	19.9	14.7	12.0	78.4	67.8	47.4	47.8	99.0	99.2	99.5	99.5
Netherlands	50.5	42.6	36.3	39.1	48.8	46.7	32.4	34.5	34.2	16.8	5.9	6.6	99.0	99.0	99.0	99.0
Norway	55.9	52.6	44.1	43.3	43.2	43.3	34.2	32.0	50.6	37.3	20.2	19.2	98.3	98.3	96.7	96.7
Portugal	75.1	73.7	71.9	72.8	66.9	66.9	62.7	66.2	59.7	52.9	48.0	45.9	98.0	99.0	99.5	99.5
Spain	75.6	78.6	65.7	65.6	64.7	70.0	46.0	48.9	68.2	64.4	40.9	39.3	98.8	99.1	99.0	98.9
Sweden	70.4	62.8	41.4	41.3	53.4	48.1	28.6	27.9	78.7	62.6	24.2	23.1	96.8	96.9	96.6	96.8
Switzerland	81.4	75.3	62.9	63.0	77.4	64.0	31.7	31.4	76.3	70.7	53.6	52.5	95.9	95.8	96.8	96.9
Turkey	48.5	49.5	52.8	49.7	60.5	56.6	41.4	40.0	28.1	23.8	33.5	30.3	88.1	96.3	99.4	99.4
United Kingdom	52.3	48.5	46.1	46.7	51.9	45.6	39.0	38.0	24.7	21.6	10.8	10.4	99.1	99.1	98.7	98.7
IEA Europe	**61.9**	**57.9**	**51.0**	**51.4**	**53.8**	**48.8**	**37.2**	**37.6**	**53.8**	**45.4**	**28.0**	**27.7**	**96.6**	**97.9**	**98.2**	**98.2**
IEA Total	**60.0**	**58.7**	**52.8**	**53.3**	**49.2**	**49.5**	**39.0**	**39.4**	**44.0**	**36.6**	**23.0**	**22.8**	**96.4**	**97.2**	**97.0**	**96.9**

1. Includes non-energy use.
2. Includes public and agricultural use.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

Table A10

Historical and Projected Oil Production in IEA Countries

(Mtoe)

	1973	1979	1997	1998[1]	2000	2005	2010
Canada	96.3	86.6	120.2	122.8	128.3	136.4	138.8
United States	533.8	495.1	396.6	388.4	376.8	358.7	354.1
North America	**630.2**	**581.7**	**516.8**	**511.3**	**505.1**	**495.2**	**492.9**
Australia	19.8	22.7	27.9	30.7	34.8	28.1	22.4
Japan	0.8	0.6	0.8	0.7	0.7	0.7	0.7
New Zealand	0.2	0.4	3.1	2.5	2.2	2.2	2.2
Pacific	**20.8**	**23.7**	**31.8**	**34.0**	**37.7**	**31.0**	**25.3**
Austria	2.7	1.8	1.0	1.0	1.0	0.7	0.6
Belgium	–	–	–	–	–	–	–
Denmark	0.1	0.4	11.6	11.9	14.6	9.4	5.4
Finland	–	–	0.1	0.1	–	–	–
France	2.1	2.1	2.2	2.0	1.0	1.0	1.0
Germany	6.8	4.9	3.5	3.6	1.0	..	..
Greece	–	–	0.5	0.3	0.1	..	..
Hungary	2.0	2.5	2.0	1.9	1.5	1.5	1.1
Ireland	–	–	–	–	–	–	–
Italy	1.1	1.8	6.2	5.9	6.0	5.8	5.5
Luxembourg	–	–	–	–	–	–	–
Netherlands	1.6	1.6	3.0	2.8	2.3	1.7	1.1
Norway	1.6	19.3	160.8	154.6	85.5	..	..
Portugal	–	–	–	–	–	–	–
Spain	0.7	1.4	0.4	0.5	0.9	..	..
Sweden	–	0.0	–	–	–	–	–
Switzerland	–	–	–	–	–	–	–
Turkey	3.6	2.9	3.5	3.3	2.9	1.9	1.2
United Kingdom	0.6	80.0	134.2	139.0	176.0	150.0	126.0
IEA Europe	**22.9**	**118.6**	**328.9**	**326.9**	**292.7**	**..**	**..**
IEA Total	**673.8**	**724.0**	**877.6**	**872.1**	**835.5**	**..**	**..**

1. IEA Secretariat estimates.

Note: The IEA Secretariat has estimated forecast data for certain countries. For details, please see Energy Balances and Key Statistical Data tables after each country review.

Sources: *Energy Balances of OECD Countries*, IEA/OECD, 1999, for 1973, 1979 and 1997; and country submissions for 2000, 2005 and 2010.

Table A11

Historical and Projected Net Oil Imports of IEA Countries[1]

(Mtoe)

	1979	1996	1997	1998[2]	2000	2005	2010
Canada	7.8	–37.1	–37.1	–41.6	–44.7	–48.7	–46.0
United States	423.7	453.8	486.9	499.4	561.6	643.1	727.5
North America	**431.5**	**416.8**	**449.8**	**457.8**	**516.8**	**594.4**	**681.5**
Australia	10.8	10.2	8.5	6.0	4.8	14.7	24.0
Japan	277.0	279.9	280.3	260.3	265.8	252.2	240.5
New Zealand	4.2	4.0	3.6	4.3	3.3	4.7	5.6
Pacific	**292.0**	**294.2**	**292.4**	**270.6**	**273.9**	**271.6**	**270.1**
Austria	11.4	10.8	11.0	11.7	10.1	10.5	10.7
Belgium	29.4	28.3	29.1	30.5	24.9	25.8	26.5
Denmark	15.8	1.0	–0.8	–0.5	–4.6	0.2	3.9
Finland	15.3	10.0	10.6	10.6	9.7	9.7	9.7
France	123.4	90.8	89.6	92.3	94.7	96.7	97.4
Germany	162.7	137.5	137.4	141.4	145.6	144.6	140.7
Greece	13.3	17.9	18.4	19.6	20.6	24.8	30.2
Hungary	9.8	4.7	5.3	5.6	5.7	6.1	6.7
Ireland	6.4	6.2	6.8	7.6	6.7	7.2	8.6
Italy	102.6	90.1	89.0	91.1	87.6	85.3	83.0
Luxembourg	1.4	1.9	2.0	2.1	1.8	1.8	1.7
Netherlands	41.5	35.3	36.8	36.9	41.2	46.3	51.4
Norway	–9.7	–150.5	–151.6	–145.2	–76.8	..	..
Portugal	9.2	13.5	14.8	16.3	14.7	15.0	15.2
Spain	49.6	58.8	63.0	68.1	55.4	..	..
Sweden	29.4	17.8	17.4	18.2	17.9	18.7	19.3
Switzerland	13.8	12.8	13.2	13.7	12.3	12.0	11.8
Turkey	11.8	28.5	27.5	27.2	35.4	41.1	49.5
United Kingdom	19.2	–48.5	–49.1	–49.3	–86.9	–53.3	–25.5
IEA Europe	**656.3**	**367.0**	**370.4**	**397.7**	**416.1**	**..**	**..**
IEA Total	**1379.7**	**1078.0**	**1112.5**	**1126.1**	**1206.8**	**..**	**..**

1. Includes requirements for marine bunkers.
2. IEA Secretariat estimates.

Note: The IEA Secretariat has estimated data for certain countries. For details, please see Energy Balances and Key Statistical Data tables after each country review.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, for 1979, 1996 and 1997; and country submissions for 2000, 2005 and 2010.

Table A12

Total IEA Electricity Generation by Fuel

(TWh and %)

	1973		1979		1997		1998[1]		2000	
	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %
Coal	1570.8	36.9	1977.7	37.7	3144.5	38.3	3165.9	38.3	3258.2	37.3
Oil	1088.4	25.5	1016.0	19.3	510.1	6.2	507.7	6.1	546.2	6.3
Natural Gas	512.2	12.0	597.6	11.4	1125.3	13.7	1142.1	13.8	1358.6	15.6
Comb. Renewables & Wastes	6.9	0.2	11.8	0.2	133.5	1.6	134.8	1.6	168.8	1.9
Nuclear	188.3	4.4	570.3	10.9	1967.2	24.0	2015.2	24.4	2041.6	23.4
Hydro	888.8	20.9	1069.1	20.4	1290.2	15.7	1252.7	15.2	1307.6	15.0
Geothermal	6.4	0.2	8.6	0.2	24.7	0.3	24.4	0.3	27.5	0.3
Solar/Wind	0.6	0.0	0.5	0.0	13.3	0.2	14.5	0.2	19.7	0.2
Total	**4262.4**	**100.0**	**5251.6**	**100.0**	**8208.9**	**100.0**	**8257.2**	**100.0**	**8728.4**	**100.0**

1. IEA Secretariat estimates.

Note: The IEA Secretariat has estimated forecast data for certain countries. For details, please see Energy Balances and Key Statistical Data tables after each country review.

Sources: *Energy Balances of OECD Countries* , IEA/OECD Paris, 1999, for 1973, 1979 and 1997; and country submissions for 2000.

Table A13

Electricity Generation in IEA Countries, 1997

	Energy Inputs[1] (Mtoe)	Output in TWh	Shares of Fuel in Electricity Generation (%)					
			Coal	Oil	Gas	Nuclear	Hydro	Other[2]
Canada	82.4	575.0	17.4	2.4	4.1	14.4	61.1	0.7
United States	878.5	3670.6	53.8	2.9	13.8	18.2	9.0	2.3
North America	**960.9**	**4245.6**	**48.9**	**2.9**	**12.5**	**17.6**	**16.0**	**2.1**
Australia	41.4	182.6	80.1	1.3	7.6	–	9.2	1.8
Japan	210.8	1029.5	19.1	18.2	20.5	31.0	8.7	2.5
New Zealand	5.8	36.8	5.5	–	23.7	–	63.2	7.7
Pacific	**258.1**	**1248.8**	**27.6**	**15.2**	**18.7**	**25.5**	**10.4**	**2.5**
Austria	8.2	55.5	11.8	5.0	15.5	–	64.8	2.9
Belgium	19.1	78.1	20.9	1.8	14.8	60.7	0.4	1.4
Denmark	10.2	44.3	64.9	12.2	15.4	–	0.0	7.4
Finland	15.4	69.2	28.3	2.0	10.0	30.2	17.7	11.9
France	119.5	498.9	5.2	1.5	1.0	79.3	12.5	0.5
Germany	139.0	548.0	53.4	1.3	9.2	31.1	3.2	1.9
Greece	10.0	43.3	70.7	19.2	0.8	–	9.0	0.3
Hungary	10.2	35.4	29.8	15.3	14.8	39.5	0.6	0
Ireland	4.3	19.7	44.9	17.6	33.4	–	3.4	0.7
Italy	46.8	246.5	10.0	46.0	24.9	–	16.9	2.2
Luxembourg	0.1	0.4	21.2	3.2	43.2	–	19.5	12.9
Netherlands	18.7	86.7	30.0	4.2	58.3	2.8	0.1	4.7
Norway	9.7	110.5	0.2	–	0.2	–	99.4	0.2
Portugal	5.8	34.1	38.2	19.8	0.3	–	38.4	3.3
Spain	38.4	185.8	34.3	7.2	8.8	29.8	18.6	1.3
Sweden	29.2	149.4	1.9	2.1	0.5	46.8	46.2	2.5
Switzerland	10.5	61.6	–	0.3	1.4	41.2	55.3	1.8
Turkey	19.3	103.3	32.8	6.9	21.4	–	38.5	0.4
United Kingdom	74.7	343.9	34.8	2.3	31.3	28.5	1.2	1.8
IEA Europe	**589.0**	**2714.4**	**26.7**	**7.3**	**13.3**	**33.1**	**17.7**	**1.9**
IEA Total	**1808.0**	**8208.9**	**38.3**	**6.2**	**13.7**	**24.0**	**15.7**	**2.1**

1. Includes CHP units.
2. Includes combustible renewables, wastes, geothermal, solar, wind, tide and wave.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

Table A14

Electricity Intensity of IEA Countries[1]

	1973	1979	1995	1996	1997	Average Annual Growth Rates (%) 1986-91	1992-97
Canada	0.75	0.77	0.85	0.86	0.83	0.5	–1.0
United States	0.53	0.55	0.58	0.58	0.56	2.1	–0.8
North America	**0.55**	**0.57**	**0.61**	**0.60**	**0.58**	**1.9**	**–0.9**
Australia	0.36	0.43	0.51	0.50	0.50	2.0	–1.2
Japan	0.29	0.30	0.31	0.30	0.31	0.7	1.5
New Zealand	0.54	0.61	0.71	0.72	0.70	3.2	–1.2
Pacific	**0.30**	**0.32**	**0.33**	**0.33**	**0.33**	**0.8**	**1.2**
Austria	0.28	0.29	0.30	0.30	0.30	0.6	–0.6
Belgium	0.29	0.32	0.37	0.37	0.37	0.8	1.0
Denmark	0.19	0.23	0.24	0.25	0.23	1.3	–1.8
Finland	0.37	0.42	0.54	0.54	0.53	2.1	–0.5
France	0.22	0.26	0.33	0.34	0.33	0.8	–0.1
Germany	0.34	0.36	0.30	0.30	0.30	–2.6	–0.6
Greece	0.27	0.32	0.48	0.48	0.49	2.1	2.2
Hungary	0.92	0.99	1.15	1.16	1.12	1.3	–0.6
Ireland	0.32	0.34	0.29	0.28	0.27	–1.3	–3.6
Italy	0.21	0.22	0.24	0.24	0.24	1.1	0.8
Luxembourg	0.56	0.57	0.41	0.38	0.39	–2.4	–0.8
Netherlands	0.27	0.29	0.29	0.29	0.30	0.7	0.3
Norway	1.03	0.97	0.83	0.78	0.76	0.1	–3.0
Portugal	0.24	0.33	0.45	0.46	0.46	0.9	1.4
Spain	0.23	0.29	0.32	0.32	0.33	–0.3	1.1
Sweden	0.47	0.52	0.60	0.60	0.59	0.2	–0.6
Switzerland	0.18	0.22	0.24	0.24	0.24	0.1	0.1
Turkey	0.17	0.25	0.48	0.50	0.52	3.9	4.5
United Kingdom	0.40	0.39	0.34	0.34	0.33	0.1	–1.5
IEA Europe	**0.30**	**0.33**	**0.34**	**0.34**	**0.33**	**–0.2**	**–0.1**
IEA Total	**0.40**	**0.42**	**0.44**	**0.44**	**0.43**	**0.8**	**–0.1**

1. Calculated as production plus net imports divided by GDP and measured in kWh per dollar of GDP at 1990 prices and exchange rates; includes CHP units.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *OECD Economic Outlook*, OECD Paris, 1998.

Table A15

Electricity Generation in IEA Countries

(GW Net)

	1997 Total Capacity							1997 Under Construction*						
	Coal	Oil	Natural Gas	Nuclear	Hydro	Other	Total	Coal	Oil	Natural Gas	Nuclear	Hydro	Other	Total
Canada	17.85	8.48	4.92	13.39	66.82	1.19	112.65	–	0.01	1.20	–	–	–	1.20
United States[1]	314.12	48.59	222.34	99.72	99.43	7.42	791.62							
North America	**332.0**	**57.1**	**227.3**	**113.1**	**166.3**	**8.6**	**904.3**	**0**	**0.01**	**1.20**	**0**	**0**	**0**	**1.20**
Australia	25.82	1.18	4.13	–	7.50	0.41	39.03	..	..	..	..	..	..	..
Japan[2, 3]	24.90	53.05	49.97	45.08	43.11	0.49	216.60	9.20	0.37	10.86	0.83	6.32	–	27.58
New Zealand	0.10	0.16	1.88	–	5.16	0.50	7.79	–	–	0.12	–	–	–	0.12
Pacific	**50.82**	**54.38**	**55.98**	**45.08**	**55.77**	**1.40**	**263.42**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
Austria	1.82	0.85	3.36	–	11.53	0.30	17.86	–	–	0.05	–	0.21	–	0.26
Belgium	3.14	0.90	3.41	5.71	1.40	0.14	14.69	–	–	1.2	–	–	–	1.2
Denmark	6.22	2.07	2.13	–	0.01	1.36	11.79	–	–	0.0	–	–	–	0.0
Finland	5.19	1.19	2.45	2.55	2.86	1.46	15.70	0.15	0.11	–	0.12	0.02	0.07	0.47
France	11.10	11.65	1.27	62.88	25.09	0.72	112.70	–	–	0.30	1.44	–	0.00	1.74
Germany	51.70	9.38	18.38	22.31	8.84	3.48	114.09	..	..	..	..	..	..	..
Greece	4.55	2.04	0.18	–	2.73	0.08	9.57	–	0.38	–	–	0.46	–	0.84
Hungary	2.30	3.69	–	1.84	0.05	0.02	7.90	1.60	–	0.05	–	–	–	1.65
Ireland[2]	1.26	0.84	1.61	–	0.52	0.06	4.30	–	–	0.31	–	–	0.01	0.32
Italy	9.08	17.14	23.34	–	19.95	0.91	70.41	0.56	1.35	3.64	–	0.84	0.78	7.17
Luxembourg	0.09	–	0.03	–	1.14	0.01	1.28	..	..	..	..	..	..	..
Netherlands	3.92	0.02	15.33	0.45	0.04	0.38	20.14	–	–	–	–	0.01	0.24	0.25
Norway	0.10	0.03	0.04	–	28.17	0.11	28.44	..	..	..	..	..	..	..
Portugal	1.78	2.75	0.25	–	4.44	0.25	9.46	–	–	1.06	–	0.24	0.09	1.38
Spain	11.32	9.00	3.54	7.25	16.87	0.57	48.54	..	..	..	..	..	..	..
Sweden	0.73	5.45	0.27	10.06	16.25	1.28	34.04	..	..	..	..	..	..	..
Switzerland	–	0.80	0.05	3.08	11.90	0.27	16.09	..	..	..	..	..	..	..
Turkey	6.54	1.72	3.50	–	10.10	0.03	21.89	0.49	0.55	3.04	–	3.50	0.01	7.59
United Kingdom	34.82	6.56	13.44	12.95	4.28	0.45	72.50	..	..	..	..	..	..	..
IEA Europe	**155.66**	**76.07**	**92.57**	**129.08**	**166.17**	**11.86**	**631.40**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
IEA Total	**538.44**	**187.53**	**375.80**	**287.26**	**388.20**	**21.86**	**1799.09**	**..**	**..**	**..**	**..**	**..**	**..**	**..**

* These figures reflect capacity under construction (as of December 1997) that will come on line by 2005, as reported in the country submissions (fiscal years for Australia, Japan and New Zealand).

Source: Country submissions.

1. Capacity is net summer capacity.
2. Only gross capacity data are available.
3. Does not include autoproducer capacity.

Table A15 (continued)

Electricity Generation in IEA Countries

(GW Net)

	2000							2005						
	Total Capacity							Total Capacity						
	Coal	Oil	Natural Gas	Nuclear	Hydro	Other	Total	Coal	Oil	Natural Gas	Nuclear	Hydro	Other	Total
Canada	17.79	7.66	7.62	14.67	65.82	2.13	115.69	17.09	7.62	8.47	14.67	65.98	2.37	116.19
United States[1]	314.81	48.74	253.34	95.51	101.70	8.68	822.76	314.43	42.76	326.87	88.03	101.68	9.69	883.46
North America	**332.60**	**56.40**	**260.96**	**110.17**	**167.52**	**10.81**	**938.46**	**331.53**	**50.38**	**335.34**	**102.70**	**167.65**	**12.06**	**999.66**
Australia	25.82	1.18	4.54	–	7.50	0.41	39.44	..	..	..	..	..	..	..
Japan[2, 3]	34.37	54.75	59.30	57.46	48.00	2.02	255.90	35.06	55.85	59.63	57.55	51.25	2.86	262.20
New Zealand	0.12	0.06	2.46	–	5.08	0.51	8.22	0.12	0.06	2.46	–	5.38	0.64	8.65
Pacific	**60.31**	**55.98**	**66.30**	**57.46**	**60.58**	**2.94**	**303.57**	..	..	..	..	..	..	..
Austria	1.90	0.87	3.36	–	11.74	0.27	18.14	1.90	0.34	4.02	–	11.90	0.27	18.43
Belgium	2.36	0.76	4.64	5.71	1.40	0.16	15.04	1.21	0.69	4.48	5.71	1.40	0.16	13.65
Denmark	6.22	2.07	2.13	–	0.01	1.36	11.79	6.22	2.07	2.13	..	0.01	1.36	11.79
Finland	5.34	1.30	2.45	2.67	2.88	1.53	16.17	..	..	..	..	..	..	18.76
France	11.10	11.65	1.70	64.31	25.13	0.92	114.81	11.11	11.77	1.77	64.33	25.11	1.10	114.9
Germany	55.73	9.36	22.32	23.43	10.23	3.68	124.75	58.05	7.76	23.22	22.40	10.44	4.86	126.72
Greece	4.55	2.07	1.09	–	3.14	0.21	11.05	5.73	2.37	1.49	–	3.33	0.27	13.19
Hungary	1.95	3.37	0.92	1.84	0.05	0.03	8.16	2.55	2.67	1.52	1.84	0.05	0.03	8.66
Ireland[2]	1.17	0.84	1.94	–	0.53	0.17	4.65	1.25	0.84	2.67	–	0.53	0.35	5.64
Italy	10.25	13.86	27.22	–	20.78	1.77	73.88	8.29	12.40	32.41	–	21.30	3.00	77.40
Luxembourg	0.09	–	0.02	–	1.14	0.01	1.26	0.09	–	0.02	–	1.14	0.01	1.26
Netherlands	3.67	0.01	12.94	0.50	0.05	1.30	18.47	3.67	–	8.27	–	0.05	1.88	13.87
Norway	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portugal	1.78	2.61	1.31	–	4.44	0.40	10.53	1.78	2.22	2.41	–	4.95	0.65	12.01
Spain	11.07	8.80	3.46	7.23	17.40	0.68	48.64	..	..	..	..	..	..	..
Sweden	..	..	..	9.46	16.20	0.27	..	..	..	..	8.86	16.30	0.33	..
Switzerland	–	0.73	0.04	3.08	13.19	0.27	17.31	..	..	..	..	..	..	..
Turkey	7.03	2.27	6.90	–	11.90	0.04	28.13	9.83	3.13	14.66	–	17.97	0.06	45.64
United Kingdom	..	..	..	..	..	..	..	..	..	..	..	..	..	..
IEA Europe	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
IEA Total	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**

1. Capacity is net summer capacity.
2. Only gross capacity data are available.
3. Does not include autoproducer capacity.

Source: Country submissions.

Table A16

Percentage Change in Real Energy Prices for End–Users in IEA Countries, 1997–1998

	Total Energy		Oil Products		Electricity		Gas		Coal	
	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial
Canada	–4.6	4.1	–10.8	–9.5	..	..	0.1	28.2	..	..
United States	–10.0	–10.9	–27.7	–15.4	–9.1	–4.3	–10.6	–3.0	0.3	..
Australia	–0.8	–5.0	..	–6.9	–0.8	–0.9	–0.8	–0.9	..	..
Japan	0.3	–5.3	–4.6	–8.0	1.4	–0.6	1.4	–0.6	5.4	..
New Zealand	1.6	–3.4	–7.3	–7.4	2.3	1.5	15.7	6.0	..	..
Austria	–7.3	–6.4	–7.3	–9.9	–7.7	–0.9	–7.7	–3.1	1.2	–1.2
Belgium	–6.7	–8.0	–9.2	–14.4	1.5	–0.9	–12.3	0.9	–0.7	–0.7
Denmark	4.5	–2.5	3.5	–5.5	9.3	8.7	..	–5.2	..	11.3
Finland	–1.3	–4.4	–5.7	–6.0	1.3	–0.9	–0.4	–0.4	1.7	..
France	–3.0	–5.3	–6.0	–7.9	0.9	–0.7	0.9	–0.7	–0.5	–0.5
Germany	–4.7	–6.7	–10.9	–10.1	0.2	–1.0	0.2	–1.0	0.2	..
Greece	–11.1	–14.6	–12.3	–16.2	–3.3	–2.8	..	..	..	..
Hungary	1.1	–0.1	–3.2	–4.4	5.8	4.0	2.8	–0.2	..	..
Ireland	–10.7	–1.1	–16.6	–0.5	–0.8	–1.9	–0.8	–2.3	..	..
Italy	–5.6	–2.8	–5.7	–4.8	–1.6	1.3	–8.9	–1.7	–0.2	..
Luxembourg	–10.4	–9.7	–10.4	–10.2	..	–0.9	..	..	..	..
Netherlands	–1.8	–1.6	–2.2	–2.7	3.2	–1.6	–3.5	–1.1	..	..
Norway	1.1	–7.2	1.1	–3.6	..	–10.1	..	..	..	..
Portugal	–8.2	–2.6	–8.3	–2.7	–6.2	–2.4	..	..	–14.7	..
Spain	–7.3	–5.1	–8.3	–6.1	0.7	–1.8	–9.2	–2.5	..	..
Sweden	1.9	–1.7	8.4	–3.6	0.4	1.0	..	..	..	..
Switzerland	–3.1	–8.6	–19.4	–11.4	0.5	–0.5	1.8	0.4	0.5	..
Turkey	–3.9	–10.6	–13.8	–9.0	–2.7	–8.3	41.2	–15.3	–4.1	–15.5
United Kingdom	–0.9	–3.1	0.1	1.1	–8.9	–7.7	2.4	–6.5	2.8	–2.1

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

Table A17

Tax as a Percentage of Oil Product Prices in IEA Countries, 1995–1998

	Heavy Fuel Oil Industry				Heating Oil Residential				Diesel Transport				Premium Unleaded Gasoline (95 RON)[1] Transport			
	1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998
Canada	..	..	..	..	..	..	..	..	41.3	39.9	38.4	39.4	47.5	48.7	47.9	53.0
United States	..	..	..	..	..	..	..	..	..	..	..	..	28.6	27.1	27.0	30.6
Australia	..	..	..	..	..	..	..	..	..	..	..	..	54.6	57.6	57.8	62.9
Japan	2.9	2.9	4.3	4.8	2.9	2.9	4.3	4.8	57.1	54.1	52.9	54.6	51.8	54.3	55.8	59.9
New Zealand	..	..	..	..	..	..	..	..	0.9	0.8	0.8	0.9	47.7	47.5	45.5	49.5
Austria	43.3	42.9	44.7	..	39.4	38.5	40.5	44.7	52.1	52.2	50.6	55.0	67.2	66.6	64.9	67.8
Belgium	16.3	14.9	14.6	17.5	24.9	23.7	23.4	25.0	58.5	54.2	53.2	58.2	72.3	72.7	72.6	75.8
Denmark	..	..	..	..	64.4	61.2	59.9	64.2	46.5	43.7	41.9	39.5	70.8	70.7	69.8	72.4
Finland	..	..	..	..	32.7	30.9	35.8	42.0	57.6	54.0	53.2	59.5	74.2	75.1	74.8	78.0
France	21.3	20.4	20.9	26.0	41.1	40.1	39.4	43.4	67.0	64.4	63.9	69.5	80.2	79.6	78.4	81.2
Germany	..	..	..	..	32.8	29.6	29.3	33.4	63.7	58.6	57.5	..	76.3	73.7	71.7	75.2
Greece	..	..	..	..	64.0	63.3	61.5	59.8	60.8	57.1	55.3	59.1	69.9	68.0	65.3	66.6
Hungary	..	..	..	..	..	..	..	..	64.5	64.5	64.8	68.7	67.4	65.6	66.2	69.7
Ireland	12.1	7.7	11.5	13.1	27.7	26.6	26.9	27.9	53.2	42.4	46.7	56.7	66.3	64.8	66.7	68.0
Italy	31.7	30.4	31.1	34.6	72.7	70.3	69.4	72.0	65.2	62.1	61.9	65.2	73.2	73.1	72.0	74.7
Luxembourg	..	..	..	..	13.5	13.1	13.0	13.5	58.3	54.2	52.6	56.9	67.2	64.7	62.3	65.5
Netherlands	21.5	20.9	..	..	42.0	41.8	40.1	45.3	51.3	48.0	56.6	61.1	74.1	72.3	71.9	74.8
Norway	..	..	..	..	33.8	32.7	30.0	31.5	59.2	55.2	61.3	61.0	66.4	72.1	74.3	76.0
Portugal	21.2	19.7	18.7	21.2	63.7	60.6	56.0	59.9	61.9	58.6	53.8	57.7	70.9	71.3	70.1	72.8
Spain	9.5	8.7	8.6	11.6	44.2	41.5	39.8	44.1	59.0	55.4	53.8	58.0	67.6	67.4	65.0	68.7
Sweden	..	..	..	..	61.3	59.8	60.0	64.7	48.9	48.6	49.4	53.0	73.5	73.7	73.2	75.5
Switzerland	..	..	..	..	13.7	12.4	10.7	11.1	79.2	74.8	73.3	78.3	70.8	69.2	66.4	70.1
Turkey	44.0	41.0	43.8	36.1	62.5	63.2	64.8	63.7	60.8	61.4	63.7	64.0	66.6	65.8	69.0	70.5
United Kingdom	18.8	18.7	21.3	26.9	22.9	21.6	23.0	26.9	68.4	70.3	72.6	78.6	73.6	75.9	77.3	81.4

1. Regular unleaded gasoline for Canada 1995 to 1998.
Regular unleaded gasoline for Australia 1996 to 1998.
Regular unleaded gasoline for Japan 1995 to 1998.
Regular unleaded gasoline for New Zealand 1995 and 1996.
Regular unleaded gasoline for Denmark 1995.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

Table A18

Energy Balances and Key Indicators for IEA and Regions

	IEA Total				North America				Pacific				IEA Europe			
	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997
SUPPLY																**Unit: Mtoe**
TOTAL PRODUCTION	**2234.1**	**2521.7**	**3382.2**	**3397.7**	**1653.5**	**1736.1**	**2044.3**	**2046.5**	**101.5**	**129.9**	**305.7**	**320.3**	**479.1**	**655.6**	**1032.2**	**1030.9**
Coal[1]	669.8	760.2	870.5	890.9	345.1	443.6	588.7	605.0	59.4	62.3	135.7	143.3	265.3	254.3	146.1	142.6
Oil	673.8	724.0	874.4	877.6	630.2	581.7	513.3	516.8	20.8	23.7	30.7	31.8	22.9	118.6	330.4	328.9
Gas	689.5	698.4	837.2	838.6	564.0	521.8	575.2	579.5	6.0	9.9	32.0	32.3	119.6	166.7	229.9	226.9
Comb. Renewables & Wastes[2]	70.2	90.8	144.9	144.4	45.3	59.9	81.7	78.3	3.5	4.0	12.8	13.4	21.3	26.8	50.4	52.7
Nuclear	49.2	149.2	521.1	512.7	27.3	80.3	210.6	195.2	2.5	18.3	78.8	83.1	19.3	50.6	231.7	234.4
Hydro	76.4	91.9	111.1	111.0	39.6	45.3	60.8	58.6	8.0	9.9	10.5	11.2	28.9	36.8	39.8	41.2
Geothermal	5.2	7.0	21.4	20.8	2.1	3.5	13.5	12.8	1.3	1.7	5.1	5.1	1.8	1.8	2.7	2.8
Solar/Wind/Other[3]	0.0	0.1	1.6	1.9	–	–	0.4	0.4	–	0.0	0.1	0.1	0.0	0.0	1.1	1.4
TOTAL NET IMPORTS[4]	**1313.0**	**1392.9**	**1182.2**	**1224.3**	**253.8**	**374.4**	**322.3**	**363.9**	**294.7**	**308.9**	**324.6**	**318.1**	**764.6**	**709.7**	**535.4**	**542.3**
Coal[1] Exports	81.4	104.3	179.4	182.0	38.7	51.5	80.0	77.2	18.1	26.7	92.7	97.4	24.7	26.1	6.6	7.4
Imports	113.8	139.8	207.3	215.7	11.2	15.5	13.2	15.1	41.3	41.3	83.1	85.0	61.3	83.0	111.0	115.6
Net Imports	32.4	35.5	27.9	33.7	–27.5	–36.1	–66.8	–62.1	23.2	14.6	–9.6	–12.4	36.7	56.9	104.4	108.2
Oil Exports	232.1	242.2	593.4	615.0	74.1	40.4	124.3	133.6	6.3	4.1	22.9	26.8	151.7	197.7	446.2	454.6
Imports	1573.6	1622.0	1671.3	1727.6	365.3	471.9	541.0	583.4	293.8	296.1	317.0	319.2	914.5	854.0	813.3	825.0
Bunkers	70.4	73.9	71.3	71.7	9.2	26.0	27.7	23.9	18.9	14.4	5.4	6.2	42.3	33.6	38.1	41.6
Net Imports	1271.0	1305.8	1006.7	1040.8	281.9	405.5	389.0	425.9	268.7	277.6	288.7	286.2	720.5	622.7	328.9	328.7
Gas Exports	50.3	82.5	153.0	155.4	24.9	24.0	69.0	70.6	–	–	8.8	8.6	25.4	58.5	75.1	76.1
Imports	59.3	133.2	299.5	303.7	24.2	29.0	69.1	70.5	2.8	16.7	54.3	53.0	32.3	87.6	176.2	180.2
Net Imports	8.9	50.8	146.5	148.4	–0.7	5.0	0.0	–0.1	2.8	16.7	45.4	44.4	6.8	29.1	101.0	104.1
Electricity Exports	6.2	9.8	21.8	21.7	1.6	2.9	4.4	4.5	–	–	–	–	4.6	6.9	17.4	17.1
Imports	6.8	10.6	22.6	22.7	1.6	2.9	4.4	4.8	–	–	–	–	5.2	7.7	18.1	17.9
Net Imports	0.6	0.8	0.8	1.0	0.0	–0.0	0.0	0.2	–	–	–	–	0.6	0.9	0.7	0.8
TOTAL STOCK CHANGES	**–20.7**	**–56.2**	**9.7**	**–20.5**	**–9.8**	**–38.5**	**8.5**	**–10.3**	**–6.7**	**–6.4**	**–2.4**	**–5.2**	**–4.2**	**–11.3**	**3.6**	**–5.0**
TOTAL SUPPLY (TPES)	**3526.4**	**3858.3**	**4574.1**	**4601.6**	**1897.4**	**2072.0**	**2375.1**	**2400.2**	**389.5**	**432.4**	**627.8**	**633.2**	**1239.5**	**1354.0**	**1571.2**	**1568.2**
Coal[1]	715.3	781.5	908.9	920.5	326.3	386.8	523.4	540.7	81.7	76.9	126.6	130.2	307.2	317.8	258.9	249.5
Oil	1923.0	1996.2	1883.8	1906.8	905.0	975.6	910.0	935.3	283.7	295.1	316.7	313.5	734.2	725.5	657.0	657.9
Gas	686.5	740.7	980.3	982.2	551.8	520.6	574.6	578.7	8.7	26.4	77.3	76.6	126.0	193.7	328.4	326.9
Comb. Renewables & Wastes[2]	70.2	90.9	145.2	144.8	45.3	59.9	81.7	78.2	3.5	4.0	12.8	13.4	21.4	26.9	50.8	53.2
Nuclear	49.2	149.2	521.1	512.7	27.3	80.3	210.6	195.2	2.5	18.3	78.8	83.1	19.3	50.6	231.7	234.4
Hydro	76.4	91.9	111.1	111.0	39.6	45.3	60.8	58.6	8.0	9.9	10.5	11.2	28.9	36.8	39.8	41.2
Geothermal	5.2	7.0	21.4	20.8	2.1	3.5	13.5	12.8	1.3	1.7	5.1	5.1	1.8	1.8	2.7	2.8
Solar/Wind/Other[3]	0.0	0.1	1.6	1.9	–	–	0.4	0.4	–	0.0	0.1	0.1	0.0	0.0	1.1	1.4
Electricity Trade[5]	0.6	0.8	0.8	1.0	0.0	–0.0	0.0	0.2	–	–	–	–	0.6	0.9	0.7	0.8

Table A18 (continued)

Energy Balances and Key Indicators for IEA and Regions

	IEA Total				North America				Pacific				IEA Europe			
	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997
SUPPLY																**Unit: Mtoe**
Fuel Shares (%)																
Coal	*20.3*	*20.3*	*19.9*	*20.0*	*17.2*	*18.7*	*22.0*	*22.5*	*21.0*	*17.8*	*20.2*	*20.6*	*24.8*	*23.5*	*16.5*	*15.9*
Oil	*54.5*	*51.7*	*41.2*	*41.4*	*47.7*	*47.1*	*38.3*	*39.0*	*72.8*	*68.3*	*50.4*	*49.5*	*59.2*	*53.6*	*41.8*	*42.0*
Gas	*19.5*	*19.2*	*21.4*	*21.3*	*29.1*	*25.1*	*24.2*	*24.1*	*2.2*	*6.1*	*12.3*	*12.1*	*10.2*	*14.3*	*20.9*	*20.8*
Comb. Renewables & Wastes	*2.0*	*2.4*	*3.2*	*3.1*	*2.4*	*2.9*	*3.4*	*3.3*	*0.9*	*0.9*	*2.0*	*2.1*	*1.7*	*2.0*	*3.2*	*3.4*
Nuclear	*1.4*	*3.9*	*11.4*	*11.1*	*1.4*	*3.9*	*8.9*	*8.1*	*0.6*	*4.2*	*12.5*	*13.1*	*1.6*	*3.7*	*14.7*	*14.9*
Hydro	*2.2*	*2.4*	*2.4*	*2.4*	*2.1*	*2.2*	*2.6*	*2.4*	*2.0*	*2.3*	*1.7*	*1.8*	*2.3*	*2.7*	*2.5*	*2.6*
Geothermal	*0.1*	*0.2*	*0.5*	*0.5*	*0.1*	*0.2*	*0.6*	*0.5*	*0.3*	*0.4*	*0.8*	*0.8*	*0.1*	*0.1*	*0.2*	*0.2*
Solar/Wind/Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	*0.1*	*0.1*
Electricity Trade	–	–	–	–	–	–	–	–	–	–	–	–	–	*0.1*	–	*0.1*
DEMAND																**Unit: Mtoe**
FINAL CONSUMPTION BY SECTOR																
TFC	**2594.4**	**2771.1**	**3153.5**	**3169.7**	**1379.1**	**1460.6**	**1620.1**	**1632.8**	**280.4**	**301.6**	**415.4**	**420.4**	**934.8**	**1008.9**	**1118.1**	**1116.4**
Coal[1]	197.5	169.4	106.6	106.3	49.4	45.8	29.1	29.2	26.0	24.2	26.6	26.8	122.2	99.4	50.8	50.3
Oil	1557.6	1626.2	1666.3	1688.4	778.7	835.7	841.8	858.8	199.8	206.2	254.3	255.8	579.1	584.4	570.2	573.8
Gas	473.6	516.2	667.9	654.6	365.0	347.5	394.6	389.5	9.5	14.3	33.1	33.8	99.0	154.4	240.3	231.4
Comb. Renewables & Wastes[2]	47.1	61.2	81.3	79.2	23.6	33.8	37.1	33.9	3.5	3.8	8.2	8.5	19.9	23.5	36.0	36.9
Geothermal	–	–	0.7	0.7	–	–	–	–	–	–	0.6	0.6	–	–	0.1	0.1
Solar/Wind/Other	–	0.0	0.4	0.4	–	–	–	–	–	0.0	0.1	0.1	–	0.0	0.3	0.3
Electricity	310.5	383.5	597.1	606.7	162.3	196.8	309.4	313.1	41.6	53.0	92.1	94.5	106.6	133.8	195.6	199.1
Heat	8.1	14.6	33.3	33.3	0.1	1.0	8.1	8.4	0.0	0.1	0.4	0.4	7.9	13.4	24.8	24.5
Fuel Shares (%)																
Coal	*7.6*	*6.1*	*3.4*	*3.4*	*3.6*	*3.1*	*1.8*	*1.8*	*9.3*	*8.0*	*6.4*	*6.4*	*13.1*	*9.9*	*4.5*	*4.5*
Oil	*60.0*	*58.7*	*52.8*	*53.3*	*56.5*	*57.2*	*52.0*	*52.6*	*71.3*	*68.4*	*61.2*	*60.8*	*61.9*	*57.9*	*51.0*	*51.4*
Gas	*18.3*	*18.6*	*21.2*	*20.7*	*26.5*	*23.8*	*24.4*	*23.9*	*3.4*	*4.7*	*8.0*	*8.0*	*10.6*	*15.3*	*21.5*	*20.7*
Comb. Renewables & Wastes	*1.8*	*2.2*	*2.6*	*2.5*	*1.7*	*2.3*	*2.3*	*2.1*	*1.2*	*1.3*	*2.0*	*2.0*	*2.1*	*2.3*	*3.2*	*3.3*
Geothermal	–	–	–	–	–	–	–	–	–	–	*0.1*	*0.1*	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Electricity	*12.0*	*13.8*	*18.9*	*19.1*	*11.8*	*13.5*	*19.1*	*19.2*	*14.8*	*17.6*	*22.2*	*22.5*	*11.4*	*13.3*	*17.5*	*17.8*
Heat	*0.3*	*0.5*	*1.1*	*1.0*	–	*0.1*	*0.5*	*0.5*	–	–	*0.1*	*0.1*	*0.8*	*1.3*	*2.2*	*2.2*

Table A18 (continued)

Energy Balances and Key Indicators for IEA and Regions

	IEA Total				North America				Pacific				IEA Europe			
	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997
DEMAND																**Unit: Mtoe**
TOTAL INDUSTRY[6]	**1020.0**	**1049.4**	**1031.8**	**1054.3**	**458.4**	**488.8**	**493.8**	**502.4**	**160.0**	**154.9**	**175.1**	**178.0**	**401.6**	**405.6**	**362.9**	**373.8**
Coal[1]	127.0	111.0	91.8	92.0	35.2	31.3	27.5	27.2	23.5	22.9	25.2	25.5	68.2	56.7	39.1	39.3
Oil	501.9	519.1	402.7	415.1	182.4	229.7	181.2	187.5	103.5	91.5	86.4	87.1	216.0	198.0	135.1	140.5
Gas	220.4	217.1	260.4	262.4	163.2	135.9	151.8	151.6	3.9	6.0	16.6	17.3	53.3	75.2	92.0	93.5
Comb. Renewables & Wastes[2]	18.0	20.9	34.9	36.1	12.9	13.7	19.0	19.2	1.5	2.1	4.9	5.2	3.7	5.1	11.0	11.8
Geothermal	–	–	0.4	0.4	–	–	–	–	–	–	0.4	0.4	–	–	–	–
Solar/Wind/Other	–	–	0.0	0.0	–	–	–	–	–	–	–	–	–	–	0.0	0.0
Electricity	149.9	176.5	231.2	237.1	64.6	77.2	108.5	110.8	27.5	32.3	41.7	42.6	57.7	67.0	81.0	83.7
Heat	2.8	4.7	10.5	11.1	0.1	1.0	5.8	6.1	–	–	–	–	2.7	3.6	4.6	5.0
Fuel Shares (%)																
Coal	*12.5*	*10.6*	*8.9*	*8.7*	*7.7*	*6.4*	*5.6*	*5.4*	*14.7*	*14.8*	*14.4*	*14.3*	*17.0*	*14.0*	*10.8*	*10.5*
Oil	*49.2*	*49.5*	*39.0*	*39.4*	*39.8*	*47.0*	*36.7*	*37.3*	*64.7*	*59.1*	*49.3*	*48.9*	*53.8*	*48.8*	*37.2*	*37.6*
Gas	*21.6*	*20.7*	*25.2*	*24.9*	*35.6*	*27.8*	*30.7*	*30.2*	*2.4*	*3.9*	*9.5*	*9.7*	*13.3*	*18.5*	*25.4*	*25.0*
Comb. Renewables & Wastes	*1.8*	*2.0*	*3.4*	*3.4*	*2.8*	*2.8*	*3.8*	*3.8*	*0.9*	*1.4*	*2.8*	*2.9*	*0.9*	*1.3*	*3.0*	*3.2*
Geothermal	–	–	–	–	–	–	–	–	–	–	*0.2*	*0.2*	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Electricity	*14.7*	*16.8*	*22.4*	*22.5*	*14.1*	*15.8*	*22.0*	*22.0*	*17.2*	*20.9*	*23.8*	*23.9*	*14.4*	*16.5*	*22.3*	*22.4*
Heat	*0.3*	*0.4*	*1.0*	*1.1*	–	*0.2*	*1.2*	*1.2*	–	–	–	–	*0.7*	*0.9*	*1.3*	*1.3*
TRANSPORT[7]	**692.4**	**787.2**	**1047.9**	**1068.4**	**455.8**	**498.7**	**609.0**	**622.4**	**58.3**	**74.4**	**120.5**	**123.3**	**178.4**	**214.1**	**318.4**	**322.8**
TOTAL OTHER SECTORS[8]	**881.9**	**934.5**	**1073.8**	**1047.0**	**464.9**	**473.1**	**517.3**	**508.0**	**62.2**	**72.3**	**119.7**	**119.2**	**354.8**	**389.1**	**436.8**	**419.8**
Coal[1]	67.1	57.5	14.7	14.2	14.0	14.5	1.7	2.0	2.2	1.2	1.3	1.2	50.8	41.8	11.7	11.0
Oil	388.4	342.1	247.4	238.2	158.1	123.6	75.2	74.1	39.4	41.7	49.7	47.8	190.8	176.8	122.4	116.3
Gas	236.3	282.8	385.0	368.7	185.0	195.7	220.8	214.9	5.7	8.3	16.3	16.3	45.6	78.8	147.9	137.5
Comb. Renewables & Wastes[2]	29.0	40.2	45.3	41.6	10.8	20.1	17.1	13.2	2.0	1.7	3.2	3.3	16.3	18.4	25.0	25.1
Geothermal	–	–	0.3	0.3	–	–	–	–	–	–	0.2	0.2	–	–	0.1	0.1
Solar/Wind/Other	–	0.0	0.3	0.4	–	–	–	–	–	0.0	0.1	0.1	–	0.0	0.2	0.3
Electricity	156.0	201.9	357.9	361.4	97.0	119.2	200.2	201.6	12.8	19.3	48.4	49.8	46.1	63.4	109.3	110.0
Heat	5.2	9.9	22.8	22.2	–	0.0	2.3	2.2	0.0	0.1	0.4	0.4	5.2	9.8	20.1	19.5

Table A18 (continued)

Energy Balances and Key Indicators for IEA and Regions

	IEA Total				North America				Pacific				IEA Europe			
	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997
DEMAND																**Unit: Mtoe**
Fuel Shares (%)																
Coal	*7.6*	*6.2*	*1.4*	*1.4*	*3.0*	*3.1*	*0.3*	*0.4*	*3.6*	*1.7*	*1.1*	*1.0*	*14.3*	*10.8*	*2.7*	*2.6*
Oil	*44.0*	*36.6*	*23.0*	*22.8*	*34.0*	*26.1*	*14.5*	*14.6*	*63.4*	*57.7*	*41.5*	*40.1*	*53.8*	*45.4*	*28.0*	*27.7*
Gas	*26.8*	*30.3*	*35.9*	*35.2*	*39.8*	*41.4*	*42.7*	*42.3*	*9.1*	*11.5*	*13.6*	*13.7*	*12.8*	*20.3*	*33.9*	*32.7*
Comb. Renewables & Wastes	*3.3*	*4.3*	*4.2*	*4.0*	*2.3*	*4.3*	*3.3*	*2.6*	*3.2*	*2.3*	*2.7*	*2.8*	*4.6*	*4.7*	*5.7*	*6.0*
Geothermal	–	–	–	–	–	–	–	–	–	–	*0.2*	*0.2*	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–	–	–	–	*0.1*	*0.1*	–	–	*0.1*	*0.1*
Electricity	*17.7*	*21.6*	*33.3*	*34.5*	*20.9*	*25.2*	*38.7*	*39.7*	*20.7*	*26.7*	*40.5*	*41.8*	*13.0*	*16.3*	*25.0*	*26.2*
Heat	*0.6*	*1.1*	*2.1*	*2.1*	–	–	*0.4*	*0.4*	–	*0.1*	*0.3*	*0.4*	*1.5*	*2.5*	*4.6*	*4.6*
ENERGY TRANSFORMATION AND LOSSES																
ELECTRICITY GENERATION[9]																
INPUT (Mtoe)	**970.3**	**1187.0**	**1799.9**	**1808.0**	**543.3**	**649.8**	**958.0**	**960.9**	**109.8**	**144.4**	**256.2**	**258.1**	**317.2**	**392.8**	**585.8**	**589.0**
OUTPUT (Mtoe)	**366.6**	**451.6**	**698.6**	**706.0**	**192.3**	**233.8**	**363.6**	**365.1**	**47.2**	**60.0**	**104.4**	**107.4**	**127.2**	**157.8**	**230.5**	**233.4**
(TWh gross)	4262.4	5251.6	8123.4	8208.9	2235.6	2718.8	4228.3	4245.6	548.3	698.1	1214.5	1248.8	1478.5	1834.7	2680.7	2714.4
Output Shares (%)																
Coal	*36.9*	*37.7*	*38.3*	*38.3*	*42.1*	*43.3*	*47.8*	*48.9*	*15.9*	*16.3*	*26.6*	*27.6*	*36.6*	*37.4*	*28.7*	*26.7*
Oil	*25.5*	*19.3*	*6.5*	*6.2*	*15.4*	*12.5*	*2.5*	*2.9*	*62.7*	*45.2*	*17.6*	*15.2*	*27.0*	*19.7*	*7.9*	*7.3*
Gas	*12.0*	*11.4*	*12.6*	*13.7*	*17.0*	*13.4*	*11.8*	*12.5*	*2.5*	*11.6*	*18.5*	*18.7*	*8.0*	*8.4*	*11.3*	*13.3*
Comb. Renewables & Wastes	*0.2*	*0.2*	*1.6*	*1.6*	*0.0*	*0.1*	*1.6*	*1.6*	*0.1*	*0.1*	*2.0*	*2.1*	*0.4*	*0.5*	*1.3*	*1.5*
Nuclear	*4.4*	*10.9*	*24.6*	*24.0*	*4.7*	*11.2*	*19.1*	*17.6*	*1.8*	*10.1*	*24.9*	*25.5*	*5.0*	*10.6*	*33.2*	*33.1*
Hydro	*20.9*	*20.4*	*15.9*	*15.7*	*20.6*	*19.4*	*16.7*	*16.0*	*16.9*	*16.4*	*10.1*	*10.4*	*22.7*	*23.3*	*17.3*	*17.7*
Geothermal	*0.2*	*0.2*	*0.3*	*0.3*	*0.1*	*0.2*	*0.4*	*0.4*	*0.3*	*0.3*	*0.5*	*0.5*	*0.2*	*0.1*	*0.1*	*0.1*
Solar/Wind/Other	*0.0*	*0.0*	*0.1*	*0.2*	–	–	*0.1*	*0.1*	–	–	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.3*
TOTAL LOSSES (Mtoe)	**903.5**	**1084.5**	**1433.3**	**1430.7**	**529.2**	**605.8**	**768.0**	**764.7**	**114.7**	**134.2**	**211.3**	**212.5**	**259.6**	**344.6**	**454.0**	**453.5**
of which:																
Electricity and Heat Generation[10]	594.7	719.5	1063.5	1064.2	351.0	415.0	583.9	585.1	62.6	84.2	151.3	150.2	181.2	220.4	328.3	328.9
Other Transformation	31.5	96.3	58.0	56.6	1.3	33.4	8.5	6.6	31.0	24.4	25.4	26.5	–0.8	38.5	24.2	23.5
Own Use and Losses[11]	277.3	268.7	311.8	310.0	176.9	157.4	175.6	173.0	21.1	25.6	34.7	35.8	79.3	85.7	101.5	101.2
Statistical Differences	**28.5**	**2.8**	**–12.7**	**1.2**	**–10.9**	**5.6**	**–13.0**	**2.7**	**–5.7**	**–3.4**	**1.1**	**0.2**	**45.1**	**0.5**	**–0.9**	**–1.8**

Table A18 (continued)

Energy Balances and Key Indicators for IEA and Regions

	IEA Total				North America				Pacific				IEA Europe			
	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997	1973	1979	1996	1997
INDICATORS																
GDP (billion 1990 US$)	10748	12619	18651	19184	4042	4748	7003	7277	1805	2199	3721	3760	4901	5672	7927	8146
Population (millions)	765	801	901	905	234	249	296	297	125	134	148	148	406	419	458	460
TPES/GDP[12]	0.3	0.3	0.2	0.2	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2
Energy Production/TPES	0.6	0.7	0.7	0.7	0.9	0.8	0.9	0.9	0.3	0.3	0.5	0.5	0.4	0.5	0.7	0.7
Per Capita TPES[13]	4.6	4.8	5.1	5.1	8.1	8.3	8.0	8.1	3.1	3.2	4.2	4.3	3.1	3.2	3.4	3.4
Oil Supply/GDP[12]	0.2	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
TFC/GDP[12]	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.1
Per Capita TFC[13]	3.4	3.5	3.5	3.5	5.9	5.9	5.5	5.5	2.2	2.3	2.8	2.8	2.3	2.4	2.4	2.4
Energy-related CO_2 Emissions (MT CO_2)[14]	9738.56	10293.14	10898.87	10993.42	5070.37	5406.89	5801.14	5947.87	1104.04	1153.92	1512.71	1511.87	3564.15	3732.33	3585.02	3533.68
CO_2 Emissions from Bunkers (Mt CO_2)	223.81	235.18	225.59	227.15	29.39	83.03	87.97	75.79	60.11	45.86	17.26	19.73	134.31	106.29	120.36	131.63
GROWTH RATES (% per year)																
	73–79	79–97	90–97	96–97	73–79	79–97	90–97	96–97	73–79	79–97	90–97	96–97	73–79	79–97	90–97	96–97
TPES	**1.5**	**1.0**	**1.6**	**0.6**	**1.5**	**0.8**	**1.7**	**1.1**	**1.8**	**2.1**	**2.3**	**0.9**	**1.5**	**0.8**	**1.1**	**–0.2**
Coal	1.5	0.9	0.1	1.3	2.9	1.9	1.7	3.3	–1.0	3.0	2.4	2.9	0.6	–1.3	–3.7	–3.6
Oil	0.6	–0.3	1.3	1.2	1.3	–0.2	1.4	2.8	0.7	0.3	1.1	–1.0	–0.2	–0.5	1.1	0.1
Gas	1.3	1.6	3.1	0.2	–1.0	0.6	2.3	0.7	20.2	6.1	3.1	–0.9	7.4	3.0	4.6	–0.5
Comb. Renewables & Wastes	4.4	2.6	2.0	–0.3	4.8	1.5	1.5	–4.3	2.3	6.9	2.4	4.8	3.9	3.9	2.6	4.9
Nuclear	20.3	7.1	2.6	–1.6	19.7	5.1	1.3	–7.3	39.1	8.8	6.7	5.6	17.4	8.9	2.5	1.2
Hydro	3.1	1.1	1.9	–0.1	2.3	1.4	2.6	–3.6	3.7	0.7	0.3	6.3	4.1	0.6	1.4	3.5
Geothermal	5.2	6.2	0.7	–2.9	9.0	7.4	–1.0	–5.3	4.7	6.3	4.9	0.0	0.1	2.5	3.1	3.5
Solar/Wind/Other	3.2	20.0	14.9	22.1	–	–	5.6	–0.5	–	11.0	1.8	1.1	–1.4	19.4	23.6	35.3
TFC	**1.1**	**0.7**	**1.6**	**0.5**	**1.0**	**0.6**	**1.7**	**0.8**	**1.2**	**1.9**	**2.1**	**1.2**	**1.3**	**0.6**	**1.2**	**–0.1**
Electricity Consumption	3.6	2.6	2.3	1.6	3.3	2.6	2.6	1.2	4.1	3.3	2.7	2.6	3.8	2.2	1.8	1.8
Energy Production	2.0	1.7	1.6	0.5	0.8	0.9	0.9	0.1	4.2	5.1	3.9	4.8	5.4	2.5	2.3	–0.1
Net Oil Imports	0.5	–1.3	0.7	3.4	6.2	0.3	3.7	9.5	0.5	0.2	1.4	–0.9	–2.4	–3.5	–2.7	–0.1
GDP	2.7	2.4	2.0	2.9	2.7	2.4	2.5	3.9	3.4	3.0	1.8	1.0	2.5	2.0	1.6	2.8
Growth in the TPES/GDP Ratio	–1.2	–1.3	–0.4	–2.2	–1.2	–1.5	–0.8	–2.7	–1.5	–0.9	0.4	–0.2	–1.0	–1.2	–0.6	–2.9
Growth in the TFC/GDP Ratio	–1.6	–1.6	–0.4	–2.3	–1.7	–1.7	–0.8	–3.0	–2.1	–1.1	0.3	0.2	–1.2	–1.4	–0.5	–2.8

Table A18 (Footnotes)

1. Includes lignite and peat.
2. Comprises solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Other includes tide, wave and ambient heat used in heat pumps.
4. Total net imports include combustible renewables and wastes.
5. Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.
6. Includes non-energy use.
7. Includes less than 1% non-oil fuels.
8. Includes residential, commercial, public service and agricultural sectors.
9. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
10. Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.
11. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
12. Toe per thousand US dollars at 1990 prices and exchange rates.
13. Toe per person.
14. "Energy-related CO_2 emissions" specifically means CO_2 from the combustion of the fossil fuel components of TPES (i.e. coal and coal products, peat, crude oil and derived products and natural gas), while CO_2 emissions from the remaining components of TPES (i.e. electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the IPCC greenhouse gas inventory methodology. TPES, by definition, excludes international marine bunkers. INC-IX decided in February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. CO_2 emissions from bunkers are those quantities of fuels delivered for international *marine* bunkers and the emissions arising from their use. Data for deliveries of fuel to international *aviation* bunkers are not generally available to the IEA, and, as a result, these emissions have not been deducted from the national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 1997 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

B

ANNEX

GOVERNMENT ENERGY R&D BUDGETS

Table B1

IEA Government R&D Budgets in National Currencies

(millions except for Italian, Japanese and Turkish currencies, which are in billions)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	412.7	397.9	369.4	378.5	362.4	367.6	315.7	322.0	322.0	300.6	265.9	243.4
United States	1 974.6	2 159.7	2 164.8	2 497.0	2 598.4	2 261.7	2 264.0	2 441.6	2 409.1	2 149.9	1 965.7	2 024.6
Australia	62.4	..	91.7	..	..	..	110.4	..	116.3	..	157.6	..
Japan	337.0	276.8	375.6	367.7	383.0	392.9	404.7	433.9	445.7	459.1	437.7	415.4
New Zealand	4.3	..	..	2.0	2.0	..	4.7	3.8	4.4	5.3	5.1	5.5
Austria	256.1	318.8	187.6	137.6	245.0	210.7	286.9	324.6	332.1	334.3	354.1	376.8
Belgium[1]	2 961.5	2 529.0	1 825.0	..	358.4	387.6	671.3	702.5	1 765.8	2 277.1	2 200.5	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	115.9	..	154.5	215.0	262.0	310.0	302.0	259.0	245.1	217.6	258.3	316.2
Finland	..	..	..	193.3	214.4	227.4	236.4	286.3	346.0	333.6	471.9	..
France	3 557.1	3 278.1	3 115.3	3 018.9	3 058.4	2 914.4	2 944.9	2 783.0	3 292.4	3 169.3	3 202.3	3 496.7
Germany[3]	1 005.4	901.7	799.1	856.0	863.0	710.1	715.9	586.8	512.8	557.4	507.0	553.3
Greece	1 184.8	2 341.3	1 546.2	1 487.0	1 577.1	1 208.0	1 125.0	1 138.9	2 091.9	2 560.3	4 863.4	..
Hungary	..	..	..	..	..	..	..	..	44.6	10.5	..	..
Ireland	1.4	2.5	..	0.7	..	..	..	..	..	..	..	..
Italy	908.5	1 011.8	844.8	798.6	788.7	..	444.7	436.5	472.1	460.5	429.6	430.0
Netherlands	270.8	245.6	279.9	304.1	304.1	299.6	338.4	310.8	303.8	263.8	293.0	..
Norway	226.9	244.4	313.7	323.7	368.5	391.9	366.5	355.7	304.4	288.3	281.8	277.4
Portugal	918.5	827.0	1 105.6	1 427.4	1 024.8	943.9	646.6	547.8	273.3	350.3	235.4	..
Spain	5 117.5	6 769.0	7 095.0	5 409.1	12 975.8	10 985.9	9 658.3	10 657.0	9 988.0	9 867.0	10 037.0	9 790.0
Sweden	485.0	533.0	585.1	591.0	567.0	714.1	553.1	598.0	452.9	413.1	467.0	..
Switzerland	134.7	142.8	165.4	187.2	199.0	220.6	223.3	220.8	215.1	206.7	196.9	..
Turkey[4]	2.6	5.8	8.9	5.2	9.7	23.6	41.2	42.1	189.1	274.8	1 608.9	3 383.5
United Kingdom	214.5	228.0	190.2	166.7	142.9	133.5	98.8	50.9	52.9	36.4	49.3	44.4
European Commission[5]	..	..	..	..	..	..	..	..	..	..	..	..

1. Figures for 1991 refer to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. The strong increase in the budget is due to high inflation rate in Turkey and to new RD&D activities.
5. The European Commission is revising its current RD&D series.

Source: Country submissions.

Table B2

IEA Government R&D Budgets in 1998 National Currencies

(millions except for Italian, Japanese and Turkish currencies, which are in billions)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	518.2	477.7	424.0	421.8	393.2	393.7	334.1	336.8	328.1	302.0	265.9	243.4
United States	2 677.9	2 826.9	2 719.9	3 006.5	3 009.7	2 548.9	2 486.9	2 618.2	2 525.6	2 212.8	1 985.1	2 024.6
Australia	88.3	..	111.0	..	..	..	121.5	..	123.5	..	160.8	..
Japan	373.5	304.8	405.2	387.9	393.4	396.6	406.2	434.8	449.5	465.3	441.0	415.4
New Zealand	5.8	..	..	2.3	2.2	..	5.0	4.0	4.5	5.3	5.1	5.5
Austria	337.4	413.5	236.9	167.9	288.1	237.5	314.7	346.4	347.0	342.1	357.7	376.8
Belgium[1]	3 934.5	3 287.4	2 269.5	..	418.5	436.9	726.1	743.2	1 843.8	2 339.2	2 228.2	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	149.4	..	183.3	246.6	293.2	339.3	329.0	277.9	258.6	225.3	262.4	316.2
Finland	..	..	..	224.0	242.5	255.4	259.2	309.8	365.5	348.0	487.0	..
France	4 454.3	3 991.0	3 682.0	3 461.2	3 393.7	3 167.2	3 122.9	2 907.3	3 385.7	3 221.3	3 225.3	3 496.7
Germany[3]	1 324.8	1 169.9	1 012.4	1 051.8	1 020.1	794.8	770.7	617.1	527.5	567.5	512.6	553.3
Greece	4 380.2	7 487.5	4 318.6	3 443.5	3 049.2	2 034.3	1 654.9	1 506.2	2 519.7	2 858.9	5 082.7	..
Hungary	..	..	..	..	..	..	..	..	72.9	14.3	..	..
Ireland	1.8	3.1	..	0.8	..	..	..	..	..	..	..	..
Italy	1 568.4	1 637.0	1 285.8	1 129.1	1 035.5	..	534.2	507.1	521.9	485.2	440.8	430.0
Netherlands	335.0	300.0	338.1	358.8	349.4	336.7	372.9	334.6	321.2	275.0	298.8	..
Norway	296.2	304.0	369.1	366.8	407.7	435.3	398.5	387.5	321.7	292.4	278.1	277.4
Portugal	2 081.8	1 674.9	1 991.7	2 280.9	1 459.6	1 222.3	784.6	625.8	296.9	370.0	241.8	..
Spain	8 745.2	10 946.6	10 716.6	7 610.6	17 049.6	13 502.7	11 376.0	12 072.6	10 794.0	10 335.8	10 304.9	9 790.0
Sweden	744.5	768.5	780.4	724.6	645.8	804.5	607.5	641.4	468.5	422.8	472.4	..
Switzerland	172.8	178.3	200.2	217.3	218.0	235.2	231.9	225.5	217.3	208.0	198.4	..
Turkey	1 232.7	1 614.7	1 409.5	518.3	613.3	911.7	948.8	468.9	1 127.2	917.4	2 958.8	3 383.5
United Kingdom	338.5	339.5	263.6	214.7	172.3	154.7	111.4	56.6	57.4	38.1	50.4	44.4
European Commission[4]	..	..	..	..	..	..	..	..	..	..	..	..

1. Figures for 1991 refer to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. The European Commission is revising its current RD&D series.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B3

IEA Government R&D Budgets

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1998 exch. rates Unit per $
Canada	349.2	321.9	285.7	284.2	265.0	265.3	225.1	227.0	221.1	203.5	179.2	164.0	1.484
United States	2 677.9	2 826.9	2 719.9	3 006.5	3 009.7	2 548.9	2 486.9	2 618.2	2 525.6	2 212.8	1 985.1	2 024.6	1.000
Australia	55.5	..	69.7	..	..	..	76.3	..	77.6	..	101.0	..	1.592
Japan	2 853.2	2 328.4	3 095.3	2 963.7	3 005.7	3 029.9	3 103.4	3 321.3	3 433.9	3 554.4	3 369.2	3 173.2	130.9
New Zealand	3.1	..	..	1.2	1.2	..	2.7	2.1	2.4	2.9	2.7	3.0	1.869
Austria	27.3	33.4	19.1	13.6	23.3	19.2	25.4	28.0	28.0	27.6	28.9	30.4	12.380
Belgium[1]	108.4	90.6	62.5	..	11.5	12.0	20.0	20.5	50.8	64.4	61.4	..	36.300
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–	36.300
Denmark	22.3	..	27.4	36.8	43.8	50.7	49.1	41.5	38.6	33.6	39.2	47.2	6.696
Finland	..	..	..	41.9	45.4	47.8	48.5	58.0	68.4	65.1	91.1	..	5.345
France	755.1	676.6	624.2	586.7	575.3	536.9	529.4	492.8	573.9	546.1	546.8	592.8	5.899
Germany[3]	753.2	665.1	575.5	597.9	579.9	451.9	438.1	350.8	299.9	322.6	291.4	314.6	1.759
Greece	14.8	25.4	14.6	11.7	10.3	6.9	5.6	5.1	8.5	9.7	17.2	..	295.300
Hungary	..	..	..	..	..	..	..	..	0.3	0.1	..	..	214.300
Ireland	2.5	4.4	..	1.2	..	..	..	..	..	..	..	..	0.703
Italy	903.5	943.0	740.7	650.4	596.5	..	307.7	292.1	300.7	279.5	253.9	247.7	1 736
Netherlands	168.7	151.1	170.3	180.8	176.0	169.6	187.9	168.6	161.8	138.5	150.5	..	1.985
Norway	39.3	40.3	48.9	48.6	54.0	57.7	52.8	51.4	42.6	38.8	36.9	36.8	7.545
Portugal	11.6	9.3	11.1	12.7	8.1	6.8	4.4	3.5	1.6	2.1	1.3	..	180.100
Spain	58.5	73.3	71.7	50.9	114.1	90.4	76.1	80.8	72.2	69.2	69.0	65.5	149.400
Sweden	93.7	96.7	98.2	91.2	81.3	101.2	76.4	80.7	59.0	53.2	59.4	..	7.947
Switzerland	119.2	122.9	138.1	149.9	150.3	162.2	159.9	155.5	149.9	143.4	136.9	..	1.450
Turkey	4.7	6.2	5.4	2.0	2.4	3.5	3.6	1.8	4.3	3.5	11.4	13.0	260 475
United Kingdom	560.4	562.1	436.4	355.4	285.2	256.2	184.5	93.7	95.0	63.2	83.4	73.5	0.604
Total Reported[4]	**9 582.0**	**8 977.5**	**9 214.8**	**9 087.3**	**9 038.9**	**7 817.0**	**8 064.0**	**8 093.2**	**8 216.4**	**7 834.1**	**7 515.9**	**..**	–
European Commission[5]	..	..	..	..	..	..	..	..	..	..	..	..	0.893

1. Figures for 1991 refer to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. Yearly totals are not comparable due to missing data.
5. The European Commission is revising its current RD&D series.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B4

IEA Government Budgets on Energy R&D

(per thousand units of GDP)

	R&D/GDP including nuclear research								
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Canada	0.56	0.53	0.53	0.44	0.42	0.40	0.37	0.31	0.28
United States	0.43	0.44	0.36	0.35	0.35	0.33	0.28	0.24	0.24
Australia	..	..	..	0.26	..	0.24	..	0.30	..
Japan	0.86	0.84	0.83	0.85	0.91	0.92	0.92	0.86	0.84
New Zealand	0.03	0.03	..	0.06	0.04	0.05	0.06	0.05	0.06
Austria	0.08	0.13	0.10	0.13	0.14	0.14	0.14	0.14	0.14
Belgium[1]	..	0.05	0.05	0.09	0.09	0.22	0.27	0.25	..
Luxembourg[2]	-	-	-	-	-	-	-	-	-
Denmark	0.26	0.31	0.35	0.34	0.27	0.24	0.20	0.23	0.27
Finland	0.38	0.44	0.48	0.49	0.56	0.63	0.58	0.76	..
France	0.46	0.45	0.42	0.42	0.38	0.43	0.40	0.39	0.41
Germany[3]	0.35	0.30	0.23	0.23	0.18	0.15	0.16	0.14	0.15
Greece	0.11	0.10	0.06	0.05	0.05	0.08	0.09	0.15	..
Hungary	..	..	..	..	..	0.01	0.00	..	..
Ireland	0.03	..	..	..	..	..	..	..	..
Italy	0.61	0.55	..	0.29	0.27	0.27	0.25	0.22	0.21
Netherlands	0.59	0.56	0.53	0.58	0.51	0.47	0.39	0.41	..
Norway	0.45	0.48	0.50	0.44	0.41	0.33	0.28	0.26	0.25
Portugal	0.14	0.09	0.07	0.05	0.04	0.02	0.02	0.01	..
Spain	0.11	0.24	0.19	0.16	0.16	0.14	0.13	0.13	0.12
Sweden	0.43	0.39	0.50	0.38	0.39	0.27	0.24	0.27	..
Switzerland	0.59	0.60	0.64	0.64	0.62	0.59	0.57	0.53	..
Turkey	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.06	0.06
United Kingdom	0.30	0.25	0.22	0.15	0.08	0.07	0.05	0.06	0.05

	R&D/GDP excluding nuclear research								
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Canada	0.32	0.30	0.28	0.21	0.20	0.19	0.21	0.17	0.16
United States	0.29	0.30	0.27	0.28	0.29	0.27	0.24	0.21	0.21
Australia	..	..	..	0.26	..	0.23	..	0.30	..
Japan	0.16	0.17	0.17	0.17	0.23	0.23	0.22	0.21	0.22
New Zealand	0.03	0.03	..	0.06	0.04	0.05	0.06	0.05	0.06
Austria	0.07	0.11	0.09	0.12	0.14	0.13	0.13	0.13	0.13
Belgium[1]	..	0.05	0.05	0.09	0.09	0.10	0.10	0.08	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–
Denmark	0.22	0.29	0.33	0.32	0.26	0.24	0.20	0.23	0.24
Finland	0.30	0.35	0.39	0.40	0.49	0.56	0.50	0.69	..
France	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03
Germany[3]	0.14	0.11	0.10	0.11	0.08	0.06	0.07	0.06	0.06
Greece	0.11	0.10	0.06	0.05	0.05	0.08	0.08	0.15	..
Hungary	..	..	..	..	..	0.01	0.00	..	..
Ireland	0.03	..	..	..	..	..	..	..	..
Italy	0.40	0.40	..	0.15	0.15	0.16	0.14	0.12	0.12
Netherlands	0.47	0.45	0.35	0.45	0.39	0.36	0.34	0.36	..
Norway	0.42	0.42	0.43	0.38	0.35	0.27	0.23	0.21	0.20
Portugal	0.09	0.06	0.05	0.03	0.01	0.02	0.02	0.01	..
Spain	0.06	0.17	0.12	0.10	0.09	0.08	0.07	0.07	0.06
Sweden	0.36	0.32	0.42	0.30	0.31	0.24	0.21	0.24	..
Switzerland	0.36	0.39	0.45	0.44	0.44	0.43	0.40	0.37	..
Turkey	0.01	0.02	0.02	0.01	0.00	0.02	0.01	0.05	0.06
United Kingdom	0.10	0.07	0.08	0.07	0.04	0.04	0.03	0.04	0.03

1. Figures for the 1991 R&D budget refer to Wallonia while GDP refers to all of Belgium. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B5

IEA Government R&D Budgets for Conservation

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	29.2	30.7	29.6	29.6	26.8	22.7	24.9	37.0	36.0	37.0	35.9	36.2
United States	225.3	188.2	199.2	218.1	251.1	321.1	337.8	458.8	530.7	425.2	391.6	421.3
Australia	4.8	..	5.0	..	..	..	4.6	..	9.3	..	6.5	..
Japan[1]	102.7	68.5	4.8	3.3	16.9	16.7	25.8	216.7	231.5	263.5	255.7	287.8
New Zealand	0.5	..	..	0.6	0.6	..	0.4	0.4	0.6	0.5	0.4	0.5
Austria	10.0	13.5	6.5	6.1	7.3	6.1	9.1	11.2	10.2	10.2	9.6	7.6
Belgium[2]	4.0	4.3	1.0	..	7.9	3.4	7.3	9.9	8.9	11.4	10.0	..
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	6.4	..	7.6	10.8	8.5	9.6	7.0	5.8	4.9	5.2	7.9	9.0
Finland	..	..	..	9.9	14.6	15.0	15.6	17.3	23.9	23.2	39.0	..
France	17.7	15.9	17.6	26.2	19.7	19.0	12.3	8.4	8.1	7.4	4.8	6.7
Germany[4]	16.0	20.7	19.4	18.7	18.7	13.2	12.4	14.3	16.3	23.7	15.4	15.4
Greece	2.0	1.8	1.6	3.3	1.3	0.2	0.2	1.4	1.6	2.1	5.2	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	0.5	1.9	..	0.2	..	..	..	..	..	..	..	..
Italy	69.7	54.6	39.7	49.5	57.6	..	55.8	52.8	55.7	56.6	52.3	52.1
Netherlands	47.6	43.4	46.1	58.6	57.0	44.8	64.3	49.4	53.4	52.7	56.9	..
Norway	4.1	9.5	10.3	9.7	11.4	13.6	13.0	7.5	1.8	1.6	1.5	1.4
Portugal	1.6	1.9	1.6	2.6	1.1	0.6	1.0	0.4	0.8	0.7	0.6	..
Spain	4.7	4.8	2.0	3.7	42.8	12.5	4.8	7.8	6.1	3.7	3.7	3.6
Sweden	31.8	27.0	31.2	29.6	27.6	31.1	25.0	23.7	21.5	25.0	18.6	..
Switzerland	18.7	15.5	19.0	19.5	21.9	24.6	26.1	29.6	28.2	26.4	20.9	..
Turkey	1.5	1.6	1.4	0.3	–	–	1.2	–	0.2	0.2	0.1	0.1
United Kingdom	67.9	54.0	49.1	35.6	27.1	33.4	37.8	4.2	2.6	2.3	1.7	1.6
Total Reported[5]	**666.6**	**557.9**	**492.7**	**535.6**	**620.0**	**587.7**	**686.4**	**956.5**	**1 052.2**	**978.4**	**938.2**	**..**

1. The items included in Conservation were expanded in 1994. Earlier budgetary data are not comparable.
2. Figures for 1991 refer to Wallonia only.
3. Luxembourg has no energy R&D programme.
4. Data do not include the new Laender of Germany prior to 1992.
5. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B6

IEA Government R&D Budgets for Oil & Gas

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	120.7	111.1	86.0	86.9	79.8	66.8	47.9	38.5	35.5	41.9	35.3	34.8
United States	64.8	61.4	62.4	71.6	92.2	97.5	174.1	105.2	116.1	79.8	68.9	73.1
Australia	17.9	..	17.9	..	..	..	32.8	..	27.0	..	56.1	..
Japan	141.2	85.3	69.6	83.4	95.9	100.8	106.2	112.4	128.3	126.5	122.3	110.6
New Zealand	0.4	..	..	–	–	..	1.3	0.5	0.4	0.5	0.5	0.6
Austria	0.7	0.9	0.5	0.1	0.6	0.8	0.4	0.3	0.3	0.6	0.3	0.3
Belgium[1]	–	–	–	..	–	–	–	–	–	0.1	0.1	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	–	..	–	–	–	2.6	3.1	3.4	3.5	2.9	2.6	2.1
Finland	..	..	..	–	–	–	–	–	–	–	2.3	..
France	45.9	45.4	44.1	42.8	38.8	37.0	34.3	34.4	32.9	32.6	32.3	32.0
Germany[3]	17.2	16.4	15.7	15.9	7.9	7.2	4.2	3.0	0.8	–	–	–
Greece	0.1	0.1	0.1	–	–	0.1	0.1	0.6	1.1	1.2	1.8	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	0.1	0.2	..	0.2	..	..	..	..	..	..	..	..
Italy	–	–	–	–	–	..	–	–	–	–	–	–
Netherlands	2.1	0.7	0.7	0.7	0.7	7.1	10.1	10.5	12.9	12.8	8.8	..
Norway	19.9	21.5	20.8	18.7	15.7	16.4	14.4	22.8	21.2	18.7	17.8	17.1
Portugal	0.1	0.1	–	–	–	–	–	0.3	0.2	0.1	0.1	..
Spain	–	–	–	–	–	–	–	–	–	–	–	–
Sweden	–	1.8	3.8	4.0	2.0	1.2	–	–	–	–	–	..
Switzerland	2.3	4.6	7.4	8.9	11.4	12.6	12.6	11.9	11.3	8.8	9.7	..
Turkey	0.6	0.7	0.7	0.2	–	0.3	0.1	0.1	2.9	2.1	4.3	3.6
United Kingdom	48.1	50.9	23.1	11.1	1.6	6.9	6.4	5.0	10.8	5.0	7.5	5.6
Total Reported[4]	**482.0**	**401.1**	**352.9**	**344.5**	**346.6**	**357.3**	**448.1**	**348.7**	**405.3**	**333.5**	**370.5**	**..**

1. Figures for 1991 refer to Wallonia only.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B7

IEA Government R&D Budgets for Coal

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	23.8	27.8	19.6	23.8	23.2	17.5	10.6	7.7	9.6	6.9	2.3	2.4
United States	289.7	500.3	503.2	966.1	794.6	347.2	260.0	415.4	200.5	274.2	97.4	104.4
Australia	11.9	..	15.4	..	..	..	13.9	..	13.2	..	16.7	..
Japan	300.8	332.1	257.9	251.7	205.5	210.9	240.2	238.0	220.1	195.8	173.1	167.2
New Zealand	1.4	..	..	0.2	0.2	..	0.2	0.3	0.2	0.4	0.4	0.4
Austria	0.3	0.2	0.2	0.1	0.5	0.6	1.2	0.7	0.6	1.3	1.6	0.4
Belgium[1]	7.9	5.2	5.1	..	1.0	1.4	1.2	1.7	1.4	1.6	2.3	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	–	..	–	4.3	6.2	6.5	5.4	4.8	2.8	0.8	–	–
Finland	..	..	..	5.6	5.0	4.8	3.2	3.9	3.4	3.7	3.7	..
France	6.4	6.2	6.0	5.8	5.6	5.5	5.8	5.7	5.8	5.3	5.3	5.3
Germany[3]	153.3	124.4	90.3	82.8	62.1	44.7	26.4	19.3	13.9	3.8	1.5	1.3
Greece	0.3	2.5	2.1	2.1	1.5	0.6	0.4	0.4	0.8	0.7	2.2	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	0.3	0.2	..	0.1	..	..	..	..	..	..	..	..
Italy	6.2	6.4	0.5	–	–	..	–	–	–	–	–	–
Netherlands	19.8	16.3	31.6	13.4	13.1	7.4	7.7	6.6	3.5	3.4	3.1	..
Norway	–	–	0.1	0.1	0.1	0.1	0.1	–	–	–	–	–
Portugal	1.6	0.8	1.7	1.1	0.8	1.6	0.6	–	–	–	–	..
Spain	8.8	5.2	2.1	2.9	3.5	2.4	1.6	4.3	4.8	4.2	4.0	3.5
Sweden	5.3	4.8	3.4	3.1	1.4	1.6	0.8	0.7	0.5	0.2	0.1	..
Switzerland	0.9	0.6	0.8	1.5	1.2	0.2	0.1	0.4	0.4	–	–	..
Turkey	1.0	1.3	1.4	0.8	2.2	0.7	0.4	0.1	0.2	0.1	3.4	7.1
United Kingdom	7.3	6.0	6.3	25.0	8.4	7.7	13.7	5.9	8.8	8.4	4.1	3.4
Total Reported[4]	**847.0**	**1 040.2**	**947.7**	**1 390.7**	**1 136.1**	**661.5**	**593.4**	**716.0**	**490.4**	**510.8**	**321.1**	**..**

1. Figures for 1991 refer to Wallonia only.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook,* OECD Paris, 1998, and country submissions.

Table B8

IEA Government R&D Budgets for Conventional Nuclear

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	134.3	115.1	114.2	112.0	104.6	114.2	111.5	111.5	108.7	82.8	80.6	66.5
United States	900.8	907.1	735.4	645.8	649.7	246.2	128.5	102.1	88.4	40.3	57.0	20.0
Australia	16.5	..	14.3	..	..	..	0.8	..	5.2	..	0.8	..
Japan	1 264.2	742.3	1 621.1	1 590.2	1 661.0	1 699.9	1 754.9	1 803.3	1 978.3	2 083.6	1 993.4	1 884.4
New Zealand	–	..	..	–	–	..	–	–	–	–	–	–
Austria	1.8	1.1	0.9	0.5	0.4	0.5	0.6	0.6	0.6	0.9	0.6	–
Belgium	31.7	34.3	35.8	..	..	..	..	..	24.7	36.1	36.9	38.6
Luxembourg[1]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	1.6	..	–	2.7	0.7	0.8	0.8	0.8	0.6	0.6	0.5	3.0
Finland	..	..	..	8.5	9.1	9.1	8.6	7.4	6.4	8.0	7.4	..
France	491.2	480.5	475.3	426.4	418.7	393.3	386.3	363.7	467.2	441.8	450.9	498.1
Germany[2]	264.7	179.8	146.2	173.1	198.4	105.0	93.0	76.6	75.1	58.7	41.7	39.8
Greece	2.4	0.1	0.4	0.1	0.1	–	–	0.2	0.3	0.3	0.2	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	–	–	..	–	..	..	..	..	..	..	..	..
Italy	255.1	166.7	106.1	93.7	61.3	..	53.8	54.2	43.1	39.0	38.4	34.6
Netherlands	21.7	25.1	24.2	23.6	23.0	31.8	26.0	22.5	25.6	12.7	12.0	..
Norway	4.2	3.3	2.9	2.8	7.5	7.7	7.7	7.3	7.4	7.0	6.8	7.7
Portugal	2.6	2.0	2.3	2.0	1.3	1.1	0.3	2.2	0.1	0.1	0.1	..
Spain	9.2	21.1	29.8	16.4	18.4	22.2	19.4	18.3	17.2	17.3	17.0	16.1
Sweden	1.9	1.4	1.3	1.2	1.5	1.6	1.6	1.5	1.4	1.2	1.1	..
Switzerland	31.8	32.4	29.7	29.5	27.5	24.7	24.4	24.4	23.6	20.5	20.9	..
Turkey	0.5	0.8	0.5	0.3	–	1.0	1.3	1.0	0.7	0.8	1.3	1.2
United Kingdom	109.2	102.0	101.0	43.9	42.0	36.9	20.5	14.7	13.1	6.9	1.7	3.3
Total Reported[3]	**3 545.3**	**2 815.0**	**3 441.3**	**3 173.0**	**3 225.2**	**2 696.0**	**2 640.1**	**2 612.5**	**2 887.4**	**2 858.5**	**2 769.4**	**..**

1. Luxembourg has no energy R&D programme.
2. Data do not include the new Laender of Germany prior to 1992.
3. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B9

IEA Government R&D Budgets for Nuclear Breeders

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	–	–	–	–	–	–	–	–	–	–	–	–
United States	18.4	–	–	–	–	–	–	–	–	–	–	–
Australia	–	..	–	..	..	..	–	..	–	..	–	..
Japan	490.3	600.8	663.9	557.1	507.2	453.3	450.6	405.8	317.3	292.8	251.0	214.6
New Zealand	–	..	..	–	–	..	–	–	–	–	–	–
Austria	0.1	–	–	–	–	–	–	–	–	–	–	–
Belgium	39.1	34.1	11.7	..	..	..	..	..	–	–	–	–
Luxembourg[1]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	–	..	–	–	–	–	–	–	–	–	–	–
Finland	..	..	..	–	–	–	0.1	–	0.9	–	–	..
France	119.9	55.9	24.6	29.5	41.4	29.5	46.9	37.7	16.0	15.5	12.5	13.1
Germany[2]	47.1	72.4	61.2	46.2	25.5	4.3	–	–	–	–	–	–
Greece	–	–	–	–	–	–	–	–	–	–	–	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	–	–	..	–	..	..	..	..	..	..	..	..
Italy	172.6	154.3	13.2	–	–	..	–	–	–	–	–	–
Netherlands	2.0	–	–	1.8	1.7	0.5	0.5	0.3	0.3	–	–	..
Norway	–	–	–	–	–	–	–	–	–	–	–	–
Portugal	–	–	–	–	–	–	–	–	–	–	–	..
Spain	–	–	–	–	–	–	–	–	–	–	–	–
Sweden	5.7	4.1	3.8	3.6	4.6	4.9	4.8	4.6	4.2	3.7	3.3	..
Switzerland	1.8	1.2	1.1	1.4	1.1	1.4	1.2	0.5	0.9	1.0	0.3	..
Turkey	–	–	–	–	–	–	–	–	–	–	–	–
United Kingdom	190.2	203.5	162.5	151.5	120.5	99.0	46.7	1.8	0.2	–	–	–
Total Reported[3]	**1 087.2**	**1 126.3**	**942.0**	**791.0**	**702.0**	**593.0**	**550.8**	**450.7**	**339.8**	**312.9**	**267.1**	**227.7**

1. Luxembourg has no energy R&D programme.
2. Data do not include the new Laender of Germany prior to 1992.
3. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B10

IEA Government R&D Budgets for Nuclear Fusion

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	15.4	14.2	6.5	9.7	9.1	9.2	6.0	5.9	5.8	6.4	–	–
United States	463.3	433.1	388.3	375.4	325.5	374.4	368.1	352.4	386.2	245.9	221.6	217.3
Australia	2.2	..	2.7	..	..	..	–	..	–	..	–	..
Japan	320.4	259.4	260.4	255.1	233.9	250.5	270.0	272.8	280.9	311.0	289.2	232.3
New Zealand	–	..	..	–	–	..	–	–	–	–	–	–
Austria	1.3	1.6	1.5	0.6	2.3	1.7	1.9	1.2	1.3	0.7	1.2	2.6
Belgium	16.8	7.4	6.8	..	..	..	..	..	3.6	5.0	5.3	5.5
Luxembourg[1]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	2.6	..	3.4	3.1	2.0	2.1	1.3	–	–	–	–	1.9
Finland	..	..	..	–	–	–	–	–	–	1.0	1.6	..
France	60.9	62.5	47.9	47.0	42.9	44.6	37.9	37.5	38.5	38.4	37.9	33.4
Germany[2]	145.8	149.1	138.6	138.5	137.3	139.4	141.2	122.1	104.3	111.5	122.0	136.0
Greece	–	0.1	0.1	0.1	0.1	–	–	–	–	–	–	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	0.1	0.1	..	–	..	..	..	..	..	..	..	..
Italy	113.0	131.9	118.2	124.8	102.1	..	88.0	71.2	71.9	78.6	76.8	73.7
Netherlands	16.1	12.3	13.0	10.9	10.7	26.0	14.6	16.5	14.4	6.0	7.8	..
Norway	0.2	–	–	–	–	–	–	–	–	–	–	–
Portugal	–	–	–	3.1	1.7	1.0	0.9	–	–	–	–	..
Spain	6.1	6.7	7.2	8.0	11.6	9.9	10.4	16.7	16.0	16.0	15.9	14.7
Sweden	10.9	11.1	11.7	10.7	9.6	9.5	9.9	10.3	1.9	1.7	1.4	..
Switzerland	25.2	23.5	25.6	28.0	24.5	23.5	23.1	19.8	17.6	20.5	21.3	..
Turkey	–	–	–	–	–	–	–	–	–	–	–	–
United Kingdom	55.9	62.0	55.3	46.6	40.0	31.3	29.9	29.5	28.5	20.8	28.8	21.5
Total Reported[3]	**1 256.1**	**1 175.0**	**1 087.3**	**1 061.9**	**953.3**	**923.1**	**1 003.3**	**956.0**	**970.9**	**863.6**	**830.9**	**..**

1. Luxembourg has no energy R&D programme.
2. Data do not include the new Laender of Germany prior to 1992.
3. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook,* OECD Paris, 1998, and country submissions.

Table B11

IEA Government R&D Budgets for Renewables

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	15.0	13.6	11.3	9.4	9.0	10.3	9.3	10.7	10.4	10.4	8.1	7.6
United States	205.5	161.3	141.9	130.9	173.7	242.4	231.8	237.0	286.2	211.3	198.9	244.7
Australia	0.9	..	4.2	..	..	..	7.6	..	3.6	..	5.2	..
Japan	125.8	138.6	113.4	112.4	109.2	104.4	108.6	100.3	101.1	102.6	101.6	105.3
New Zealand	0.5	..	..	0.4	0.4	..	0.7	0.8	0.9	1.2	1.2	1.3
Austria	3.8	6.1	3.4	2.2	5.1	4.4	6.0	7.7	9.1	7.0	8.4	10.9
Belgium[1]	5.4	2.5	0.6	..	0.4	2.1	2.4	2.6	4.1	3.0	3.4	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	5.2	..	11.4	9.1	18.4	19.6	21.1	18.4	17.2	14.0	18.0	19.7
Finland	..	..	..	2.4	2.0	2.1	6.2	5.9	6.1	7.7	12.5	..
France	13.1	10.1	8.7	9.0	8.2	8.0	5.8	5.5	5.4	5.1	3.1	4.2
Germany[3]	89.3	95.0	93.2	110.8	121.2	127.1	138.4	91.5	80.6	100.0	78.3	84.4
Greece	7.9	19.5	9.1	4.5	4.6	4.9	3.5	1.9	3.3	3.1	6.5	..
Hungary	..	..	..	..	..	..	..	..	0.3	0.1	..	..
Ireland	1.3	1.4	..	0.4	..	..	..	..	..	..	..	..
Italy	40.7	57.1	43.9	50.2	38.4	..	28.2	32.0	43.6	40.9	37.5	35.0
Netherlands	25.2	20.9	24.2	36.5	35.5	21.1	21.1	18.3	20.6	20.3	30.0	..
Norway	2.4	2.4	3.1	5.2	9.3	10.2	8.1	6.7	4.4	4.0	4.0	4.7
Portugal	2.9	2.4	3.4	1.8	1.7	2.4	1.5	0.6	0.5	1.1	0.6	..
Spain	13.0	14.0	14.9	19.9	16.6	22.6	20.4	14.9	14.5	14.5	14.5	14.1
Sweden	18.5	20.7	20.9	17.6	11.7	28.5	14.3	17.3	13.3	8.5	8.8	..
Switzerland	15.1	20.1	25.0	30.4	32.5	38.6	40.2	38.0	37.1	35.3	37.3	..
Turkey	0.8	1.3	0.9	0.2	0.1	1.3	0.3	0.4	0.1	0.1	2.1	0.6
United Kingdom	31.9	32.6	32.4	31.4	34.2	30.9	28.3	16.7	16.3	10.7	7.3	6.0
Total Reported[4]	**624.2**	**619.5**	**565.8**	**584.9**	**632.1**	**681.1**	**703.9**	**627.2**	**678.9**	**600.9**	**587.4**	**..**

1. Figures for 1991 refer to Wallonia only.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B12

Total Reported Government R&D Budgets for Renewable Energy Sources

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Solar Heating	47.4	50.2	51.0	54.6	57.0	247.3	54.6	51.7	49.5	33.3	33.7	24.6
Solar Photo Electric	189.2	197.6	198.6	202.8	218.7	155.8	372.5	230.1	234.5	209.7	213.4	192.5
Solar Thermal Electric	66.1	59.5	30.8	44.8	43.5	19.5	23.8	46.5	49.8	43.4	42.9	27.7
Wind	84.6	75.1	85.6	97.5	92.4	69.6	82.4	88.6	111.3	109.1	93.0	81.8
Ocean	14.2	11.9	10.9	12.7	11.7	2.9	4.2	3.8	2.2	2.1	2.1	10.1
Biomass	121.7	126.4	95.8	82.3	107.1	86.6	81.6	133.6	140.5	123.8	124.7	137.3
Geothermal	100.7	98.6	92.7	89.9	97.6	84.0	76.1	61.9	77.5	68.1	67.3	59.5
Large Hydro (>10 MW)	..	..	..	..	3.6	7.8	7.4	9.2	11.9	8.5	6.8	3.2
Small Hydro (<10 MW)	0.3	0.2	0.4	0.3	0.6	7.6	1.4	1.7	1.8	3.0	3.4	2.0
TOTAL	**624.2**	**619.5**	**565.8**	**584.9**	**632.1**	**681.1**	**703.9**	**627.2**	**678.9**	**600.9**	**587.4**	**..**

Note: Yearly totals are not comparable due to missing data (see Table B11).

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B13

IEA Government R&D Budgets for Electricity

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	4.6	4.4	4.0	3.5	3.0	8.1	8.8	8.2	8.0	6.8	3.8	3.4
United States	60.5	67.0	61.4	64.9	63.4	45.1	46.5	124.4	138.0	124.5	126.9	126.3
Australia	1.0	..	8.8	..	..	..	5.7	..	4.5	..	4.2	..
Japan	76.5	78.2	84.2	89.9	90.9	92.5	57.0	65.1	65.3	67.8	69.6	64.4
New Zealand	0.1	..	..	–	–	..	–	–	0.1	0.2	0.2	0.2
Austria	6.1	7.1	5.0	3.1	5.9	3.7	3.8	4.9	4.1	4.7	4.1	4.6
Belgium[1]	–	2.1	1.5	..	0.1	2.7	7.7	4.3	5.9	5.9	1.9	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	1.5	..	3.2	5.1	4.2	4.9	5.7	4.2	4.0	4.3	4.3	4.4
Finland	..	..	..	12.3	11.9	14.1	12.1	16.9	17.5	12.9	16.8	..
France	–	–	–	–	–	–	–	–	–	–	–	–
Germany[3]	19.8	7.4	9.3	9.8	6.7	5.1	2.8	3.3	2.2	13.0	22.5	27.3
Greece	0.5	0.8	0.7	0.5	0.9	0.1	–	0.1	0.1	0.1	0.2	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	0.2	0.3	..	–	..	..	..	..	..	..	..	..
Italy	45.2	98.9	104.8	32.4	56.4	..	11.8	20.5	16.3	16.8	15.4	16.1
Netherlands	6.5	4.9	1.9	1.8	1.8	20.8	34.0	36.7	17.9	17.6	15.8	..
Norway	3.5	1.4	3.8	4.7	0.7	2.7	2.7	2.7	3.3	2.5	2.2	2.0
Portugal	–	0.1	0.2	0.1	–	–	–	–	–	–	–	..
Spain	16.7	–	–	–	–	–	–	–	0.3	0.3	0.3	0.3
Sweden	2.5	2.4	2.0	1.8	2.8	2.1	3.9	9.6	4.5	1.1	11.0	..
Switzerland	11.3	16.2	19.1	21.9	21.2	25.6	21.5	18.7	18.8	20.0	15.7	..
Turkey	0.1	0.4	0.3	0.1	–	–	0.1	0.1	–	–	0.1	0.2
United Kingdom	7.1	3.6	–	1.7	2.2	3.1	–	6.9	5.5	1.9	1.9	2.2
Total Reported[4]	**263.7**	**295.3**	**310.2**	**253.6**	**272.0**	**230.4**	**224.0**	**326.6**	**316.4**	**300.6**	**317.2**	**..**

1. Figures for 1991 refer to Wallonia only.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B13A

IEA Government R&D Budgets for Energy Systems Analysis & Others

(US$ million at 1998 prices and exchange rates)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Canada	6.3	4.9	14.4	9.5	9.5	16.5	6.1	7.4	7.2	11.3	13.1	13.0
United States	449.7	508.5	628.2	533.7	659.5	874.8	940.2	822.9	779.5	811.7	822.8	817.5
Australia	0.4	..	1.5	..	..	..	11.0	..	14.8	..	11.5	..
Japan	31.3	23.2	20.1	20.4	85.4	100.8	90.1	106.7	111.2	110.8	113.2	106.6
New Zealand	0.2	..	..	–	–	..	–	0.2	0.1	0.1	–	–
Austria	3.2	2.9	1.1	0.8	1.2	1.6	2.4	1.3	1.9	2.3	3.1	4.0
Belgium[1]	3.5	0.6	–	..	2.2	2.4	1.3	2.0	2.0	1.2	1.5	..
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Denmark	4.9	..	1.8	1.7	3.8	4.4	4.7	4.2	5.6	5.9	5.8	7.0
Finland	..	..	..	3.2	2.8	2.7	2.8	6.6	10.2	8.7	7.8	..
France	–	–	–	–	–	–	–	–	–	–	–	–
Germany[3]	–	0.1	1.6	2.2	2.0	5.8	19.6	20.7	6.6	11.9	10.0	10.3
Greece	1.8	0.5	0.5	1.1	1.8	1.0	1.4	0.6	1.4	2.2	1.1	..
Hungary	..	..	..	..	..	..	..	..	–	–	..	..
Ireland	0.1	0.2	..	0.2	..	..	..	..	..	..	..	..
Italy	201.0	273.1	314.4	299.8	280.7	..	70.0	61.4	70.1	47.6	33.5	36.1
Netherlands	27.7	27.6	28.7	33.4	32.5	10.1	9.7	7.7	13.3	13.1	16.1	..
Norway	5.0	2.1	8.0	7.4	9.4	7.0	6.8	4.5	4.6	4.9	4.6	3.8
Portugal	2.8	1.9	1.8	2.0	1.4	0.1	–	–	–	–	–	..
Spain	–	21.4	15.7	–	21.2	20.7	19.5	18.7	13.4	13.1	13.5	13.2
Sweden	17.2	23.4	20.2	19.5	19.9	20.7	16.1	13.0	11.7	11.8	15.1	..
Switzerland	12.1	9.0	10.4	8.7	9.0	11.0	10.7	12.3	12.1	10.9	10.8	..
Turkey	0.1	0.1	–	–	–	0.2	0.2	0.1	0.3	0.2	0.2	0.1
United Kingdom	42.8	47.6	6.8	8.5	9.3	6.9	1.1	8.9	9.2	7.1	30.5	29.9
Total Reported[4]	**810.0**	**947.1**	**1 075.0**	**952.0**	**1 151.6**	**1 086.8**	**1 213.9**	**1 098.9**	**1 075.1**	**1 074.8**	**1 114.1**	**..**

1. Figures for 1991 refer to Wallonia only.
2. Luxembourg has no energy R&D programme.
3. Data do not include the new Laender of Germany prior to 1992.
4. Yearly totals are not comparable due to missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Table B14

IEA Government Energy R&D Expenditure by Country, 1997 and 1998

(US$ million at 1998 prices and exchange rates)

	Australia[1]				Austria			
	1997		1998		1997		1998	
	$	%	$	%	$	%	$	%
1.1 Industry	0.85	0.84	..	..	1.78	6.17	0.64	2.11
1.2 Residential. Commercial	1.07	1.06	..	..	3.58	12.39	3.46	11.35
1.3 Transportation	2.81	2.79	..	..	3.14	10.85	3.24	10.66
1.4 Other Conservation	1.76	1.75	..	..	1.07	3.70	0.26	0.86
TOTAL CONSERVATION	**6.50**	**6.44**	**..**	**..**	**9.56**	**33.10**	**7.60**	**24.98**
2.1 Enhanced Oil & Gas	5.89	5.83	..	..	0.19	0.65	–	–
2.2 Refining. Transp. & Stor.	0.61	0.60	..	..	0.01	0.03	–	–
2.3 Oil Shale & Tar Sands	1.43	1.42	..	..	–	–	–	–
2.4 Other Oil & Gas	48.17	47.71	..	..	0.08	0.27	0.27	0.89
Total Oil & Gas	56.10	55.56	..	..	0.27	0.95	0.27	0.89
3.1 Coal Prod. Prep. & Trans.	9.85	9.75	..	..	0.02	0.06	–	–
3.2 Coal Combustion	4.35	4.31	..	..	0.67	2.31	0.32	1.04
3.3 Coal Conversion	1.30	1.29	..	..	0.94	3.24	0.04	0.15
3.4 Other Coal	1.18	1.17	..	..	0.01	0.03	0.02	0.08
Total Coal	16.68	16.52	..	..	1.63	5.64	0.38	1.26
TOTAL FOSSIL FUELS	**72.78**	**72.08**	**..**	**..**	**1.90**	**6.59**	**0.66**	**2.15**
4.1 Solar Heating & Cooling	0.43	0.42	..	..	1.37	4.76	1.79	5.87
4.2 Solar Photo-Electric	1.95	1.93	..	..	0.93	3.21	2.02	6.63
4.3 Solar Thermal-Electric	0.31	0.30	..	..	0.03	0.09	0.15	0.48
Total Solar	2.68	2.65	..	..	2.33	8.06	3.95	12.97
5. Wind	0.15	0.15	..	..	0.52	1.80	0.63	2.07
6. Ocean	0.09	0.09	..	..	–	–	–	–
7. Biomass	2.06	2.04	..	..	4.63	16.04	5.05	16.60
8. Geothermal	..	..	..	..	0.05	0.16	0.44	1.46
9.1 Large Hydro (>10 MW)	0.27	0.27	..	..	0.69	2.38	0.49	1.62
9.2 Small Hydro (<10 MW)	..	..	..	..	0.14	0.49	0.35	1.14
Total Hydro	0.27	0.27	..	..	0.83	2.86	0.84	2.77
TOTAL RENEWABLE ENERGY	**5.25**	**5.19**	**..**	**..**	**8.35**	**28.92**	**10.92**	**35.87**
10.1 Nuclear LWR	–	–	..	..	0.01	0.04	–	–
10.2 Other Converter Reactors	–	–	..	..	–	–	–	–
10.3 Nuclear Fuel Cycle	0.76	0.75	..	..	–	–	–	–
10.4 Nuclear Supporting Tech.	–	–	..	..	0.63	2.18	–	–
10.5 Nuclear Breeder	–	–	..	..	–	–	–	–
Total Nuclear Fission	0.76	0.75	..	..	0.64	2.22	–	–
11. Nuclear Fusion	–	–	..	..	1.25	4.31	2.64	8.68
TOTAL NUCLEAR	**0.76**	**0.75**	**..**	**..**	**1.89**	**6.54**	**2.64**	**8.68**
12.1 Electric Power Conversion	–	–	..	..	2.35	8.12	1.18	3.89
12.2 Electricity Transm. & Distr.	2.36	2.34	..	..	1.06	3.68	2.29	7.53
12.3 Energy Storage	1.79	1.78	..	..	0.72	2.49	1.16	3.81
TOTAL POWER & STORAGE	**4.16**	**4.12**	**..**	**..**	**4.13**	**14.29**	**4.63**	**15.22**
13.1 Energy Systems Analysis	1.11	1.10	..	..	0.72	2.51	1.45	4.77
13.2 Other Tech. or Research	10.43	10.33	..	..	2.33	8.05	2.53	8.32
TOTAL OTHER TECH./RESEARCH	**11.54**	**11.42**	**..**	**..**	**3.05**	**10.56**	**3.98**	**13.09**
TOTAL ENERGY R&D	**100.98**	**100.00**	**..**	**..**	**28.89**	**100.00**	**30.44**	**100.00**

1. Australia has not provided data for 1998. Biomass includes geothermal and other renewable energy not elsewhere classified.
2. For 1998, Belgium has only provided data on nuclear R&D.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Belgium[2]				Canada				Denmark			
1997		1998		1997		1998		1997		1998	
$	%	$	%	$	%	$	%	$	%	$	%
4.24	6.91	..	..	10.42	5.82	10.40	6.34	4.40	11.23	6.72	14.23
1.40	2.29	..	..	8.19	4.57	8.85	5.40	3.14	8.01	1.16	2.47
3.90	6.35	..	..	10.97	6.12	11.31	6.90	–	–	0.18	0.38
0.49	0.80	..	..	6.34	3.54	5.59	3.41	0.36	0.93	0.94	1.99
10.04	**16.35**	**..**	**..**	**35.92**	**20.05**	**36.15**	**22.05**	**7.90**	**20.17**	**9.01**	**19.07**
–	–	..	..	1.31	0.73	1.31	0.80	1.59	4.07	1.52	3.23
0.11	0.17	..	..	6.58	3.67	5.67	3.46	–	–	–	–
–	–	..	..	21.48	11.98	21.64	13.20	–	–	–	–
–	–	..	..	5.94	3.32	6.22	3.79	0.99	2.52	0.57	1.20
0.11	0.17	..	..	35.32	19.71	34.85	21.25	2.58	6.58	2.09	4.43
0.51	0.84	..	..	0.42	0.23	0.42	0.25	–	–	–	–
0.60	0.99	..	..	0.05	0.03	0.03	0.02	–	–	0.04	0.09
0.36	0.59	..	..	1.02	0.57	1.27	0.77	–	–	–	–
0.78	1.26	..	..	0.86	0.48	0.73	0.44	–	–	–	–
2.25	3.67	..	..	2.34	1.30	2.45	1.49	–	–	0.04	0.09
2.36	**3.84**	**..**	**..**	**37.65**	**21.01**	**37.29**	**22.74**	**2.58**	**6.58**	**2.14**	**4.52**
0.30	0.48	..	..	0.70	0.39	0.65	0.39	3.02	7.70	3.08	6.51
1.11	1.81	..	..	0.77	0.43	0.84	0.51	0.46	1.16	0.78	1.64
–	–	..	..	–	–	–	–	–	–	–	–
1.41	2.29	..	..	1.47	0.82	1.48	0.90	3.47	8.87	3.85	8.16
0.97	1.59	..	..	1.65	0.92	1.45	0.88	8.80	22.45	7.72	16.35
–	–	..	..	0.02	0.01	0.02	0.01	–	–	0.90	1.90
0.75	1.22	..	..	3.59	2.00	3.37	2.05	5.77	14.71	5.35	11.32
–	–	..	..	–	–	–	–	–	–	1.91	4.05
–	–	..	..	–	–	–	–	–	–	–	–
0.26	0.42	..	..	1.36	0.76	1.31	0.80	–	–	–	–
0.26	0.42	..	..	1.36	0.76	1.31	0.80	–	–	–	–
3.39	**5.52**	**..**	**..**	**8.09**	**4.52**	**7.63**	**4.66**	**18.04**	**46.03**	**19.73**	**41.78**
24.72	40.27	25.93	..	–	–	–	–	–	–	–	–
–	–	–	..	68.71	38.34	60.84	37.10	–	–	–	–
2.91	4.74	4.48	..	11.35	6.33	5.22	3.18	–	–	–	–
9.26	15.09	8.16	..	0.57	0.32	0.48	0.29	0.52	1.32	2.99	6.33
–	–	–	..	–	–	–	–	–	–	–	–
36.89	60.10	38.57	..	80.63	45.00	66.54	40.57	0.52	1.32	2.99	6.33
5.27	8.59	5.46	..	–	–	–	–	–	–	1.88	3.98
42.16	**68.69**	**44.03**	**..**	**80.63**	**45.00**	**66.54**	**40.57**	**0.52**	**1.32**	**4.87**	**10.31**
1.17	1.90	..	..	0.16	0.09	0.15	0.09	4.34	11.07	3.70	7.84
0.32	0.52	..	..	1.35	0.75	1.35	0.82	–	–	–	–
0.40	0.66	..	..	2.30	1.29	1.90	1.16	–	–	0.73	1.55
1.89	**3.08**	**..**	**..**	**3.81**	**2.13**	**3.40**	**2.07**	**4.34**	**11.07**	**4.44**	**9.39**
1.09	1.78	..	..	1.66	0.93	1.54	0.94	3.32	8.48	4.02	8.51
0.45	0.74	..	..	11.42	6.37	11.44	6.98	2.49	6.35	3.03	6.42
1.55	**2.52**	**..**	**..**	**13.09**	**7.30**	**12.98**	**7.91**	**5.81**	**14.83**	**7.05**	**14.93**
61.38	**100.00**	**..**	**..**	**179.20**	**100.00**	**163.99**	**100.00**	**39.19**	**100.00**	**47.22**	**100.00**

Large hydro includes both large and small hydro.

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 1997 and 1998

(US$ million at 1998 prices and exchange rates)

	Finland[1]				France			
	1997		1998		1997		1998	
	$	%	$	%	$	%	$	%
1.1 Industry	19.45	21.35	..	..	1.45	0.27	1.95	0.33
1.2 Residential. Commercial	13.55	14.87	..	..	1.21	0.22	2.05	0.35
1.3 Transportation	1.51	1.66	..	..	1.93	0.35	2.56	0.43
1.4 Other Conservation	4.46	4.90	..	..	0.17	0.03	0.17	0.03
TOTAL CONSERVATION	**38.97**	**42.77**	**..**	**..**	**4.76**	**0.87**	**6.73**	**1.14**
2.1 Enhanced Oil & Gas	–	–	..	..	11.27	2.06	11.19	1.89
2.2 Refining. Transp. & Stor.	2.32	2.54	..	..	–	–	–	–
2.3 Oil Shale & Tar Sands	–	–	..	..	–	–	–	–
2.4 Other Oil & Gas	–	–	..	..	21.00	3.84	20.85	3.52
Total Oil & Gas	2.32	2.54	..	..	32.27	5.90	32.04	5.41
3.1 Coal Prod. Prep. & Trans.	1.17	1.29	..	..	0.34	0.06	0.34	0.06
3.2 Coal Combustion	..	..	..	..	4.10	0.75	4.07	0.69
3.3 Coal Conversion	..	..	..	..	0.17	0.03	0.17	0.03
3.4 Other Coal	2.54	2.79	..	..	0.68	0.12	0.68	0.11
Total Coal	3.71	4.07	..	..	5.29	0.97	5.26	0.89
TOTAL FOSSIL FUELS	**6.03**	**6.62**	**..**	**..**	**37.56**	**6.87**	**37.29**	**6.29**
4.1 Solar Heating & Cooling	–	–	..	..	0.15	0.03	0.17	0.03
4.2 Solar Photo-Electric	1.19	1.31	..	..	0.89	0.16	1.47	0.25
4.3 Solar Thermal-Electric	–	–	..	..	–	–	–	–
Total Solar	1.19	1.31	..	..	1.04	0.19	1.64	0.28
5. Wind	0.73	0.80	..	..	0.29	0.05	0.42	0.07
6. Ocean	–	–	..	..	–	–	–	–
7. Biomass	10.15	11.14	..	..	0.90	0.17	1.73	0.29
8. Geothermal	–	–	..	..	0.90	0.17	0.39	0.07
9.1 Large Hydro (>10 MW)	0.38	0.42	..	..	–	–	–	–
9.2 Small Hydro (<10 MW)	–	–	..	..	–	–	0.05	0.01
Total Hydro	0.38	0.42	..	..	–	–	0.05	0.01
TOTAL RENEWABLE ENERGY	**12.45**	**13.67**	**..**	**..**	**3.14**	**0.57**	**4.24**	**0.71**
10.1 Nuclear LWR	4.51	4.95	..	..	102.27	18.71	121.21	20.45
10.2 Other Converter Reactors	–	–	..	..	3.41	0.62	3.73	0.63
10.3 Nuclear Fuel Cycle	2.28	2.50	..	..	212.74	38.91	241.06	40.67
10.4 Nuclear Supporting Tech.	0.58	0.63	..	..	132.49	24.23	132.06	22.28
10.5 Nuclear Breeder	–	–	..	..	12.46	2.28	13.05	2.20
Total Nuclear Fission	7.36	8.08	..	..	463.38	84.75	511.10	86.22
11. Nuclear Fusion	1.63	1.79	..	..	37.90	6.93	33.40	5.63
TOTAL NUCLEAR	**8.99**	**9.87**	**..**	**..**	**501.28**	**91.68**	**544.50**	**91.86**
12.1 Electric Power Conversion	7.47	8.20	..	..	–	–	–	–
12.2 Electricity Transm. & Distr.	8.33	9.14	..	..	–	–	–	–
12.3 Energy Storage	1.04	1.14	..	..	–	–	–	–
TOTAL POWER & STORAGE	**16.84**	**18.48**	**..**	**..**	**–**	**–**	**–**	**–**
13.1 Energy Systems Analysis	7.37	8.08	..	..	–	–	–	–
13.2 Other Tech. or Research	0.46	0.50	..	..	–	–	–	–
TOTAL OTHER TECH./RESEARCH	**7.82**	**8.59**	**..**	**..**	**–**	**–**	**–**	**–**
TOTAL ENERGY R&D	**91.11**	**100.00**	**..**	**..**	**546.75**	**100.00**	**592.76**	**100.00**

1. Finland has not provided data for 1998. Coal production, preparation and transport includes coal production and coal conversion.
2. Greece has not provided data for 1998.
3. Hungary has not provided data for 1997 and 1998.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Germany				Greece[2]				Hungary[3]			
1997		1998		1997		1998		1997		1998	
$	%	$	%	$	%	$	%	$	%	$	%
7.07	2.43	4.60	1.46	2.72	15.81	..	..	..	..	..	..
5.29	1.81	6.82	2.17	1.32	7.65	..	..	..	..	..	..
–	–	–	–	0.01	0.08	..	..	..	..	..	..
3.05	1.05	3.98	1.27	1.13	6.58	..	..	..	..	..	..
15.41	**5.29**	**15.41**	**4.90**	**5.18**	**30.12**	**..**	**..**	**..**	**..**	**..**	**..**
–	–	–	–	1.36	7.90	..	..	..	..	..	..
–	–	–	–	0.13	0.76	..	..	..	..	..	..
–	–	–	–	–	–	..	..	..	..	..	..
–	–	–	–	0.31	1.77	..	..	..	..	..	..
–	–	–	–	1.80	10.44	..	..	..	..	..	..
0.17	0.06	–	–	0.02	0.12	..	..	..	..	..	..
1.32	0.45	1.31	0.42	0.04	0.21	..	..	..	..	..	..
–	–	–	–	0.09	0.50	..	..	..	..	..	..
–	–	–	–	2.02	11.74	..	..	..	..	..	..
1.49	0.51	1.31	0.42	2.16	12.58	..	..	..	..	..	..
1.49	**0.51**	**1.31**	**0.42**	**3.96**	**23.01**	**..**	**..**	**..**	**..**	**..**	**..**
10.35	3.55	11.37	3.61	0.22	1.29	..	..	..	..	..	..
28.51	9.78	34.22	10.88	0.36	2.07	..	..	..	..	..	..
8.79	3.02	5.46	1.74	0.13	0.75	..	..	..	..	..	..
47.65	16.35	51.05	16.23	0.71	4.11	..	..	..	..	..	..
23.45	8.05	25.87	8.22	2.70	15.67	..	..	..	..	..	..
–	–	–	–	0.19	1.13	..	..	..	..	..	..
5.12	1.76	5.69	1.81	0.59	3.43	..	..	..	..	..	..
2.13	0.73	1.76	0.56	2.04	11.84	..	..	..	..	..	..
–	–	–	–	–	–	..	..	..	..	..	..
–	–	–	–	0.27	1.59	..	..	..	..	..	..
–	–	–	–	0.27	1.59	..	..	..	..	..	..
78.35	**26.88**	**84.37**	**26.82**	**6.50**	**37.78**	**..**	**..**	**..**	**..**	**..**	**..**
29.55	10.14	28.65	9.11	–	–	..	..	..	..	..	..
–	–	–	–	–	–	..	..	..	..	..	..
12.13	4.16	11.14	3.54	0.23	1.36	..	..	..	..	..	..
–	–	–	–	–	–	..	..	..	..	..	..
–	–	–	–	–	–	..	..	..	..	..	..
41.67	14.30	39.80	12.65	0.23	1.36	..	..	..	..	..	..
121.98	41.85	135.99	43.23	–	–	..	..	..	..	..	..
163.65	**56.15**	**175.78**	**55.88**	**0.23**	**1.36**	**..**	**..**	**..**	**..**	**..**	**..**
21.67	7.44	26.83	8.53	0.19	1.09	..	..	..	..	..	..
–	–	–	–	0.03	0.16	..	..	..	..	..	..
0.86	0.30	0.51	0.16	–	–	..	..	..	..	..	..
22.53	**7.73**	**27.35**	**8.69**	**0.22**	**1.25**	**..**	**..**	**..**	**..**	**..**	**..**
1.72	0.59	1.71	0.54	0.52	3.04	..	..	..	..	..	..
8.28	2.84	8.64	2.75	0.59	3.45	..	..	..	..	..	..
10.00	**3.43**	**10.35**	**3.29**	**1.12**	**6.49**	**..**	**..**	**..**	**..**	**..**	**..**
291.44	**100.00**	**314.55**	**100.00**	**17.21**	**100.00**	**..**	**..**	**..**	**..**	**..**	**..**

Other coal refers to peat.

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 1997 and 1998

(US$ million at 1998 prices and exchange rates)

	Ireland[1]				Italy			
	1997		1998		1997		1998	
	$	%	$	%	$	%	$	%
1.1 Industry	..	..	..	..	16.85	6.63	16.13	6.51
1.2 Residential. Commercial	..	..	..	..	13.24	5.21	12.67	5.12
1.3 Transportation	..	..	..	..	13.30	5.24	15.26	6.16
1.4 Other Conservation	..	..	..	..	8.87	3.49	8.06	3.26
TOTAL CONSERVATION	**..**	**..**	**..**	**..**	**52.25**	**20.58**	**52.13**	**21.05**
2.1 Enhanced Oil & Gas	..	..	..	..	–	–	–	–
2.2 Refining. Transp. & Stor.	..	..	..	..	–	–	–	–
2.3 Oil Shale & Tar Sands	..	..	..	..	–	–	–	–
2.4 Other Oil & Gas	..	..	..	..	–	–	–	–
Total Oil & Gas	..	..	..	..	–	–	–	–
3.1 Coal Prod. Prep. & Trans.	..	..	..	..	–	–	–	–
3.2 Coal Combustion	..	..	..	..	–	–	–	–
3.3 Coal Conversion	..	..	..	..	–	–	–	–
3.4 Other Coal	..	..	..	..	–	–	–	–
Total Coal	..	..	..	..	–	–	–	–
TOTAL FOSSIL FUELS	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
4.1 Solar Heating & Cooling	..	..	..	..	–	–	–	–
4.2 Solar Photo-Electric	..	..	..	..	23.41	9.22	20.16	8.14
4.3 Solar Thermal-Electric	..	..	..	..	–	–	–	–
Total Solar	..	..	..	..	23.41	9.22	20.16	8.14
5. Wind	..	..	..	..	6.32	2.49	6.05	2.44
6. Ocean	..	..	..	..	–	–	–	–
7. Biomass	..	..	..	..	7.80	3.07	8.81	3.56
8. Geothermal	..	..	..	..	–	–	–	–
9.1 Large Hydro (>10 MW)	..	..	..	..	–	–	–	–
9.2 Small Hydro (<10 MW)	..	..	..	..	–	–	–	–
Total Hydro	..	..	..	..	–	–	–	–
TOTAL RENEWABLE ENERGY	**..**	**..**	**..**	**..**	**37.53**	**14.78**	**35.02**	**14.14**
10.1 Nuclear LWR	..	..	..	..	11.82	4.66	8.64	3.49
10.2 Other Converter Reactors	..	..	..	..	–	–	–	–
10.3 Nuclear Fuel Cycle	..	..	..	..	17.73	6.98	17.28	6.98
10.4 Nuclear Supporting Tech.	..	..	..	..	8.87	3.49	8.64	3.49
10.5 Nuclear Breeder	..	..	..	..	–	–	–	–
Total Nuclear Fission	..	..	..	..	38.42	15.13	34.56	13.95
11. Nuclear Fusion	..	..	..	..	76.84	30.26	73.73	29.77
TOTAL NUCLEAR	**..**	**..**	**..**	**..**	**115.26**	**45.39**	**108.29**	**43.72**
12.1 Electric Power Conversion	..	..	..	..	10.99	4.33	11.52	4.65
12.2 Electricity Transm. & Distr.	..	..	..	..	–	–	–	–
12.3 Energy Storage	..	..	..	..	4.43	1.75	4.61	1.86
TOTAL POWER & STORAGE	**..**	**..**	**..**	**..**	**15.43**	**6.08**	**16.13**	**6.51**
13.1 Energy Systems Analysis	..	..	..	..	9.81	3.86	10.37	4.19
13.2 Other Tech. or Research	..	..	..	..	23.64	9.31	25.75	10.40
TOTAL OTHER TECH./RESEARCH	**..**	**..**	**..**	**..**	**33.46**	**13.18**	**36.12**	**14.58**
TOTAL ENERGY R&D	**..**	**..**	**..**	**..**	**253.93**	**100.00**	**247.70**	**100.00**

1. Ireland has not provided data for 1997 and 1998.
2. Luxembourg has no energy R&D programme.
3. Netherlands has not provided data for 1998.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Japan				Luxembourg[2]				Netherlands[3]			
1997		1998		1997		1998		1997		1998	
$	%	$	%	$	%	$	%	$	%	$	%
159.64	4.74	117.86	3.71	–	–	–	–	34.68	23.04	..	..
39.21	1.16	42.41	1.34	–	–	–	–	9.15	6.08	..	..
41.65	1.24	17.60	0.55	–	–	–	–	9.92	6.59	..	..
15.22	0.45	109.93	3.46	–	–	–	–	3.19	2.12	..	..
255.72	**7.59**	**287.80**	**9.07**	**–**	**–**	**–**	**–**	**56.93**	**37.82**	**..**	**..**
3.83	0.11	3.76	0.12	–	–	–	–	3.70	2.46	..	..
113.27	3.36	101.94	3.21	–	–	–	–	2.83	1.88	..	..
–	–	–	–	–	–	–	–	–	–	..	..
5.23	0.16	4.87	0.15	–	–	–	–	2.26	1.50	..	..
122.33	3.63	110.57	3.48	–	–	–	–	8.79	5.84	..	..
14.65	0.43	19.53	0.62	–	–	–	–	–	–	..	..
55.11	1.64	50.34	1.59	–	–	–	–	0.31	0.20	..	..
103.21	3.06	94.09	2.97	–	–	–	–	1.95	1.30	..	..
0.15	0.00	3.26	0.10	–	–	–	–	0.82	0.55	..	..
173.12	5.14	167.22	5.27	–	–	–	–	3.08	2.05	..	..
295.45	**8.77**	**277.79**	**8.75**	**–**	**–**	**–**	**–**	**11.87**	**7.88**	**..**	**..**
2.19	0.07	1.32	0.04	–	–	–	–	0.46	0.31	..	..
60.73	1.80	62.17	1.96	–	–	–	–	16.85	11.19	..	..
–	–	–	–	–	–	–	–	–	–	..	..
62.92	1.87	63.49	2.00	–	–	–	–	17.31	11.50	..	..
4.27	0.13	3.64	0.11	–	–	–	–	7.24	4.81	..	..
1.44	0.04	8.72	0.27	–	–	–	–	–	–	..	..
4.51	0.13	4.43	0.14	–	–	–	–	5.29	3.52	..	..
28.42	0.84	25.00	0.79	–	–	–	–	0.15	0.10	..	..
–	–	–	–	–	–	–	–	–	–	..	..
–	–	–	–	–	–	–	–	–	–	..	..
–	–	–	–	–	–	–	–	–	–	..	..
101.56	**3.01**	**105.28**	**3.32**	**–**	**–**	**–**	**–**	**30.01**	**19.93**	**..**	**..**
155.14	4.60	143.85	4.53	–	–	–	–	5.19	3.45	..	..
138.52	4.11	49.94	1.57	–	–	–	–	0.87	0.58	..	..
829.77	24.63	771.47	24.31	–	–	–	–	2.16	1.43	..	..
870.00	25.82	919.10	28.96	–	–	–	–	3.75	2.49	..	..
251.02	7.45	214.60	6.76	–	–	–	–	–	–	..	..
2 244.45	66.62	2 098.95	66.15	–	–	–	–	11.97	7.95	..	..
289.24	8.59	232.30	7.32	–	–	–	–	7.81	5.19	..	..
2 533.70	**75.20**	**2 331.25**	**73.47**	**–**	**–**	**–**	**–**	**19.78**	**13.14**	**..**	**..**
17.20	0.51	10.89	0.34	–	–	–	–	11.41	7.58	..	..
23.54	0.70	20.89	0.66	–	–	–	–	4.16	2.76	..	..
28.85	0.86	32.62	1.03	–	–	–	–	0.26	0.17	..	..
69.59	**2.07**	**64.41**	**2.03**	**–**	**–**	**–**	**–**	**15.82**	**10.51**	**..**	**..**
13.86	0.41	13.55	0.43	–	–	–	–	7.76	5.15	..	..
99.30	2.95	93.09	2.93	–	–	–	–	8.37	5.56	..	..
113.16	**3.36**	**106.65**	**3.36**	**–**	**–**	**–**	**–**	**16.13**	**10.72**	**..**	**..**
3 369.18	**100.00**	**3 173.18**	**100.00**	**–**	**–**	**–**	**–**	**150.54**	**100.00**	**..**	**..**

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 1997 and 1998

(US$ million at 1998 prices and exchange rates)

	New Zealand				Norway			
	1997		1998		1997		1998	
	$	%	$	%	$	%	$	%
1.1 Industry	0.07	2.54	0.07	2.34	0.72	1.95	0.30	0.83
1.2 Residential. Commercial	0.09	3.29	0.09	3.03	0.26	0.71	1.13	3.06
1.3 Transportation	–	–	–	–	–	–	–	–
1.4 Other Conservation	0.29	10.39	0.34	11.38	0.52	1.42	–	–
TOTAL CONSERVATION	**0.45**	**16.22**	**0.50**	**16.75**	**1.50**	**4.08**	**1.43**	**3.89**
2.1 Enhanced Oil & Gas	0.52	18.78	0.56	18.85	7.59	20.58	5.74	15.61
2.2 Refining. Transp. & Stor.	–	–	–	–	1.31	3.55	1.33	3.60
2.3 Oil Shale & Tar Sands	–	–	–	–	1.27	3.44	0.90	2.45
2.4 Other Oil & Gas	–	–	–	–	7.60	20.62	9.15	24.87
Total Oil & Gas	0.52	18.78	0.56	18.85	17.76	48.19	17.11	46.54
3.1 Coal Prod. Prep. & Trans.	0.10	3.52	0.10	3.25	–	–	–	–
3.2 Coal Combustion	0.25	9.27	0.27	9.00	–	–	–	–
3.3 Coal Conversion	–	–	–	–	–	–	–	–
3.4 Other Coal	–	–	–	–	–	–	–	–
Total Coal	0.35	12.79	0.36	12.25	–	–	–	–
TOTAL FOSSIL FUELS	**0.87**	**31.57**	**0.92**	**31.09**	**17.76**	**48.19**	**17.11**	**46.54**
4.1 Solar Heating & Cooling	–	–	–	–	0.39	1.06	0.60	1.62
4.2 Solar Photo-Electric	0.28	10.37	0.31	10.37	0.39	1.06	0.41	1.12
4.3 Solar Thermal-Electric	–	–	–	–	–	–	–	–
Total Solar	0.28	10.37	0.31	10.37	0.78	2.13	1.01	2.74
5. Wind	0.13	4.81	0.12	4.04	0.52	1.42	0.32	0.87
6. Ocean	–	–	–	–	0.07	0.18	0.46	1.26
7. Biomass	0.05	1.96	0.08	2.71	0.92	2.48	0.81	2.20
8. Geothermal	0.73	26.64	0.76	25.46	–	–	0.17	0.47
9.1 Large Hydro (>10 MW)	–	–	0.05	1.80	1.70	4.61	1.95	5.30
9.2 Small Hydro (<10 MW)	–	–	–	–	–	–	–	–
Total Hydro	–	–	0.05	1.80	1.70	4.61	1.95	5.30
TOTAL RENEWABLE ENERGY	**1.20**	**43.78**	**1.32**	**44.38**	**3.99**	**10.82**	**4.72**	**12.83**
10.1 Nuclear LWR	–	–	–	–	–	–	–	–
10.2 Other Converter Reactors	–	–	–	–	–	–	–	–
10.3 Nuclear Fuel Cycle	–	–	–	–	1.57	4.26	1.99	5.41
10.4 Nuclear Supporting Tech.	–	–	–	–	5.23	14.19	5.70	15.50
10.5 Nuclear Breeder	–	–	–	–	–	–	–	–
Total Nuclear Fission	–	–	–	–	6.80	18.45	7.69	20.91
11. Nuclear Fusion	–	–	–	–	–	–	–	–
TOTAL NUCLEAR	**–**	**–**	**–**	**–**	**6.80**	**18.45**	**7.69**	**20.91**
12.1 Electric Power Conversion	0.07	2.46	0.07	2.27	–	–	–	–
12.2 Electricity Transm. & Distr.	0.16	5.97	0.16	5.50	2.22	6.03	2.01	5.48
12.3 Energy Storage	–	–	–	–	–	–	–	–
TOTAL POWER & STORAGE	**0.23**	**8.43**	**0.23**	**7.77**	**2.22**	**6.03**	**2.01**	**5.48**
13.1 Energy Systems Analysis	–	–	–	–	1.18	3.19	1.39	3.79
13.2 Other Tech. or Research	–	–	–	–	3.40	9.23	2.41	6.56
TOTAL OTHER TECH./RESEARCH	**–**	**–**	**–**	**–**	**4.58**	**12.42**	**3.80**	**10.35**
TOTAL ENERGY R&D	**2.75**	**100.00**	**2.97**	**100.00**	**36.86**	**100.00**	**36.77**	**100.00**

1. Portugal has not provided data for 1998.
2. Sweden has not provided data for 1998.

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

Portugal[1]				Spain				Sweden[2]			
1997		1998		1997		1998		1997		1998	
$	%	$	%	$	%	$	%	$	%	$	%
0.46	34.57	..	..	1.75	2.54	2.01	3.06	5.05	8.50	..	..
0.03	2.29	..	..	1.20	1.74	1.00	1.53	3.55	5.97	..	..
0.11	8.16	..	..	0.74	1.07	0.60	0.92	8.57	14.41	..	..
0.02	1.40	..	..	–	–	–	–	1.45	2.44	..	..
0.62	**46.42**	**..**	**..**	**3.69**	**5.35**	**3.61**	**5.52**	**18.62**	**31.33**	**..**	**..**
0.06	4.61	..	..	–	–	–	–	–	–	..	..
0.01	0.47	..	..	–	–	–	–	–	–	..	..
–	–	..	..	–	–	–	–	–	–	..	..
–	–	..	..	–	–	–	–	–	–	..	..
0.07	5.08	..	..	–	–	–	–	–	–	..	..
–	–	..	..	0.98	1.41	0.90	1.38	–	–	..	..
–	–	..	..	1.75	2.53	1.94	2.96	–	–	..	..
–	–	..	..	1.24	1.79	0.67	1.02	–	–	..	..
–	–	..	..	–	–	–	–	0.11	0.19	..	..
–	–	..	..	3.96	5.74	3.51	5.36	0.11	0.19	..	..
0.07	**5.08**	**..**	**..**	**3.96**	**5.74**	**3.51**	**5.36**	**0.11**	**0.19**	**..**	**..**
0.09	6.85	..	..	1.61	2.33	1.67	2.55	1.39	2.33	..	..
0.04	2.61	..	..	2.24	3.25	2.34	3.58	0.45	0.75	..	..
–	–	..	..	5.68	8.23	5.69	8.68	–	–	..	..
0.13	9.46	..	..	9.52	13.81	9.71	14.81	1.83	3.08	..	..
–	–	..	..	1.67	2.42	1.34	2.04	1.53	2.57	..	..
0.26	19.37	..	..	–	–	–	–	–	–	..	..
0.08	5.69	..	..	3.35	4.85	3.01	4.60	5.37	9.04	..	..
0.02	1.77	..	..	–	–	–	–	–	–	..	..
0.07	5.31	..	..	–	–	–	–	–	–	..	..
–	–	..	..	–	–	–	–	0.05	0.09	..	..
0.07	5.31	..	..	–	–	–	–	0.05	0.09	..	..
0.56	**41.60**	**..**	**..**	**14.54**	**21.08**	**14.06**	**21.45**	**8.78**	**14.78**	**..**	**..**
–	–	..	..	–	–	–	–	–	–	..	..
–	–	..	..	–	–	–	–	–	–	..	..
–	–	..	..	–	–	–	–	1.09	1.84	..	..
0.07	5.44	..	..	17.04	24.71	16.06	24.51	–	–	..	..
–	–	..	..	–	–	–	–	3.30	5.55	..	..
0.07	5.44	..	..	17.04	24.71	16.06	24.51	4.39	7.39	..	..
–	–	..	..	15.92	23.07	14.73	22.47	1.40	2.36	..	..
0.07	**5.44**	**..**	**..**	**32.96**	**47.78**	**30.79**	**46.99**	**5.79**	**9.74**	**..**	**..**
–	–	..	..	0.34	0.50	0.33	0.51	9.04	15.20	..	..
0.01	0.72	..	..	–	–	–	–	2.01	3.38	..	..
–	–	..	..	–	–	–	–	–	–	..	..
0.01	**0.72**	**..**	**..**	**0.34**	**0.50**	**0.33**	**0.51**	**11.05**	**18.59**	**..**	**..**
0.01	0.47	..	..	0.43	0.62	0.40	0.61	1.48	2.48	..	..
0.00	0.28	..	..	13.06	18.93	12.82	19.56	13.61	22.89	..	..
0.01	**0.75**	**..**	**..**	**13.48**	**19.55**	**13.22**	**20.17**	**15.08**	**25.37**	**..**	**..**
1.34	**100.00**	**..**	**..**	**68.98**	**100.00**	**65.53**	**100.00**	**59.44**	**100.00**	**..**	**..**

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 1997 and 1998

(US$ million at 1998 prices and exchange rates)

	Switzerland[1]				Turkey			
	1997		1998		1997		1998	
	$	%	$	%	$	%	$	%
1.1 Industry	2.85	2.08	..	..	0.04	0.37	0.07	0.57
1.2 Residential. Commercial	4.59	3.35	..	..	0.03	0.25	0.06	0.44
1.3 Transportation	8.69	6.35	..	..	–	–	–	–
1.4 Other Conservation	4.73	3.45	..	..	–	–	–	–
TOTAL CONSERVATION	**20.85**	**15.24**	**..**	**..**	**0.07**	**0.62**	**0.13**	**1.01**
2.1 Enhanced Oil & Gas	–	–	..	..	0.12	1.03	0.05	0.40
2.2 Refining, Transp. & Stor.	–	–	..	..	0.99	8.70	0.50	3.86
2.3 Oil Shale & Tar Sands	–	–	..	..	–	–	–	–
2.4 Other Oil & Gas	9.66	7.06	..	..	3.15	27.72	3.08	23.72
Total Oil & Gas	9.66	7.06	..	..	4.25	37.45	3.63	27.98
3.1 Coal Prod. Prep. & Trans.	–	–	..	..	0.24	2.09	0.69	5.28
3.2 Coal Combustion	–	–	..	..	1.84	16.16	3.46	26.60
3.3 Coal Conversion	–	–	..	..	–	–	–	–
3.4 Other Coal	–	–	..	..	1.28	11.27	2.93	22.58
Total Coal	–	–	..	..	3.35	29.52	7.07	54.46
TOTAL FOSSIL FUELS	**9.66**	**7.06**	**..**	**..**	**7.61**	**66.97**	**10.71**	**82.43**
4.1 Solar Heating & Cooling	6.81	4.98	..	..	0.08	0.72	0.04	0.28
4.2 Solar Photo-Electric	10.77	7.87	..	..	1.43	12.61	0.18	1.37
4.3 Solar Thermal-Electric	5.70	4.16	..	..	0.02	0.14	0.02	0.12
Total Solar	23.28	17.01	..	..	1.53	13.47	0.23	1.77
5. Wind	1.11	0.81	..	..	0.01	0.12	0.02	0.18
6. Ocean	–	–	..	..	–	–	–	–
7. Biomass	6.46	4.72	..	..	0.03	0.29	0.01	0.07
8. Geothermal	2.43	1.78	..	..	0.53	4.67	0.38	2.96
9.1 Large Hydro (>10 MW)	2.71	1.98	..	..	–	–	–	–
9.2 Small Hydro (<10 MW)	1.25	0.91	..	..	–	–	–	–
Total Hydro	3.96	2.89	..	..	–	–	–	–
TOTAL RENEWABLE ENERGY	**37.32**	**27.27**	**..**	**..**	**2.11**	**18.56**	**0.65**	**4.97**
10.1 Nuclear LWR	3.41	2.49	..	..	–	–	–	–
10.2 Other Converter Reactors	0.21	0.15	..	..	0.08	0.70	0.10	0.78
10.3 Nuclear Fuel Cycle	5.42	3.96	..	..	0.59	5.15	0.49	3.75
10.4 Nuclear Supporting Tech.	11.89	8.68	..	..	0.59	5.21	0.63	4.83
10.5 Nuclear Breeder	0.35	0.25	..	..	–	–	–	–
Total Nuclear Fission	21.27	15.54	..	..	1.26	11.07	1.22	9.36
11. Nuclear Fusion	21.27	15.54	..	..	–	–	–	–
TOTAL NUCLEAR	**42.61**	**31.13**	**..**	**..**	**1.26**	**11.07**	**1.22**	**9.36**
12.1 Electric Power Conversion	4.31	3.15	..	..	0.14	1.26	0.08	0.61
12.2 Electricity Transm.. & Distr.	4.03	2.95	..	..	–	–	0.06	0.47
12.3 Energy Storage	7.37	5.38	..	..	0.01	0.06	0.04	0.30
TOTAL POWER & STORAGE	**15.71**	**11.48**	**..**	**..**	**0.15**	**1.32**	**0.18**	**1.37**
13.1 Energy Systems Analysis	9.24	6.75	..	..	–	–	–	–
13.2 Other Tech. or Research	1.53	1.12	..	..	0.17	1.46	0.11	0.85
TOTAL OTHER TECH./RESEARCH	**10.77**	**7.87**	**..**	**..**	**0.17**	**1.46**	**0.11**	**0.85**
TOTAL ENERGY R&D	**136.85**	**100.00**	**..**	**..**	**11.36**	**100.00**	**12.99**	**100.00**

1. Switzerland has not provided data for 1998.

2. Because of missing data for Australia, Belgium, Finland, Greece, Hungary, Ireland, the Netherlands, Portugal, Sweden and Switzerland,

Sources: *OECD Economic Outlook*, OECD Paris, 1998, and country submissions.

United Kingdom				United States				Total Reported[2]			
1997		1998		1997		1998		1997		1998	
$	%	$	%	$	%	$	%	$	%	$	%
0.90	1.08	0.98	1.33	116.56	5.87	133.91	6.61	391.97	5.22	..	..
0.61	0.73	0.20	0.27	100.84	5.08	97.41	4.81	211.55	2.81	..	..
0.20	0.24	0.43	0.59	174.16	8.77	189.97	9.38	281.59	3.75	..	..
–	–	–	–	–	–	–	–	53.12	0.71	..	..
1.71	**2.05**	**1.61**	**2.18**	**391.56**	**19.72**	**421.29**	**20.81**	**938.23**	**12.48**	**..**	**..**
4.63	5.56	3.92	5.34	48.81	2.46	49.62	2.45	90.87	1.21	..	..
–	–	–	–	12.08	0.61	14.12	0.70	140.23	1.87	..	..
–	–	–	–	–	–	–	–	24.18	0.32	..	..
2.84	3.41	1.66	2.25	8.00	0.40	9.41	0.46	115.23	1.53	..	..
7.48	8.97	5.58	7.59	68.88	3.47	73.14	3.61	370.50	4.93	..	..
0.20	0.24	0.28	0.38	5.07	0.26	4.99	0.25	33.74	0.45	..	..
3.04	3.65	1.80	2.45	67.23	3.39	68.04	3.36	140.65	1.87	..	..
0.24	0.28	0.15	0.20	4.69	0.24	9.83	0.49	115.20	1.53	..	..
0.63	0.75	1.19	1.62	20.44	1.03	21.53	1.06	31.49	0.42	..	..
4.11	4.93	3.43	4.66	97.43	4.91	104.38	5.16	321.09	4.27	..	..
11.59	**13.89**	**9.01**	**12.25**	**166.31**	**8.38**	**177.52**	**8.77**	**691.58**	**9.20**	**..**	**..**
1.79	2.15	1.29	1.76	2.30	0.12	2.63	0.13	33.66	0.45	..	..
0.88	1.05	0.63	0.86	59.79	3.01	66.97	3.31	213.42	2.84	..	..
0.08	0.10	0.07	0.09	22.14	1.12	16.32	0.81	42.87	0.57	..	..
2.76	3.31	1.99	2.70	84.23	4.24	85.91	4.24	289.95	3.86	..	..
2.03	2.43	1.82	2.48	28.93	1.46	32.42	1.60	93.04	1.24	..	..
–	–	–	–	–	–	–	–	2.07	0.03	..	..
2.37	2.84	1.99	2.70	54.86	2.76	96.95	4.79	124.66	1.66	..	..
–	–	–	–	29.92	1.51	28.69	1.42	67.33	0.90	..	..
–	–	–	–	0.98	0.05	0.73	0.04	6.81	0.09	..	..
0.10	0.12	0.25	0.34	–	–	–	–	3.44	0.05	..	..
0.10	0.12	0.25	0.34	0.98	0.05	0.73	0.04	10.25	0.14	..	..
7.26	**8.70**	**6.04**	**8.22**	**198.93**	**10.02**	**244.70**	**12.09**	**587.36**	**7.81**	**..**	**..**
–	–	–	–	37.36	1.88	–	–	373.97	4.98	..	..
–	–	–	–	–	–	–	–	211.81	2.82	..	..
–	–	–	–	–	–	–	–	1 100.72	14.65	..	..
1.69	2.03	3.31	4.50	19.67	0.99	20.00	0.99	1 082.86	14.41	..	..
–	–	–	–	–	–	–	–	267.13	3.55	..	..
1.69	2.03	3.31	4.50	57.02	2.87	20.00	0.99	3 036.49	40.40	..	..
28.76	34.48	21.52	29.28	221.61	11.16	217.29	10.73	830.88	11.05	..	..
30.45	**36.51**	**24.83**	**33.78**	**278.64**	**14.04**	**237.29**	**11.72**	**3 867.44**	**51.46**	**..**	**..**
1.52	1.83	1.82	2.48	95.17	4.79	83.03	4.10	187.53	2.50	..	..
0.34	0.41	0.33	0.45	27.69	1.40	39.42	1.95	77.62	1.03	..	..
–	–	–	–	3.99	0.20	3.84	0.19	52.03	0.69	..	..
1.86	**2.23**	**2.15**	**2.93**	**126.85**	**6.39**	**126.29**	**6.24**	**317.18**	**4.22**	**..**	**..**
0.95	1.14	0.93	1.26	–	–	–	–	62.23	0.83	..	..
29.58	35.48	28.94	39.37	822.80	41.45	817.50	40.38	1 051.92	14.00	..	..
30.53	**36.61**	**29.87**	**40.63**	**822.80**	**41.45**	**817.50**	**40.38**	**1 114.14**	**14.82**	**..**	**..**
83.39	**100.00**	**73.51**	**100.00**	**1 985.09**	**100.00**	**2 024.60**	**100.00**	**7 515.87**	**100.00**	**..**	**..**

the total reported has not been calculated for 1998.

C

ANNEX

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

Member countries of the IEA* seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1 **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2 Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3 **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays principle.

4 **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil

* Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

sources is also a priority. A number of IEA Members wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5 **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6 Continued **research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-Member countries, should be encouraged.

7 **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8 **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9 **Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris)

D

ANNEX

MEASUREMENT OF FINANCIAL SUPPORT FOR COAL PRODUCTION USING A PRODUCER SUBSIDY EQUIVALENT CALCULATION

Introduction

This annex describes the Producer Subsidy Equivalent (PSE) calculation and provides an interpretation of its application to forms of financial support for coal production. The purpose of the PSE is to provide a single measure of the financial support provided by a variety of components so that the extent of support between countries and the movement over time can be considered. The aim has been to include in the PSE all items of support provided to the current domestic production of coal that the industry itself would normally be expected to cover in a competitive situation. These include not only direct state payments but also the value of protection provided by import constraints and the practical effects of special sales agreements.

PSEs and their Interpretation

A PSE defines the monetary payment to domestic producers equivalent to the total value of existing support provided at current levels of production, consumption and trade, and hence world prices. Put in another way, it is the payment that would just keep all domestic production competitive with imports at existing levels of coal output, current producer incomes and import prices. It thus evaluates the support system that maintains domestic production and imports at their current levels. Clearly, if all support systems for high-cost coal production in all countries were withdrawn at once, world coal import requirements would likely rise, and with them coal import prices in the short term. In the resulting equilibrium situation, with no systems of support remaining, the PSE would be zero. However, the PSE in a given year does not presuppose some different level of imports, it only evaluates the system of support that is maintaining the existing situation.

It is important to keep in mind this aspect of the PSE as a static measure when interpreting the results of the calculations. In the 1987 review of *Coal Prospects and Policies in IEA Countries,* for example, it is argued that the coal prices that prevailed in the international markets of 1987 are not sustainable in the longer run in the sense that at these prices coal exporters would not be willing to invest in significant additional production facilities because they would be unable to earn an adequate rate of return on the capital involved. Similarly, appraisal analyses for investment, disinvestment or policy change decisions would need to take account of expected future prices. In the medium to longer term it would be prudent to assume that future prices will be close to sustainable levels when additional production capacity will be needed to meet growing coal demand. However, the PSE methodology does not anticipate situations in

the future; for each particular year it uses data from that year only; it does not use data relating to some other year, a trend year or an optimal situation.

The PSE method is purely descriptive. It merely provides a measure that can be used as an aid evaluating the support systems for domestic coal production that maintain the current situation in terms of the levels of domestic production, trade and world prices. The PSE does not provide a useful basis for making decisions on mine closures or coal purchase contracts. Nor is it a measure of savings that could be realised immediately if protected production were closed down.

The PSE does provide, however, a useful but limited indication of the scale of support to indigenous coal production and the differences between countries in this respect. No alternative measure is available for these purposes. The PSE is not a prescriptive tool; it cannot be used to explain why a support system exists nor can it suggest how, how much or how fast a support system should be changed. It takes no account of the social, regional and unemployment problems experienced to date, or likely to arise in the future, from actions to reduce protection or of the costs of dealing with those problems. It does not reflect changes in policy taken now to reduce support in the future and it does not distinguish between temporary support to pave the way to a viable coal industry and long-term support with no such prospect. It takes no account of emerging trends of domestic coal production and the increasing importance of imported coal. It takes no account of any price distortions arising from supportive financial measures, royalties or taxes in coal exporting countries. Above all, the PSE measure, as calculated in the tables, is not precise.

The General Method

In the tables given in the individual country reviews, the total PSE for each country examined is obtained by adding together the relevant net budgetary payments to producers and the calculated value of the indirect measures, as described below. The aim is to include in the PSE the total value of those forms of protection provided to the domestic coal industry that the industry itself would normally be expected to cover in a competitive situation.

Support for production normally takes two forms: direct (or budgetary) assistance and price support. Many direct monetary payments to producers, such as government deficit payments, clearly help to maintain current domestic production and are therefore included in the calculation of the PSE. Other direct payments are designed to speed contraction of the industry, or are otherwise unrelated to current production, and are therefore excluded from the PSE.

Price support is typically provided in one of two main ways:

- by government-imposed limitations on coal imports;
- as the result of some long-term agreements between coal producers and large coal consumers (usually electric utilities), arranged directly and on a bilateral basis or involving government in tripartite agreements.

The details of these latter arrangements are frequently complex and specified in statutes or private contracts. Many of the arrangements are of long standing, though they may have been modified over the years. Published information is limited and sometimes unavailable when confidential, commercial contracts are involved.

There is scope for argument about whether specific long-term arrangements between coal producers and major consumers, particularly electricity generating utilities, constitute support when they are not underpinned by government measures such as restrictions on coal imports. The issue turns on the extent to which:

- the utility in question entered into these arrangements because it considered that to fulfil its own obligations to maintain electricity supplies, it needed an assured long-term local source of coal supply, or

- it entered into the arrangement for reasons of national policy.

Whatever the answer to this question in a specific case, the practical effect of the arrangement on coal imports and prices in either case is the same as if there were protection for indigenous coal production. For the purposes of this study, all such arrangements have been included in the calculations of PSEs for the countries concerned.

Selection of an appropriate reference price, against which the domestic price is to be compared, is clearly critical to an accurate measurement of the level of support provided through high prices. Ideally, the two sets of prices should compare like with like – that is, they should relate to commodities of similar quality and conditions of exchange (e.g. contract lengths). With coal, as with many commodities, however, it is often the case that none of the available reference price series perfectly fits this ideal, and so the result must inevitably be approximate.

Because price information is not usually available for individual transactions, both the domestic and the reference prices have been calculated for an average or typical consumer. Where possible, however, the difference between the actual price received by domestic consumers and the reference price has been calculated for comparable coal qualities and for similar lengths of contract. Differences in thermal quality between domestic and imported steam coals have been adjusted by expressing prices (and quantities) in thermal-equivalent terms. When comparing coking coal, other properties, such as coke strength, have been taken into account. Inevitably, such adjustments mean that individual prices are specified separately for each country. This causes no great conceptual problems as long as the general principles are applied consistently in each case.

For purposes of comparison, the total PSE for each country has been divided in each year by the affected production, to yield an average PSE per tonne produced. Such a calculation undoubtedly conceals any dispersion there may be in support for production within individual countries. Thus, some mines may require more support than the average and some less, perhaps none at all.

E

ANNEX

COMMUNIQUE
INTERNATIONAL ENERGY AGENCY
Meeting of the Governing Board at Ministerial Level
24-25 May 1999

A QUARTER CENTURY OF ENERGY SECURITY

The International Energy Agency was founded in 1974 in response to the first "oil shock". Meeting on the Agency's 25th anniversary, Ministers reviewed the profound changes and challenges in the global energy system since that time. While the threat of a deliberate disruption of oil supplies has faded, other threats persist, from natural disaster, technological breakdown and political turmoil. *There is still no room for complacency*. Since 1974, discovery of new oil and gas reserves has bolstered supply, lowered prices and swelled the ranks of producing nations. Deregulation and privatisation have fostered freer and more transparent energy markets, increased efficiency through competition and provided many consumers the ability to choose their suppliers. Concern about how the production and use of energy can harm the environment – and the global climate – has risen to the top of the energy agenda in many countries. And, as a result of shifting economic patterns, almost half the world's energy is consumed outside the OECD.

The IEA has responded to all these changes. Along with emergency preparedness, based largely on oil stockpiling, the Agency now recognises liberalised markets and environmental sustainability as critical to long-term energy security. The Agency increasingly engages on energy matters with non-Member countries, including oil producers.

Ministers expressed confidence that collective efforts conducted through the Agency will continue to ensure energy security while responding flexibly to the challenges of the next century. Ministers reaffirmed their commitment to the IEA's Shared Goals. They recognised the continuing importance of the Agency's analytical work and convening power as vital resources in achieving the "3 E's": Energy security, Economic growth and Environmental protection.

ENERGY SECURITY FOR A NEW MILLENNIUM

Ministers stressed that maintaining energy security remains the Agency's core mission, as it has been since 1974. They pledged to remain vigilant to all threats to energy security, including those arising from political instability or unusual occurrences. They

expressed concern about potential Year 2000 "Millennium Bug" computer problems which could undermine energy security and welcomed the Agency's efforts to contribute to their resolution. Ministers noted that, as energy markets have become global, energy security must now be pursued globally; they asked the Agency to continue sharing as widely as possible its experience in energy policy and security with key Asian and other non-Member countries.

Ministers acknowledged that lower oil prices produce economic benefits but cautioned that sustained low prices could induce unwarranted complacency about energy security. They could discourage investment in conventional energy sources. They could slow development of and investment in new, more efficient and cleaner energy technologies, including those based on renewable energy sources.

CLEANER ENERGY FOR A BETTER WORLD

Ministers agreed that reducing energy-related carbon emissions into the world's atmosphere is one of their most urgent challenges. They restated the commitments made in the 1997 Kyoto Protocol, including the promise to achieve demonstrable progress by the year 2005. They pointed out that it is vital to use energy efficiently and to promote the use of less carbon-intensive energy technologies and sources. They urged continued efforts to find cost-effective approaches, which help lower carbon emissions, without reducing energy services. To this end, Ministers stated that effective domestic policies and measures will be needed. These include voluntary commitments by industry, environmental standards, regulations, and economic instruments, e.g., energy taxes and incentives, whose details will vary, depending on national circumstances.

Ministers acknowledged that meeting the Kyoto commitments offers a substantial economic and political challenge. They stated that, along with domestic measures, the "flexible mechanisms" in the Protocol – emissions trading, joint implementation and the Clean Development Mechanism – will be needed to meet the commitments cost-effectively, and they called on Member countries to demonstrate leadership in both areas. The challenge for all countries is to create a less carbon-intensive future, while encouraging vigorous economic growth. Environmental concerns are an urgent priority, especially when long-lived capital stock is built or modernised.

Ministers recognised the importance of controlling greenhouse gas emissions beyond the 2008-to-2012 fulfilment period set by the Protocol and of developing appropriate long-term policies and measures to that end. They underlined the vital role of long-term technology research and development in this context. They affirmed the importance of co-operative efforts under IEA Implementing Agreements in developing and deploying a new generation of sustainable energy technologies. Ministers emphasised the need to mobilise public and private resources to deploy environmentally sound technologies globally and to implement long-term emission reductions.

Ministers welcomed the Secretariat's comprehensive analytical work, including its *World Energy Outlook* and its "energy indicators" project, which explores the links

between human activity, economic growth and carbon emissions. They **asked** the Secretariat to continue assessing the full range of energy issues and choices, including renewable energy and nuclear power, and the implications of an emerging market value for carbon.

HARNESSING THE POWER OF MARKETS

Ministers emphasised that free and competitive energy markets, appropriately regulated, together with liberalised international trade and investment provide an essential foundation for sustained economic growth. At the same time, Ministers noted the challenge involved in designing policies fully compatible with free markets to achieve goals that may not be attained by markets alone, such as energy security and environmental sustainability. Ministers directed the Secretariat to continue developing concrete analyses of such policies. They instructed the Secretariat to work with the energy industry to find long-term solutions to these challenges.

GLOBAL APPROACHES: THE KEY TO SUCCESS IN THE THIRD MILLENNIUM

Ministers agreed that developing countries will play a critical role in the evolution of energy markets in the new century, as their rapid economic growth increases their energy consumption. They further agreed that the IEA should promote the objectives of the Agency by widening and deepening its relations with major non-Member countries, in some cases by bringing them into IEA membership, in others by regularly sharing with them the IEA's expertise and analytical insight.

Ministers welcomed the reaffirmation of the Czech Republic's candidacy for full IEA membership and its accelerated progress towards that goal, as well as the sustained efforts by Korea, Poland and the Slovak Republic to meet the conditions for membership.

F

ANNEX

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and abbreviated subsequently, this glossary provides a quick and central reference for many of the abbreviations used.

bcm	billion cubic metres.
b/d	barrels per day.
cal	calorie.
CERT	Committee on Energy Research and Technology of the IEA.
CFCs	chlorofluorocarbons.
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term "co-generation" is used.
ECU	European Currency Unit.
EU	The European Union, whose members are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
EFTA	Europe Free Trade Association: Iceland, Norway, Switzerland and Liechtenstein.
FCCC	Framework Convention on Climate Change.
GDP	gross domestic product.
GJ	gigajoule, or 1 joule $\times 10^9$.
GW	gigawatt, or 1 watt $\times 10^9$.
IEA	International Energy Agency whose Members are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.
J	joule; a joule is the work done when the point of application of a force of one newton is displaced through a distance of one metre in the direction of the force (a newton is defined as the force needed to accelerate a kilogram by one metre per second). In electrical units, it is the energy dissipated by one watt in a second.

ktoe	thousand tonnes of oil equivalent.
LDC	local distribution company.
LNG	liquefied natural gas.
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature.
mcm	million cubic metres.
Mt	million tonnes.
Mtce	millions tonnes of coal equivalent.
Mtoe	millions tonnes of oil equivalent; see toe.
MW	megawatt of electricity, or 1 Watt $\times 10^6$.
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$.
NEA	the Nuclear Energy Agency of the OECD.
OECD	Organisation for Economic Co-operation and Development.
ppm	parts per million.
PPP	Purchasing power parity: the rate of currency conversion that equalises the purchasing power of different currencies, i.e. estimates the differences in price levels between different countries.
PSE	Producer Subsidy Equivalent.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
SB	Single Buyer
SLT	Standing Group on Long-Term Co-operation of the IEA.
tce	tonne of coal equivalent.
TFC	total final consumption of energy; the difference between TPES and TFC consists of net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses.
toe	tonne of oil equivalent, defined as 10^7 kcal.
TPA	third party access
TPES	total primary energy supply.
TW	terawatt, or 1 watt $\times 10^{12}$.
TWh	terawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^{12}$.
..	not available.
–	nil.
x	not applicable.

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ANNEX

FOOTNOTES TO ENERGY BALANCES AND KEY STATISTICAL DATA

[1] Includes lignite and peat, except for Finland, Ireland and Sweden. In these three cases, peat is shown separately.

[2] Comprises solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.

[3] Other includes tide, wave and ambient heat used in heat pumps.

[4] Total net imports include combustible renewables and waste.

[5] Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.

[6] Includes non-energy use.

[7] Includes less than 1% non-oil fuels.

[8] Includes residential, commercial, public service and agricultural sectors.

[9] Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.

[10] Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.

[11] Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.

[12] Toe per thousand US dollars at 1990 prices and exchange rates.

[13] Toe per person.

[14] "Energy-related CO_2 emissions" specifically means CO_2 from the combustion of the fossil fuel components of TPES (i.e. coal and coal products, peat, crude oil and derived products and natural gas), while CO_2 emissions from the remaining components of TPES (i.e. electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the IPCC greenhouse gas inventory methodology. TPES, by definition, excludes international marine bunkers. INC-IX decided in February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. CO_2 emissions from bunkers are those quantities of fuels delivered for international *marine* bunkers and the emissions arising from their use. Data for deliveries of fuel to international *aviation* bunkers are not generally available to the IEA and as a result, these emissions have not been deducted from the national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 1997 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.