INTERNATIONAL ENERGY AGENCY

ENERGY POLICIES OF IEA COUNTRIES

2002 Review

OECD

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The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

It carries out a comprehensive programme of energy co-operation among twenty-six* of the OECD's thirty Member countries. The basic aims of the IEA are:

- to maintain and improve systems for coping with oil supply disruptions;
- to promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;
- to operate a permanent information system on the international oil market;
- to improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
- to assist in the integration of environmental and energy policies.

** IEA Member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States. The European Commission also takes part in the work of the IEA.*

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996), the Republic of Korea (12th December 1996) and Slovakia (28th September 2000). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

FOREWORD

Reviewing the energy policies of Member countries is a central activity of the International Energy Agency. Regular peer reviews have contributed substantially over the years to policy-making at the national level.

Each Member country is reviewed in depth every four years. This book contains summaries of reviews of Denmark, Germany, Greece, Korea, Norway, the United Kingdom and the United States, conducted from October 2001 to June 2002. Shorter standard reviews are also included covering six other Member countries: Canada, France, Luxembourg, the Netherlands, Portugal and Sweden.

An overview focuses on recent developments in the energy market and in energy policies. The subjects highlighted this year include energy security, the progress of Member countries in regulatory reform, their actions to meet the Kyoto greenhouse gas emission targets and their R&D policies as well as developments in major non-member countries. Key statistical information is also included.

Robert Priddle
Executive Director

ACKNOWLEDGEMENTS

Much of the information in this report is drawn from in-depth reviews conducted by representatives of IEA Member countries and members of the IEA Secretariat. The information contained in this publication is the best available as of July 2002 and is subject to change. The desk officer listed in each team was responsible for managing the review and was principal author of the report, which has also been published in a separate volume and appears in summary form here. The desk officers also wrote the shorter standard reviews included here.

Shigetaka Seki, the outgoing head of the Country Studies Division, and Jun Arima, its incoming head, supervised preparations for this book and wrote the Energy Market Trends section. Many members of the IEA staff contributed to this book. Major contributions came from Shigetaka Saki (energy security). Carlos Ocaña (electricity), Sylvie Cornot-Gandolphe (gas), John Cameron (coal), Jonathan Pershing (environment), Mitsuhide Hoshino (R&D), Laurent Dittrick (renewables), Xavier Chen (China), Pierre Audinet (India), Bret Jacobs (South-East Asia), Sylvie d'Apote (Latin America), Emmanuel Bergasse (central and south-eastern Europe), Isabelle Murray (Russia), Meredydd Evans (Ukraine and Baltics), Dunia Chalabi (Gas Grid Project in the Middle East). Karen Treanton and Pierpaolo Cazzola prepared the Key Statistics and Indicators, Monica Petit prepared the figures, and Marilyn Ferris provided administrative assistance for the project.

2001–2002 In-depth Reviews

Austria

At the time of publication this report is under preparation. The summary of conclusions and recommendations will be included in the 2003 edition.

Denmark

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Standard Reviews

Canada – Pierre Audinet; France – Gudrun Lammers; Luxembourg – Lea Gynther; Netherlands – Gudrun Lammers; Portugal – Lea Gynther; Sweden – Jonathan Coony.

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PART

OVERVIEW OF ENERGY POLICY AND MARKET DEVELOPMENTS

INTRODUCTION

Energy security has been actively discussed in the past two years. This renewed interest reflects various factors, among them higher and more volatile energy prices, growing geopolitical concerns in the Middle East, recognition of the importance of adequate market design learned from the lessons of California, and the implications of the terrorist attacks on 11 September 2001. Secure, sustainable and affordable energy supply remains a central objective of energy policies. Now discussions have to be deepened to examine how energy security can best be ensured in the context of liberalised markets and environmental constraints.

There have been important policy discussions in IEA countries, including debates on energy policies in the European Union (EU) countries, particularly after the publication of the Green Paper "Toward a European Strategy for the Security of Energy Supplies" in March 2001. Debates took place also in the US Congress followed by a paper on "National Energy Policy" published in May 2001. The Asia-Pacific Economie Co-operation (APEC) launched an energy security initiative that was endorsed by their leaders and ministers in November 2001. In the United Kingdom, a Performance and Innovation Unit of the Cabinet Office released a report in February 2002 which emphasises the international nature of both energy security and climate change issues; national debates are expected to follow on its recommendations. In their meeting in May 2002, G8 energy ministers confirmed their support for continued efforts to reduce oil price volatility and enhance security through increased reliance on market forces, diversification of energy supplies, increased efficiency of energy use, improved data and better communications. Later in that month, the Finnish parliament voted in favour of installing a new nuclear power plant, which is the first nuclear plant construction since the introduction of competition in the electricity market (the last nuclear power plant in OECD Europe was built in France and came into service in 1999).

After the terrorist attacks of 11 September, the IEA acted quickly to make an initial response plan to prepare for a potential disruption in the supply of oil. The oil market situation and political and economic developments were carefully monitored by the IEA committees. The implication of possible terrorist attacks on energy infrastructures was also studied.

Energy markets continued to be active, though showing changes over previous years. Oil prices fell in the second half of 2001, reflecting the economic slowdown and concerns about the possible adverse effects of the terrorist attacks on the world economy. In November 2001, the Organization of Petroleum Exporting Countries (OPEC) announced that it would cut its crude oil production by 1.5 million barrels per day effective as of 1 January 2002, in an effort to steady or raise world oil prices, but under the condition that non-OPEC producers would follow suit. Some non-OPEC producers, including Russia, agreed to cut production. Oil prices surged sharply in the first half of 2002 as a result of these production cuts and as the economy showed signs of recovery. Gas prices continued to fall since the sharp peak in the first quarter of 2001 as the 2001–2 winter turned out to be mild in all three OECD regions (Europe, North America, Pacific).

The electricity crisis in California was a reminder to the world that proper market design is essential for efficient, secure and sustainable energy supply. Though the Californian episode slowed down the process of market reform in some cases, there are many successful examples in other markets and there has been solid progress in market liberalisation in most countries. The bankruptcy of the Enron Corporation did not cause major problems in the energy markets. In spite of a decrease of monetary liquidity in energy markets, both trade and supply continued smoothly in all regions where Enron was active.

Electricity reforms have continued to make progress in OECD Europe, where there are plans for a new EU directive on electricity, and in many other OECD countries, but reform activity has been weak elsewhere, particularly in the United States as a consequence of the California power crisis of 2000–1. The decision by the EU Council in March 2002 to adopt a new EU electricity directive by a majority vote before the end of 2002 gave a new thrust for accelerating market reform. Under the directive, all non-household end-users will be given the choice of suppliers by the end of 2004 at the latest.

Reform of the natural gas sector is well under way in OECD countries and is spreading and deepening. It has already brought choice of suppliers and service providers to many customers, although in some countries only a few customers have made use of the option. Natural gas prices, however, do not necessarily drop as a result of market reform, since prices are established under long-term contracts and are still predominantly pegged to development in the prices of oil products. Tight market conditions, as seen in the United States between 2000 and 2001, generated a sharp spike in gas prices.

In recent years, climate change has played an increasingly important role in both national and international policy debates. After several years of difficult international negotiations, the United States – responsible for 23% of global CO_2 emissions from fossil fuel use in 1990 – announced in early 2001 its decision not to ratify the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). A consensus was nevertheless reached at the 7th meeting of the Conference of the Parties (COP7) on several key issues essential to the ratification process. At the end of September 2002, 95 countries had ratified the legally binding agreement, including all the EU countries and Japan. However, the Protocol ratification thresholds have not yet been met which would allow its entry into force.

To fight against climate change, countries have continued to adopt a portfolio of policies and measures involving all energy-intensive sectors. Although few IEA Member countries have respected their non-binding commitment under the UNFCCC to reduce their greenhouse gas emissions back to 1990 levels by 2000, all are actively developing new policy strategies with the objective of reducing emissions in the most cost-effective manner. These include traditional actions, such as fiscal measures, regulatory instruments, or R&D investments, as well as more innovative initiatives such as market mechanisms and voluntary agreements. Educational measures are also increasingly being used in an attempt to induce behavioural change.

Over the past five years, renewable energy has shown considerable progress in technology, cost competitiveness and market penetration. Most IEA countries have now set clear targets for the penetration of renewable energy as well as the supporting instruments to meet those goals. Policies to promote emerging technologies typically evolve to follow technology advances and market developments. At present, countries are using a combination of policy instruments, ranging from direct financial support, portfolio targets and tradable renewables certificates to mechanisms that directly value the contribution of renewables in the market place. Continuous efforts are necessary to try to reflect the full costs and benefits of all energy decisions to set a level playing field for renewables.

Many non-OECD countries have undertaken market reform in the energy sector in the pursuit of increased economic efficiency and/or private investment, and substantial progress has been made in many countries. This book contains a short introduction to developments in China, India, the Association of South-East Asian Nations (ASEAN), Latin America, Russia and the Baltic countries; there is also a short introduction to a gas grid project in the Middle East.

In sharp contrast with the robust expansion seen in the late 1990s, demand for oil in the OECD countries swung into decline in 2001. The downturn reflects various factors, including the US and global economic slowdown, the relatively high oil prices brought by OPEC's policy of production restraint, unseasonably warm weather in the winter of 2001–2 and the effect of the terrorist attacks of 11 September 2001.

Demand for natural gas in the OECD area fell in 2001, which represented the first decline since 1986. By contrast, OECD demand for coal grew. This reversal of the long-term substitution of coal with natural gas was conspicuous in North America where the price of natural gas rose sharply from late 2000 to early 2001 because of cold weather in late 2000, low gas stocks and low hydroelectric output. As a result more coal was used in generation and in industry at the expense of gas.

In 2000, world oil production had grown over 1999 figures, reflecting three consecutive production increases by OPEC countries, in March, June and October. World gas production has been continuously growing in the last decade, led by North America, the Middle East and Asia. Oil and gas production in the countries of the former Soviet Union (FSU), which had been declining since the early 1990s, began to increase from 1997, while world coal production over the last decade experienced ups and downs mainly because of the restructuring of the coal industry in the former USSR and China.

Average prices for crude oil were lower in 2001 than during the previous year reflecting the slowing oil demand growth. The prices of oil products showed considerable fluctuation over the past two years. The price of natural gas increased sharply, reflecting the exceptional price peak in the United States in the winter of 2000–1 (at first quarter of 2001). Then it fell, by the second quarter of 2002, to the position it occupied in the first quarter of 2000.

Energy intensity, as measured by final consumption divided by total GDP (in PPPs), continued to fall in the industry and the residential/commercial sectors, although it fell only marginally in the transport sector. Energy-related CO_2 emissions continued to increase – to 11.8 billion tonnes – in 2000, up 14% from 1990. Emissions in some countries have been stabilised or reduced as a consequence of radical economic change, or through fuel-switching in power generation. On the whole, improvements in overall energy intensity, although sometimes accompanied by a reduction in carbon intensity, have not been enough to offset overall increases in energy demand and in CO_2 emissions.

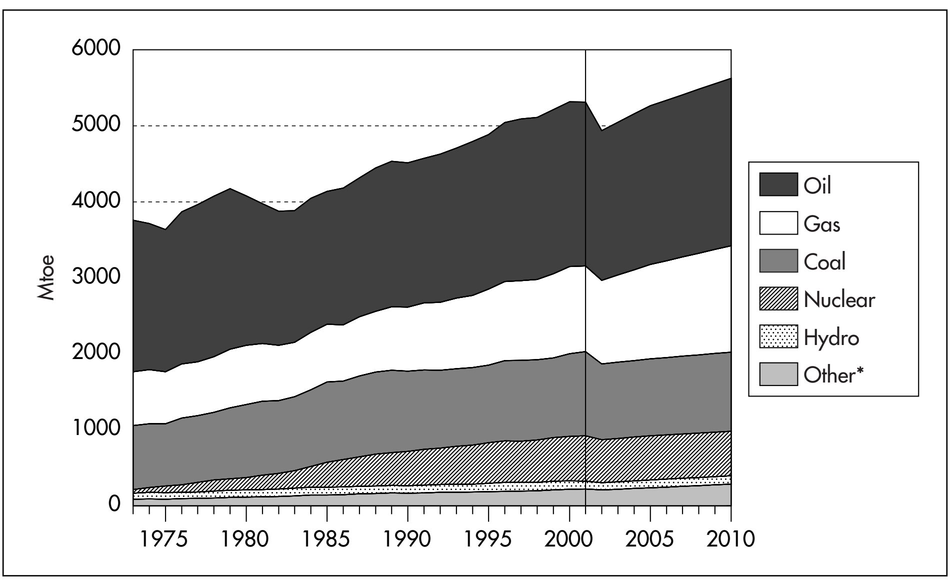
MARKET TRENDS

ENERGY DEMAND: OECD

Total primary energy supply (TPES) in OECD countries was 5 312 Mtoe (million tonnes of oil equivalent) in 2001, down 0.1% from the previous year. TPES decreased by 1.2% in North America, while it increased by 1.2% in OECD Europe and by 0.6% in OECD Pacific. This decline in TPES is the first since 1990 and can be attributed to various factors, not least economic slowdown in the US and global economies, warm weather, volatile energy prices and the terrorist attacks of 11 September. On the mid-term basis,TPES increased by 18% over its 1990 level. TPES increased by 35% in OECD Pacific, by 18% in North America and by 10% in OECD Europe.

In 2001, oil remained the largest source of energy, with 41% of TPES in OECD countries. The share of natural gas, which had been continuously growing since 1986, decreased from 22% in 2000 to 21% in 2001, while the share of coal increased from 20% to 21%. This reversal from the long-term trend of substitution of coal with gas was conspicuous in North America where the share of natural gas dropped from 24% to 23%; in the OECD as a whole it increased from 22% to 23%.

Figure 1
Total Primary Energy Supply in OECD Countries, 1973 to 2010



* includes combustible renewables, heat, geothermal, solar and wind.

Note: excluding Korea, Mexico, Norway, Poland and the Slovak Republic from 2002 to 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submissions.

Table 1
Total Primary Energy Supply in OECD Regions
(Mtoe)

	1990	*1999*	*2000*	*2001*[1]
TPES TOTAL				
Total OECD	4 515	5 213	5 317	5 312
North America	2 260	2 641	2 704	2 672
Europe	1 621	1 750	1 766	1 788
Pacific	633	823	847	853
Oil				
Total OECD	1 901	2 162	2 167	2 154
North America	931	1 061	1 071	1 064
Europe	631	693	684	688
Pacific	340	408	412	402
Gas				
Total OECD	840	1 107	1 149	1 128
North America	517	627	653	613
Europe	258	380	390	403
Pacific	65	100	106	111
Coal				
Total OECD	1 058	1 045	1 086	1 108
North America	486	557	579	595
Europe	437	315	323	321
Pacific	136	173	184	192

[1] Preliminary data.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Oil

In sharp contrast with the robust expansion of the late 1990s, OECD oil demand swung into decline in 2001 for the first time since 1990. Demand contracted by 0.6% over the year, to 2 154 Mtoe, following sluggish growth of only 0.2% in 2000. Although demand growth is expected to resume, in line with the global economy, the recovery is likely to be slow. As of mid-2002, demand was expected to inch up by only 0.1% for the year. OECD demand contracted steeply for three quarters in a row in the second half of 2001 and early 2002: it fell by an estimated 0.9% in the third quarter of 2001, 1.4% in the fourth and a provisional 2.3% in the first quarter of 2002.

The downturn reflects various factors, including the US and global economic slowdown, the relatively high oil prices brought upon by OPEC's policy of production restraint, unseasonably warm weather in the winter of 2001–2 and the effect of the terrorist attacks of 11 September. A protracted downturn in manufacturing activity curtailed demand for residual fuel oil and middle distillates across most of the OECD, especially in Japan, where the relocation of producing facilities to lower-cost Asian economies, not least China, is considered to have compounded the effect of reduced domestic and export demand. A sudden drop in the demand for air travel in the wake of the September terrorist attacks also deepened the impact of the economic slowdown, severely curtailing consumption of jet fuel and aviation kerosene.

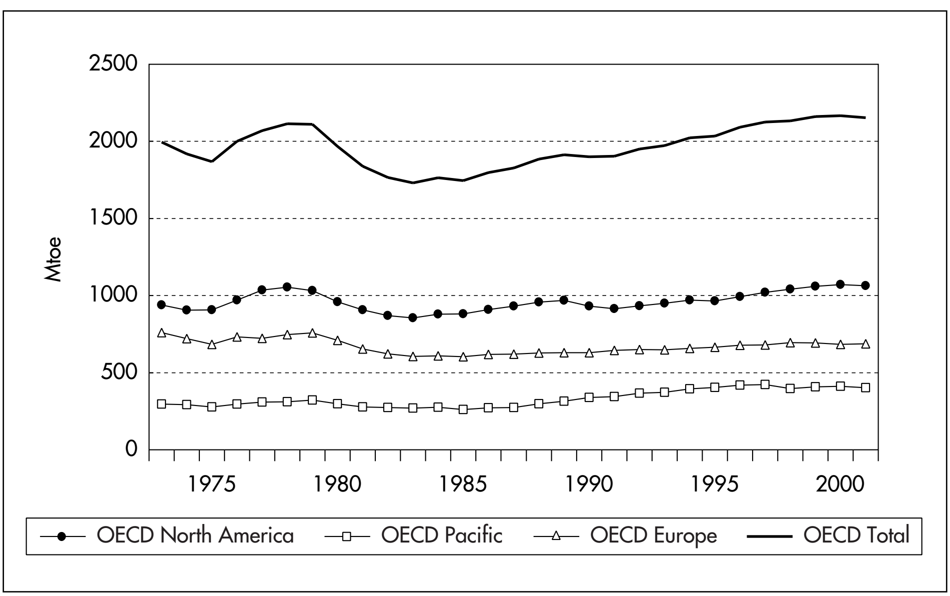
Most of these factors are expected to fade as time goes by, though at the time of writing there is still a considerable degree of uncertainty about the pace and scope of the US and global economic recovery. The effect of fuel efficiencies and the diversification of energy sources, which also curtailed oil demand in recent years, will last longer. In Japan and Korea, the share of oil consumed in electricity generation has been on a protracted downward trend, to the benefit of such alternate boiler fuels as natural gas and coal. In OECD Asia-Pacific as a whole, oil made up 47% of TPES in 2001, down from 49% in 2000, reversing the slight increase in share during the previous ten years. In Europe, the dieselisation of the automobile fleet continued to yield efficiency gains. There, too, power generators are switching away from oil, especially in Italy, though the trend was recently distorted as a drought curtailed hydropower generation in the winter of 2001–2, following heavy rainfall and above-average hydroelectricity output a year earlier. The share of oil in TPES in OECD Europe and North America remained almost stable, at 39% and 40% respectively.

Among the three OECD regions, the downturn in oil demand was felt most acutely in North America. After expanding briskly in 1999, North American oil demand saw a slowdown in growth in 2000 before swinging into reverse in 2001, when demand contracted by 0.6%, or 7 Mtoe, to 1 064 Mtoe. Broken down by product, the growth-pattern of North American demand for oil in 2001 presents a contrasted picture. Reversing the trend of the previous ten years, petrochemical feedstocks accounted for most of the drop. Demand shed 9.2% for liquefied petroleum gas (LPG) and 16.3% for naphtha, mirroring the downward pattern in petrochemicals. Demand for jet fuel plummeted after 11 September. The decline in the second half of the year more than offset relatively robust gains in the first half, bringing the annual average 4.1% below the figure for 2000. Demand for residual fuel oil tumbled by 4.1% on the back of mild winter weather and a protracted manufacturing downturn. Exceptionally strong deliveries in 2000, when a rally in the price of natural gas and delivery problems for gas boosted consumption of residual fuel oil and heating oil, made the data for demand in 2001 look all the weaker by comparison. Demand for gasoline, by contrast, defying the economic slowdown, grew by 1.7%, fuelled by strong sales of sports utility vehicles, a switch from air to road transport after 11 September, and a prolonged construction boom. As a result, the share of gasoline in total North American demand for oil gained one percentage point from 2000, to 41.4%.

Demand in the Asia-Pacific region contracted by 10 Mtoe in 2001 after leaping upwards by 12 Mtoe in 1999 and showing a slight increase by 4 Mtoe in 2000. In terms of year-on-year percentage change, however, demand fell even faster in the Asia-Pacific region than in North America, contracting by 2.4% in 2001 after a slight increase, of 1.0%, in 2000 and soaring by 3.2% in 1999. Practically all of the recent contraction occurred in Japan, where demand, in line with the country's economic situation, fell by 1.6% in 2000 and by 1.1% in 2001. Korean demand swung from a 4.1% advance in 2000 to a 2.0% drop in 2001. For the region as a whole, a drop in residual fuel oil demand, a result both of the economic slowdown and of fuel-switching policies, accounted for most of the contraction. By contrast, demand for motor gasoline proved surprisingly resilient.

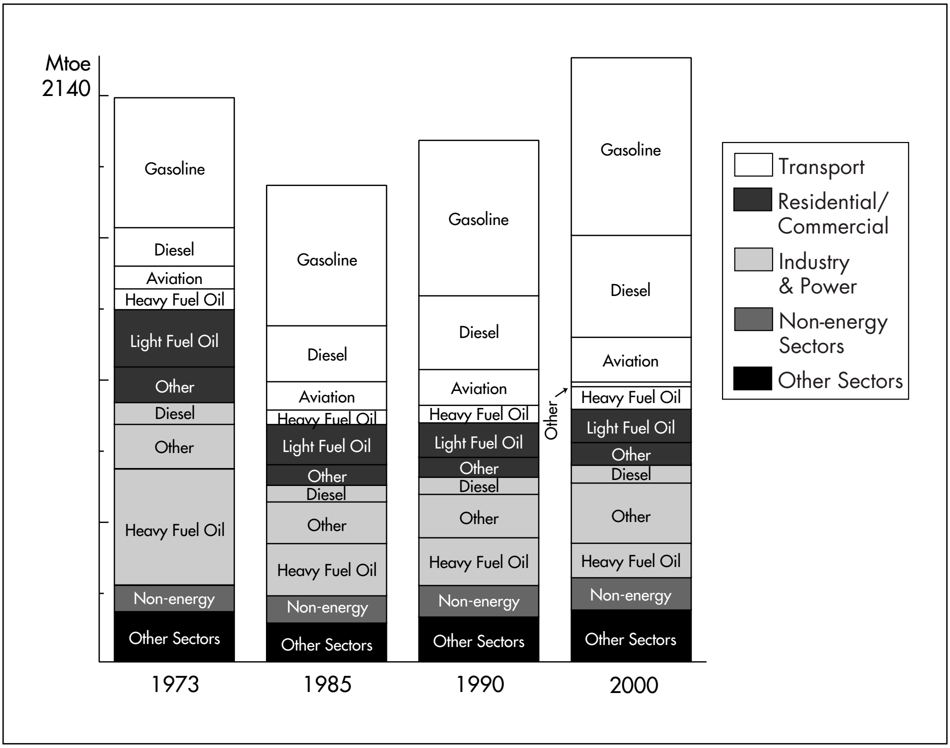
European demand bucked the trend in 2001, inching up by 0.4%, or 4 Mtoe, after falling by 0.4% in 1999 and 1.3% in 2000. However, much of the recent gain reflects one-off spikes in demand for diesel and residual fuel oil. The combined share of these two products in total oil demand grew from 49.5% in 2000 to 50.7% in 2001. Heavy stockpiling of heating oil by German home-owners ahead of winter helped boost the share of diesel in total oil demand by one percentage point, to 37.5%. Meanwhile, a drought in southern Europe cut hydropower generation, causing demand for residual fuel oil to soar at double-digit rates in the fourth quarter of 2001, and lifting annual average growth in demand for the product to 2.1%. A return to more normal demand patterns for those products should trim year-on-year growth in 2002.

Figure 2
Oil Demand in OECD Countries (by Region), 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Figure 3
Consumption of Oil Products by Sector in IEA Countries, 1973 to 2000



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

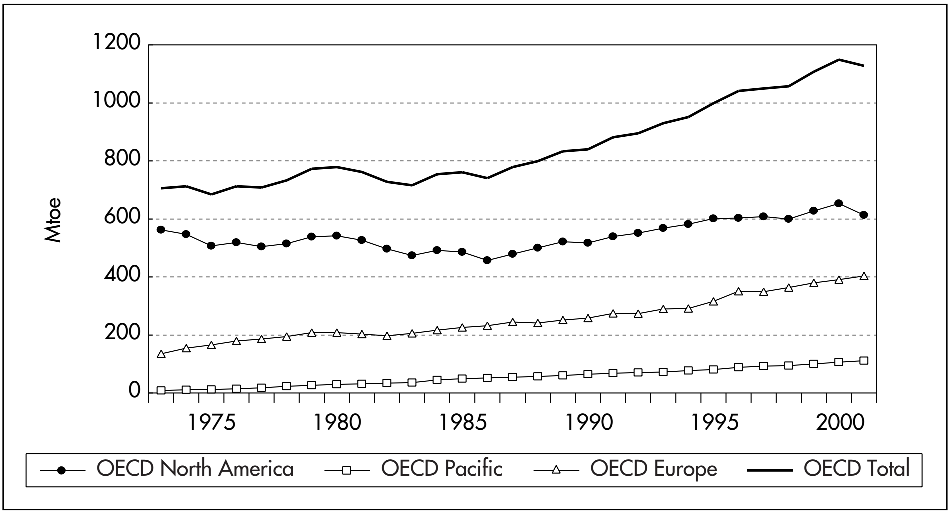
Gas

Demand for natural gas in the OECD countries fell by 1.8% in 2001 from its 2000 figure, which represented the first decrease since 1987. In OECD North America, demand contracted sharply, by 6.2%, offsetting the increase in OECD Europe and OECD Pacific by 3.3% and 4.7% respectively.

The downturn in North American demand for gas can be ascribed to the sharp increase in natural gas prices from late 2000 to early 2001. The price increase was a result of exceptionally cold weather in November and December 2000, an unusually low volume of gas stocks at the beginning of the heating season and the low volume of hydroelectric output in the Pacific North West and California. Consequently, more coal was burned in the power sector, and gas consumption in the industrial sector declined sharply, too. OECD Europe and OECD Pacific, by contrast, did not experience such a price hike because the majority of their supplies were still on long-term contracts. The relatively high increase in OECD Pacific was due to a strong increase, of 9.8%, in Korea and a steady increase, of 4.3%, in Japan, primarily for power generation.

Figure 4

Natural Gas Demand in OECD Countries (by Region), 1973 to 2001



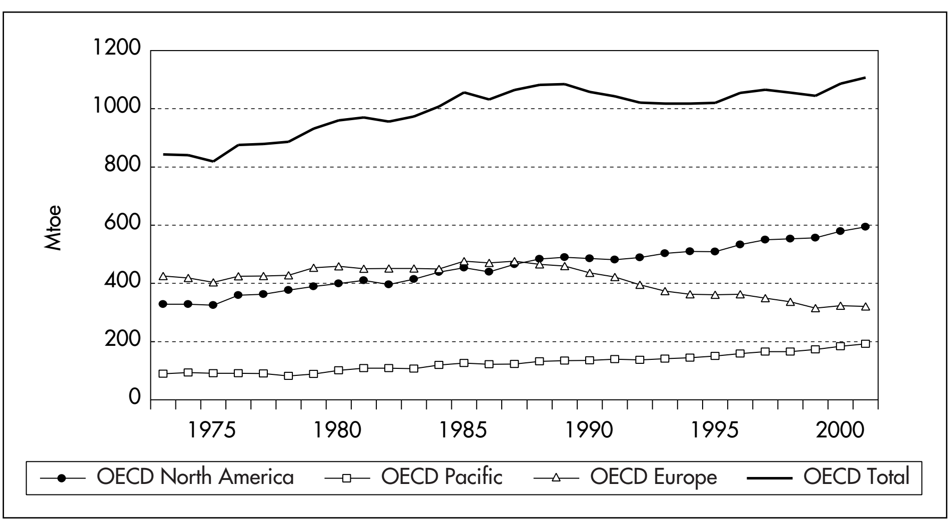
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Coal

Coal demand in OECD countries increased by 1.9% in 2001 from the 2000 figure. In North America and OECD Pacific, demand increased by 2.7% and 4.4% respectively, while it declined in OECD Europe by 0.7%.

Figure 5

Coal Demand in OECD Countries (by Region), 1973 to 2001



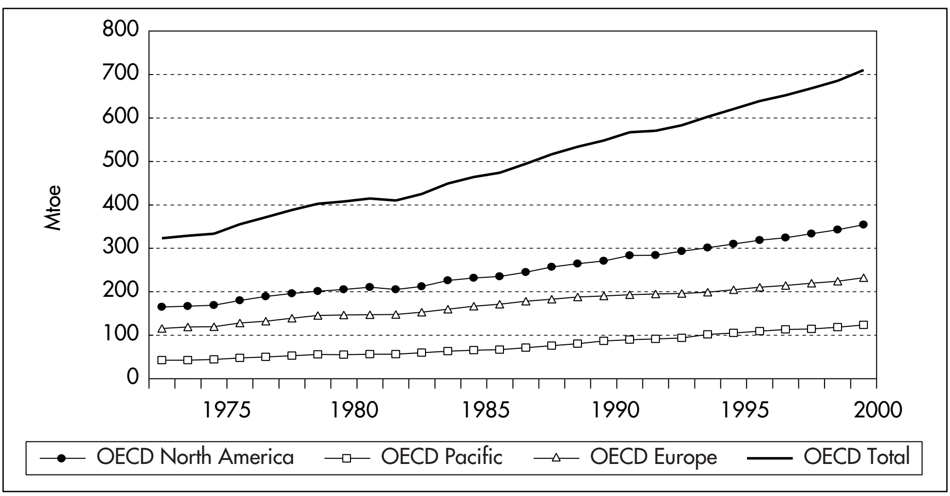
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

The increase in North America was mainly attributed to coal-burning in the power sector, caused by the sharp increase in natural gas prices described above. On the other hand, in OECD Europe, coal demand decreased again following the first annual increase for a decade in 2000. The major factors were pressure from the European Commission to reduce subsidies for domestic coal producers and consumers, increased environmental awareness and growing natural gas penetration.

Electricity

In 2000, electricity consumption in OECD countries was 710 Mtoe, up 3.6% from 1999 in line with GDP growth. North America accounted for 50% of total OECD electricity consumption, followed by Europe (33%) and Pacific (17%). In OECD Pacific, electricity consumption grew by 4.1%, in particular in Korea (by 11%), faster than in North America (3.4%) and OECD Europe (3.6%). Alternatively, GDP growth in OECD Pacific was 2.9%, lower than the OECD average (3.6%), reflecting the increasing trend of electricity intensity in this region in the 1990s.

Figure 6
Electricity Final Consumption in OECD Countries (by Region), 1973 to 2000



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Table 2
Electricity Consumption
(Mtoe)

	1990	*1998*	*1999*	*2000*
Total OECD	548	669	686	710
North America	271	334	343	355
Europe	190	220	224	232
Pacific	87	115	119	124

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

ENERGY CONSUMPTION BY SECTOR: OECD

Total final consumption (TFC) in OECD countries was 3 612 Mtoe in 2000, growing at an annual average of 1.5% from 1990. Petroleum products accounted for the largest share in total final consumption, with 53%, followed by electricity and gas (20% each) and coal (4%). Electricity grew faster, at 2.6% per year, followed by gas (1.8%) and oil (1.5%). Coal consumption shrank by one-third in the last decade.

Table 3

Total Final Consumption in OECD Regions

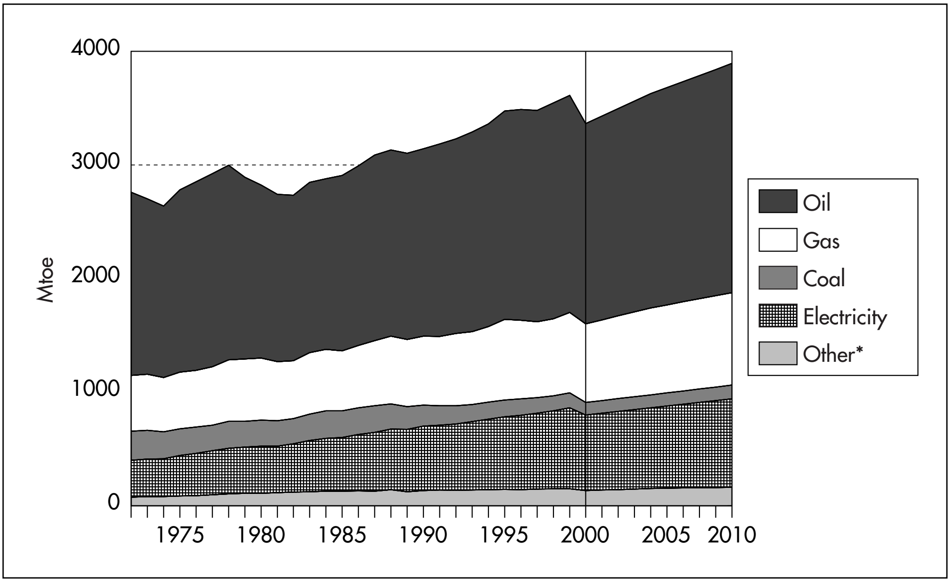
(Mtoe)

	1990	*1998*	*1999*	*2000*
TFC Total				
Total OECD	3 104	3 481	3 547	3 612
North America	1 533	1 709	1 748	1 785
Europe	1 145	1 243	1 251	1 265
Pacific	427	529	548	561
Industry				
Total OECD	1 085	1 167	1 179	1 203
North America	478	520	528	526
Europe	420	422	417	436
Pacific	187	226	235	241
Residential/Commercial				
Total OECD	1 031	1 145	1 165	1 189
North America	477	519	532	558
Europe	430	473	474	468
Pacific	124	153	160	163
Transport				
Total OECD	988	1 169	1 203	1 219
North America	578	671	689	701
Europe	295	349	360	361
Pacific	115	150	154	157

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Figure 7

Total Final Consumption in OECD Countries by Source, 1973 to 2010



* includes geothermal, solar, wind, combustible renewables and waste.

Note: excluding Korea, Mexico, Norway, Poland and the Slovak Republic from 2002 to 2010

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submissions.

Industry Sector

In 2000, OECD energy consumption in the industry sector was 1 203 Mtoe, increasing by 11% from 1990. Electricity consumption grew sharply, up 25% from 1990, while coal fell by 12%. Petroleum products and gas consumption both increased by some 10%.

In 2000, petroleum products accounted for 38% of industrial energy consumption, followed by natural gas (24%) and electricity (23%). The shares of petroleum products and gas in final consumption have remained stable over the past ten years, while that of electricity increased by 2.7 percentage points and that of coal made up the balance.

In 2000, the industry sector accounted for 43% of total final consumption in OECD Pacific, 31% in OECD Europe and 29% in OECD North America. The pace of growth was highest in OECD Pacific, at an annual average of 2.6% from 1990, followed by OECD North America at 1%. Consumption was stable in OECD Europe.

The consumption of electricity went up in all three regions. It rose faster in OECD North America and OECD Pacific, by 2.7% and 2.8% respectively, than in OECD Europe, where it rose by about 1.4%. The share of electricity among fuels was about the same (some 25%) in all three regions in 2000.

In OECD Europe, the share of petroleum products in the industrial sector was 34% in 2000, having remained stable throughout the 1990s. The share of gas rose to 26% in 2000 from 22% in 1990, while the share of coal fell sharply from 18% to 11% over that period. In OECD North America, the share of natural gas fell from 33% in 1990 to 28.5% in 2000; the oil product share was 36–38% over the past decade. The share of coal increased marginally, from 5% in 1990 to 6.5% in 2000. Petroleum products accounted for a half of industrial energy consumption in OECD Pacific in 2000. The share of natural gas increased from 6% in 1990 to 9% in 2000, while that of coal fell from 15.5% to 13.2%.

Residential/Commercial Sector

In 2000, energy consumption in the residential/commercial sector in OECD countries was 1 189 Mtoe, up 15% over 1990. Electricity and gas consumption grew by 33% and 29% respectively from 1990. Oil consumption has decreased since its peak in 1996; it returned to its 1990 figure in 2000. Coal consumption shrank to one-fourth of the 1990 volume in the past decade. Shares by fuel in the residential/commercial sector in 2000 were 35% for electricity, 34% for gas, 22% for petroleum products, 5% for renewables, 3% for heat and 2% for coal. The share of electricity increased by 4.5 percentage points from 1990 and that of gas by 3.2 percentage points, while the coal share fell by 5 percentage points.

In 1999, the residential/commercial sector accounted for 38% of total final consumption in OECD Europe, 31% in OECD North America and 29% in the OECD Pacific region. Between 1990 and 1999, the growth of energy consumption was strongest in OECD Pacific, at an average annual rate of 2.8%, followed by OECD North America (1.6%) and OECD Europe (0.9%).

The structure of fuel use differed considerably between regions. In OECD Pacific, the shares of petroleum products and electricity were some 40%, followed by gas (16%) in 2000. Electricity accounted for the largest share in OECD North America (41%), followed by natural gas (39%) and petroleum products (15%). In OECD Europe, natural gas held the largest share (33%), followed by electricity (27%) and oil (24%). The share of coal fell sharply, dropping from 12% to 3% between 1990 and 2000 in OECD Europe and from 8% to 1% in the OECD Pacific.

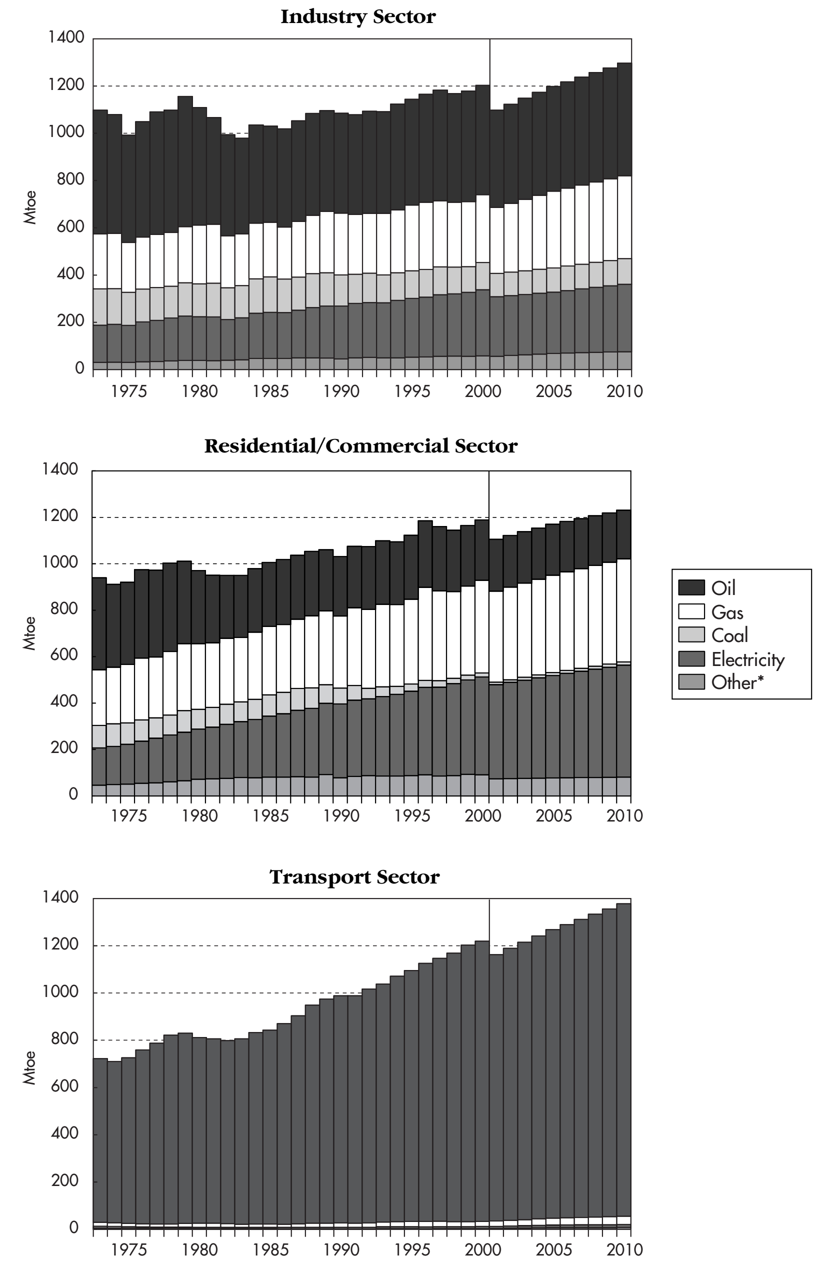
Transport Sector

In 2000, total final consumption in the OECD transport sector was 1 219 Mtoe, up 23% from 1990. Since 1990, the share of oil has remained at 97%, and the shares of gas and electricity were stable at 2% and 1% respectively.

OECD North America accounted for 56% of the OECD's total transport demand, followed by OECD Europe (30%) and OECD Pacific (13%). Between 1990 and 2000, the growth of consumption was strongest in OECD Pacific (3.0% per year), while it was some 2% per year in both OECD Europe and OECD North America. Penetration of natural gas, at 3.3%, was strongest in OECD North America, while it was only 0.2% in the other OECD regions. On the other hand, electricity had shares of 1.8% and 1.5% respectively in OECD Europe and OECD Pacific, while it was 0.1% in the OECD North America.

Figure 8

Final Consumption by Sector and by Source in OECD Countries, 1973 to 2010



* includes geothermal, solar, wind, combustible renewables and waste.

Note: excluding Korea, Mexico, Norway, Poland and the Slovak Republic from 2001 to 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002 and country submissions.

WORLD ENERGY PRODUCTION

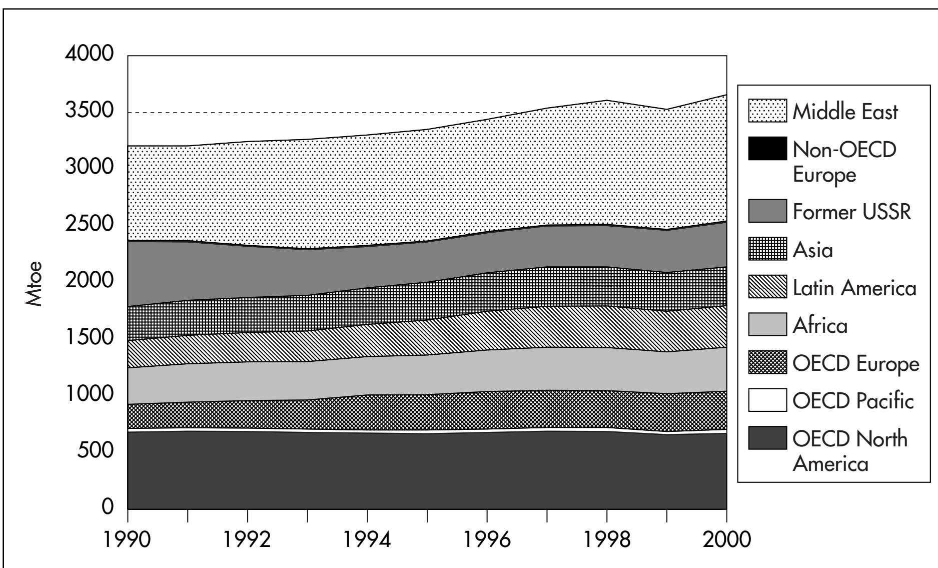
Oil

World oil production was 3 657 Mtoe in 2000, up 14% over 1990. From 1990 to 2000, oil production increased by 284 Mtoe in the Middle East, 129 Mtoe in Latin America, 124 Mtoe in OECD Europe, 62 Mtoe in Africa and 41 Mtoe in Asia, while it sharply dropped in the former Soviet Union (FSU), by 178 Mtoe. Oil production in OECD North America slightly decreased by 12 Mtoe. In 2000, the Middle East accounted for 31% of world oil production, followed by OECD North America (18%), FSU (11%), Africa (11%), Latin America (10%), Asia (9.3%) and OECD Europe (9.2%). During the last decade, the Middle East, Latin America and OECD Europe increased their share by 4.6, 2.6 and 2.4 percentage points respectively, while the share of the FSU sharply decreased, by 7 percentage points. Oil production in the FSU, which had plunged from 574 Mtoe in 1990 to 352 Mtoe in 1996, started to increase from 1997, reaching 395 Mtoe in 2000.

Oil production in 2000 grew by 130 Mtoe, or 3.7%, from 1999, mainly because of three consecutive production increases by OPEC countries in March, June and October. OPEC increased its production by 75 Mtoe, or 5.2%. Oil production in the FSU continued to grow, by 23 Mtoe or 6.3%. OECD North America, which had been suffering from low investments in 1998, increased its production by 10 Mtoe, or 1.6%, boosted by high investment in 1999 because of oil price hikes from 1999 to 2000.

Figure 9

World Oil Production, 1990 to 2000

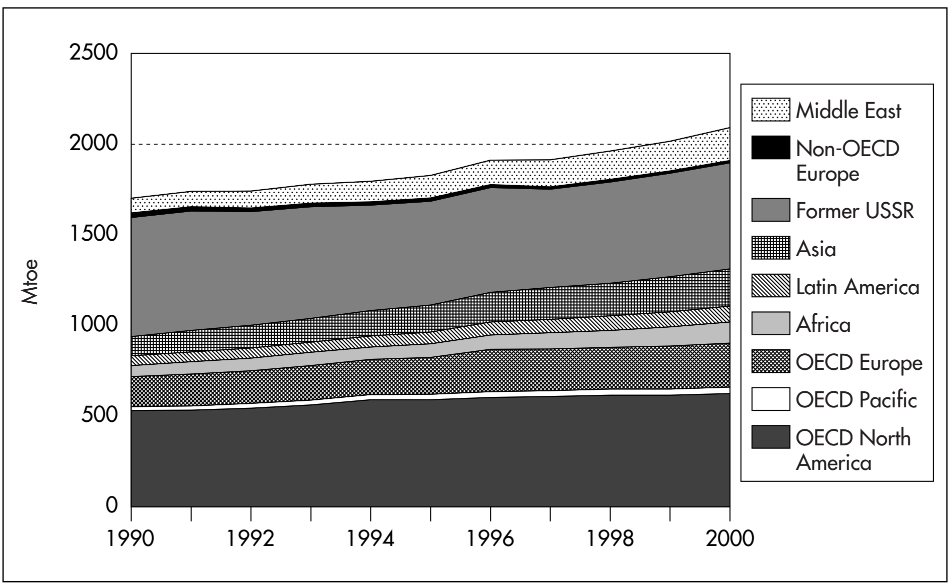


Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and *Energy Statistics of Non-OECD Countries*, IEA/OECD Paris, 2002.

Gas

World production of natural gas grew to 2 092 Mtoe in 2000, up 23% over 1990, reflecting strong demand for power generation. During this period, gas production increased by 100 Mtoe in Middle East, 98 Mtoe in Asia, 95 Mtoe in OECD North America, and 79 Mtoe in Europe, while it dropped by 71 Mtoe in the FSU – these large increases likewise explained by the strong demand for gas in power generation. Although production in the FSU had been decreasing up to 1997 because of decrepit production and transport facilities and the sharp decline in domestic gas consumption, it started to grow again from 1998. In 2000, OECD North America accounted for 30% of world natural gas production, followed by the FSU (28%), OECD Europe (11%), Asia (9.8%) and the Middle East (8.7%). During the last decade, the Middle East, Asia and OECD Europe increased their share by 3.9, 3.5 and 2.0 percentage points respectively, while the FSU share sharply decreased, by 11 percentage points.

Figure 10
World Natural Gas Production, 1990 to 2000



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and *Energy Statistics of Non-OECD Countries*, IEA/OECD Paris, 2002.

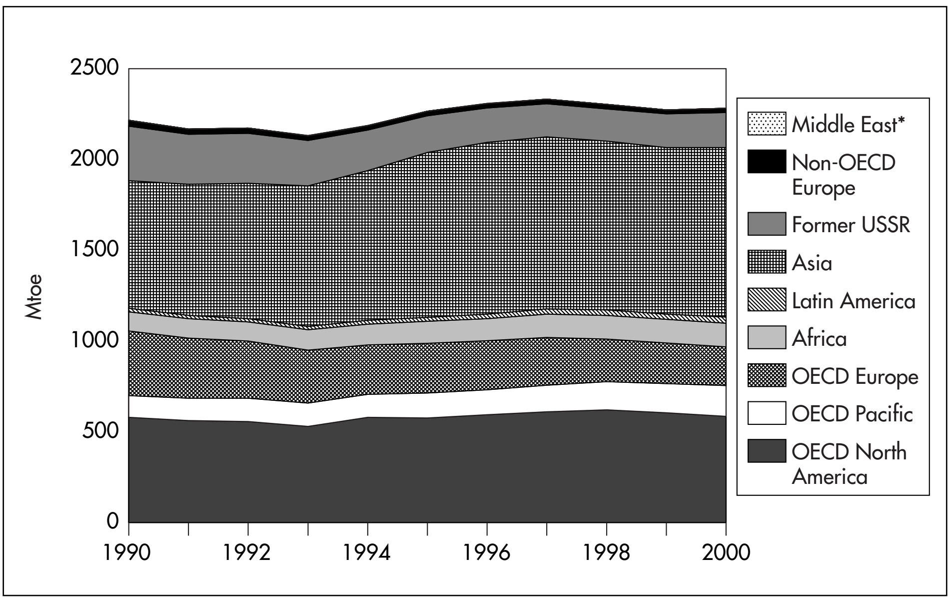
Coal

World coal production was 2 282 Mtoe in 2000, up 3.0% from 1990, although it did experience several ups and downs during this period. After falling slightly in the early 1990s, it increased from 2 131 Mtoe in 1993 to 2 332 Mtoe in 1997 and then fell again during two consecutive years. There was a slight increase of 0.4% from

1999 to 2000. These changes were largely attributed to coal production in Asia, which had grown from 704 Mtoe in 1990 to 947 Mtoe in 1997, and fell again down to 917 Mtoe in 1999. It increased again in 2000, by 1.7%. The restructuring of the local coal industries in China was the major factor. On the other hand, production in the FSU, which had been continuously declining, from 301 Mtoe in 1990 to 176 Mtoe in 1998, reversed for the first time in 1999 and reached 194 Mtoe in 2000. Production in OECD Europe continuously dropped throughout the 1990s, from 356 Mtoe in 1990 to 213 Mtoe in 2000.

Figure 11

World Coal Production, 1990 to 2000



* too insignificant to appear.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and *Energy Statistics of Non-OECD Countries*, IEA/OECD Paris, 2002.

Electricity: OECD

Electricity generation in OECD countries was 9 640 TWh in 2001, up only 0.1% from 2000 – a reflection of economic slowdown. Gas-fired electricity generation and nuclear power rose by 5.2% and 2.3% respectively, while oil- and coal-fired generation dropped by 0.7% and 1.5% respectively. Electricity generation from hydropower decreased sharply, by 7.2%, mainly because of dry weather conditions in North America where hydropower generation dropped by 13%. Although electricity generated from other renewables grew by 4.7%, its share is still marginal (2.3%). The shares in electricity generation in the OECD countries were as follows: coal, 39%; nuclear, 24%; gas, 17%; hydro, 13%; and oil, 6%.

From 1991 to 2001, the share of gas in OECD electricity generation sharply increased at the expense of coal and oil. This trend is apparent in OECD Europe, particularly in the United Kingdom and Italy. Dependence on coal in the United States and Germany is still much higher than the OECD average.

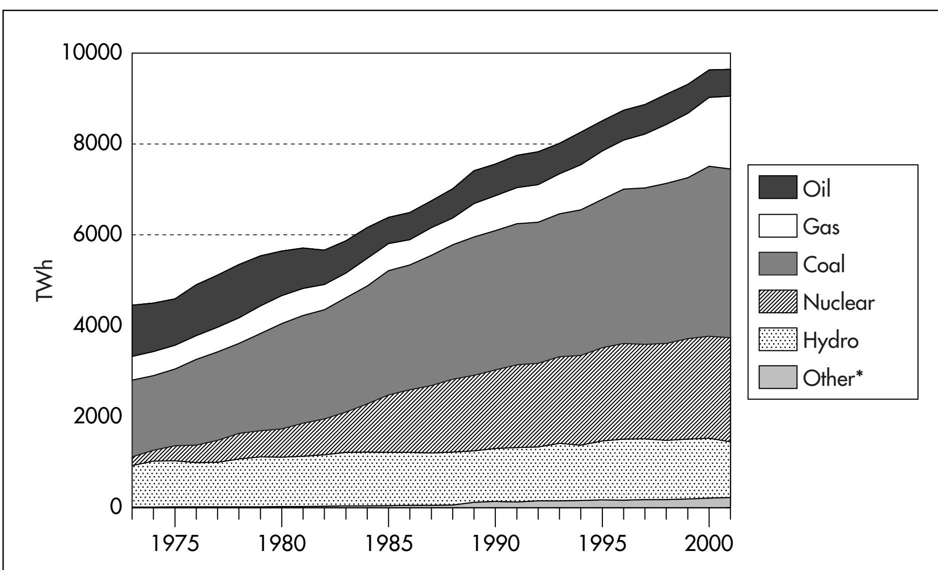
Table 4
Electricity Generation by Source, 1991 and 2001[1]
(TWh)

	France		*Germany*		*Italy*		*Japan*		*United Kingdom*		*United States*	
	1991	*2001*	*1991*	*2001*	*1991*	*2001*	*1991*	*2001*	*1991*	*2001*	*1991*	*2001*
Coal	43	24	317	303	32	29	130	274	210	133	1712	2047
Oil	14	7	15	4	104	76	243	143	30	7	127	134
Gas	3	14	36	51	36	112	176	244	4	144	402	672
Nuclear	331	422	147	171	-	-	213	325	71	90	649	806
Hydro	57	73	15	23	42	48	97	88	5	3	288	197
Comb. Renew.	2	4	5	24	3	8	19	20	1	6	73	93

[1] Preliminary data.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Figure 12
OECD Electricity Supply by Source, 1973 to 2001



* includes geothermal, solar, wind, combustible renewables and waste.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

ENERGY PRICES

Crude Oil

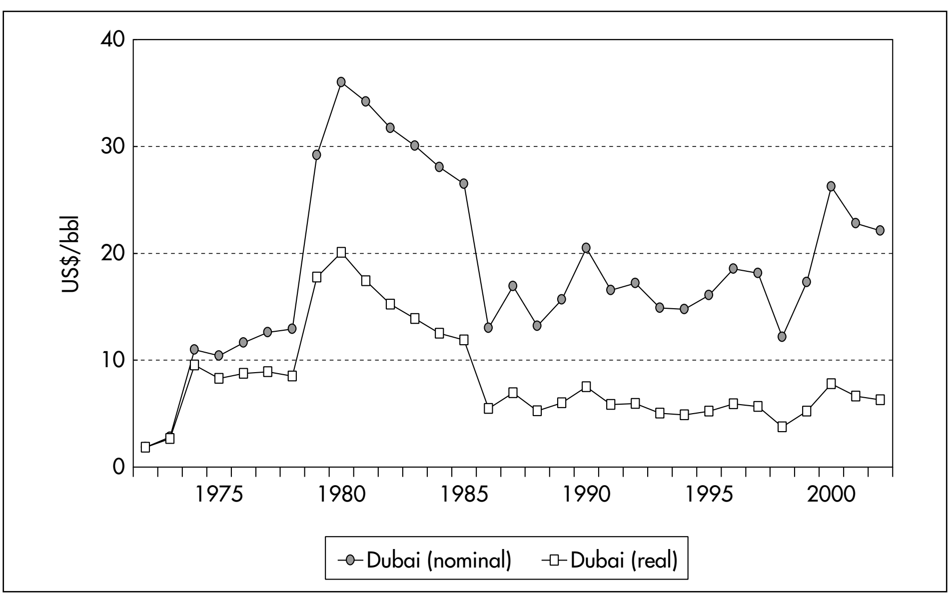
Average prices for crude oil were lower in 2001 than during the previous year. Prices for the three main marker crudes were $25.93 per barrel for West Texas Intermediate (down $4.44 from $30.37 in 2000), $24.44 for dated Brent (down $4.06 from $28.50 in 2000), and $22.80 for Dubai (down $3.44 from $26.24 in 2000).

As 2001 progressed, the world economy decelerated, slowing the growth of demand for oil. OECD crude and product inventories built in the first half of the year, and the stocks situation changed from tight to comfortable. In order to offset weakening demand and growing inventories, OPEC began to reduce output. A series of four agreements to cut production, which totalled 5 million barrels per day (mb/d) on paper, resulted in roughly 4 mb/d of supply being removed from the markets by the first quarter of 2002.

OPEC's supply restraint, which resulted in lower market share and growing spare capacity, more than offset healthy growth in non-OPEC production, which was led by Russia. As a result, crude oil prices tracked broadly sideways until 11 September.

The terrorist attacks on the United States steepened the economic slowdown. For the oil markets, the attacks brought a shock to demand, not to supply. Demand was

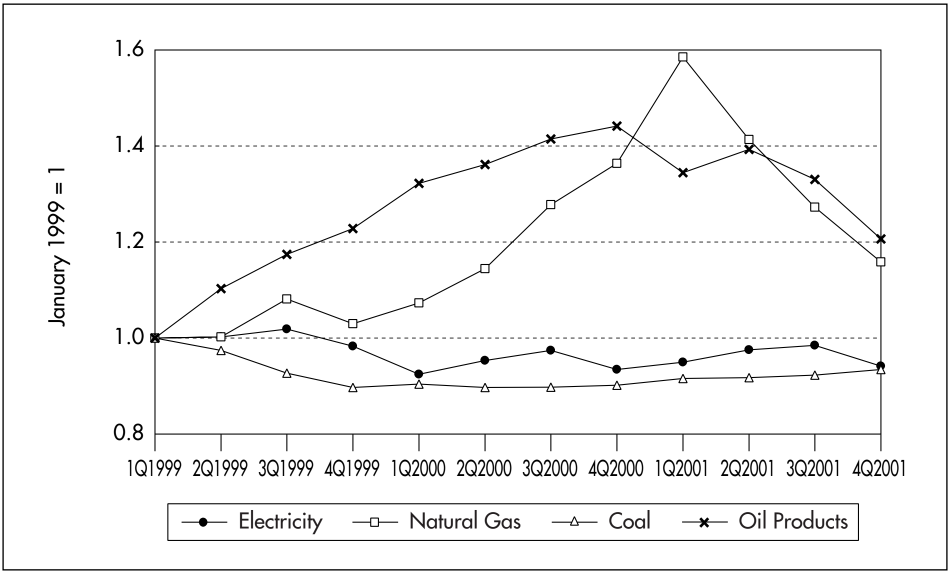
Figure 13
Crude Oil Prices, 1972 to 2002



Note: crude oil prices are Arabian Light (1972 to 1985) and Dubai (1986 to 2002). Real oil price is based on 1972 dollars.

Source: IEA.

Figure 14
Indexed Fuel Prices, First Quarter 1999 to Fourth Quarter 2001



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

lost in two ways: lower demand for jet fuel because of dramatic reductions in air travel and a broader loss of product demand because of the economic situation. This effect became evident within weeks after 11 September, and as a result, crude oil prices shifted downward to figures roughly $5–6 lower than before the attacks. Prices remained at this position for the rest of the year.

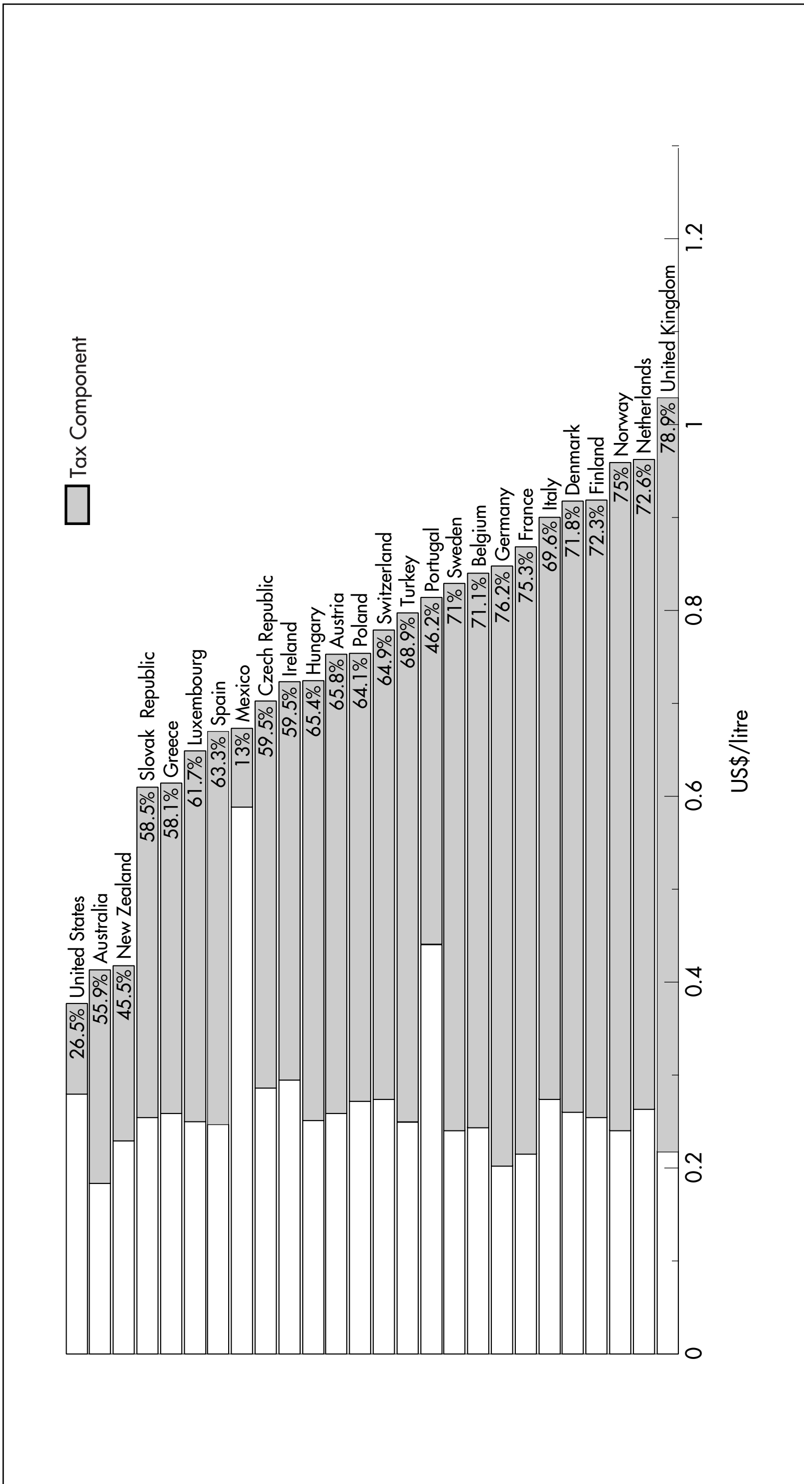
Gasoline

Average gasoline prices fell in 2001 compared to the previous year. OECD gasoline inventories, a key factor underlying prices, began the year relatively low. This tight situation led to an early and rapid rise in gasoline prices, ahead of the US peak summer driving season. However, as refiners returned from maintenance, they increased throughputs and maximised yields of gasoline. As a result, gasoline inventories rose to comfortable levels, and the price surge dissipated even before the driving season began. Prices in Europe and Asia followed the US lead. Inventories began to tighten again during July and August of 2001, and prices staged a late-season rally.

Refiners responded to the dramatic reduction in demand for jet fuel after the September attacks by reducing its yield and increasing the yield of naphtha, diesel and heating oil. Because of weak demand for petrochemicals, the excess naphtha was blended into gasoline. Thus, either directly or indirectly, the post-11 September

Figure 15

OECD Unleaded Gasoline Prices and Taxes, Fourth Quarter 2001

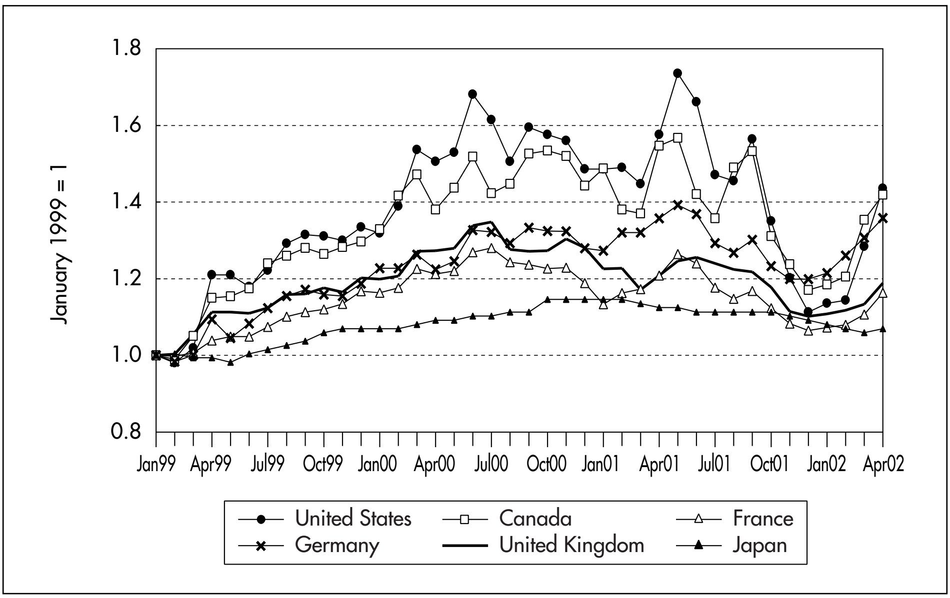


Note: data not available for Canada, Japan and Korea.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

oversupply of jet fuel contributed to lower prices for all of the other middle distillates and for light products. Gasoline supply was ample, stocks built, and gasoline prices were relatively low through the autumn and winter. In the spring of 2002, gasoline prices once again rose ahead of the summer driving season, although comfortable inventories kept the seasonal price peaks much lower than in 2000 or 2001.

Figure 16

Gasoline Price Trends in Selected IEA Countries, January 1990 to April 2002



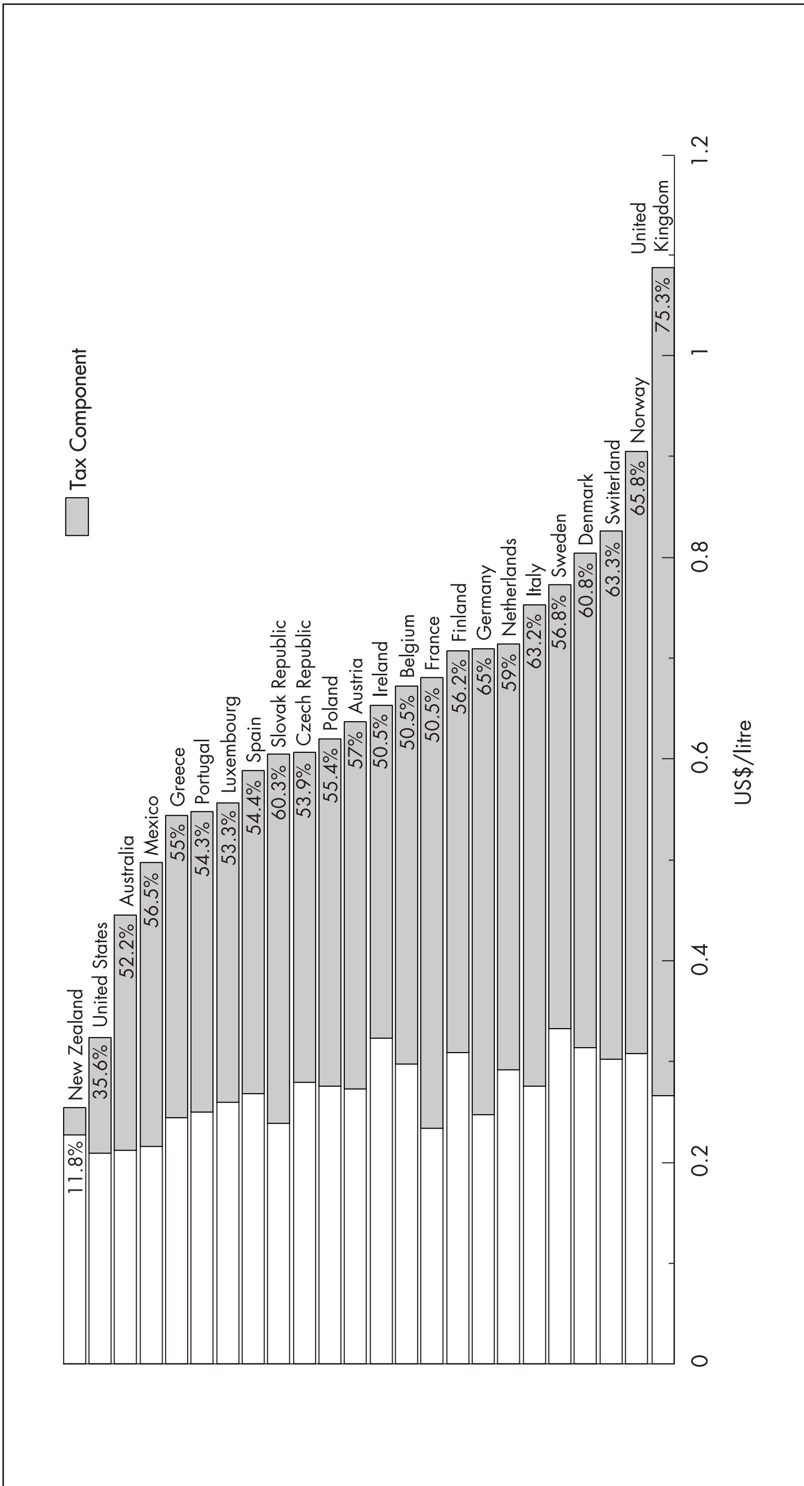
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Diesel

Average diesel prices were lower in 2001 than the previous year. As with gasoline, OECD inventories of middle distillates (including both road diesel and space heating oil) began the year at relatively low figures. In the United States, high prices for natural gas during the winter of 2000–1 encouraged industrial users and electric utilities to switch away from gas, resulting in a combined 300–500 kb/d incremental demand of heating oil and fuel oil. Unlike gasoline, middle distillate stocks took longer to rebuild, because refiners focused on gasoline in the spring. Diesel prices therefore remained stronger for a longer period, though the situation changed after 11 September, when diesel supply became ample (as described above), and prices fell.

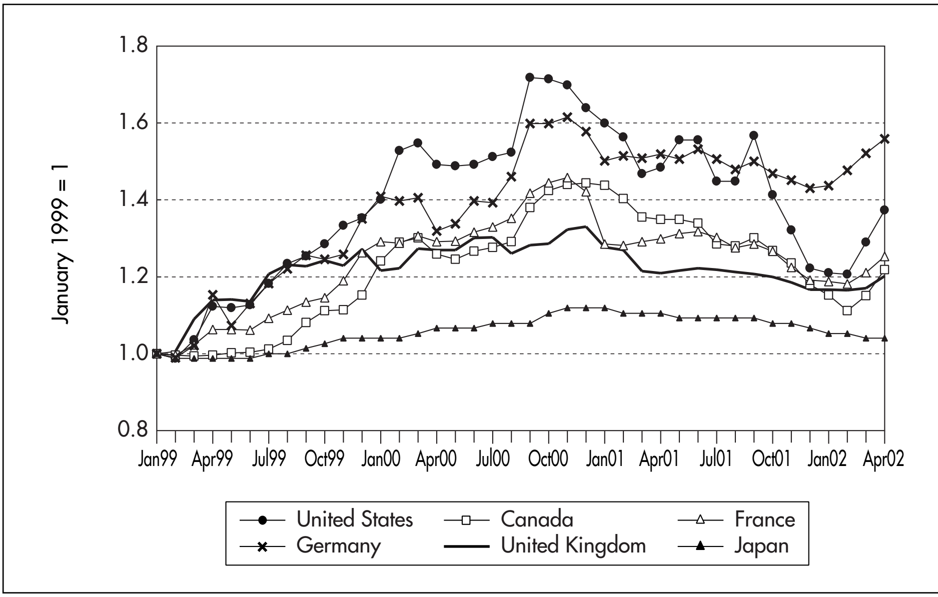
Figure 17

OECD Automotive Diesel Prices and Taxes, Fourth Quarter 2001



Note: data not available for Canada, Hungary, Japan, Korea and Turkey.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 18
Diesel Price Trends in Selected IEA Countries, January 1999 to April 2002



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Space Heating Oil

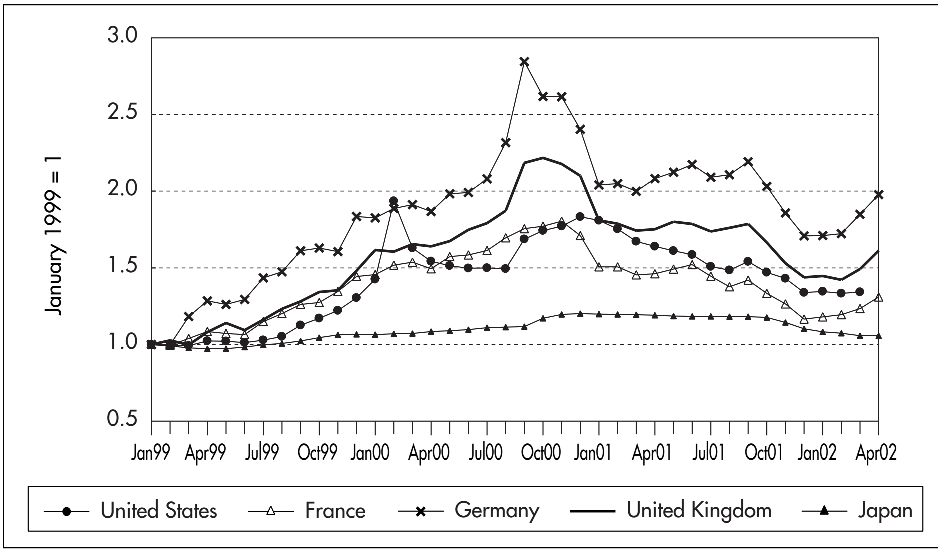
Average prices for space heating oil fell in 2001 compared with the previous year, with the key driving factors being the middle distillate stocks situation (described above) and the weather. In the key OECD regions of the United States, Europe and Japan, the winter of 2000–1 was colder than the previous winter, although still warmer than normal. Along with stocks, a key element in the heating oil markets in 2001 was strong and early buying by German consumers, who built stocks in the second half of the year, while prices were low. The winter of 2001–2 was warmer than a year earlier, in Europe and elsewhere, so the price support from Germany did not endure.

Natural Gas

Import prices for natural gas increased in OECD North America and Europe in 2001 compared with 2000, reflecting some time-lag in the increase of crude oil prices of 2000 which generally maintained during the year and the first nine months of 2001, as well as local conditions of supply and demand.

Figure 19

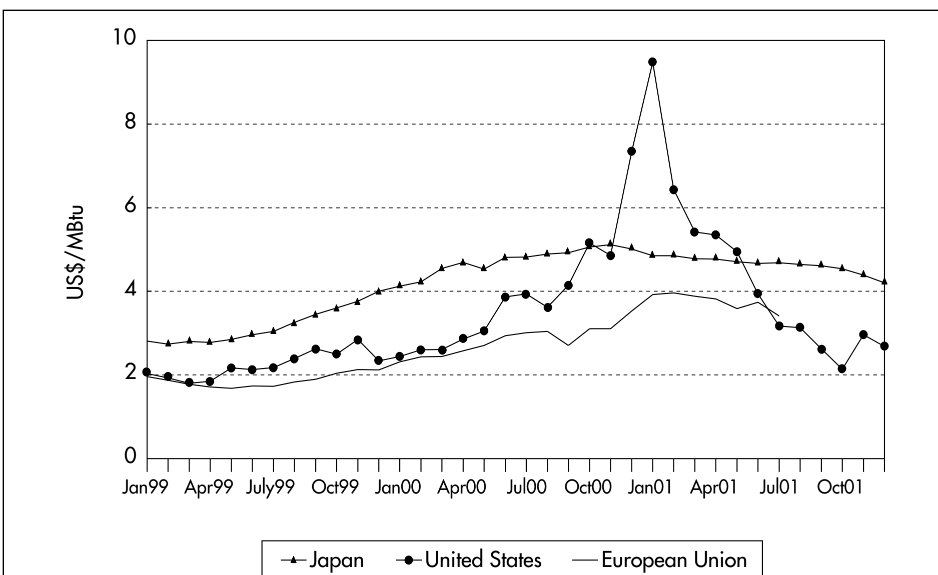
Space Heating Oil Price Trends in Selected IEA Countries, January 1999 to April 2002



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 20

Gas and LNG Import Prices in Japan, the European Union and the United States, January 1999 to December 2001



Note:Japan: average LNG import price; United States: average gas and LNG import price; the European Union: average gas import price

Sources: *Energy Prices and Taxes*, IEA/OECD Paris, 2002, and the United States Department of Energy.

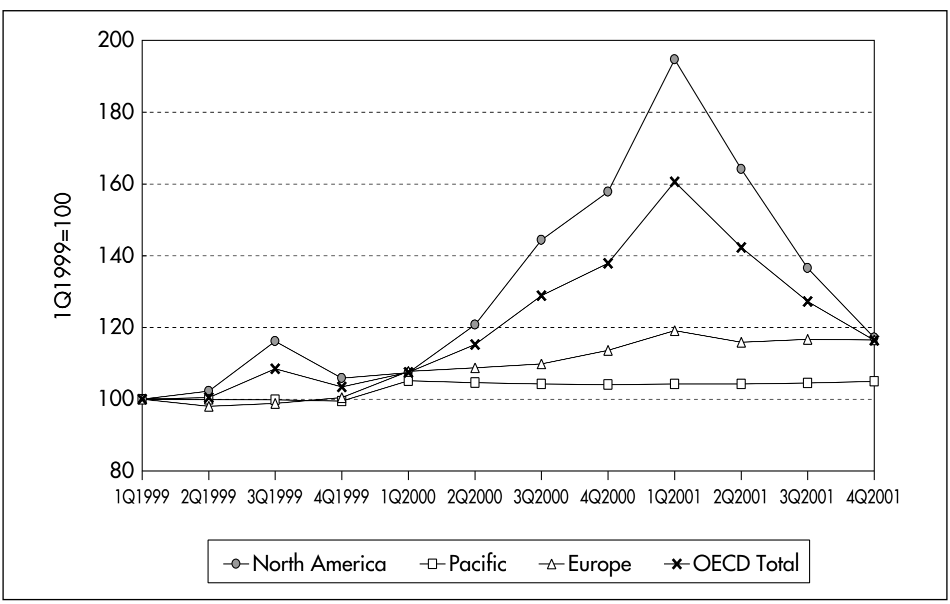
In the United States, the average import price in 2001 reached US$ 4.43/MBtu (up 12% from 2000 and a doubling compared with the 1999 figure). Import prices are based on the evolution of prices on the US spot market (Henry Hub) and therefore reflect the evolution and volatility caused by local conditions of supply and demand. The sharp increase observed in January 2001 (to US$ 9.48/MBtu) reflects a combination of winter weather than was colder than usual, a low volume of gas stocks at the beginning of the heating season and constrained supply at a time of increased demand. Thereafter prices decreased, stabilising at around US$ 3/MBtu. One factor that kept prices at this relatively high position was the requirement of unusually large refill volumes for underground storage.

Import prices in Europe increased, too, although not as sharply as in the United States. EU prices for imported gas averaged US$ 3.78/MBtu in 2001, compared with $2.78 in 2000, an increase of 36%. This rise reflects – with an approximately six-month time-lag – the increase of crude oil prices in 2000 (+61% in 2000 for the average import price of crude oil in IEA Europe) and that of gasoil (+71% in 2000) and fuel oil (+58% for low-sulphur fuel oil in 2000), to which the price of imported gas is indexed in European contracts.

Compared with 2000, import prices for liquefied natural gas (LNG) in Japan and Korea have been stable in 2001. In Japan, cif import prices for LNG reached US$ 4.64/MBtu on average, compared with US$ 4.73 in 2000. Prices are based on the "Japanese crude cocktail" (JCC) and reflect its shorter time-lag than the European one. In Korea, imported LNG prices reached US$ 5.07/MBtu in 2001, compared with $5.04 in 2000.

Figure 21

End-use Gas Prices by Region, First Quarter 1999 to Fourth Quarter 2001

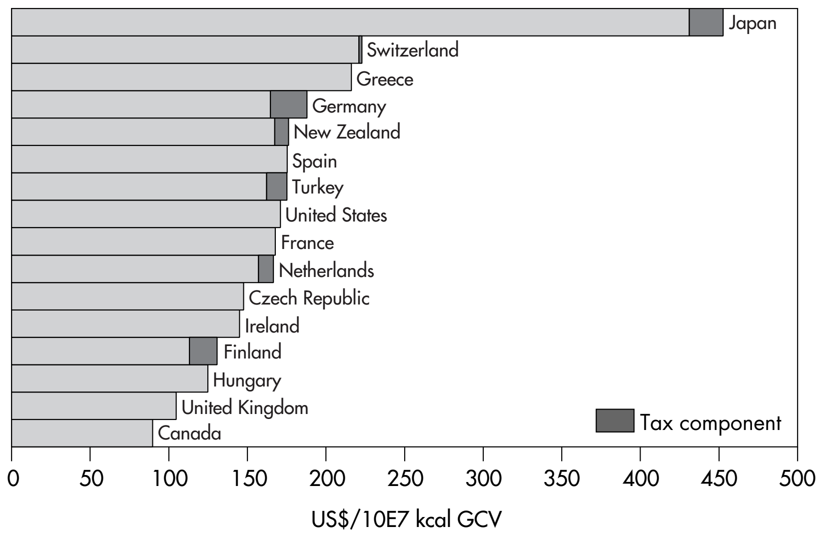


Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 22

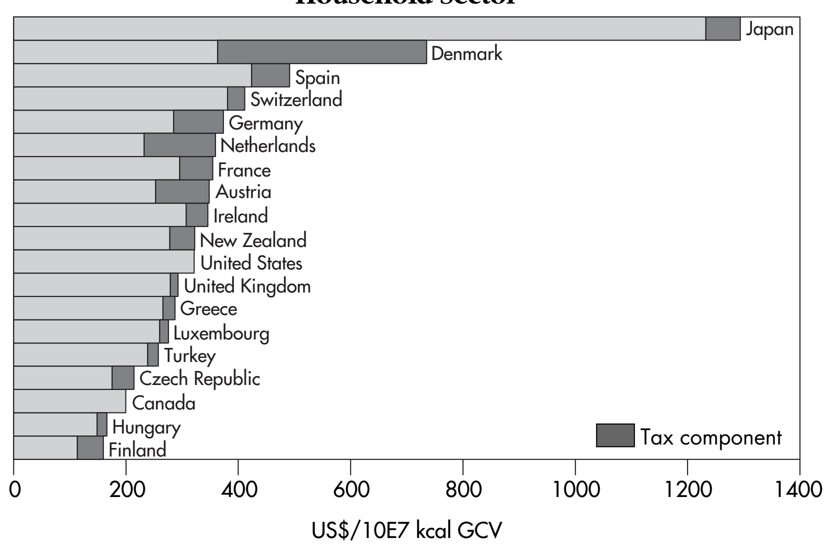
Gas Prices in IEA Countries, 2000

Industry Sector



Note: Tax information is not available for Canada and the United States. Data not available for Australia, Austria, Belgium, Denmark, Italy, Korea, Luxembourg, Norway, Portugal and Sweden.

Household Sector



Note: Tax information is not available for Canada and the United States. Data not available for Australia, Belgium, Italy, Korea, Norway, Portugal and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

End-use prices for natural gas in the United States increased sharply, reflecting the exceptional price peak in the winter of 2000–1. The price doubled from IQ1999 to IQ2001, reflecting the exceptionally cold weather in November and December 2000 and the unusually low volume of gas stocks as a result of a particularly hot summer in July–August 2000. Consumers with interruptible contracts switched to other fuels and heating oil prices also increased. The price has since fallen sharply in line with a better balance between supply and demand and the decrease of spot gas prices. The winter of 2001–2 was milder than the previous one and prices returned almost to the positions of 1Q2000 by 2Q2002.

Prices in OECD Europe also rose – but not as sharply as in the United States – between 1Q1999 and 1Q2001. The industrial index showed an increase of 33% during that period; household prices rose by 6%. Then industrial prices have been on a declining trend, while household prices continued to increase. Long-term contracts in the OECD European gas market (reinforced by a time-lag) meant that prices were less elastic than in the United States.

End-use prices for natural gas in Japan increased slightly between 1Q1999 and 4Q2001. Industrial prices rose by 13% during that period, whereas household prices increased by 4%.

Table 5
Quarterly Natural Gas Price Indices

	OECD	*North America*	*Europe*	*Pacific*
1Q 2001	160.5	198.4	117.3	108.1
1Q 2002	116.7	119.2	114.1	110.0

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Coal

Steam coal prices have been recovering from the bottom of 2Q2000 but were still lower than 1Q1999. These prices varied the least among all fuels over the past three years.

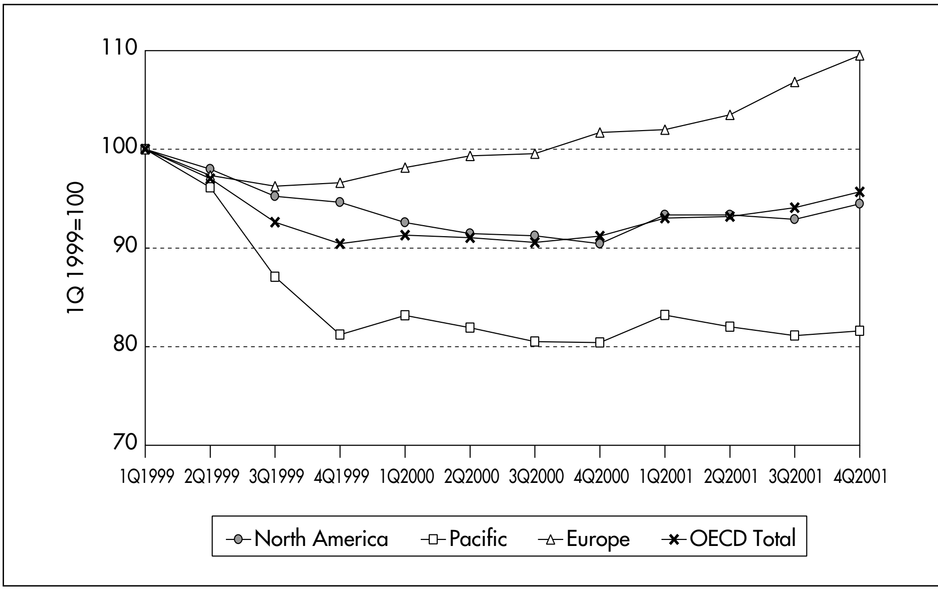
Table 6
Quarterly Steam Coal Price Indices

	OECD	*North America*	*Europe*	*Pacific*
1Q 2001	98.6	90.8	108.4	94.2
1Q 2002	101.3	89.4	118.0	92.7

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 23

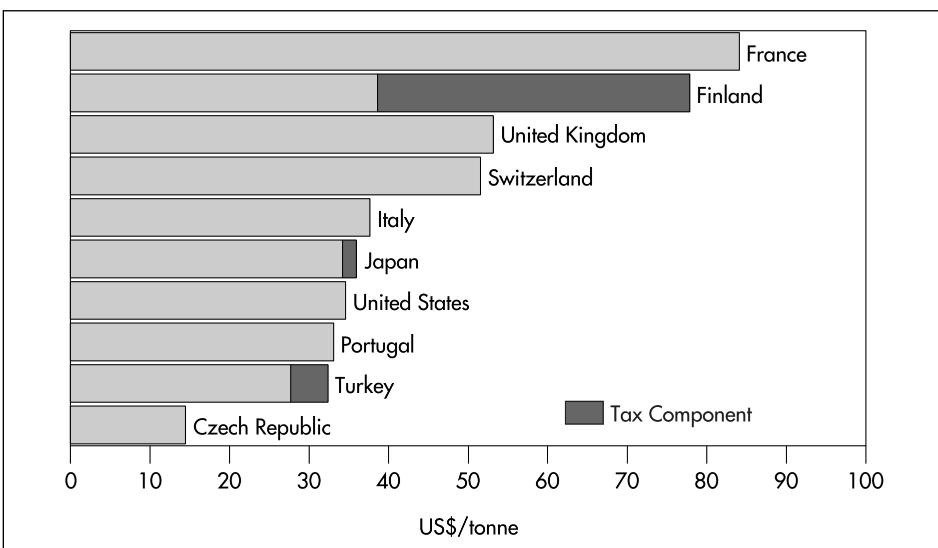
End-use Coal Prices by Region, First Quarter 1999 to Fourth Quarter 2001



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 24

Steam Coal Prices in IEA Countries, 2000
Industry Sector



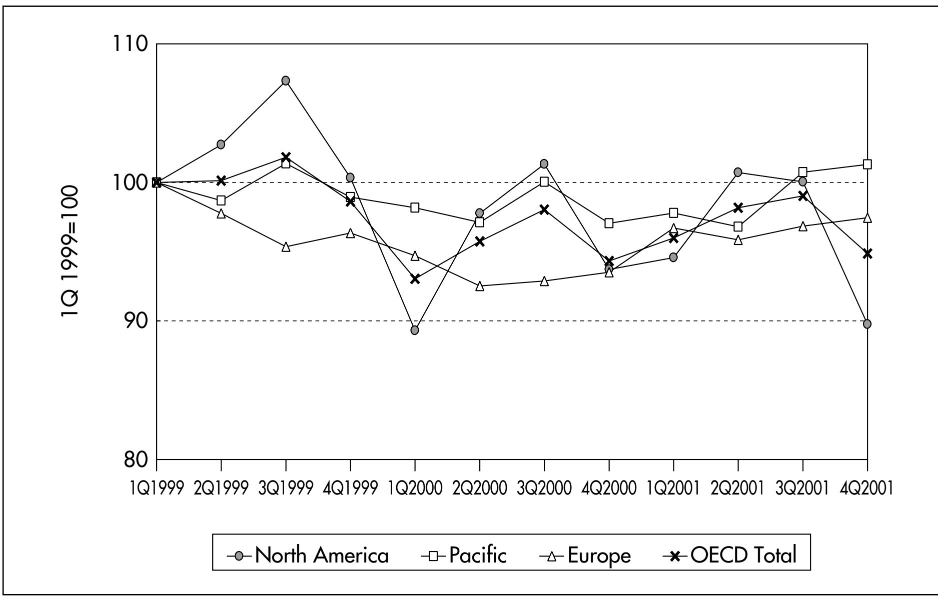
Note: brown coal price for the Czech Republic and Turkey. Data not available for Australia, Austria, Belgium, Canada, Denmark, Germany, Greece, Hungary, Ireland, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Spain and Sweden.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Electricity

Average electricity prices in the OECD area have been on a declining trend throughout the past decade but were stable in the last two years. Higher fuel prices have created an upward pressure on prices in OECD countries, particularly in those with growing electricity demand. In OECD North America and OECD Pacific, the price tends to peak in 3Q, reflecting peak summer demand.

Figure 25

End-use Electricity Prices by Region, First Quarter 1999 to Fourth Quarter 2001



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

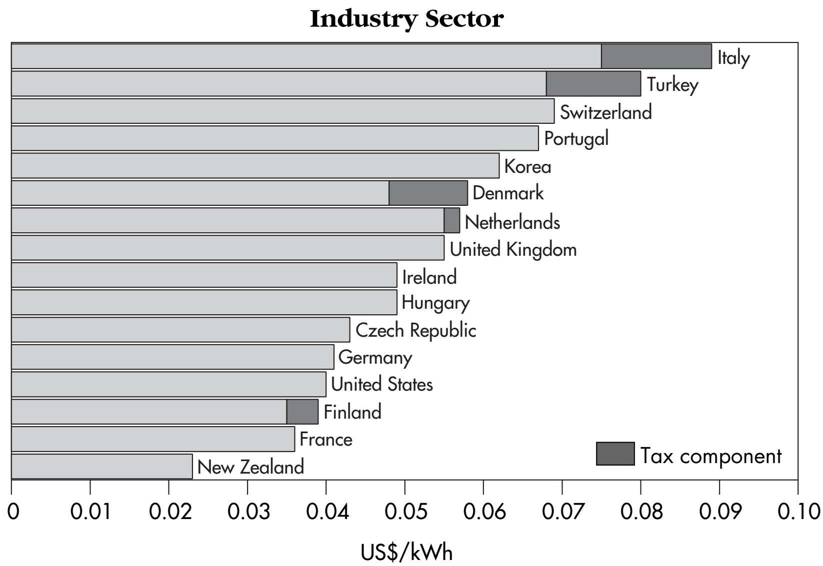
Table 7

Quarterly Electricity Price Indices

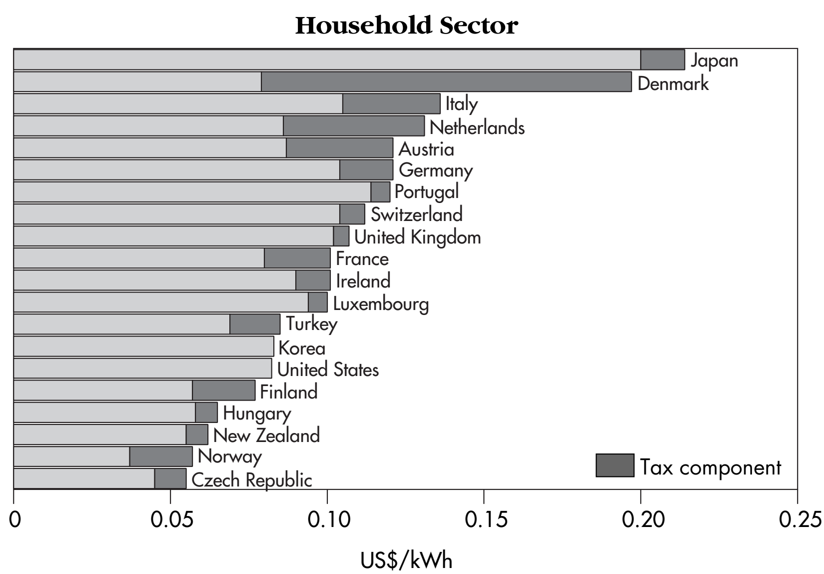
	OECD	*North America*	*Europe*	*Pacific*
1Q 2001	87.3	80.8	91.0	95.9
1Q 2002	89.3	84.2	91.9	96.8

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 26
Electricity Prices in IEA Countries, 2000



Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Austria, Belgium, Canada, Greece, Japan, Luxembourg, Norway, Spain and Sweden.



Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Belgium, Canada, Greece, Spain and Sweden.

Sources: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

ENERGY INTENSITY AND CO_2 EMISSIONS

Energy Intensity

In IEA countries, energy intensity, expressed as total primary energy supply divided by GDP (in PPPs)[1], fell by 8% in 2000 from the 1990 figure.

Energy intensity, as measured by final consumption divided by total GDP (in PPPs), continued to fall in the industry sector in IEA countries. Since 1990, it has fallen by 23% in Germany, 20% in the United States, 6.7% in France and 5% in Japan. The average IEA indicator declined by 28% in the 1980s and by 12% in the 1990s.

From 1990 to 2000, energy intensity dropped by 10% in the residential/commercial sector. (It fell by 21% in the 1980s.) It showed a notable decline in the United States and Germany, down by 16% and 15% respectively in the past decade. Though it remained low at two-thirds of the IEA average, intensity gradually increased in Japan from 1990 and peaked in 1995. It was stable from 1997 to 2000 although some 7% up from the 1990 level.

Energy use in the transport sector divided by total GDP showed a very modest decline in the IEA countries over the past decade. The United States made a substantial improvement, with the intensity dropping by 12% from 1990 to 2000. Its level in 2000 is nonetheless still 36% higher than the IEA average. By contrast, intensity rose by 10% in Japan, though it was 40% below the IEA average in 2000. Consumer preference for larger cars and the increase in driving distances can tend to offset improvement in energy efficiency. The higher fuel prices since 1999 may have contributed to reduce energy intensity (down by 2.3% in the IEA countries) between 1999 and 2000.

CO_2 Emissions

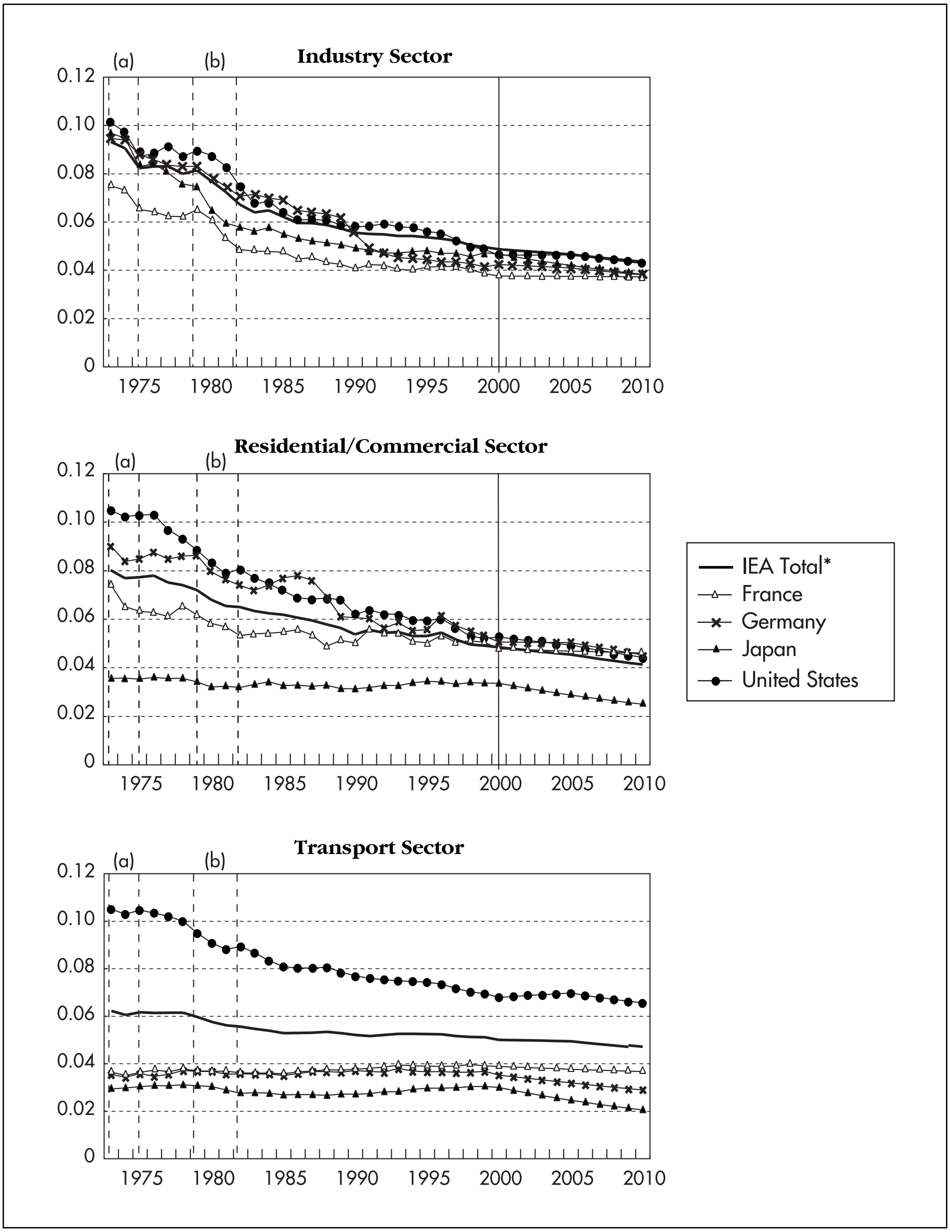
Energy-related CO_2 emissions in IEA countries reached 11.8 billion tonnes in 2000, up 14% from 1990. Emissions in some countries have been stabilised or reduced as a consequence of radical economic change (the Czech Republic, Germany and Hungary are particularly striking examples) or through fuel-switching in power generation (the United Kingdom in particular). On the whole, improvements in overall energy intensity, although sometimes accompanied by a reduction in carbon intensity, have not been enough to offset overall increases in energy demand. Increased power generation and the rapid growth of road transport have been responsible for the vast majority of increased CO_2 emissions in the OECD.

1. PPPs: purchasing power parities are the rates of currency conversion that equalise the purchasing power of different currencies.

Figure 27

Energy Intensity by Sector in Selected IEA Countries, 1973 to 2010

(toe per thousand US$ at 1995 prices and purchasing power parities)



Note : excluding Korea and Norway from 2001 to 2010.

(a) corresponds to the first oil shock (end 1973) and macro-economic recession induced by this shock.

(b) corresponds to the second twin oil shock (early 1979 and end 1980) and the macro-economic recession induced by this double shock.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002; *National Accounts of OECD Countries*, OECD Paris, 2002; and country submissions.

Over the last decade, IEA countries as a group have reduced the intensity of CO_2 emissions from power generation, largely as a result of the penetration of natural gas, nuclear and, to a much lesser extent, renewable power generation. The contribution of electricity to the increase in CO_2 emissions varies from region to region. Emissions from power generation have remained roughly stable in Europe over the last decade, largely as a result of a switch by the United Kingdom from coal to gas and improvements in the availability of nuclear power plants. North America and the Pacific region have witnessed rising emissions from power generation, driven by a rapid growth in demand. It is not clear now whether ongoing reforms in electricity markets will encourage more or less CO_2 emissions. However, policies recently introduced in many IEA countries to include a minimum share of renewable energy should, if properly implemented, contribute to lower the CO_2 content of electricity production.

Energy-related CO_2 emissions in the industry sector of IEA countries declined by 22% between 1990 and 2000 (Figure 30), although energy consumption grew by 11% over the period. Factors behind the decrease in emissions were substitution of electricity and gas for oil and coal, as well as structural changes and improvements in energy efficiency. The reduction in CO_2 emissions in the industry sector was 31% in the United States and 36% in Germany – explained by structural changes in the former East Germany. The substitution of electricity for fuels that are more CO_2-intensive lies behind the decline in US industry emissions.

Emissions continued to increase in the transport sector in IEA countries, up 14.4% from 1990. Alternative fuels and vehicles (electric, hybrid or fuel cell) have not yet penetrated the automobile market to the point where overall CO_2 emissions are affected.

Power generation remains a steadily growing source of CO_2 emissions in IEA countries. The majority of the increase has been in North America and the Pacific; emissions from power generation in Europe have remained roughly stable over the decade. Although overall generation has grown substantially, CO_2 emissions have not increased as rapidly. Coal-based generation (with the highest proportion of CO_2 per unit of energy produced) has declined in IEA Europe, while the contributions of natural gas, nuclear and, to a much smaller extent, renewable energy have increased. In the two other regions, coal use in power generation has been a growing source of emissions. Behind the trend in power generation is the rising demand for electric power for a variety of uses in industry, commerce and the residential sector.

Emissions declined modestly in the residential/commercial sector in IEA countries, although there is much room for improvements in energy efficiency, not least through improved insulation and the use of more efficient electric appliances. Firm new measures are required to bring about sustainable improvements.

Table 8
Energy-related CO_2 Emissions, Excluding International Marine and Aviation Bunkers
(million tonnes of CO_2)

	1990	*2000*	*% change 1990-2000*	*2010*	*% change 1990-2010*
Canada	430	527	22.44	556	29.28
United States	4 826	5 665	17.40	6 624	37.27
North America	**5 256**	**6 192**	**17.81**	**7 180**	**36.61**
Australia	260	329	26.79	364	40.19
Japan	1 019	1 155	13.36	1 056	3.63
Korea	226	434	91.70	..	..
New Zealand	22	32	41.93	35	57.89
Pacific	**1 527**	**1 949**	**27.67**	**..**	**..**
Austria	57	63	10.32	64	12.93
Belgium	107	120	12.15	115	7.00
Czech Republic	154	119	–22.75	101	–34.58
Denmark	51	50	–0.93	59	16.30
Finland	55	55	–0.35	65	17.35
France	353	373	5.84	462	30.86
Germany	964	833	–13.61	838	–13.07
Greece	71	88	24.33	134	89.52
Hungary	71	55	–21.71	59	–16.97
Ireland	30	41	36.15	47	56.81
Italy	400	426	6.41	451	12.85
Luxembourg	10	8	–23.21	8	–22.16
Netherlands	160	177	10.85	186	16.20
Norway	29	34	17.70	..	..
Portugal	40	60	50.49	61	55.14
Spain	207	285	37.86	289	40.09
Sweden	51	52	1.60	53	3.44
Switzerland	41	42	2.66	40	–0.81
Turkey	129	204	58.45	467	262.54
United Kingdom	560	531	–5.08	585	4.50
IEA Europe	**3 537**	**3 615**	**2.21**	**..**	**..**
IEA Total	**10 320**	**11 757**	**13.92**	**..**	**..**

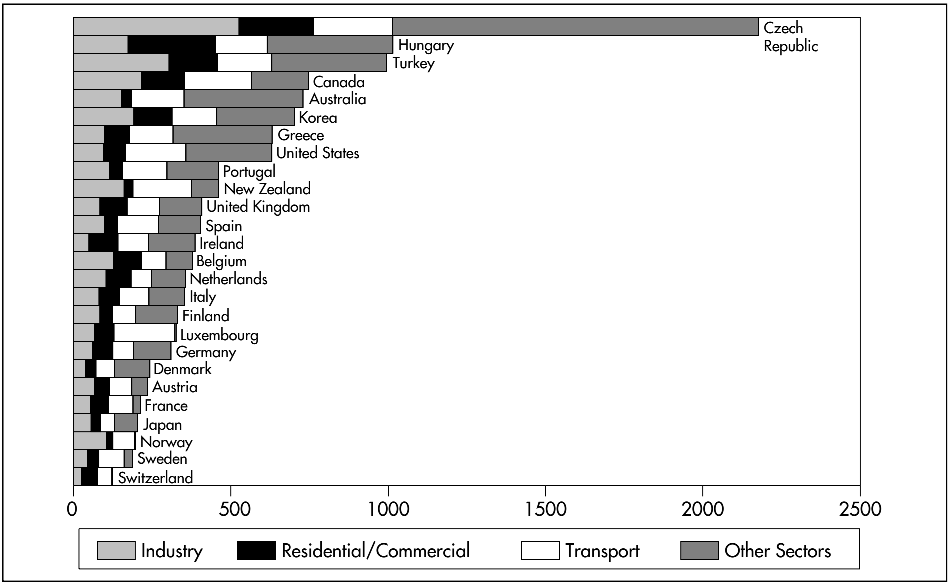
Note: "energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2000 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.

Sources: *CO_2 Emissions from Fuel Combustion*, IEA Paris, 2002, and country submissions.

Figure 28

CO_2 Emissions per GDP by Sector in IEA Countries, 2000

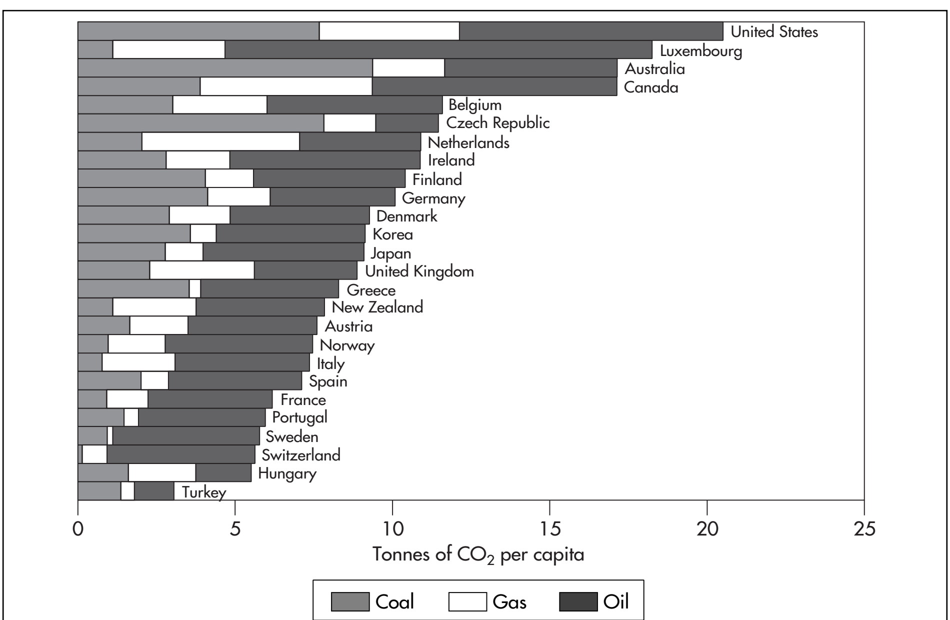
(CO_2 emissions/GDP using 1995 prices and purchasing power parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and *National Accounts of OECD Countries*, OECD Paris, 2002.

Figure 29

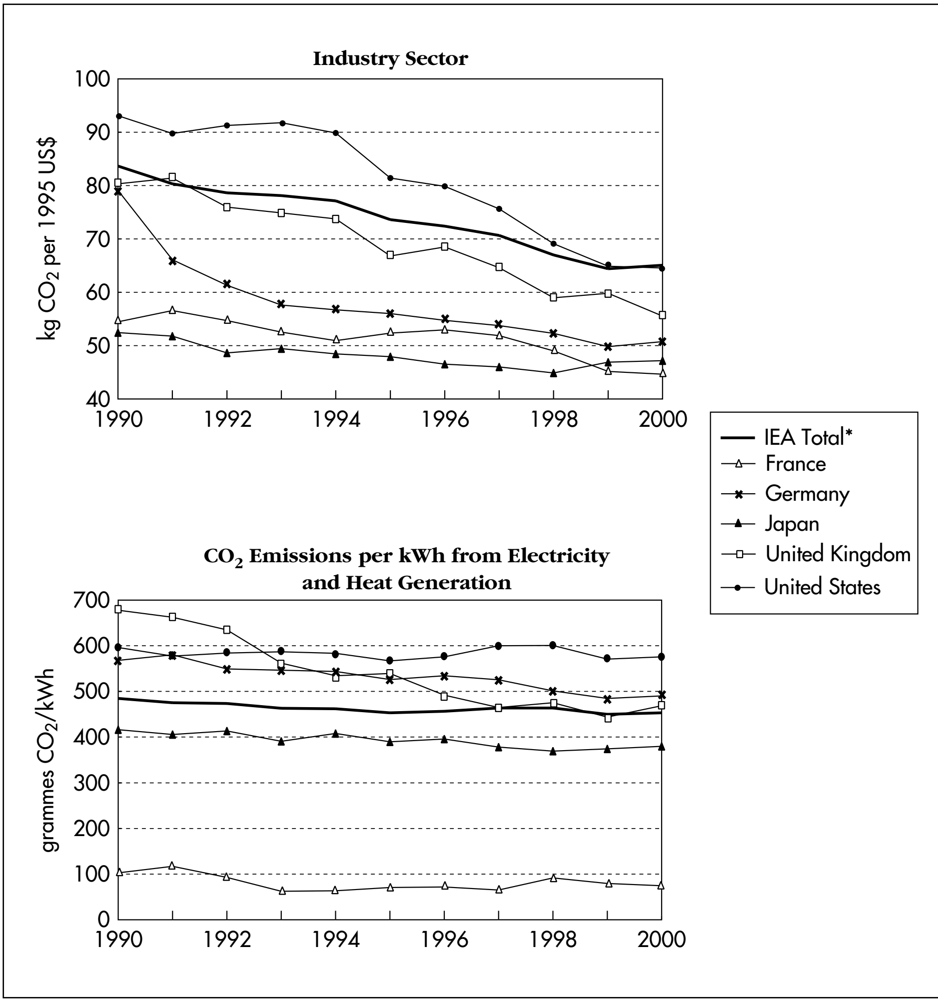
CO_2 Emissions per Capita by Fuel in IEA Countries, 2000



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and *National Accounts of OECD Countries*, OECD Paris, 2002.

Figure 30

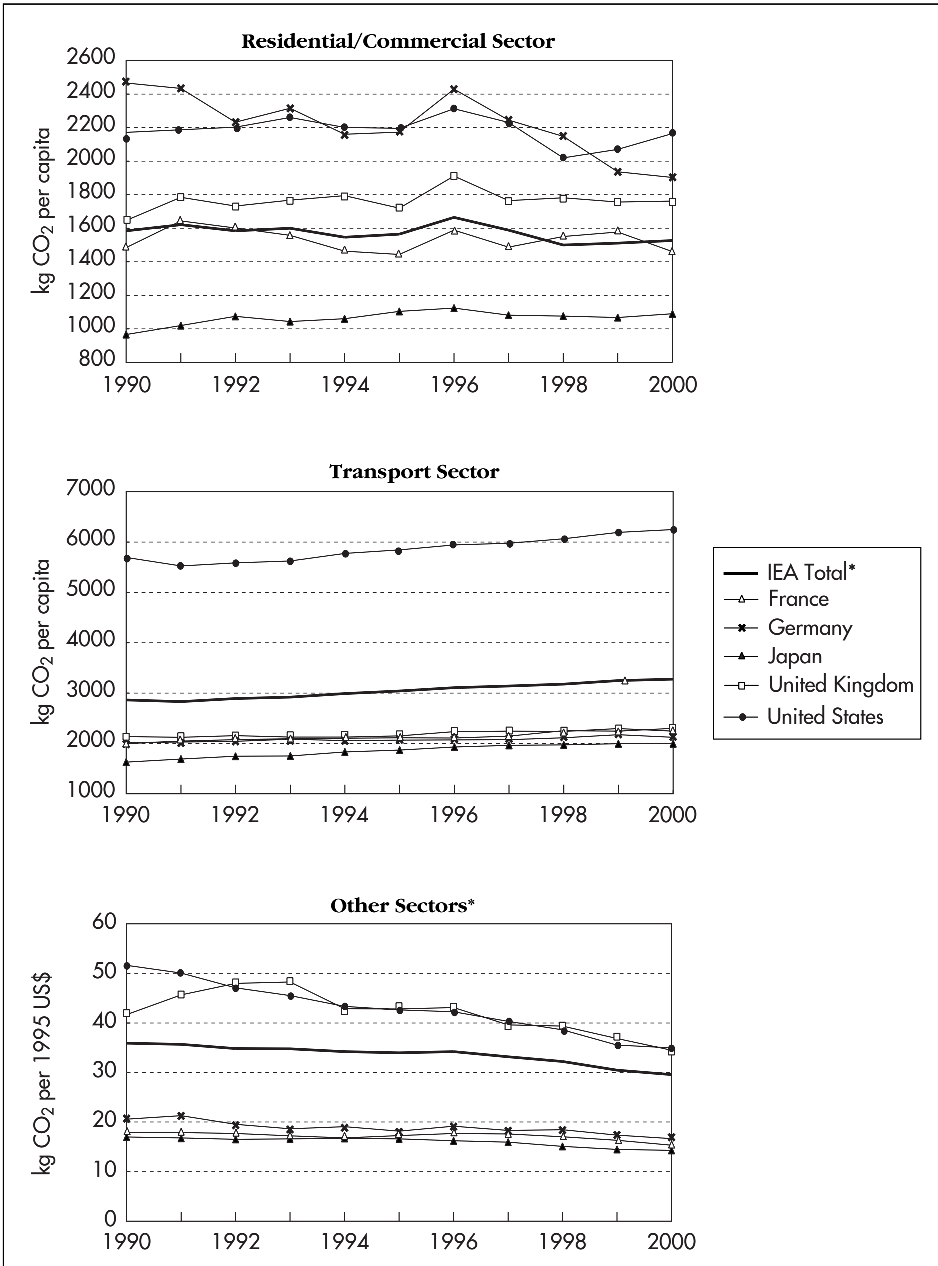
Energy-related CO_2 Emissions by Sector in Selected IEA Countries, 1990 to 2000



* includes other energy industries, agricultural sector, other non-specified sectors and non-energy use in other sectors.

Sources: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2002 and *National Accounts of OECD Countries*, OECD Paris, 2002.

Figure 30 (continued)
Energy-related CO_2 Emissions by Sector in Selected IEA Countries, 1990 to 2000

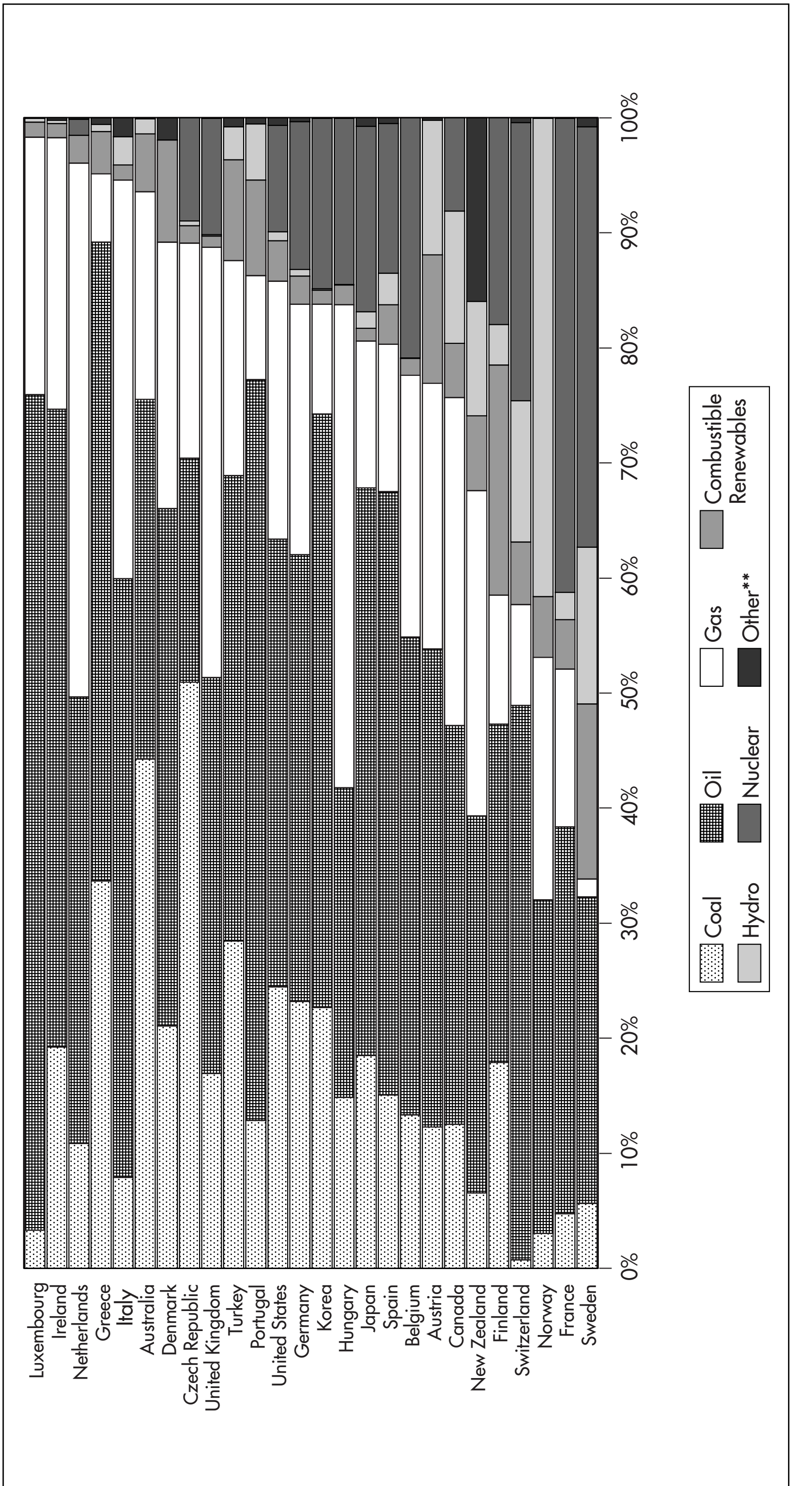


* includes other energy industries, agricultural sector, other non-specified sectors and non-energy use in other sectors.

Sources: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2002, and *National Accounts of OECD Countries*, OECD Paris, 2002.

Figure 31

Total Primary Energy Supply in IEA Countries, 2001*



* preliminary data.

** includes solar, wind and ambient heat production.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002

ENERGY SECURITY

RECENT DEVELOPMENTS

The landscape surrounding energy policy has changed quite significantly since early 1999, with energy security receiving renewed attention. Crude oil prices increased sharply in 1999 and have been generally high and volatile. The prices of oil products also rose, and some IEA countries saw protests from lorry drivers and other consumers in September 2000. As political tension continues in the Middle East, the security of oil supplies remains an important policy objective.

Although sustainable development and market reform featured on the agenda, it was the question of energy security that dominated the IEA Ministerial meeting in May 2001. Energy ministers confirmed that the experiences of the last two years have underscored that a secure supply of affordable energy is not a foregone conclusion. They reaffirmed the importance of building and holding adequate stocks and called for early action to improve transparency in world energy markets, especially the oil market. They expressed their support for continuing diversification, efforts for energy efficiency improvements and a commitment to develop and use the most effective possible means to achieve sustainable development. They welcomed the expanding energy dialogue with non-member countries and other international organisations.

In November 2001, in light of the terrorist attacks, the Asia-Pacific Economic Co-operation (APEC) countries launched an energy security initiative, whereby APEC ministers directed the APEC Energy Working Group (EWG) to intensify its work on strengthening the security and reliability of affordable energy for all in APEC, by exchanging information and experience on oil stockpiling, facilitating energy efficiency and conservation, and improving the stability of energy supply.

Energy security was a primary topic on the agenda in the G8 Energy Ministerial in May 2002, too. G8 ministers confirmed their support for continued efforts to reduce the volatility of oil prices and enhance security through increased reliance on market forces, diversification of energy supplies, increased efficiency of energy use, improved data and better communication. They also expressed their belief that a regular open dialogue among energy producers and consumers can strengthen energy security.

Maintaining a secure supply of oil continues to be an important policy objective in view of its growing share in total final consumption and increasing dependence on a decreasing number of sources. At the G8 Energy Meeting in May 2002, the ministers reaffirmed the importance that net importing countries should maintain emergency oil stocks and co-ordinate their use during significant disruptions in supply. In addition, the oil markets in IEA countries are now more rigid than before:

there is less potential for further substitutions or switches from oil since demand is becoming increasingly concentrated in the transport sector, which is inflexible in its choice of fuels.

Energy security concerns do not pertain solely to the supply of oil. In the United States, prices for natural gas almost doubled between 1Q1999 and 1Q2001, increasing also in OECD Europe by 20% during the same period. The halting of LNG exports from Arun in Indonesia in 2001 because of political unrest reminded the international community that supply security increasingly involves gas as well as oil. Nor is electricity an exception: the crisis in electricity supply in California demonstrated that a poorly designed market could cause a supply security problem. And the events of 11 September 2001 served as a warning to policy-makers that major energy infrastructures could be the object of such attacks.

It is clear that a broad perspective is required when questions of energy security are considered – such issues cannot be addressed merely at the national border. Final consumers must be protected from the potential threat to energy security. Energy security policies must address failures in energy systems that might not be handled by market mechanisms and could bring about unacceptable damage to the economy, the environment or social conditions. Although oil security is still the central consideration, the stable supply of other forms of energy, not least gas and electricity, is no less important. A number of IEA countries are therefore incorporating a broader concept of energy security into their national energy strategies.

In March 2001, an EU Green Paper voiced concern about growing import dependency and warned that the objective of its policy on energy supply – ensuring that in 30 years' time the EU will depend on external supplies for less than 70% of its energy – will be very difficult to achieve. It tried to assess the risks to all fuels in both the short and the long term. The report lists four risks as hurdles to security of supply: physical risks, or disruption of energy supply, economic risks, social risks and environmental risks.

A US National Energy Policy report released in May 2001 contains a concept of energy security risks similar to that of the EU paper: "Energy security requires preparing our nation for supply emergencies, and assisting low-income Americans who are most vulnerable in times of supply disruption, price spikes, and extreme weather". The report, which comprehensively covers all areas of energy policy, made various proposals, including increasing domestic energy production, developing the energy infrastructure, improving energy efficiency, stimulating the use of renewables and enhancing international co-operation. Its most marked impact is likely to be on supply-side measures, particularly those to encourage domestic production. The US government is also increasing the volume of strategic oil reserves.

The 2001 Report of the Energy Council of the Ministry of Economy, Trade and Industry in Japan reiterates concern about growing energy consumption and increasing imports of energy in the Asian region, especially the growing dependence on Middle East oil. Energy security policies recommended in the report include improvements in energy efficiency and further efforts in energy diversification, namely more use of natural gas, increasing renewables and installation of additional nuclear capacity.

Energy policy reviews were conducted in the United Kingdom as well. Concerns about the depletion of North Sea oil and gas reserves, the extensive shift towards gas for electricity generation, and the challenge of climate change were an important background to the reviews. The Performance and Innovation Unit of the Cabinet Office released a report in February 2002 which emphasises the international nature of both energy security and climate change issues and concludes that there appears to be no pressing problems connected with increased dependence on gas, including gas imported from overseas. The liberalisation of European gas markets will make an important contribution to security. Another report issued by the House of Lords contains similar observations but considers it unrealistic to replace the 20% or more of nuclear-generated electrical power with renewables and, instead, proposes to promote the renewal of nuclear capacity.

ENERGY SECURITY AND SUSTAINABLE DEVELOPMENT

Energy security cannot be pursued without achieving long-term sustainability consistent not only with economic growth but also with the maintenance of the basic ecosystem and a healthy environment, and achievement of cohesive societies. On the other hand, social and economic development can be attained only as long as a secure, reliable and affordable supply of energy is ensured. Concerns are not limited to physical disruption: a price spike can happen even without such an interruption and can create substantial problems in economic activities, and even social unrest. Environmental risks associated with energy use, such as global warming, cannot be neglected in considering energy supply.

Under the IEA's *Shared Goals* adopted in 1993, IEA Member countries seek to create the conditions in which the energy sector of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their population and of the environment. The IEA "Statement on Sustainable Development" adopted in 2001 elaborates on the concept of sustainable energy.

ENERGY SECURITY AND MARKET LIBERALISATION

Market liberalisation creates both opportunities and challenges. A competitive energy market is an effective means of increasing efficiency in the energy sector, broadening the choice of energy sources, and mobilising investment, all of which contribute to the security of supply. But the question is how best to introduce liberalisation. A poorly designed market can even cause a supply problem, as was observed in California. There are, though, many examples in which energy liberalisation and security of supply have been successfully reconciled.

In a liberalised market, prices provide important signals for potential investors – and yet energy markets are becoming increasingly volatile. To take advantage of the liberalised market, market players should be allowed to use appropriate financial or other tools to hedge risks. Moreover, with the rigorous pursuit of efficiency, investment decisions become more cautious. The regulatory framework has to ensure that the market can deliver a price signal on which sound decisions on long-term investments can be taken; otherwise, investments in new capacity and new technology may prove insufficient.

APPROACHES TO SECURITY

The basic means of ensuring the security of energy supply have not changed. Diversification of the national energy mix and the geographic diversity of energy sources are fundamental and widespread. Emergency stockholding is spreading from IEA countries to some non-IEA countries. International co-operation is growing. These measures are important for both short- and long-term security, with the former enhanced by increased ability to switch between fuels and interruptible contracts with consumers. Demand restraint is also effective to counter short-term supply disruption. Measures with a longer-term emphasis include long-term contracts with suppliers, energy saving through improvements in energy efficiency, increased domestic production and the development of robust energy infrastructures. The choice and focus of specific measures can differ considerably among countries, reflecting their natural endowments, supply and demand structure, industrial structure, fuel structures, geographical settings, and so on.

As concluded in the *World Energy Outlook 2002*, the resource base for all fuels is ample. There are different forces at work on costs: technology and productivity are driving them down, but there are countervailing forces, arising from the increasing distance between the location of the resources and the location of the markets they are destined to serve. Prices are likely to continue to be shaped by wider considerations than cost. Oil and gas prices, for example, are at present above long-run marginal costs, reflecting imperfect competitive conditions, which could facilitate the mobilisation of investment capital.

Nevertheless, the scale of investment necessary if growing demand is to be met is formidable. The bulk of this investment is required in developing countries in Africa, the Middle East and Latin America, but the capital itself must come primarily from the developed countries. Mobilising foreign direct investment in a timely manner will require an enabling investment climate through lowering regulatory and market barriers in the recipient countries.

PROSPECTS FOR EACH FUEL

Oil

There exist sufficient proven oil reserves to satisfy projected demand for at least the next three decades. Oil will retain its position as the single largest source of primary energy and is forecasted to represent 38% of the world's energy mix in 2030. To exploit the potential, however, a considerable amount of capital is required, in continuous investment both upstream and downstream. Government policies, as well as industry restructuring, influence this investment. The share of OPEC countries in world oil supply is expected to increase, and so the dependency on OPEC oil will increase. Oil may become more susceptible to geopolitics. Prices are volatile and sharp price peaks may cause social problems.

The International Energy Program remains a core component of IEA Members' plans for security in oil supply. Under the IEP, IEA Member countries undertake to maintain emergency oil reserves equivalent to at least 90 days of net oil imports. They are prepared to implement programmes of demand restraint to reduce national oil consumption and, ultimately, to share available supplies with other IEA countries in the event of a severe supply disruption. Co-ordinated Emergency Response Measures have also been adopted as an additional set of measures, available as a rapid response to a supply disruption, or the threat of one. The IEA, in co-operation with the oil industry through its Industry Advisory Board, maintains a network of international contacts to handle the practicalities of any energy emergency. These arrangements are regularly tested: the last test was conducted in March 2002.

Reflecting increasing awareness of the importance of emergency stockholdings, many non-IEA countries (such as China) have announced their intention of holding stocks for emergency preparedness. APEC has announced its intention to intensify its work on strengthening the security and reliability of an affordable energy supply, including an exchange of information and experience on oil stockpiling, and the exchange and improvement of oil data in co-operation with several international organisations, including the IEA and OPEC.

Gas

The market for natural gas will continue to grow fast, thanks to its ample availability, its cost-competitiveness and its environmental advantages over other fuels. Gas is indeed an abundant energy source: current reserves equal, in energy terms, the world's total proven reserves of oil. Though a few countries dominate the global picture for gas reserves, the reserves are more evenly dispersed throughout the world than oil, with the result that gas is less susceptible to geopolitical disruption than oil.

Gas prices, however, tend to be volatile, in particular in North America where prices are not determined under long-term contracts. Long-term gas supplies will require massive investment in production facilities and infrastructure to transport gas to markets, from production centres further away from the point of consumption. Since gas will provide a large part of energy supply in OECD countries, in particular in power generation, the consequences of an interruption to supply could be substantial, underlining the importance of policies to enhance security in supplies.

Coal

Reserves of hard and brown coal are abundant and geographically widespread. Proven economically recoverable reserves would support production of hard coal for over 200 years and production of brown coal for over 1 000 years, at current volumes of production. Almost half the world's reserves of hard coal are located in OECD Member countries. IEA Member countries dominate the international coal market, accounting, in 2000, for 35% of world hard coal production, 47% of world hard coal exports, and 72% of imports. Costs are expected to remain stable.

For these reasons, and because coal accounts for 37% of world electricity generation, there is renewed policy interest in the security of coal-fired power as a component of energy security – but in the context of sustainable development, which must reconcile the supply security benefits of coal with the environmental impact of coal use. Advances in coal-fired power generation technology, which could substantially reduce carbon and other emissions, have an important bearing on prospects for coal, and the question of how to encourage the deployment of such technologies continues to be an issue for policy debate.

Nuclear

Nuclear is a stable energy supply source and does not emit greenhouse gases (GHGs). Uranium reserves are abundant and concentrated largely in OECD countries. Power plants can be operated for a year or two without refuelling. However, rigorous safety procedures are required to operate the plants and the issue of nuclear wastes has to be addressed. Economic risks in building new nuclear power plants are high because of the huge investment costs upfront, and today new nuclear plants are generally not considered competitive against plants which burn fossil fuels in a competitive market for power. However, a commercial decision has been taken in Finland to construct a new nuclear power plant and the necessary political endorsement has been secured.

Renewables

Renewables are clean and secure sources of energy, with substantial technical potential: these literally limitless resources could meet a large proportion of world energy demand. However, under current market conditions, their economic potential is much lower. Compared with conventional sources of energy, most forms of renewable energy are not competitive now, and require continuing government support. Wind is the most rapidly expanding source of renewable energy, although the cost of producing electricity from wind power is still high compared with fossil fuels. But declining capital costs and improved performance are likely to reduce the costs of generation, and over the next decade, on the best sites on land, wind power is expected to become competitive with generation based on fossil fuels. The inherent drawback is that wind power generation is intermittent. Hydro is another source which can be competitive, but growing environmental concerns make it more difficult to install large-scale new plants.

THE IMPLICATIONS OF 11 SEPTEMBER

After 11 September, increased concern about terrorist attacks has brought a new focus to bear on protection of the key features of national energy infrastructures, including oil and gas pipelines, oil terminals and refineries, electricity transmission lines and major power plants. Sea lanes may also be vulnerable. Many IEA countries tightened security controls on major energy infrastructures after the attacks.

INTERNATIONAL CO-OPERATION

International co-operation between producing and consuming countries has developed significantly in recent years. There are various kinds of dialogue between producers and consumers, among them the International Energy Forum, a biennial, Ministerial-level meeting of producing and consuming countries, and the Energy Expert Group, an expert-level meeting, also biennial, of producing and consuming countries, sponsored by the IEA (and, on occasions, the Gulf Co-operation Council). The Joint Oil Data Exercise (JODE) is an example of solid co-operation between the producers and consumers to improve statistical information and thus enhance the transparency of the energy market.

The reactions to the events of 11 September 2001 demonstrated how far mutual understanding and a heightened sense of mutual dependence have developed among producers and consumers as the result of ten years of organised dialogue. On the very day of the attack, the Secretary-General of OPEC publicly assured the market that "All [OPEC] member countries remain committed to continuing their policy of strengthening market stability and ensuring that sufficient supplies are available to satisfy market needs". OPEC members were ready if necessary, he said, "to use their spare capacity ... to achieve these goals", and he categorically denied that OPEC members would contemplate using oil as a political weapon, as in the past.

ENERGY MARKET REFORM

ELECTRICITY

Electricity market reforms have continued to make progress in OECD Europe, where there are plans for a new EU directive on electricity, and in Canada and Korea, but reform activity has been weak in other countries, particularly the United States, as a consequence of the Californian power crisis of 2000–1. The regulation of electricity trading has been under the spotlight following the bankruptcy of Enron. Electricity trade went largely undisrupted by these events.

IEA Europe

New EU Electricity Directive

Prospects for the development of an integrated European electricity market improved with the decision in March 2002 by the Council of the European Union to adopt a new EU electricity directive by majority vote before the end of 2002. The new directive will extend the right to choose electricity suppliers to all non-household end-users and to at least 60% of total demand by the end of 2004. A majority of countries are also committed to open the household market (Table 9). This decision partly adopts proposals for a new directive tabled by the EU Commission in 2001 aimed at fully opening electricity markets, reducing existing barriers to competition and reinforcing regulation.

No decision has been made yet on other key aspects of the Commission's proposals, including the adoption of regulated third-party access (TPA) as the only access model in the EU and the strengthening of unbundling requirements imposed on system operators. Regulated TPA is already the primary access model chosen in all the EU countries except Germany. On the other hand, unbundling requirements show considerable variation. In Finland, Sweden and the United Kingdom, separation of ownership is required, so that the operator of the transmission system is fully independent from the generators. At the other extreme, there is only managerial separation within vertically integrated companies in France, Germany and Greece. In the remaining EU countries, there is legal separation, so that system operation is the responsibility of a separate company, but generation and transmission have, at least in part, the same owners. The new directive does not include provisions on the access model or on the strengthening of unbundling requirements.

Table 9
Electricity Market Opening in EU Countries

	Declared market opening %	*Full opening date*
Austria	100	2001
Belgium	35	2007
Denmark	90	2003
Finland	100	1997
France	30	None
Germany	100	1999
Greece	30	None
Ireland	30	2005
Italy	45	None
Netherlands	33	2003
Portugal	30	None
Spain	45	2003
Sweden	100	1998
United Kingdom	100	1998

Source: EU Commission.

EU Cross-border Electricity Trade

The European Electricity Regulatory Forum – made up of EU regulators, system operators and industry representatives – agreed in February 2002 that a harmonised tariff for cross-border electricity trade among EU countries, plus Switzerland and Norway, should be adopted. A standardised export tariff of one euro per MWh is proposed, abolishing all import and transit tariffs. The proposal is being examined by the EU Commission. This system is intended to be a temporary solution, to be replaced in 2003 by a permanent system that would introduce separate location factors into the tariff structure, in order to provide signals for new investments in generation. The adoption of common rules for cross-border electricity trade, which has been an unfulfilled priority since the inception of the Forum in 1998, would represent an important step forward in the integration of national European markets.

However, effective market integration across the EU also requires addressing other issues, including the augmentation of cross-border interconnections, which are congested between several EU countries. In December 2001 the Commission set out priority projects for reducing bottlenecks on the electricity networks, particularly those affecting trade from and to Italy, Spain, Portugal, the Netherlands, Belgium, the United Kingdom, Ireland and Greece, although no schedule for capacity augmentation has been established. Other obstacles to competition identified by the European Commission include market dominance by incumbents and high network tariffs, particularly in Austria, Germany, Portugal and Spain.

Developments in European Countries

In parallel to these regulatory developments, electricity markets continued to evolve at a fast pace in IEA Europe. Overall, there is convergence in market design. Most markets are energy-only markets (there are no capacity payments or other mechanisms to encourage investment) and participation is voluntary, thus allowing for long-term bilateral trade of electricity.

In the United Kingdom, the New Electricity Trading Arrangements (NETA), implemented in March 2001, completed their first year of operation. Under NETA, the old mandatory pool has been replaced by a system in which electricity trade occurs freely until so-called "gate closure", three-and-a-half hours before the time of despatch. A balancing market operates after gate closure to adjust supply and demand. An initial review conducted by the regulator indicates that wholesale prices have declined by about 40% following the introduction of NETA, that market liquidity has increased and system-balancing costs have halved. The review also noted that NETA has had an adverse impact on some groups of "green" generators, which have to buy electricity from the balancing market relatively often because of the fluctuating nature of their supply. Options to support these generators are being considered.

In Portugal and Spain, a decision was made to create an integrated Iberian market by 1 January 2003, prompting consideration of a number of changes to harmonise the regulatory frameworks and institutions in the two countries. There are plans, for instance, to introduce bilateral electricity trade in Spain.

In France, EDF is giving access to competitors to 6 000 MW of generating capacity, following an undertaking agreed by EDF with the European Commission when it obtained approval to acquire a further interest in the German electricity utility EnBW. The capacity is being offered through a series of auctions, the first of which took place in September 2001; it is expected that the entire 6 000 MW will have been offered by November 2003. Around 5 000 MW are being offered as "Virtual Power Plants", representing rights to nominate electricity output for delivery on the following day at a pre-defined price. In addition, EDF will make available capacity equivalent to 1 000 MW of co-generation plant.

In addition, a new power exchange (PowerNext) opened in France in November 2001, in Austria (EXAA) in March 2002, and an Italian Power Exchange is expected to start operation in the second half of 2002. The two German power exchanges, located in Frankfurt and Leizpig, merged in March 2002.

Figure 32
Electricity Power Exchanges in Europe

Source: IEA.

In several countries, the institutions which regulate electricity are being reformed. A regulatory entity linked to the Ministry of Economic Affairs and Labour was established in Austria in March 2001. The scope of the Portuguese electricity regulator was extended in early 2002 to cover the gas market as well. The Dutch Parliament decided to establish an independent regulatory agency for electricity as of 2005.

IEA North America

Regulatory Developments

The status of reforms varies by state/province in both Canada and the United States, ranging from a number of states where markets have been open for several years to others in which reforms are not yet being considered. Reform activity in the US electricity supply industry slowed down following California's power crisis in late 2000 and early 2001. Restructuring activity was delayed in six states and suspended in California (Figure 33), although restructuring plans progressed in some states such as Texas, where retail choice was introduced in January 2002 for most consumers. In Canada, plans to open electricity markets to competition in Alberta and Ontario were implemented as scheduled in June 2001 and May 2002, respectively.

A focal point of current regulatory activity in the United States is electricity transmission. In July 2001, the Federal Energy Regulatory Commission (FERC) swiftly moved to impulse the creation of large regional transmission organisations (RTOs) that would integrate the currently fragmented transmission networks. The FERC has encouraged the creation of four RTOs in the North-East, South-East, Midwest and West, with an exception for Texas, and has ordered proceedings to develop RTOs in some of these areas. This move has resulted in a proposal to merge into a single RTO the system operators covering twenty Midwest and South-West states and the Canadian Province of Manitoba. In addition, the FERC intends to develop a single transmission tariff setting standard conditions for access, including rules for the allocation of transmission capacity. The aim of this initiative is to facilitate competition in wholesale markets and, in particular, to prevent incumbents from imposing discriminatory access conditions to networks.

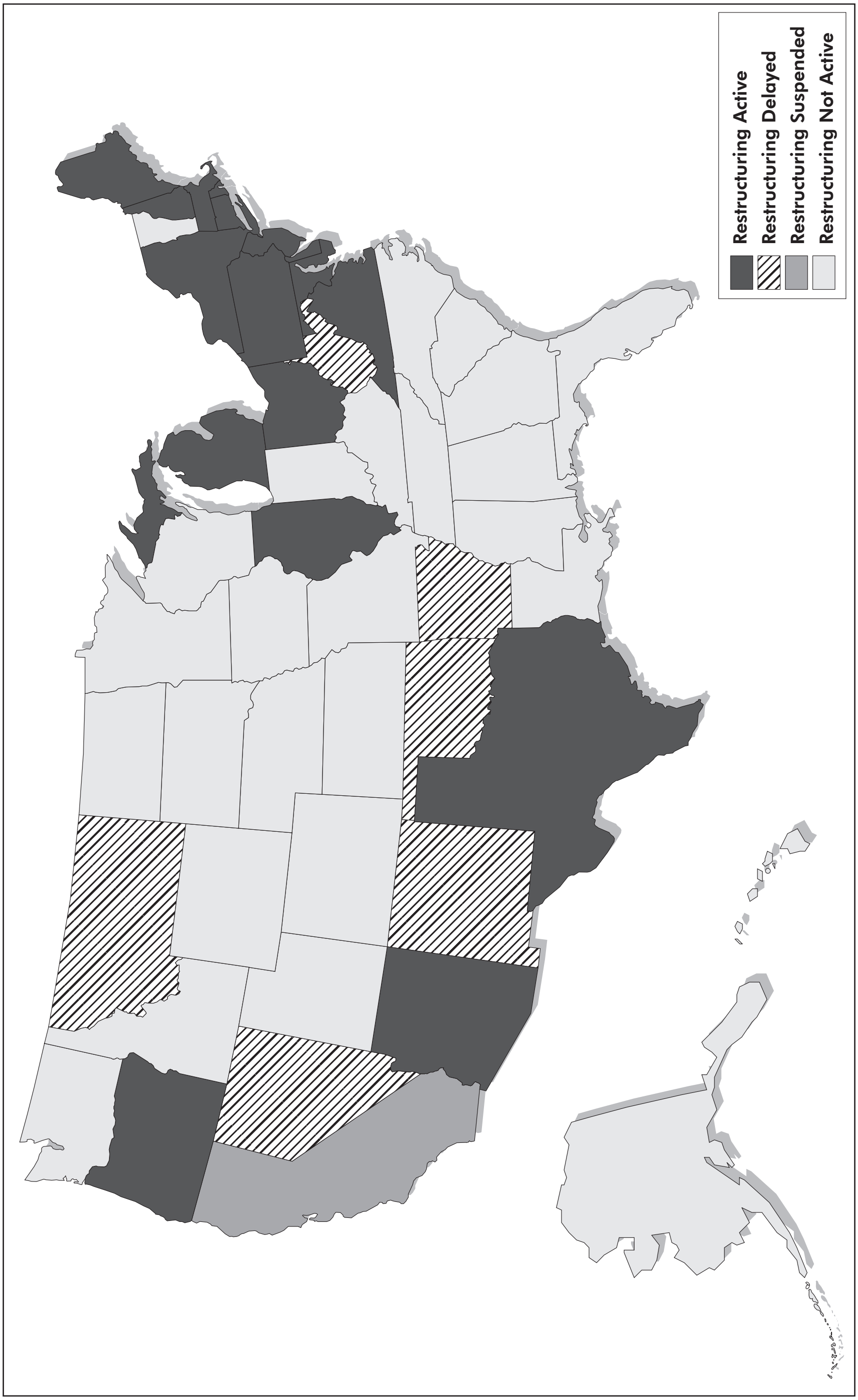
California after the Power Crisis

The situation in the Californian electricity market stabilised from 3Q2001 (the last rolling black-out was recorded on 8 May 2001), with reliability being restored, wholesale prices returning to normal positions and investment activity picking up. To address the financial crisis of the utilities, the State of California has been buying power on behalf of the utilities both in the spot market and through long-term contracts. Power purchases are estimated at US$ 12.45 billion and 68 683 000 MWh for the period January 2001–February 2002. In February 2002, the California regulator agreed to a rate increase to finance the approximately US$ 10 billion in debt incurred by the government of California (through the Water Resources Department) to purchase power. This form of power procurement is only intended as an interim solution and consideration is being given to new market arrangements. The future regulation of the industry remains uncertain.

In August 2001, the California Consumer Power and Conservation Financing Authority (CPA) was established, with a general mandate to serve as a vehicle in acquiring power to meet energy requirements in California and securing a sufficient reserve of power. The CPA is authorised to issue up to US$ 5 billion in revenue bonds to finance energy projects and conservation programmes. It will focus on

Figure 33

Status of State Electric Industry Restructuring Activity (July 2002)



Source: United States Department of Energy.

financing the deployment of renewable energy and distributed generation and is also considering load management and conservation projects.

The Bankruptcy of Enron

The impact on energy markets of the bankruptcy of the Enron Corporation in December 2001 has been very limited. In spite of a momentary decrease of liquidity in energy markets, both trade and supply continued smoothly in all regions where Enron had been active. Although investigations on these events are still going on, including one carried out by the FERC, their potential impact on the future of energy regulation appears to be limited.

IEA Asia-Pacific

In Japan, a panel has started to discuss further reform of the electricity sector under the auspices of the Ministry of Economy, Trade and Industry. Among the issues being considered are the unbundling and regulation of transmission, the setting-up of a spot market and the further opening of the retail market. The industry was partially opened to competition in March 2000. In the first twenty months since these reforms were introduced, only 0.2% of the market switched to new entrants.

In Australia, the Council of Australian Governments has put in place new governmental processes to progress energy market reform, including in the national electricity market (NEM). A NEM Ministers' Forum has been established to address a number of priority operational, regulatory and institutional issues. One matter being considered is how the regulatory structures charged with overseeing the NEM, currently the responsibility of three different institutions, can best be simplified. At the retail level, a schedule for the introduction of full retail contestability is established for all states, except for Queensland.

The Korean electricity sector is in the early stages of a lengthy process of restructuring, privatisation and liberalisation. Non-nuclear generation assets have been broken up into five wholly owned generating subsidiaries in April 2001 and privatisation is planned to begin in 2002. A cost-based electricity pool and power exchange (KPX) was put into operation in April 2001; it is expected that it will be transformed into a competitive mandatory pool in 2003. At the end of 2002, the distribution subsidiaries have yet to be created, and final decisions concerning the liberalisation of the retail market have yet to be taken.

GAS

Reform of the natural gas sector is well under way in OECD countries and it is spreading and deepening. It already brought a choice to most consumers in choosing supplier and service, although in some countries, only a few have used the option to switch their supplier. While consumers will get more choice and a more efficient and transparent market will develop, prices will not necessarily always decrease as a result of market reform, since prices, under long-term contracts, are still predominantly pegged to the development of fuel oil prices, and because prices will increasingly be determined by the relation between supply and demand.

With the market opening in all of the EU countries, Zeebrugge (near the landing point of the UK interconnector, Zeepipe, and near the Belgian LNG terminal) has evolved as a first gas-trading hub in Continental Europe. Another trading hub is emerging at Bunde, near the delivery point of Dutch gas at the German-Dutch border and the landing points of Norwegian gas. With market liberalisation spreading throughout Europe, other trading hubs could develop at strategic points on the European Network. While OECD Europe and Japan will increasingly depend on imported gas (and even the United Kingdom will become a net importer of gas in view of the progressive depletion of the UK Continental Shelf gas reserves), there is no shortage of gas supplies foreseeable for the next few years. A crucial question is what role long-term contracts will play in securing the development of the production and transportation infrastructure necessary to cope with increasing import demand and what other instruments might evolve to replace or complement long-term contracts[2].

In Europe, mergers continue between companies from different regions, but also between gas and electricity companies with the emergence of several large multi-utility companies. Partly as a reaction to the California power crisis, a large capacity of gas-fired power plants (more than 60 gigawatts) has been put into operation in the last two years in the United States and an even larger capacity is planned to be operational by 2005.

IEA Europe

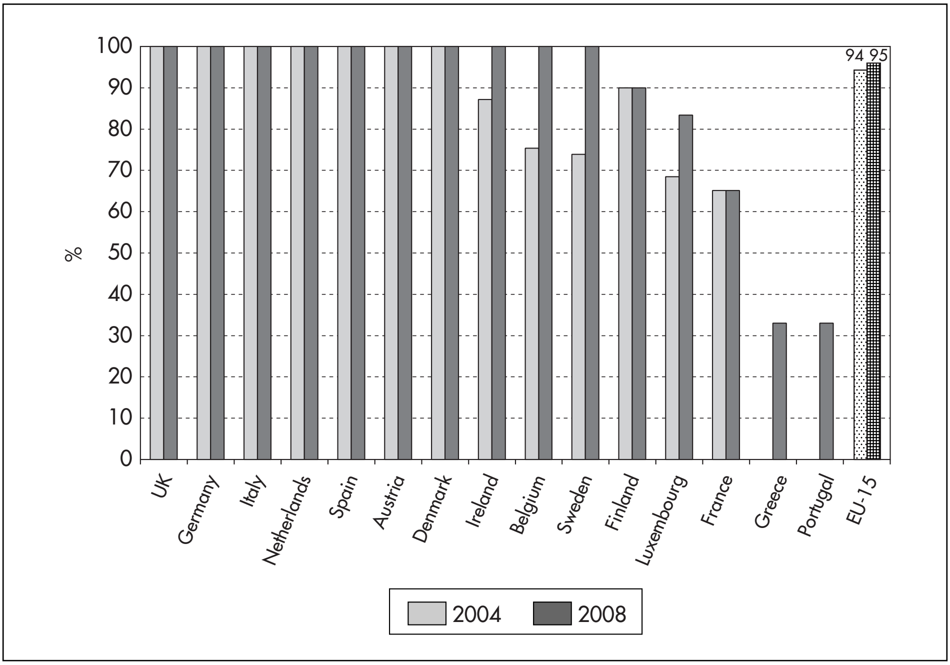
Implementation of the EU Gas Directive

The EU Council meeting in Barcelona on 16 March 2002 decided upon full market opening for all non-household consumers as of 2004; before spring 2003 the European Council will decide on further measures. The Council decided also that each member state should establish a regulatory function within the appropriate regulatory framework to ensure effective control of tariff-setting. An amendment of the EU gas directive is under discussion, proposing more uniform regulation across the EU, mandatory legal unbundling and regulated third-party access (TPA) to the grid, and that TPA (negotiated or regulated) to storage facilities should be extended.

The planned market opening resulting from the Barcelona Council summit is shown in Figure 34.

2. For further information, please see *Flexibility in Natural Gas Supply and Demand*, IEA/OECD Paris, December 2002.

Figure 34
European Union Gas Market Opening



Source: European Commission DGTREN.

Only Germany has not yet installed a regulatory authority and taken negotiated access through the *ex post* control of tariffs. On 3 May 2002, after long discussions, the Associations Agreement II was concluded and allows Germany to follow its model of negotiated access.

In the United Kingdom, NETA resulted in short-term optimisation opportunities for gas-fired power plants depending on the electricity spot market. In consequence, a change of the balancing regime in the gas sector (from daily to a shorter balancing regime), which would be more consistent with the electricity regime, is under discussion. NETA also resulted in a substantial decrease of power prices, even, at times, not allowing the gas-fired power plants to recover their fuel and operating costs. In 2001, for the first time over the last ten years, supply from gas-fired power plants fell by 2%, although new gas-fired stations came on stream in 2000 and 2001.

IEA North America

Although competition in wholesale markets has been successfully introduced throughout the United States, the picture for retail market opening is less uniform. Some states have successfully introduced it, but the majority are still at the beginning of the process.

Table 10 provides an overview of the status of the restructuring of the natural gas industry in each state, focusing on the residential customer class. Retail unbundling, or restructuring, is the division of those services required to supply natural gas to consumers into various components, which can then be purchased separately. With complete unbundling, consumers can choose their own gas supplier and the local distribution company continues to provide local transport and distribution services. The various unbundling programmes are often called "customer choice" programmes.

Table 10

Status of US Natural Gas Industry Restructuring at the Retail Level

Residential natural gas restructuring status	*States*
State-wide unbundling 100% eligibility	DC, NJ, NM, PA, WV
State-wide unbundling – Implementation phase	CA, CO, GA, MD, MA, OH, VA
Pilot Programmes/ Partial unbundling	IL, IN, KY, MI, NE, SD, WY
No unbundling – Considering action	IA, KS, ME, MN, NV, NH, OK, SC, TX, VT
No unbundling	AK, AL, AR, AZ, CT, FL, HI, ID. LA, MS, MO, NC, ND, OR, RI, , UT, WA
Pilot programme discontinued	DE, WI

Source: EIA website.

Five states and the District of Columbia (D.C.) have had changes of status since March 2000. Pennsylvania has allowed customer choice state-wide since July 2000 and D.C. gave approval for a full-scale choice programme in February 2001. Michigan and Virginia are in the process of implementing programmes allowing choice state-wide after conducting pilot programmes for several years. In contrast, Delaware and Wisconsin discontinued their pilot programmes on 31 October 2001.

Although markets were sufficiently liquid to ensure that the filing for Chapter Eleven by Enron did not cause any interruption in gas delivery, questions about accounting, auditing and trading practices were raised.

The sharp increase and volatility of gas prices at the end of 2000 and the beginning of 2001 have also adversely affected reforms in some states. Prices began to increase in the summer of 2000, primarily in response to extreme weather conditions and low volumes of underground gas storage. Spot prices spiked at \$10.53/MBtu on 29 December 2000. The rise reflected several factors, among them flat natural gas production for several years, increased demand for gas, especially for electricity generation, a colder winter than experienced in the last few years, low levels of natural gas in storage and high prices for oil limiting the economic incentive to switch to fuel oil.

The issue was particularly sensitive in California where extreme weather conditions in December 2000 and heavy restraints on transport capacity increased Southern California border prices to as high as \$65/MBtu on 11 December. On average, Los Angeles December city-gate prices were \$16.28, compared with \$5.74 in November.

Japan

In Japan, competition has emerged in the gas industry as a result of deregulation of the power sector and the opening of the gas market to large industrial customers whose annual consumption exceeds 1 million m^3. The government has speeded up access for new entrants to the existing large-user market by dropping a requirement for prior approval in favour of notification of intention to compete. Currently gas and electricity utilities, as well as new entrants (mainly oil companies), can compete because each side can enter the other side's territory. Some Japanese gas and electricity utilities are beginning to look outside their traditional markets and some oil refiners are looking at new opportunities in the LNG retail market.

For instance, Tokyo Electric Power Company (Tepco), the largest company importing electricity and LNG , is aiming to become a wholesale gas supplier. It has signed a contract with Keiyo Gas, Japan's fifth-largest local gas distributor based in Chiba prefecture. Tepco is also selling gas to Otaki Gas, another small gas distributor in the same prefecture. Tepco plans to start selling surplus LNG in 2006 under two- to three-year contracts with small domestic gas companies.

Tokyo Gas, the largest gas utility company, has recently established a joint venture with Shell and Nijo Gas Co, to sell gas in the metropolitan district of Tokyo. The joint venture will sell gas to independent power producers and other large consumers.

The Japanese Ministry of Economy, Trade and Industry (METI) is taking steps to ensure competitive third-party access to city gas grids for small and medium-sized companies. Third-party access to LNG facilities, storage tanks and pipelines is due in 2003. The government is also investigating how to develop a natural gas grid to foster competition and the creation of a spot market for gas.

Security of Gas Supply

So far most IEA countries are well supplied with gas and, to the extent they have to rely on imports, well diversified or backed by sufficient storage capacity so that they can withstand all major external disruptions of whatever origin. This situation is not likely to change in the years to come.

However, the progress of market reform has raised two issues with regard to security of supply:

- How to ensure timely and adequate investment in gas infrastructure to meet increasing demand for gas.

- Whether liberalised markets give adequate signals to make investment in gas production, export and cross-border transportation attractive for countries outside the OECD and for private investors.

Although the liberalisation of markets is creating improved short-term flexibility in gas supplies – for example through market participants' reactions to price signals – and additional supply options (spot markets), it also creates new features which could affect security, such as short-term arbitrage between the gas and the electricity systems during peak periods of demand in winter. There is ongoing discussion in many IEA countries about the role of governments and market participants with regard to security of supply and the best market-friendly instruments to ensure security of supply.

With the opening of the electricity and gas markets in Japan, LNG buyers are trying to use the opportunity of contract prolongation to negotiate LNG contracts that provide more delivery flexibility and can more easily be adapted to a more uncertain market development.

Outlook

As market reforms spread and deepen, reaching down to the retail sector, new market places (hubs) and new gas-related services (mainly flexibility and back-up services) are developing. The resulting development of financial services offers very helpful risk management instruments to market participants, but seems to require more control and protection against manipulation and fraud.

Although long-term contracts continue to be the dominant feature for imports of gas, they are gradually being complemented by spot deals at hubs or on the LNG market (8% of LNG global trade was on a spot basis in 2001).

With the development of spot markets for gas and in parallel with electricity, increased scope for arbitrage is developing between different gas markets (between hubs, but also via LNG between the three different market regions). Arbitrage opportunities in the Atlantic Basin developed in 2001 and could lead to a more global LNG market.

COAL

Growth of a Secure International Market

The international coal market has developed over the last 25 years into a mature, stable market, largely free of government involvement. Many producers and buyers trade quantities of hard coal that can be large in relation to national energy supply, but small in relation to total world coal production and potential production capacity. Trade is principally by sea in very large vessels. Coal trade is only one influence on the highly competitive market for dry bulk freight. Shipping costs, which account for a significant proportion of delivered price, and shipping capacity fluctuate largely independently of movements in coal supply and demand. For these reasons, the risk of a persistent interruption of supplies, or of a sudden sustained rise in coal prices, can be regarded as minimal.

Australia continues to dominate world coal exports. Australia, the United States and Canada are the major coal exporters among the IEA Member countries. Among the non-member countries, South Africa is the second-largest exporter in the world, and is a member of the IEA's Coal Industry Advisory Board. China's coal exports are growing rapidly and exceeded those of the United States in 2000.

Japan and Korea are the world's largest coal importers. IEA Member countries account for 14 of the world's top 20 importers of hard coal.

Important developments are occurring in the international market. A few large mining companies, with operations in several countries, now dominate world coal supply. To date, there is no evidence that coal prices have been influenced as a result, although it would appear that major companies are now more closely relating the volume of their production to demand and price. In the recent past, coal production by individual companies has not much responded to price falls, or even increased, to maintain cash flow.

Coinciding with growing concentration among suppliers, US production and exports of coal have fallen, despite high domestic demand. US exports have not responded to higher international coal prices as they have in the past and the United States is no longer playing the role of "swing producer", capping any rising trend in prices. The reasons are complex. US producers are based in two regions, in the west and the east of the country. Eastern producers have faced strong competition from lower-cost western producers of low-sulphur coal, and adverse environmental rulings have reduced the incentive to invest in new capacity. Western producers focused on the domestic market while international coal prices were low and no longer have excess capacity to take advantage of any peaks in the international market. Whether this situation will continue remains to be seen.

Among buyers, the pattern of annual price negotiations continues but the spot market and electronic trading continue to gain ground.

Government Support for Coal Production

A number of hard coal-producing countries give varying measures of financial and other protective assistance to their indigenous producers. In most cases, the grounds for support are based on a pragmatic concern to maintain employment and regional industry. Security of supply and support for coal-mining technology industries are emerging as more sophisticated justifications for support. In Norway, support for expanding coal-mining in 2001–2 was justified as a matter of foreign policy, to maintain a Norwegian presence in a remote area.

The IEA does not consider there to be a realistic security-of-supply justification for such assistance to continue. Where Member countries justify aid on social and regional grounds, the IEA believes that there are other, more efficient methods of targeting support for regions affected by the decline of the indigenous hard coal industry.

Outlook for Subsidised Production

In 2001, Japan closed its last coal mine and the last government-supported coal mine in Canada, on Cape Breton, also closed. Although production is subsidised in the Czech Republic, Turkey and Norway, the future of coal subsidies in EU countries is the principal concern. France, Germany, Spain and the United Kingdom continue to provide support for coal production, with the approval of the European Union.

The 1953 European Coal and Steel Community Treaty ended in June 2002. The main objective of the treaty since the early 1980s has been to ensure that contraction in production capacity, and resulting unemployment, is carried out in as socially acceptable a manner as possible. At the end of 2001, total state aid over the last eight years stood at nearly €60 000 million. During this period, there was a marked shift away from operating aid (aid to producers which could improve their economic viability, or at least reduce their losses) to aid to reduce production or close mines by July 2002. The main reason for the shift has been Germany. While virtually all state aid to the hard coal industry was operating aid in 1994, only 43% of the aid authorised in 2001 was operating aid; 23% was for the reduction of activity and the remaining 34% for inherited liabilities.

Coal production in the EU has declined dramatically over the past ten years. Compared with 1992, the year before the current policy framework came into force, hard coal production in the EU has fallen by well over half, from nearly 185 million tonnes to an estimated 77 Mt in 2002. France has, proportionately, seen the biggest contraction, with production down by 85% or 8 Mt. The United Kingdom has seen the largest absolute decline, by 51 Mt or some 60%. Germany has reduced production by 43 Mt or 60%, and Spain by over 5 Mt or some 28%.

UK production fell over those ten years, while the reduction in other countries has been most marked in the last few years. German hard coal production fell by a third between 1999 and 2002, from 44 Mt to an estimated 29 Mt. French production was cut by more than two-thirds between 1999 and 2002, from 4.9 to 1.4 Mt. Spanish production fell 14% between 1999 and 2002, from 11.8 to 10.2 Mt.

Outlook for EU Subsidies

Among changes to the state aid framework since 1994, the EU has required that all indigenous coal be delivered to electricity producers at prices equivalent to those from third countries. A form of competition has therefore been possible. From supplying 56% of internal consumption in 1992, indigenous coal now supplies only about 30%. Imports have risen from 147 Mt in 1992 to an estimated 184 Mt in 2001.

France is on target to end coal production in 2005. In Spain and Germany, average production costs are around three times the world market price, and production cutbacks have occurred only through mine closures resulting from reductions in aid. Only in the United Kingdom are production costs close to the world market price, but a two-year state aid package of up to £100 million was nonetheless announced for the UK industry in April 2002.

EU production subsidies will continue after July 2002, justified, in part, on the requirement of continued support for social and regional adjustment as uncompetitive coal production is reduced. The EC's Green Paper on *Security of Energy Supply* also envisages keeping open uneconomic collieries to maintain a minimum coal-producing capability and to retain professional qualifications and technical expertise. Aid to production is expected to be replaced by aid to "safeguard resources". Other mines would be subject to closure by 31 December 2007. By 31 December 2006, however, the Commission would be required to submit revised proposals for the regime, to apply from 2008 to 2010.

Although no price preference will be permitted for indigenous coal, to prevent distorting competition in the electricity market, France and Spain have legislation in place that allows priority to be given to indigenous fuels in electricity production.

Importantly, two candidates for EU membership are Poland and the Czech Republic. Although both have restructuring policies in place, Poland's hard coal production exceeds total EU production and could be expected to benefit from subsidies permitted by the EU.

CLIMATE CHANGE POLICIES IN IEA MEMBER COUNTRIES

2001 was an important turning point in the national and international debate on climate change. The auspices at the beginning of the year were poor: at the end of 2000, the 6th Conference of the Parties (COP6) under the United Nations Framework Convention on Climate Change (UNFCCC) in The Hague, Netherlands, ended with no agreement on several vital aspects necessary to the adoption of the Kyoto Protocol. Further concerns about the future success of climate activities were raised in early 2001, when the newly elected Republican administration of the United Sates of America decided not to ratify the Kyoto Protocol. Their announcement marked a sharp turn in the more than ten-year global effort to address climate change through the international arena, and under the UNFCCC (see box).

US Policy

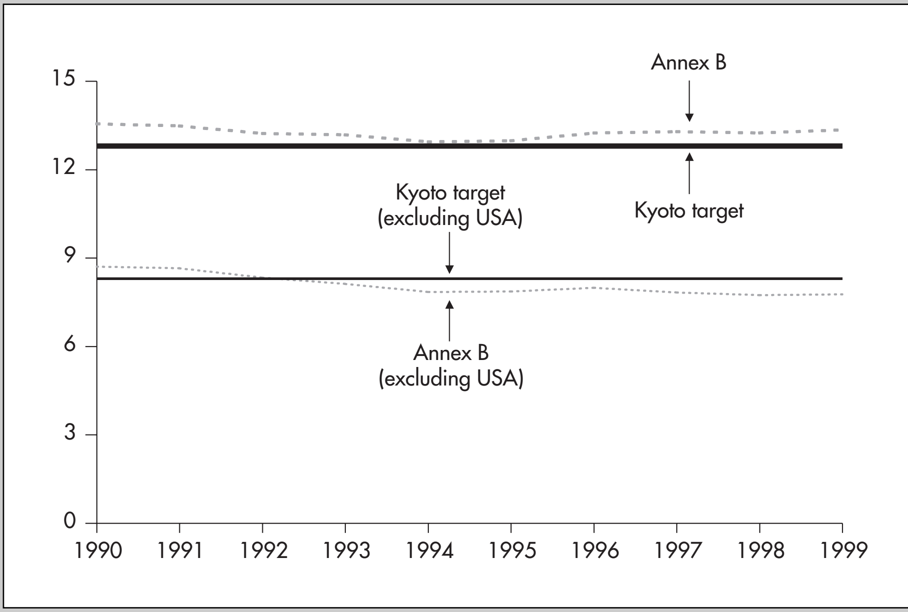
In view of its importance to global emissions and international stance, it is useful to review US policies on climate during 2001. The United States represents over 30% of Annex I emissions and fully over 40% of IEA Member countries' emissions (based on 1999 data, including land-use change and forestry). Following a decade of engagement in the climate change negotiations (including being the first OECD country to ratify the UNFCCC in 1992, and strongly influencing the form of the Kyoto Protocol), a new Administration was elected in 2000 that considered the Kyoto agreement flawed – and forcefully rejected it.

The United States announcement of its withdrawal from the Kyoto Protocol has potential implications for the overall environmental effectiveness of the Protocol. Without the participation of the United States – and with relatively liberal rules on sinks of GHGs agreed in COP7 – the scale of prospective reductions has decreased sharply pending US domestic policy decisions to reduce its emissions. The international market price for emissions reductions is expected to be lower than earlier expectations. The US withdrawal will also have a major impact on future emissions trading and on the development of the Clean Development Mechanism since the United States was expected to be the largest buyer. Figure 35 indicates the change represented by US withdrawal in historic terms.

Figure 35

Annex B CO_2 Emissions – with and without the United States

(gigatonnes of CO_2)



Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2001.

However, more critical than the historic measure is any gap in global reductions during the commitment period of the Protocol as a result of the US withdrawal from Kyoto and adoption of an alternative set of climate policies as announced in the National Energy Plan. All other things equal, the US withdrawal from the international emissions trading market is likely to mean a very low price (possibly approaching zero) for allowances. Further analyses explored strategies that economies in transition could implement in order to maintain the price of their allowances, through the banking of allowances for future use. Other parties could also limit the extent to which entities could acquire allowances from other parties to comply with their targets. Either of these actions would tend to trigger more domestic reductions than under a scenario where all available allowances would be for sale. No modelling work has quantified the global implications of the newly announced US climate change policy.

Although the United States rejected the Kyoto Protocol, in February 2002 it released a new climate change policy as an alternative to the binding commitments of Kyoto. This policy states that the United States intends to decrease its GHG emissions per unit of GDP by 18% over the next ten years. Specifically, the proposal calls for reducing US emissions from 183 metric tonnes of emissions per million dollars GDP emitted in 2001, to 151 tonnes of emissions per million dollars of GDP by 2012. This goal implies a 4% reduction in total emissions below baseline by 2012, i.e., a 391 Mt CO_2 reduction according to the US Energy Information Agency (see "Addendum to the Global Climate Change Policy Book", White House, February 2002). This volume is within the range of domestic abatement under Kyoto estimated by the US Council of Economic Advisors in March 1998 of 370–550 Mt CO_2 by 2012. The IEA's World Energy Model (2000) projected that US domestic abatement in 2010 would amount to approximately 560 Mt CO_2, with roughly twice that amount purchased from the international market to achieve compliance with Kyoto (*World Energy Outlook 2000*, IEA, p. 239).

To support this reduction, the United States also announced a new set of tax incentives and government funding for technology development to support climate mitigation. With proposals for $4.5 billion on total climate spending in 2003, the programme includes: tax incentives for renewable energy, co-generation and new technology, and funding basic research on climate science and on sequestration technologies. The programme will include new voluntary initiatives from industry (and a registry to record business action), the reconsideration of fuel economy standards in the transport sector, and aggressive sequestration programmes. Further, the US National Energy Policy recommends a number of measures that will help support climate change policies, including developing sources that emit low and no GHGs, such as natural gas, nuclear energy, biomass, wind, geothermal and solar; and others encouraging increased energy efficiency and conservation. Specific measures range from increased R&D funding to improved licensing procedures or leasing schemes, and include tax credits for renewables and consumer-awareness campaigns. Internationally, the United States is proposing to pay off its arrears to the Global Environment Facility, as well as to increase funding for bilateral research initiatives.

It is noteworthy that the proposed measures do not include emissions trading regimes (a measure strongly championed by the United States over the past decade of international negotiations). In his climate policy statement, the President did say that companies making real reductions in emissions would receive transferable credits for such reductions such that they will not be penalised under any future actions that may be implemented. Furthermore, the plan does not offer any clear milestones for interim reductions in emissions – in fact, the policies are to be reviewed only in 2012, well beyond the end of the current Administration, and only after the end of the first commitment period of the Kyoto Protocol.

Notwithstanding the immediate adverse consequences of these events, over the remainder of the year they helped catalyse a stronger global commitment to the climate issue. Thus, in July 2001, the resumed session of the 6th COP in Bonn resulted in international accord. With the United States acting essentially in an observer capacity, the other countries concluded the agreements necessary to move forward with ratification of the Kyoto Protocol. Political consensus was reached on key issues previously unresolved, chief among them:

- How to implement the flexible mechanisms (emissions trading, joint implementation and the Clean Development Mechanism).

- How to undertake the necessary financial assistance and technology transfer to developing countries.

- How to assess and address the impacts of climate change on developing countries – as well as the potential impacts of response measures to mitigate climate change.

- Methods to account for national emissions and "sinks" in land use, land-use change and forestry (LULUCF).

- Agreement on compliance issues, and how to levy sanctions if emissions reduction targets were not reached.

These international political agreements were codified in a more explicit manner at COP7 in Marrakech at the end of 2001, opening the road for ratification. Through the remainder of 2001 (and into 2002), countries have indeed been developing ratification legislation: at the end of September 2002, 95 countries have ratified the legally binding agreement – including all EU States, Japan and the Czech Republic.

In part because of the developments in the international arena, as well as the US announcement, attention on climate change has begun to shift to the national issues. Governments of IEA Member countries (and others) are now in the midst of their domestic political assessment of the international accords. Some have yet to determine whether indeed they will ratify the Protocol, although all Parties are seeking to understand better how they can reduce their emissions to meet both Kyoto emission goals and national commitments.

Some insight is available on national progress. With respect to progress on emissions reductions, the UN Convention itself obliged all Annex I Parties (which, in addition to the IEA Member countries, include countries in the former Soviet Union and in Eastern Europe) to take policies and measures with the "aim" of returning emissions to 1990 levels by the end of the decade. Parties are to submit reports periodically to the Convention outlining the policies taken – and estimating the effects of these efforts. In 2001, Annex I countries to the UNFCCC were to prepare and present their third National Communications reporting on their actions, as well as on the most recent inventories of their GHG emissions.

While only fourteen of the IEA Member countries have so far provided these reports, some trends (based on the reports submitted, as well as on IEA statistics) are clear. Numerous policies and measures have indeed been taken over the past decade – in fact, a separately maintained IEA database of energy policies records nearly 250 policies in 2001 alone. Using a collective measure of 1990 and 2000 emissions, the Annex I Parties to the Convention have indeed reduced emissions below 1990 levels. However, notwithstanding these efforts, only a few of the UNFCCC Annex I Parties have individually managed to meet the Convention's non-binding goal.

It appears, from a review of national climate policies, that much of the success in reducing emissions was due less to climate policies than to other energy-related activities. Thus Germany, while implementing an aggressive programme to reduce emissions, has seen the majority of its emissions decline as a result of "wall-fall" benefits – many of which come from the closure of inefficient industrial activities in the east. The United Kingdom, which has likewise had a significant climate programme, has nonetheless seen the majority of its reductions accrue from the switch from coal to gas early in the decade. In a similar fashion, the overall success in meeting the Annex I commitment to reduce emissions is a consequence of the drastic decline in emissions in the former Soviet Union – where they fell nearly 50% below 1990 levels, and where reductions more than offset the increases in emissions in the IEA countries.

Although policies specifically targeted on climate change may not have been the key determinants in the successes of those countries with substantial emissions reductions, it is clear that over recent years IEA Member countries have made progress in reducing GHG emissions through the adoption of a variety of policies and measures. Most of the policies tend to use conventional instruments well known by governments and widely used in other policy areas (e.g., regulatory instruments, fiscal measures and public information campaigns). However, market-based instruments contributing to climate change mitigation, such as emissions trading and other Kyoto Protocol mechanisms as well as green certificates, have also played an important role in national strategies over the past year, particularly in European countries. Voluntary agreements between governments and various actors in energy-intensive sectors have also been used, and governments continue to emphasise a longer-term programme of continued or refocused research and development funding for clean energy technology. The following sections review these policy instruments as used by IEA Member countries to reduce GHG emissions, providing a particular focus on measures taken in 2001.

FISCAL MEASURES

Fiscal measures are commonly used in climate change mitigation. In 2001, as in 2000, they represented approximately one-quarter of all new measures taken or planned by IEA Member countries to mitigate climate change. The vast majority of these measures are used to promote renewable energy technologies, while the remaining few were aimed at putting economic pressure on existing polluting sources. Although a number of countries have announced their intent of considering additional fiscal policies as they approach the first commitment period of the Kyoto Protocol (2008–12), the three-year trend does not suggest a significant increase in the degree of attention given to these instruments. Indeed, conventional sources of energy are already heavily taxed in European countries and Japan for reasons other than their environmental impacts, and, particularly in Europe, proposals for further increases have proved unpopular. However, notwithstanding the political concerns raised by tax increases, fully three-quarters of the fiscal measures taken or planned in 2001 have been taken in Europe. Australia, New Zealand, Canada and the United States have relatively low taxes on conventional energy sources. Although new taxes in these countries are still part of the policy tool kit, they are little used, and political circumstances in these countries suggest that such measures are unlikely to be a major focus for further policy initiatives.

The vast majority of fiscal measures take the form of either incentives or subsidies. These are usually grants or preferential loans/funds such as the Carbon Trust of the United Kingdom, developed to promote energy efficiency, or the grants made by the Dutch government to promote combined heat and power (CHP) and renewable energy sources in the residential sector. Feed-in tariffs are more complex to set up but have also been developed in 2001 in both Austria and France. The other main type of fiscal measure is taxes – and in 2001, these were initiated in almost all European countries. The majority of tax measures adopted in 2001 were tax credits, reductions or exemptions for low-emission technologies and renewable energy, such as the tax exemption programme to promote the rational use of energy in Belgium.

In addition, a few countries adopted fiscal measures directly aimed at limiting the use of conventional energy sources, i.e., direct taxes. Most commonly, these were rather limited in scope (the heavy vehicle tax in Switzerland). In 2001, the only new tax policy adopted was in the United Kingdom, which introduced a broad tax scheme, the Climate Change Levy.

REGULATORY POLICIES

Regulatory policies represent close to a third of all new measures taken or planned in 2001 by IEA Member countries. Mandates and standards are the most common type of regulatory policies used to promote either energy efficiency or renewable sources of energy.

In energy efficiency, standards were set for electricity consumption (such as those for washing machines and other appliances in the United States, or the planned EU-wide efficiency standards in buildings). A requirement for mandatory efficiency labelling was another policy option used by IEA Member countries to stimulate the purchase of energy-efficient goods. Such measures taken in 2001 include fuel consumption labelling of passenger cars in both Australia and the Netherlands, and of refrigerators in Turkey.

2001 also marked the adoption of a number of renewable energy mandates. Mandates and standards in this sector were often used to set a minimum mandatory share of electricity to be produced from renewable sources. In 2001, EU Member

States agreed on a directive on the "Promotion of electricity from renewable energy sources"[3], setting indicative country-by-country objectives for renewable energy production by 2010. In individual countries, these goals are sometimes coupled with Tradable Renewable Energy Certificates (TRCs) schemes that offer more flexibility to energy producers, retailers or end-users to reach their mandatory target at lowest possible cost.

Emissions reduction programmes were also often introduced as part of regulatory reforms of existing policy frameworks. In 2001 this was the case in fourteen IEA Member countries, and ranged from the planned bio-energy ordinance in Germany to an EU-wide reform for the optimisation of existing gas and electricity infrastructures.

Voluntary agreements are increasingly being introduced as a co-operative and less rigid way of reducing GHG emissions. In 2001, twelve Member countries enacted such voluntary agreements. Using the IEA classification, these can be qualified as "strong" (legally binding) – such as the agreement signed between the German government and energy-intensive industries to develop combined heat and power (CHP) solutions to reduce their energy consumption by 30% – or "weak", without involving any legally binding commitments. This more common category includes the agreement signed by the Australian Department of Defence to reduce its GHG emissions by 13%, and the agreements signed by three industrial sectors (cement, limestone and non-ferrous) in Wallonia (Belgium) voluntarily to reduce GHG emissions.

Because of their non-binding nature, the potential of such voluntary agreements for reducing emissions is far from clear, making them a less than reliable tool in meeting the specific and binding emissions reduction targets under the Kyoto Protocol. Yet they can be very effective in combination with other measures. For example, the United Kingdom has negotiated particular energy efficiency or carbon saving targets agreements with industry-sector associations. Companies which have joined in the negotiated sector agreements receive an 80% discount from the Climate Change Levy in return for working towards their targets. At the end of 2001, over 40 of these "umbrella agreements" had been signed.

TRADABLE PERMITS

The appropriate use of market instruments has been a central theme in international and national debates on strategies to mitigate climate change. Countries' inexperience in using such options to reduce GHG emissions, as well as the complex framework required to exploit the flexible and efficient nature of these measures fully, have led to a slow start in their use. With such measures now representing over 10% of all measures newly undertaken in IEA countries, 2001 confirmed the pivotal role market instruments seem likely to play in climate

3. Voted by the European Parliament on 3 July 2001, formally adopted by the EU Council of Ministers on 27 September 2001 [Directive 2001/77/EC].

mitigation strategies, both nationally and internationally. In 2001, policies and measures involving tradable permits were adopted or planned by thirteen countries and by the EU, twice the number of countries using such tools as in 2000. Europe was the focus of the new measures. In fact, outside the EU, only Australia adopted a new measure related to tradable permits in 2001 (although in previous years, most other non-EU countries had incorporated – or planned to incorporate – these policies into their national programmes).

Market mechanisms to mitigate climate change generally consist of either a CO_2 emissions trading scheme or a Tradable Renewable Certificates (TRCs) system. However, the Kyoto Protocol also allows international project-based emissions reduction units under the Clean Development Mechanism (CDM) or Joint Implementation (JI) to be counted against the targets of IEA Member countries, and these instruments are also being developed as part of national GHG reduction strategies. The Netherlands and Norway have been the most active here, both having formed various JI partnerships with other Annex I countries (e.g., the bilateral Climate Change Agreement on project co-operation signed between Norway and Romania).

Since 2000 and the release of the EU Green Paper on GHG emissions trading, followed in 2001 by a proposal for a directive, it seems likely that an EU-wide emissions trading scheme will be developed and in place by 2005. As a result, European countries have actively been developing frameworks to incorporate emissions trading in their national strategies. The United Kingdom officially launched its emissions trading scheme in April 2002 – although several emissions trades between large corporations had already taken place in 2001. Danish electricity companies have also been subject to a CO_2 cap-and-trade system since 2001. Norway and the Netherlands have also pursued additional efforts in 2001 to develop such schemes; all are closely watching developments of the European Commission directive to ensure compatibility between international and national trading programmes.

Tradable Renewable Energy Certificates (TRCs) systems are increasingly being used to promote renewable energy sources. By combining a green (tradable) certificate scheme with a mandatory minimum share of energy to be produced by sources of renewable energy, governments offer a flexible solution for energy producers to achieve their mandatory targets. The use of such green certificates represents the majority of new tradable permit measures taken or planned in 2001. In 2001, Belgium, the Netherlands, Sweden and the United Kingdom have been the most active in this field, while trading of certificates has started in Australia under its Mandatory Renewable Energy Target and Italy's system begins in 2002. Currently, the qualifying sources of "renewable" energy vary considerably from programme to programme. In 2001, for example, Austria launched a small hydro certificate scheme, while the Belgian system includes good-quality CHP in its green certificate scheme.

A particular case of tradable certificates programme was set up in Italy in 2001, where a renewable energy certificate system already exists. The Italian system involves certificates for energy savings achieved by electricity and gas distributors. Each distributor has been allocated a target level and can rely on trading of energy efficiency certificates to comply.

POLICY PROCESSES

Policy processes represent one-third of all policies and measures taken or planned in IEA Member countries in 2001. This is the most broadly used category of policy instruments and plays an important role in all IEA Member countries' mitigation strategies. A clear distinction can be made within policy processes between "planning" policies (consultation, strategic planning and institutional development) and "outreach" policies (information dissemination and advisory efforts). In 2001, policy processes were more or less evenly distributed between the two.

Planning policies are the backbone of GHG mitigation programmes. In the past three years, all IEA Member countries have developed national, regional or sectoral climate change strategies. These set out a co-ordinated plan of action for more specific measures to be undertaken. In 2001 alone, twenty IEA Member countries developed or were in the process of developing national, regional or sectoral programmes. These include, for example, the Czech National Programme for Energy Conservation and the Use of Renewable and Secondary Energy Sources, the Korean Basic Plan for New and Renewable Energy Research and Development, and the EU's Common Transport Policy. Consultation processes involving both the public and the private sectors often precede such measures. This was the case in New Zealand, Belgium and Denmark in 2001. Planning policies also often involve the creation of specific institutions for the implementation of climate change strategies; this is the situation in the Netherlands, with the creation of their Clean Development Mechanism (CDM) office, and in Spain, with the creation of their National Climate Council.

Outreach policies aim to inform and advise people or organisations on how to reduce their GHG emissions efficiently. In 2001, for example, Canada set up a wide range of advice and "aid in implementation" programmes for industries to reduce their energy-related emissions. The Australian government announced a new public information campaign to advise citizens on energy-efficient practices inside and outside the home. The general aim of these programmes is to increase awareness and influence behaviour regarding GHG abatement. The form of public information dissemination varies considerably. Although visits, seminars and exhibitions are most commonly the focus of the initiatives, more aggressive and modern means have recently been introduced, including television, newspaper and magazine advertising, information dissemination on the Internet and the use of telephone hotlines.

RESEARCH, DEVELOPMENT AND DEMONSTRATION (RD&D) POLICIES

Funding for energy research and technology development is another traditional area of government intervention. Although many analytical studies suggest that the private sector is best suited to pursue such measures, such investment occurs only under a specific (and limited) set of market conditions. At an early stage of technological development, risks are high, the payback period of RD&D investments is undetermined, and R&D findings are often difficult to protect. In the case of RD&D for climate-friendly technology, the current uncertainties regarding the timing of entry of the Kyoto Protocol into force is another aspect that limits private-sector interest. In these cases, whether it is investing public money or developing fiscal incentives for private investment, government intervention plays an essential role in filling the RD&D investment gaps.

Although publicly funded energy R&D[4] has been decreasing throughout the 1980s and 1990s, funding for research in such areas as energy conservation and renewable energy has increased. Funding is increasingly aimed at helping industry to reduce costs of energy production to increase commercial viability. Most IEA countries have been engaged in R&D activities to develop climate-friendly technologies[5]. In 2001, among other RD&D measures, the United States started a National Climate Change Technology Initiative to identify and support future technology and R&D opportunities that could contribute to a long-term carbon-stabilisation climate strategy. Japan provided substantial subsidies for R&D projects that contribute to energy saving and the development of renewable energy. The EU countries have also been active in the R&D area: for example, in 2001 the Swedish government launched a programme with the car manufacturing industry to develop environmentally improved vehicles and components; Germany started the "Investing in the Future Programme" supporting research on renewable and new energy sources such as geothermal energy, offshore wind energy and hydrogen fuel cells; and the European Union developed several RD&D support schemes in the transport sector.

4. Energy Technology R&D Statistics Database, IEA.
5. See: *Dealing with Climate Change – Policies and Measures in IEA Member Countries, IEA/OECD Paris, 2002*.

RENEWABLES

Environmental concerns have raised the profile of renewable energy technologies. Renewables' environmental performance can be measured in terms of the local pollution, GHG emissions and long-term risks avoided by their use. Renewables are also noted as a potential contributor to energy-sector diversification, with resulting economic and security benefits depending on the degree of their penetration. Full-cost pricing of all energy technologies, including all the above externalities, would determine renewables' appropriate contribution to energy supply. Although it is probably out of reach in the near term, governments are pursuing a wide range of strategies through a combination of policy instruments to promote the development and broader use of renewable energy technologies. This approach will be necessary because the diversity of renewable technologies and benefits makes it difficult to capture their public value (current and potential) through a single instrument. Recent trends indicate that the combination of policies have so far been successful in accelerating renewable energy market growth.

Over the past five years, renewable energy technologies have advanced considerably, and costs are continuing to decline, resulting in increasing market penetration. According to the IEA *World Energy Outlook* (IEA, 2002), renewables are the fastest-growing segment of the energy sector. Nevertheless, the *Outlook*'s "Reference Scenario" indicates that non-hydro renewables, at 2% of electricity generation in the OECD in 2000 (the base year), will achieve only 8% in 2030, on the basis of policies in place by mid-2002. Yet, the *WEO* 2002 Alternative Policy Scenario suggests that policies and measures under consideration in 2002 could more significantly increase the share of non-hydro renewables in electricity generation in the OECD, reaching over 14% in 2030. In terms of CO_2 emissions, the reference case projects that emissions in OECD countries will increase by 25.5% between 1990 and 2010, and 39.2% between 1990 and 2020. The alternative case projects that total emissions could be reduced by 3% in 2010 and 9% in 2020 compared to the reference case. These widely divergent scenarios are an indication of the degree to which the recent and near-term market success of renewable energy sources is dependent on government intervention.

Over the past years, most IEA countries have increased market support for renewable energy, with the intention that they should play a larger role. Budgets that fund these measures are, therefore, rising accordingly – although studies of historical support in the EU[6] and the United States[7] show that current annual tax relief and budget transfers for renewable energy are still substantially below support for more mature

6. F. H Oosterhuis, *Energy Subsidies in the European Union*, final report, IVM (Institute for Environmental Studies), November 2001.
7. Marshall Goldberg, *Federal Energy Subsidies: Not All Technologies Are Created Equal*, REPP (Renewable Energy Policy Project), Research Report No.11, July 2000.

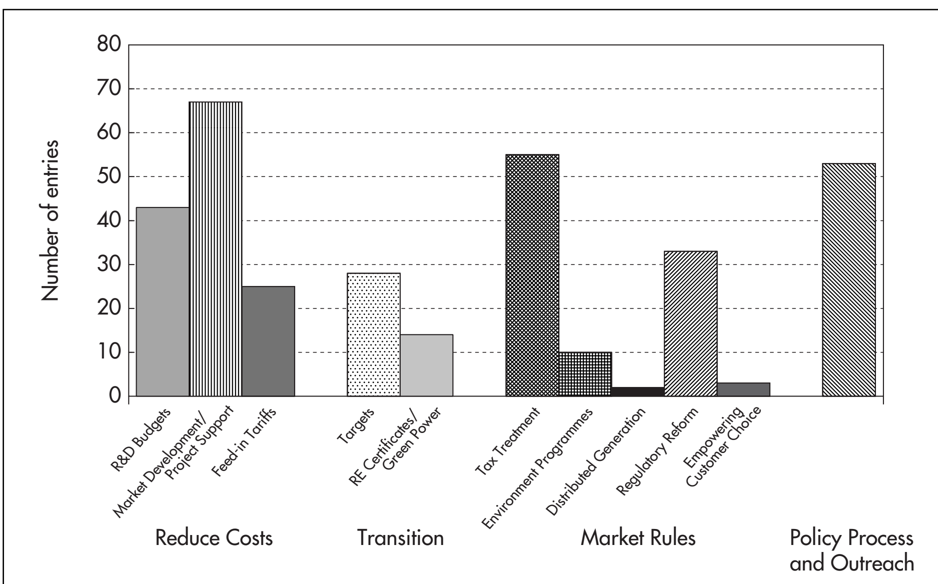
energy sources. Nevertheless, budgets to support renewable energy could increase with growing market shares, leading countries to examine ways to improve the effectiveness of incentive programmes.

INSIGHTS FROM THE POLICIES AND MEASURES DATABASE

Recently, the IEA has collected information on existing national renewable energy policy frameworks in IEA countries, building from annual reports from the *Dealing With Climate Change* database. The Database on Renewable Energy Policy Frameworks in IEA Countries (RE Database) does not include regional or local programmes, which are either too difficult to track or already sufficiently covered under national programmes. The balance of database entries is shown in Figure 36. Information on budgets associated with these policies has not yet been fully compiled, but some preliminary implications can be drawn nevertheless.

Types of governmental instruments for emerging technologies typically evolve to follow technology advances and market developments. Variations in the balance of policies in each group give an indication of how the focus of incentive systems is changing. IEA countries seem to be enhancing direct technology and project support mechanisms with policies that establish competitiveness by valuing a fuller range of costs and benefits in the context of sustainable development goals although, until historical information is included in the database, it will be difficult to measure this evolution. The following graph presents entries by policy type.

Figure 36
Current Renewable Energy Policies in IEA Countries



Source: Database on Renewable Energy Policy Frameworks in IEA Countries, IEA, 2002.

Instruments in Use and Main Trends

Research and development: although publicly funded energy R&D[8] decreased throughout the 1980s to stabilise in the 1990s, research on renewable energy has stayed relatively stable. Funding is increasingly aimed at helping industry to reduce costs of energy production to increase commercial viability.

Market development/project support mechanisms are still a major element of renewable energy policies in IEA countries (see Figure 36). There are currently 66 entries in the renewable energy policies and measures database[9] related to public grants for the development of renewable energy (including support for pre-feasibility studies), although insufficient information is available on actual spending to draw any further conclusions. In most cases, however, this type of instrument is now either limited to very small-scale technologies which cannot compete directly on mainstream markets under current conditions such as photovoltaic (PV), or to technologies which are handicapped by high costs of market entry.

Feed-in tariffs: by rewarding energy production instead of investments, feed-in tariffs encourage market deployment while promoting increases in production efficiency. Fourteen IEA countries are applying favourable tariffs for electricity production from renewable sources. Advanced feed-in tariffs – where incentives are reduced over time to reflect reductions in the cost of learning technologies, or are banded to reflect differences in available resources and other variables – have recently been implemented in France and Germany (April 2000 and January 2001 respectively).

Targets: clear targets have now been set for the size of future markets for renewable energy, providing more policy stability for stakeholders. Australia has established a target for renewables penetration and has implemented renewable energy certificate trading. The United States is debating a national portfolio target for renewables; fourteen of the 50 states have already instituted renewable portfolio standards. Europe has agreed on the directive on renewable energy supply[10], setting indicative national targets for the penetration of renewable energy in EU member States (an EU-wide target of 12% of gross domestic energy consumption by 2010). Japan and New Zealand are in the process of establishing targets.

Renewable energy certificates: Tradable Renewable Energy Certificates (TRCs), as a means to achieve renewable targets, are being presented as the future instrument of preference to build renewable energy markets. It is too early to say how effective it will be. These mechanisms generally include penalties for non-compliance – or ceilings on the certificate price – that should be sufficiently high to encourage a range of investments in renewable energy.

8. Energy Technology R&D Statistics Database, IEA.
9. Database on Renewable Energy Policy Frameworks in IEA countries, IEA, 2002.
10. *Electricity Production from Renewable Energy Supply*, Directive 2001/77/EC of the European Parliament and the Council on the promotion of the electricity produced from renewable energy sources in the international electricity market (http://europa.eu.int/comm/energy/en/fa_3_en.html); European Commission: 27 September 2001.

Tax treatment: CO_2 and other environmental taxes are being used in many countries, resulting in competitive gains for renewable energy projects compared with fossil fuel projects. Some ten IEA countries have implemented taxes to reflect environmental costs based on the CO_2 content of energy sources or on electricity consumption[11]. These taxes have been introduced over the last ten years to serve environmental goals (reduction in CO_2 emissions, etc.) but also as a means to offset other more distortionary taxes seen as hampering economic growth.

Environment programmes: although aimed at improving the environment, only programmes benefiting renewable energy deployment are listed here.

Distributed generation rules are being set throughout IEA countries to facilitate local energy production.

Regulatory reform encompasses legislation aimed at opening electricity markets to competition. All IEA countries are at different stages of liberalisation. However, a few global trends can be observed, such as the emergence of regulatory agencies for electricity markets. This tends to clarify the legislative environment even if renewables are not necessarily advantaged.

Empowering customer choice covers measures aimed at giving the public the opportunity to choose their energy sources. This includes green electricity products offered by distributors and labelling schemes which oblige utilities to reveal what resources were used to produce the electricity.

Policy processes and outreach entries cover all the other programmes announced by governments (education, information programmes, etc.) which do not directly affect project economics.

The diversity of the characteristics and benefits of renewable energy makes it difficult to envisage a single instrument to foster its market development. Currently, the database reveals that a combination of instruments is being used to address different aspects of the challenge of bringing renewables to mainstream use. Full-cost pricing of all energy sources would set a level playing field that would sustain renewables in the mainstream of the energy portfolio.

POLICY EVOLUTION

Measures which offer governmental support for renewable energy are becoming more elaborate, reflecting experience with previous measures and the importance of evolution. The following assessment describes policies in IEA countries from the

11. But few of these countries have applied the full CO_2 tax on the use of fossil fuel in electricity generation.

perspective of progression of renewable energy from laboratory towards market competitiveness. The evolution of feed-in tariff systems and the emergence of portfolio targets and TRCs are shown in the following sections.

Feed-in Tariffs from Straight/Direct Incentives to Advanced Systems

Feed-in tariffs are based on actual energy production, providing an incentive to maximise capital use and reduce the costs of energy production. In doing so, unlike capital incentives, feed-in tariffs reduce costs to consumers.

Fixed feed-in tariffs set a predetermined buy-back rate for all electricity produced under certain conditions. In the case of bidding systems, regulatory authorities decide on an amount of electricity to be produced from renewable energy and invite project developers to bid for that capacity. Successful bidders are guaranteed their bid price for a specified period, fifteen years in the case of the Non-Fossil Fuel Obligation (NFFO) of the United Kingdom.

Table 11
Impact of Incentive Schemes on the Installed Wind Power Capacity in Europe

Incentives	*Country*	*Installed capacity in MW (end 1999)*	*Additional capacity in MW (in 2000)*
Fixed feed-in tariffs	Germany	4 445	1 668
	Denmark	1 742	555
	Spain	1 530	872
	Total	**7 717**	**3095**
Bidding systems	United Kingdom	356	53
	Ireland	73	45
	France	23	56
	Total	**452**	**154**

Source: *Wind Power Monthly*, The Wind Indicator (www.wpm.co.nz).

To date, fourteen IEA countries are applying favourable tariffs for electricity produced from renewable sources. Experience seems to show that countries that have chosen to implement stable, long-term feed-in tariffs are those that boast the highest deployment rates (Table 11). Of the countries that had chosen bidding systems, the United Kingdom has not issued any bids beyond the fifth round of NFFO and has now introduced a Renewable Obligation, combined with TRCs. France, too, has chosen a feed-in tariff system to overcome low deployment from Eole 2005.

In spite of their success, some early feed-in tariffs did not differentiate according to available resources, leading to strong geographical concentration of projects in the regions with highest resources. Wind feed-in tariff programmes have been modified to address this issue. For example, to calculate the recently announced French feed-in tariff for wind, governmental authorities defined a standard rate of return for projects to make those in high and low-resource regions equally profitable[12]. The intention is to balance the geographical development of wind projects.

Some feed-in programmes, moreover, failed to recognise that costs drop as markets grow. In newer programmes, though, technology learning[13] is reflected as buy-back rates for successive fifteen-year contracts decrease from year to year. This system is now in place in Germany (as well as in France), with the EEG (Erneuerbare Energiengesetz, the Renewable Energy Act) which became effective in April 2000.

Comparisons of markets nonetheless show that in those countries with feed-in tariff rates, reductions in technology costs have not necessarily been maximised[14]. On the other hand, those countries have developed the most vibrant industry. Achieving the highest market and industry growth at lowest cost is still an elusive goal, but governments continue to innovate in instruments that could reduce costs and increase performance.

Obligations and Trading

The success of feed-in tariff systems has led to a number of debates on their economic efficiency. One of the main issues being raised is how the benefits from price reductions linked to government support systems are redistributed.

Many countries are now considering or have implemented renewable energy targets combined with TRC systems as a way to force the growth of renewables markets while decreasing the costs of supporting them. By introducing competitiveness in the renewable energy market, governments seek to encourage to reduce technology costs and increase efficiency in production.

Portfolio targets: by guaranteeing a minimum market size and a schedule for implementation, governments reduce regulatory uncertainty and attract private-sector investment. Environmental goals are often used to justify targets for renewable energy in IEA countries, but energy security is also increasingly being cited as a major factor. The requirement to meet the target can be imposed on a variety of market participants. How it is implemented and enforced has, of course, a critical bearing on its success.

12. B. Chabot, P. Kellet and B. Saulnier, *Defining Advanced Wind Energy Tariff Systems to Specific Locations and Applications: Lessons from the French Tariff System and Examples*, paper presented at the 2002 Global Wind Power Conference, Paris, 2–5 April 2002.
13. *Experience Curves for Energy Technology Policy*, OECD/IEA Paris, 2000.
14. *Statistical Analysis of Wind Farm Costs and Policy Regimes*, Asia Alternative Energy Programme (ASTAE), World Bank, Washington DC; Working Paper, 2001.

Clear targets have now been set or are being considered by virtually all IEA Members, often combined with the possibility of trading renewable energy certificates as a means of bringing in competition and inducing economic efficiency. Australia has implemented legislation for a mandatory portfolio target, coupled with a TRC market which has been in operation for over a year. At the time of writing, the United States is debating a national portfolio target for renewables, while fourteen states have already instituted renewable portfolio standards[15]. The European Union has implemented the Directive on the Promotion of Electricity from Renewable Energy Sources in the Internal Electricity Market[16], setting indicative national targets for the penetration of renewable energy in EU countries (an EU-wide target of 12% of gross domestic energy consumption by 2010). Although not mandatory, these targets will become binding if projections show that countries will not meet their targets. Most EU countries are examining legislative options to implement a mandatory renewable energy target. Japan and New Zealand are also considering portfolio targets.

Renewable energy certificates as a means to achieve portfolio targets TRCs are being promoted in some quarters as the instrument to develop in the future. They provide a vehicle that theoretically reveals the marginal cost of reaching a particular degree of market penetration by renewables by creating a tradable commodity.

Tradable Renewable Energy Certificates

"TRC systems depart from the textbook illustration of tradable permits for environmental policy, largely because what they seek to promote is not exactly the internalisation of an externality – or, even, the reduction in cost to achieve a certain environmental goal – but technological development at least cost. In a sense. TRCs would undermine market opportunities for certain technologies that are not yet, but could become, cost-competitive in a decade and bring sizeable environmental gains as well. Supporting these technologies outside the TRC system may not be rational in static terms, but is coherent with efforts toward a more sustainable energy future."

R. Baron, Y. Serret, *Renewable Energy Certificates: Trading Instruments for the Promotion of Renewable Energy*, IEA; ENV/EPOC/WPNEP(2001)21; IEA/OECD, 2001.

The principle of such certificates is simple: liable entities (generators, suppliers or end-users) are mandated to generate or use a certain quantity or percentage of renewable electricity. Certificates are issued by the generators of renewable

15. Database of State Incentives for Renewable Energy, DSIRE (http://www.dsireusa.org/).
16. *Electricity Production from Renewable Energy Supply*, Directive 2001/77/EC of the European Parliament and the Council on the promotion of the electricity produced from renewable energy sources in the international electricity market (http://europa.eu.int/comm/energy/en/fa_3_en.html); European Commission: 27 September 2001.

electricity and must be surrendered by liable entities to prove compliance. Certificates are traded separately from the electricity, and their price represents a premium that the generators will seek to maximise by lowering their production costs and competing for the largest market share. TRCs have the advantage of letting liable entities fulfil their renewable energy obligations at least cost by acquiring the cheapest available certificates.

Each certificate contains information on its source of origin, which means that actors can choose to buy certificates from specific technologies. In theory, preferences can be defined, leading to different TRC market prices for each technology. For example, data from Australia's Office of the Renewable Energy Regulator (ORER) show that companies without a public profile tend to pick up the lowest-cost certificates[17], regardless of the underlying energy source, while others have been less inclined to acquire certificates that environmental groups question on ecological grounds. Prices in the Australian spot market for TRCs vary according to the origin of certificates. But spot market prices are of limited significance since most trades (for the moment, at least) are based on bilateral contracts for which prices are not communicated. What can be said is that markets apparently differentiate between certificates from different technologies, even if the price differences do not necessarily reflect the cost differences of the underlying technologies but rather a higher willingness to pay for sources perceived as cleaner.

This distinction occurs because certificate trading does not monetise the expected contribution of renewable energy as full-cost pricing would; instead, it reflects an assumed value, based on the governments' commitment to develop a specific share of renewables in the generation portfolio. The price of certificates will depend on targets, how they are to be enforced (specific penalties), other support measures for eligible renewable sources and the resulting scarcity of certificates.

Combined TRC and obligation systems will not necessarily result in the development of a diversified portfolio of renewables without other support systems, since they would benefit mostly those technologies that are closest to market competitiveness. This is why governments often complement TRCs with other support measures for those renewable sources that are not competitive enough to find their niche on the market set by the obligation. In some cases, they have also banded the obligations (setting detailed targets for each source of renewable energy) to ensure the development of a diverse portfolio of such energies.

Countries contemplating these instruments should carefully consider the firmness of targets, the interaction and compatibility with other support schemes and implementation measures (including the level of penalties for non-compliance) before applying them. TRCs may run the risk of undermining the development of potentially promising technologies by locking them out of the market, if they are not supported by a firm obligation or if other support measures are dropped in the process.

17. ORER registry for renewable energy certificates (http://www.rec-registry.com/).

TECHNOLOGY AND RESEARCH AND DEVELOPMENT POLICY

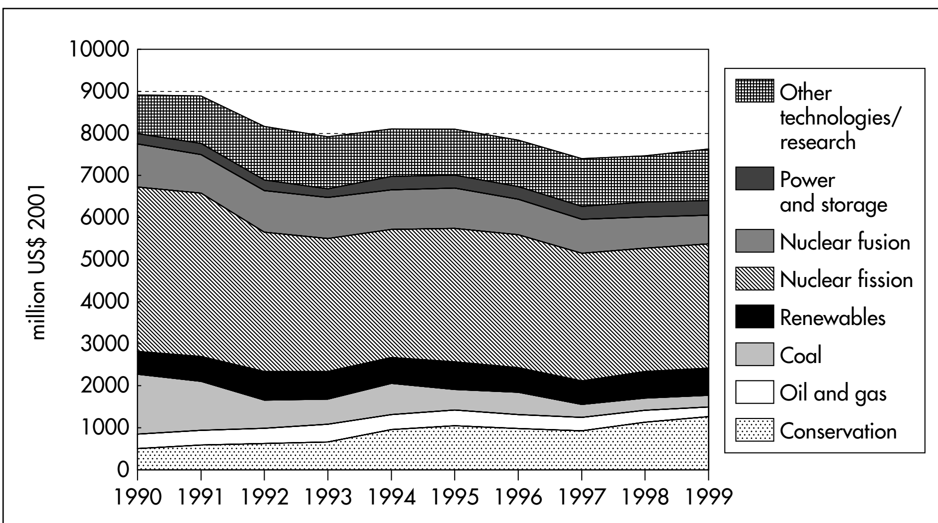
In the 1990s, government energy R&D budgets in IEA countries had a declining trend of, on average, 1.7% per annum, although they increased slightly after 1997.

In that decade R&D budgets for fossil fuels and nuclear energy decreased, while those for energy conservation, renewables, power and storage increased. Budgets for fossil fuels declined substantially, at an average annual rate of 12.9%. Coal research declined drastically by 16.5% per annum, its share decreasing from 16.0% in 1990 to 3.7% in 1999. The decline of R&D in oil and gas was relatively modest, at 4.5% per annum. Nuclear R&D (for both fission and fusion) also declined by 3.3% a year, although it still maintained the largest share (47.6%), even at the end of the 1990s.

R&D funds for conservation grew considerably, by 10.7% a year, their share increasing from 5.7% in 1990 to 16.6% in 1999. Funds for renewables also increased by 1.9% a year, their share rising from 6.1% in 1990 to 8.5% in 1999. Power and storage R&D made a steady growth at 3.9% per annum, its proportion advancing from 2.8% in 1990 to 4.6% in 1999.

Figure 37

Government Energy R&D Budgets in IEA Countries, by Technology Area



Note: data on public spending in energy R&D collected by the IEA Statistics Division from the governments of Member countries; budget information is not available for all countries for all years considered (1990–1999). To ensure consistency, data from the following countries have been used: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States; data for Italy for 1992 and 1999 are estimates.

Source: Country submissions.

RECENT TRENDS IN MEMBER COUNTRIES' TECHNOLOGY AND R&D POLICIES

Stronger awareness of sustainable development is the most important recent trend. However, in many instances the role of technology developments that enhance energy security also comes in for emphasis, so that technologies in efficiency, renewables, fuel cell, hydrogen, CO_2 sequestration and clean coal are becoming important. Enhancement of industrial competitiveness is being considered by a number of countries.

Other recent trends include understanding the importance of innovation, involvement of industries, universities, research institutes, and international co-operation.

ENERGY POLICIES IN NON-MEMBER COUNTRIES

CHINA[18]

The most significant policy initiative in 2002 is perhaps the government's plan to reform China's power industry.

In February 2002, China's State Development Planning Commission (SDPC) announced a plan to restructure the power industry, which will break down the monopoly power of the State Power Corporation. The proposed actions include:

- Separation of transmission from generation business.
- Creation of two grid companies with the Southern Power Grid Company for provinces in southern China and the State Power Grid Company for the rest of the country.
- Redistribution of State Power Corporation's generating assets into several companies.
- Establishment of an Electrical Power Regulatory Commission under the State Council to regulate the power industry.

Earlier, in 2001, China formulated a number of goals for the energy sector and industries in the framework of its 10th Five-Year Plan (2001–5). They concern the energy sector as a whole as well as the coal, oil, gas, petrochemical industries, electricity, energy conservation and resource utilisation, and renewable energy. The plan calls for a rationalisation of the energy structure by increasing the share of clean and efficient energy sources, including natural gas, hydropower and other clean fuels, and by reducing the share of coal in end uses. The building of national strategic oil reserves was also a very important development of the energy plans. The target was to build a limited level of national strategic oil reserves within the coming five years.

China also included the building of major pieces of energy infrastructure in its plans for the energy sector. Construction has already started for parts of the West-East Gas Pipeline, which would bring natural gas from the Tarim basin in the far west of the country to Shanghai by 2003–4. The Guangdong project for LNG imports, the first one of its kind in the country, is also under construction and is scheduled for completion by 2005. Major projects to transport electricity from the middle and western regions of the country to major consuming markets along the eastern coast are also under way.

18. For further information, please see *Developing China's Natural Gas Market: The Energy Policy Challenges*, IEA Paris, December 2002.

INDIA[19]

Wide-ranging reforms are currently being implemented in India's energy sector. They include the deregulation of pricing mechanisms of petroleum products and improvement of the financial situation of the electricity sector. They are pursued in an institutional set-up that has prevailed for a number of years, in which energy policy is formulated not in a co-ordinated and integrated manner but is mainly the result of the decisions of individual ministries in relation to electricity, oil and gas, coal, renewables and nuclear.

The gap between demand for electricity and its supply is still large, reaching an average 8% in 2000–1, and 13% at times of peak power demand. The failure of the public sector to supply the growing electricity requirements meant reforms of the sector were necessary to boost investments and increase efficiency. Although the independent power producers (IPPs) in the private sector have been able to enter the generation sector since 1991, this strategy has led to only limited capacity additions, below 10% of the total current capacity. The conditions for the development of a market for electricity are emerging slowly, with the setting-up of Electricity Regulatory Commissions in central and state governments (in eighteen states as of January 2002) which issue new tariff orders, and with plans to reform financially fragile state utilities in all of India's twenty-two main states.

The focus of the Government of India is now to find ways to reduce losses in transmission and distribution, often through theft. The government has been increasing the volume of public investments in distribution through the Accelerated Power Development Programme and is generally attempting to promote reforms of the electricity sector within the states. The difficult financial situation of the electricity sector in India is not new, but it has reached a critical stage, where the federal government in New Delhi can no longer afford to cover the losses of the state power utilities.

India imports oil. Its domestic production of oil has been decreasing since 1995–96, in spite of a growth in production by the private/joint-venture sector, reaching 13% in 1999–2000. In April 2000, additional production-sharing contracts were signed for 22 exploration blocks under the New Exploration Licensing Policy. In 2002, the government is planning a third bidding round to offer exploration blocks. The structure of India's external oil dependency has been radically modified over the past two years with the addition of around 1 mb/d of refining capacity, and India, which was importing products, has now become a net product exporter. The refiners, public and private, have been adding capacity, enjoying the last remaining advantages of a situation where international oil prices were not passed on to the consumers, through the administered prices mechanism (APM) – dismantled in April 2002, when the Oil Co-ordination Committee was also abolished. The committee used to serve as a clearing house to compensate product retailers for the loss they would incur selling products at subsidised rates. A bill was

19. For further information, please see *Electricity in India – Providing Power for the Millions*, IEA Paris, April 2002.

introduced in the Parliament in May 2002, proposing the creation of a new authority to promote competitive markets and to regulate the refining, processing, storage, transportation, distribution, marketing and sale of petroleum and petroleum products, excluding the production of crude oil and natural gas.

SOUTH-EAST ASIA: ADDRESSING ENERGY SECURITY IN ASEAN

With a projected regional oil demand growth of close to 4% per annum and the region's major oil exporters set to become net importers soon after 2010, the oil import dependency of the ASEAN (Association of South-East Asian Nations) region is set to increase substantially.

As provided for in the Hanoi Plan of Action in 1998, ASEAN governments are focusing on energy security. However, this is generally within the context of national energy policies. Under the ASEAN Plan of Action for Energy Co-operation 1999–2004, ASEAN governments are also working regionally to address regional energy security. Current medium- to long-term measures being addressed include:

- Development of indigenous national oil resources (although it remains unlikely that such efforts can result in a major increase in production over the long term).

- The development of natural gas resources for domestic use, to which end ASEAN is developing the TransASEAN Gas Pipeline (TAGP) to link regional fields to regional markets over the next 20 years.

- Making national and regional electricity supply more efficient and secure over the next twenty years by the integration of the ten national electricity systems into an ASEAN Power Grid (APG).

- Strengthening the diversity of the regional fuel mix by intra-regional trade and cross-investment in clean steaming coal.

- Diversification of energy sources, suppliers and delivery modes, which requires major and timely investment in resources and infrastructure; ASEAN countries are generally moving towards structural reform and more open markets to attract investment.

- Growing strengths in cross-border investment and cross-border co-operation and trade.

National and regional energy security policy that addresses short-term emergency response measures is also an area under development. National emergency response measures for the supply of oil are intended to curb demand in the short term and increase domestic supply by such measures as fuel switching, surge production and demand restraint. Thailand, however, is the only ASEAN country to have legislatively established its Emergency Response Measures.

Emergency response measures to ensure the supply of oil can also include the holding and release of stocks. Although ASEAN governments recognise that oil stocks are particularly effective for short-term oil market stabilisation, no ASEAN nation has government-controlled emergency stocks at present. Some have mandated oil stocks to be held by oil producers and importers, but the majority of these are commercial inventory or operational stocks.

ASEAN energy ministers established the ASEAN Petroleum Security Agreement (APSA) in 1986. But it has not been invoked, and it is not clear whether its operation mechanism has been tested or could be applied. National policies on oil stocks and the implications of a regional energy security agreement for ASEAN's oil-producing and oil-consuming members are issues of considerable regional sensitivity.

At the direction of the ASEAN energy ministers, the APSA is currently being reviewed. The scope of the review is not limited to making the existing APSA operational but also addresses more fundamentally both short- and long-term energy security measures.

The IEA recognises the potential positive regional and global outcomes from engaging ASEAN in dialogue on energy security. In March 2002, following an invitation from the ASEAN Council on Petroleum, the IEA provided expert input to the development of a framework for a revised APSA. This framework was agreed at the ASEAN senior officials' meeting in July 2002 and is currently being developed by the ASEAN Council on Petroleum.

The IEA and ASEAN anticipate further dialogue on this topic in late 2002 and spring 2003 that will focus on regional requirements and how IEA policy and experience may assist the development of regional energy security policy and operation.

LATIN AMERICA

In spite of much progress in recent years, the 2001 Brazilian electricity crisis and the economic and political crises in Argentina and Venezuela in 2002 come as reminders that the economic, political and social challenges facing the region are still enormous. Inevitably, the economic crisis of Argentina and the political difficulties in Venezuela will have considerable consequences not only on the energy demand and supply trends in those countries; they will also affect investors' decisions and strategies for the whole region, and may slow down the pace of regional economic and energy integration.

ARGENTINA

Argentina's economic and financial difficulties are having an important impact on the energy sector. The first affected by the "pesification" of the economy and the sharp devaluation of the peso were the companies distributing gas and electricity.

Largely indebted in US dollars on the international markets, these companies saw their tariffs converted to Argentinian pesos on a one-to-one basis. Already debilitated by three years of recession and affected by an increasing incidence of unpaid bills, the distribution companies are accumulating huge debts, which their international mother companies are unwilling to cover. The first to declare default on its debt payment was recently Metrogas, Argentina's largest natural gas distribution company, supplying over 1.8 million customers in the Greater Buenos Aires area.

The situation is no less difficult in the upstream sector, affecting particularly those companies whose production mix leans on natural gas, where sales are mainly on the domestic market. With the devaluation of the peso, the well-head price – which is determined on a netback basis by the spot price in Buenos Aires – has been falling drastically, in some cases below production costs. In addition, distributors have been falling behind on payments to producers, but producers are obliged by the regulator to continue supply. Contrary to expectations, exports to Chile have not helped alleviate the financial difficulties of gas producers, because the price of a large part of the gas exported to Chile is also indexed to the spot price in Buenos Aires.

The situation is only slightly better for oil producers, who can sell their products on the international market at international prices if domestic prices are not attractive. Exports, however, are subject to a new export tax (20% on crude oil and 5% on products), imposed by the government as part of its emergency budgetary measures. In addition, in an attempt to keep domestic oil product prices from rising to international figures, the government is planning to restrict exports. This decision points to the re-emergence of an old problem which affected the Latin American energy industries in the 1980s: the conflict between the policies aiming at controlling inflation and the liberalisation of energy prices as a precondition to encourage new investments.

Perhaps more important is the adverse impact that the Argentinian economic crisis may have on market reform of other Latin American countries, as Argentina had been seen as a model for energy liberalisation in the region. The role of the private sector as the main motor to sustain rapid growth in the energy sector is not generally disputed. But there is a call for a more active role for government, in particular to establish a comprehensive, clear and stable policy framework for energy that will attract sufficient domestic and foreign financing in the energy sector and also address social and environmental concerns.

BRAZIL

In Brazil, a combination of the worst drought in 70 years and insufficient investments in electricity generation and transmission capacity in the last fifteen years pushed the government to implement a strict ten-month electricity rationing programme in June 2001 to avoid rolling blackouts. The programme was extremely successful, reducing electricity consumption by an average 20% over the same period of the previous year. Efforts to cut electricity consumption were borne in large part by the residential sector, which acted co-operatively and responsibly throughout the crisis. The crisis was declared over in February 2002 and the rationing gradually toned down in the following two months.

Although the rain has now replenished the reservoirs to a level sufficient to ensure supply for the next year or two, and the gains in energy efficiency made during the rationing have permanently reduced the energy demand level (but not the rate of growth), Brazil still has to address the structural problems which generated the crisis in the first place. The debate now centres on the "re-reform" of the electricity sector and on the controversial Priority Thermo-electrical Programme (PPT) which aims at promoting the construction of 49 gas-fired power stations in the next two to three years through particularly attractive gas prices and conditions in electricity contracts.

Since elections took place in October 2002, the outgoing government had little time or political incentive to implement major changes in the electricity and gas legislation before the end of its term. The crisis did at least generate a widespread discussion on the importance of clear and comprehensive energy policies to guide the development of the sector and the decisions of operators. It also generated a positive degree of political awareness on the role of energy efficiency and renewables, and a momentum for the implementation of long-awaited legislation and programmes in these areas.

The new government will face important challenges, especially within the electricity sector. The most pressing problem concerns electricity tariffs. The reduction in demand (about 10%) after the rationing programme and the currency devaluation have pushed up distributors' costs, and passing this increase on to end tariffs can have strong effects on inflation and on consumers' capacity to pay for their electricity bills. In the generation segment, the principal uncertainties arise from the pricing policy for the "old electricity", i.e., that generated by existing (amortised) hydropower plants, which is sold to distributors at prices linked to historical costs. If the price of this type of electricity were to be liberalised, it could aggravate the expected boost in final tariffs. In view of the current macro-economic situation, it is unlikely that the new government will liberalise the electricity sector further; rather, one can expect cross-subsidies between "old power" and power generated by new thermal generation plants to be adopted. The main challenge for the new government will be to find mechanisms to allow companies to re-establish acceptable profit margins while preserving reasonable final tariffs.

MEXICO

Mexico is the world's fifth-largest oil producer and a major non-OPEC oil exporter. In spite of substantial oil, gas, geothermal and hydroelectric resources, energy supply is not keeping up with domestic demand, with the exception of crude oil, exports of which account for 50% of production. Domestic energy demand has been growing consistently at high rates during the last decade, even in years of low or negative GDP growth. In particular, there is a rapidly growing imbalance in natural gas that might lead to very high prices or shortages in the event of a cold winter in North America, or if the North American economies were to resume accelerated growth. More investment in the energy sector is urgently required if Mexico is to avoid electricity shortages and the financial burden of rising imports of natural gas and oil products. Given the other pressing social and economic priorities of the country, the public sector will not be able to face the investment requirements of the energy sector alone. Reforms to allow increased private participation in the hydrocarbon and electricity sectors are therefore essential.

President Vicente Fox's election in July 2000 ended 71 years of rule by the Institutional Revolutionary Party (PRI), and generated expectations that the new government would take steps to liberalise the country's energy industry. As yet, however, little has happened, partly because of more pressing issues to be discussed in Congress, and partly because the presidential party (the National Action Party, PAN) does not have a majority in either of the legislative houses, and thus faces considerable difficulties in getting any controversial legislation through Congress.

The key elements of Mr. Fox's energy agenda are the reform of the petrochemical, gas and electricity sectors. As for the exploration and production sector, popular opposition during the campaign forced Mr. Fox to retract an initial suggestion that Pemex (the state-owned oil and gas company) might be sold, and he has officially stated that Pemex will not be privatised. He has instead settled for modernisation of the company with a view to increasing its revenues through more tax breaks.

The energy agenda now being discussed by the Congress includes consideration of reform in electricity, as well as fiscal and administrative reforms for Pemex and the state electricity company, CFE. In view of the current make-up of Congress, it is unlikely that any major changes will take place before the July 2003 legislative elections. As far as natural gas is concerned, Pemex is finalising a model for "multiple service contracts" and expects to issue the first call for proposals by early 2003. If successful, this type of contract would allow a rapid increase in the investment for the development of natural gas reserves, by circumventing the red-tape delays that affect public investment, while, at the same time, attracting technology and private capital to finance this effort.

CENTRAL AND SOUTH-EASTERN EUROPE

Market reforms have continued to gain momentum in the region although at a different pace in each country.

The process is well advanced in central European countries as their energy policies converge with those in western Europe. The regulatory agencies have continued the adjustment of energy prices and the preparation of the electricity markets for partial competition. However, the remaining cross-subsidies and dominance of monopolies are major obstacles to effective liberalisation of the market. Energy intensities remain much higher than the average in IEA Europe because of higher losses in the supply chain and inefficient use. Increased efforts are necessary to develop and implement energy efficiency strategies and policies and to allocate sufficient resources for sectoral programmes and institutional structure.

In Poland, the newly elected government has announced further efforts to restructure the electricity and gas sectors by unbundling the transmission grid and to reduce the importance of long-term power contracts in the wholesale market. The privatisation of the oil sector is in process, but increasing the concentration of refining and retailing activities is likely to harm competition. The government may extend the restructuring plan for coal-mining of 1998–2002, which increased efficiency by 25%. However, the accumulated debt continues to represent a burden for the industry and the State. Coal still accounts for two-thirds of total energy supply.

The role of Poland as a gas transit country is likely to increase as the Europol/Yamal pipeline, which transports Russian gas to Germany, approaches its nominal capacity (32 bcm) in 2003. The country is also seeking to diversify its supply with gas from the North Sea; the Polish government is expected to announce decisions on the contracted volumes and routes (offshore or onshore) by the end of 2002.

The Slovak Republic continued its ambitious energy reform plan in 2002; the power of the regulatory body, established in 2001, will be progressively reinforced and the government should conclude the partial privatisation (49%) of three electricity distribution companies by the end of 2002. Already Transpetrol, the oil transit company, and SPP, the gas transit and distribution monopoly, have been partially privatised. However, these sales to upstream (the Russian hydrocarbon companies Yukos and Gazprom) and downstream (Ruhrgas and Gaz de France) interests may harm the interests of the Slovak transit companies and limit the access to the pipelines by additional companies. These developments may adversely affect the liberalisation of the EU gas market.

In Romania, reforms have progressed more slowly. The government has reorganised the electricity distribution sector into eight regional entities and a separate company to operate the transmission grid.

The new Bulgarian government ambitiously plans to establish the country as an energy hub in south-eastern Europe. Considerable efforts have been made to restructure the energy sector: the national electricity company has been unbundled to fifteen different companies – seven generation, seven distribution and one transmission. The regulatory agency has continued to reform the price system and lay the groundwork for a wholesale market.

Slovenia has continued to harmonise its legislation with related EU energy directives and to prepare for privatisation of the largest energy companies. Croatia has adopted an Energy Law and has moved forward on its planned privatisation of the oil and electricity monopolies.

In other countries of south-eastern Europe, market reforms are less advanced as governments have yet to establish their national energy policies and create the necessary institutions. Several ongoing international assistance projects are focusing on rehabilitating energy supply and transmission capacity. The reconnection of the national electric systems to the Union for the Co-ordination of Transmission of Electricity (UCTE) system and the creation of a regional electricity market will require extensive market reforms such as those launched in central Europe in the early 1990s.

RUSSIA[20]

Increasingly, the energy security of Russia and its export markets are dependent on the creation of a stable and competitive investment environment, energy price reform, corporate transparency and dramatic improvement in energy efficiency. Effective implementation of economic reforms is critical for the energy sector to be able to match energy demand in this period of strong GDP growth. This is especially important to Russia in its effort to sustain the economic growth experienced since its financial crisis in 1998.

Projection of Energy Demand

Russia's new energy strategy rests on the fundamental assumption that the growth of the economy since 1999, fuelled in its early stages by external factors, will take root and continue. It is not certain that the energy sector can match increasing demand during a period of strong GDP growth. The *Main Provisions of the Energy Strategy to 2020* calls for hefty increases in energy supply to match rising demand, with a particular emphasis on coal to redress what is seen as an over-dependence on natural gas. The *Main Provisions* call for reducing the share of natural gas in TPES from about 50% in the 1990s to 42–45% in 2020. The share of coal would increase from 16% in 1998 to 22% in 2010 and to 21–23% in 2020. Nuclear energy will rise to 6% in 2020 from its current 5%. The share of oil in TPES would remain practically unchanged. The total investment requirements of the energy sector from 2001 to 2020 are estimated at somewhere between $550 billion and $700 billion.

Energy Supply Security in the Face of Changing Domestic Energy Policy

Natural Gas Sector

The new Energy Strategy projects energy supply to 2020 based on a major change in the energy policy outlook: the new perception of an energy security risk from Russia's heavy dependence on natural gas. So the strategy foresees that the share of gas in TPES will decrease from about 50% in the 1990s to 42–45% in 2020, as stated

20. For further detail on Russia's long-term energy strategy to 2020, see *Russia Energy Survey 2002*, IEA/OECD Paris, March 2002.

above; coal and nuclear will make up the difference. With a third of the world's natural gas reserves in Russia, it cannot accurately be said to be "short of gas". Russia can also import gas on commercially attractive terms from central Asian and Caspian countries through established pipeline networks. Existing gas resources will be adequate for the next several decades. But investments in future supplies – domestic or imported – will have to be made several years ahead of anticipated requirements. Security of supply will not be a major problem so long as Russia succeeds in reforming the price and tax regime of the late 1990s.

Coal and Nuclear

Coal and nuclear are expected to be primary sources of the additional energy necessary to meet the growing demand and to make up the possible reduction of gas supply. The new Energy Strategy projects that coal production will have to rise by almost 75% by 2020. The demand, however, may not be as big as projected as energy prices may increase sharply.

The coal sector did progress towards restructuring during the 1990s with large-scale closure of uneconomic mines, with increased competitiveness and labour productivity. But it still may have difficulty meeting such expectations. There are questions about the capacity of the sector to attract the requisite investment, about the competitiveness of coal as an input fuel versus natural gas, and about the environmental implications of the increased use of coal.

Nuclear power is another possible alternative to gas. In January 2000, 29 commercial nuclear reactors operated within Russia at nine sites built between 1971 and 1993. Within the next eight years, all the units belonging to the first generation, built before issuance of the basic safety regulations in 1973, will end their designed lifetimes of 30 years. Units of the second generation will do so over the next 9–19 years. Russia wants to add a significant amount of new capacity and to extend the life of existing plants. Both of these aims are considered very ambitious. The Ministry of Atomic Energy (MinAtom) calls for nearly twice as much new nuclear capacity over the next 20 years as was built during the 1970s and 1980s in the centrally planned economy of the former USSR. MinAtom also calls for extending the life of certain plants. But extending the operation of existing units beyond 30 years will require substantial financial resources and the special attention of both the state company, Rosenergoatom, and the independent safety regulator, GosAtomNadzor (GAN), especially for the first-generation units. It is not clear if this is the most economic option. Safety concerns remain, in particular for the Chernobyl-type RBMK reactors. The safety regulatory body, GosAtomNadzor, requires adequate resources to address the continuing concern for safety.

Energy Markets Reform

From 1995 to 2000, Russia took important steps forward in energy-sector reform, but many of the goals set in 1995 were not achieved, largely because of the poor functioning of the overall economy. Reform of the energy sector is a prerequsite if Russia's Economic Development Plan is to succeed.

The *Main Provisions* place a priority on creating a competitive environment in gas and electricity and on encouraging independent producers. Non-discriminatory access to the gas and electricity grids is a key element included in the *Main Provisions*. Effective implementation of the Electricity Industry Restructuring Plan is essential if the sector is to attract investment to meet increasing electricity and heat demand. The plan is in line with the approach of many OECD countries in unbundling the electricity sector. If reform is successfully implemented, it will facilitate trade among regions and form a sound basis on which competition and an open electricity market can build. Federal and regional regulatory bodies have to receive sufficient power and independence to ensure a competitive, level playing field for competition in all natural resource sectors and the electricity and heat industries. New rules have to be established to cover third-party access, transparent and cost-reflective tariff-setting and licensing rules for new players in the markets.

Investment Climate

Throughout the 1990s, barriers to investment hampered the ability of the energy sector to maintain capacity and replace reserves. In spite of the growing call for investment, many barriers remain, and they reduce Russia's ability to attract the necessary funds, both domestic and foreign. Passage of Part II of the Tax Code and its effective implementation are essential. They are the final steps in Russia's comprehensive fiscal reform, with important implications for enterprises in the energy sector. Although streamlined and simplified taxation and reduced tax rates for corporate profits are positive steps in the tax reform process, an overall more profit-based structure of taxation is essential. This is especially important in the mineral resource sector, where upfront costs are substantial and returns are long-term. Petroleum licensing and operations require a comprehensive, clear and stable legal framework. Completion of the production-sharing agreement (PSA) regime and its efficient implementation will provide a mechanism to attract investment and bridge the gap while the Tax Code and investment laws are put in place. The passage of the normative acts, the PSA chapter of the Tax Code and further amendments to the PSA law are essential.

Oil Sector

Russia surprised the world by increasing oil production almost one million barrels a day from 1998 to 2001. Oil and oil product exports from the FSU – 90% of them from Russia – have increased dramatically, from 2.8 mb/d in 1996 to 4.7 mb/d in 2001. The enormous potential of modern reservoir management to expand production and improve productivity is amply illustrated in the recent results of some Russian companies. But it is not certain that improvements in efficiency and effectiveness can sustain the growth of oil production in the long run. New field discoveries are increasingly smaller, and a growing portion of remaining reserves falls into the "difficult-to-recover" category. Since 1994, new discoveries have failed to offset oil production.

Effective oil-sector reform will help sustain Russia's oil production in the long run. It is important to establish a comprehensive, clear and stable legal framework for petroleum licensing and operations, in order to attract the long-term investments necessary to develop new and more difficult fields; current production increases are based mainly on short-term investments aimed at enhancing the productivity of existing wells. Russia's current oil taxation regime relies on volume-based revenue and excise taxes at very high combined rates. The current regressive fiscal system offers little incentive to invest in long-term new oil production. In view of the higher oil prices in world markets, the impact of this regressive system is less onerous, which is reflected in the waning momentum behind fiscal reform in Russia. Production-sharing agreements can act as a bridge to attract investment while a legal and tax regime is put in place and confidence in it is built.

Energy Price Reform

The Russian government is concerned that its low energy prices do not reflect costs and lead to inefficient use of energy. The *Main Provisions* focus much attention on higher energy prices and their realignment to shift the balance in energy demand and the shares of fuels in total supply. They also set challenging targets for the raising of gas prices to parity with European import prices by 2007. Higher coal prices leading to higher electricity and central heating prices will follow. However, the plans are ambitious and may lead to serious problems for industries and regions, not least bankruptcies, social hardship and dislocation. Contingency plans will be required to resolve these problems. Impressive progress towards normal payments in cash for energy consumption has been made since budget constraints took hold in 2000. As tariffs increase, more vigilance is necessary to avoid a relapse into the vicious cycle of non-payment. The plans to end electricity cross-subsidies by 2002 are commendable and a positive sign that reflects an understanding of how targeted assistance to vulnerable social groups is more effective and economically efficient than extensive price subsidies.

Energy Efficiency

Given the share of energy consumption in disposable incomes and industrial input costs, as well as the structural inefficiencies of Russian central heating systems, it is critical that consumers gain control of energy consumption through metering and thermostats. Business and residential consumers will consume energy efficiently if empowered to do so. But, with limited funds available and a relatively unattractive investment environment in Russia, energy efficiency investment has to be prioritised to maximise efficiency gains. Furthermore, many low-cost investments can foster the consumer awareness and control which is essential to the efficient consumption of energy, including the continued introduction and enforcement of standards and labels, building codes and the wider dissemination of information on energy efficiency.

Energy and the Environment

Energy efficiency and the environment are closely linked, especially in Russia. Although energy-related emissions declined in absolute terms over the 1990s, they did not fall as fast as GDP. At the same time, the threat of increased emissions in the future has grown with increased reliance on heavy and energy-intensive industries, ageing capital stock, lack of new investment and systemic inefficiencies in energy consumption. The 1991 Law on Environmental Protection sought to balance economic development and environmental protection, using fines for pollutant emissions as the main economic instrument. This system, effective in the early 1990s, lost much of its force when the real value of the fines failed to keep pace with rapid inflation. With the current outlook for stronger economic growth, more effective implementation and funding will become possible. And it has to be achieved if the country is to limit the environmental damage inherent in meeting increased energy demand. Under the Kyoto Protocol, Russia has committed itself to stabilise emissions of six GHGs at 1990 levels by 2008–12. The fact that the GHG emissions are already lower than in 1990 has opened opportunities for emissions trading. With the outlook for economic growth, the Kyoto mechanisms – emissions trading and joint implementation – could raise revenues and attract investment to improve Russia's energy efficiency.

It is encouraging to see inter-ministerial groups led by the Ministry of Energy working on environmental regulatory issues that block project development under production-sharing agreements (PSAs). Solutions should tend towards a less prescriptive and more goal-oriented regulatory framework, which tells companies what has to be done and leaves them to assess the most cost-effective ways to do it. This will encourage ingenuity and new and improved technology.

Trade and Transit

Ratification of the Energy Charter Treaty and adoption of its energy transit regime by Russia and its neighbouring States would help depoliticise transit tariff and quota negotiations between Russia and FSU States. Ratification by Russia would send positive signals to entice other transit countries into more predictable and transparent business transit practices. This would help avoid the construction of expensive bypass pipelines, such as the one planned around Ukraine. Ratification would provide a common tariff basis for gas transit from and through the CIS countries, including the central Asian States. It would provide all parties with an international legal foundation – including a mechanism for international dispute settlement – on which to base transit grievances and receive compensation for transit violations.

UKRAINE

Ukraine's energy sector has seen several noteworthy changes in the recent past. Most importantly, non-payments for energy are substantially down as the government has given utilities more power to disconnect non-payers. In the electricity sector, for example, consumer non-payments had been running as high as 90% before 2000, but now are down to about 15%. Still, the power sector is burdened with massive debt, which continues to grow. Remaining non-payments are prevalent among low-income residents and some state-owned organisations.

Ukraine moved forward with privatising six regional power distribution companies in the spring of 2001, but the President subsequently decided to place a temporary moratorium on the sales of energy companies. The next group of power distribution companies may be privatised in 2003, though no firm decisions have yet been taken.

Ukraine still has substantial excess generating capacity, even with the closure of the Chernobyl Nuclear Power Plant in 2001, but much of this capacity is old and antiquated thermal capacity, though no plans exist to close these plants *en masse*.

Non-payments have also been a problem in the natural gas sector, often stemming from arrears for electricity. Little hard data exist on the extent of the problem today, but payment discipline appears to be much better than two years ago. Ukraine's state-owned oil and gas company, Naftohaz Ukrainy, recently resolved a debt dispute with Russia's Gazprom, rescheduling $1.4 billion in old debt.

Ukraine is one of the most energy-intensive countries in the world, though it has been making important strides in energy efficiency in recent years. Because non-payments are down, effectively increasing energy prices, and the investment climate has improved, Ukrainians have been investing more in energy efficiency. The Ukrainian economy has also shifted to some extent away from heavy industry and towards commercial services, which consume less energy.

THE BALTICS

The Baltic States are undertaking significant changes in energy policy and legislation in preparation for European Union accession. Lithuania, Latvia and Estonia have all passed new legislation or approved strategies to allow wholesale electricity competition.

In January 2002, Lithuania unbundled its power distribution, transmission and generation by divesting generation and distribution assets from the main power company. Lithuania now allows limited but growing wholesale competition. However, many experts in Lithuania feel it is difficult for the country to have a balanced power market as long as the Ignalina Nuclear Power plant continues to operate. Lithuania currently gets about 75% of its power from Ignalina. The country has agreed to close one of the two Ignalina reactors by the end of 2004 and is negotiating with the EU about closing the second reactor, possibly by the end of 2009. Lithuania is privatising its gas company, Lietuvos Dujos; Ruhrgas and E.On (Germany) are buying a 34% stake in the first stage of privatisation.

Latvia cannot privatise its main power company according to its Energy Law, but it is unbundling the sector by creating separate subsidiaries for generation, distribution and transmission. The separation of the transmission function is under way; the separation of generation and distribution assets should begin by the end of 2002. Latvia has few domestic energy resources so it has placed a major emphasis on developing renewable energy, particularly in the district heating sector. According to the Latvian Development Agency, 30.4% of total primary energy supply in Latvia came from renewable energy, primarily in the form of biomass and woodchips for small boilers. Hydropower and peat made up most of the rest of the renewable sources (Latvia considers peat a renewable resource when it removes peat at or below the natural rate of renewal). A new 22-MW wind power plant is also being built in western Latvia.

Estonia is likewise moving forward with reform of the power sector. It is breaking up its main power company, Eesti Energia, to unbundle generation from distribution. The largest Estonian generators are already separated and registered as independent companies, and two small distribution companies have been privatised. Estonia will launch a wholesale power market in 2003. Domestic oil shale is the dominant fuel in Estonia, covering 58% of energy supply in 1999.

All three Baltic States have seen tremendous improvements in energy efficiency in the last decade as their economic structure changes and end-user energy intensity has dropped: in Latvia by almost 20% from 1990 to 1998, and in Estonia by 32% between 1996 and 2000[21].

CLIMATE CHANGE IN TRANSITION ECONOMIES

The countries of the former East bloc are playing an important role in global climate change mitigation. Under the Kyoto Protocol, most industrialised nations have undertaken commitments to reduce their GHG emissions relative to those in 1990[22]. Countries in transition are among the only Kyoto signatories to have made substantial reductions in their emissions. These reductions are important for two reasons. First, they are real reductions and as such are contributing to solving the dilemma of climate change. Second, under the Kyoto Protocol, industrialised nations are allowed to trade their emission allotments among themselves, either through direct emissions trading or through joint projects to reduce emissions further (called joint implementation). Table 12 illustrates the degree to which transition economies have reduced their emissions relative to their Kyoto Protocol baselines.

21. These data are for illustrative purposes only since they do not take purchasing power parity into consideration.
22. Under the UN Framework Convention on Climate Change, countries in transition could select a year other than 1990 as their base year for comparing future emissions. Bulgaria and Poland have selected 1988, Romania selected 1989 and Hungary chose an average of 1985-87; all other countries use 1990.

Table 12

Transition Economies' Commitments and Progress under the Kyoto Protocol

(emissions of all greenhouse gases, excluding land-use change and forestry)

Country	*Base year emissions (Mt CO_2)*	*1999 emissions (Mt CO_2)*	*% change in gross emissions (1990-99)*	*Kyoto target (% reduction from base year)*
Bulgaria	157	78	–51	–8
Czech Republic	190	141	–26	–8
Estonia	41	20	–51	–8
Hungary	102	87	–15	–6
Latvia	31	14	–56	–8
Lithuania	52	..	..	–8
Poland	564	400	–29	–6
Romania	265	..	..	–8
Russia	3040	1962	–35	0
Slovakia	73	52	–29	–8
Slovenia	19	..	..	–8
Ukraine	919	455	–50%	0

Notes: Lithuania, Romania, Russia, Slovenia, Ukraine have not submitted greenhouse gas inventories for 1999. Russia figures in columns two and three reflect 1996 data. Ukraine figures reflect 1998 data. Energy-related CO_2 emissions in 2000 were 45% below 1992 in Lithuania, 48% below 1990 levels in 2000 for Romania, 14.5% higher than 1990 levels in Slovenia.

Sources: UN Framework Convention on Climate Change Secretariat, FCCC/SBI/2001/13 and FCCC/SBI/2001/13/Corr.1; IEA *CO_2 Emissions from Fossil Fuel Combustion 1971-2000*, Paris, 2002.

Countries in transition are also very important for future efforts to mitigate emissions for the simple reason that they have tremendous potential to do so because of their inefficient use of energy and their economic structures, which still tend to focus on heavy industry even in cases where it might not be economically rational.

A GAS GRID PROJECT IN THE MIDDLE EAST (DOLPHIN PROJECT)

In spite of the Middle East's vast reserves of natural gas[23] and relatively low production costs, intra-regional trade in gas remains embryonic. Plans to

23. Qatar and Iran hold, respectively, the world's largest and second-largest reserves.

establish an integrated regional gas grid within the Gulf Co-operation Council[24] and the eastern Mediterranean States have been under consideration but little or no progress has been made. Among the hurdles that prevent this regional trade is the absence of transport networks and limited market transparency. The politically sensitive issue of pricing also has to be addressed.

In the Gulf region, plans to establish a regional Gulf grid essentially entail the construction of a gas pipeline linking Qatar to the United Arab Emirates (UAE), Oman, Kuwait, Saudi Arabia and Bahrain. A regional gas grid is of particular interest to Dubai and Kuwait, which are emerging as potentially strong regional gas importers. Although Qatar and Oman have established themselves as major suppliers of natural gas, the development of non-associated gas has so far been driven by LNG exports with the economics revolving around LNG project finance and prices established in long-term contracts. As the subsidisation of imported gas continues to be politically sensitive, gas prices will have to rise to guarantee the success of a regional project.

Among plans to establish an integrated regional gas grid is the ambitious Dolphin Gas Project, which involves the construction of a 440km-long, 48-inch, undersea pipeline with an initial capacity of 2 billion cubic feet/day. The project, which is sponsored by the UAE's Offsets Group (UOG), will deliver gas from Qatar's North Field to al Taweelah in Abu Dhabi's al Maqta' district. Here, in the first phase, it will link with another pipeline to the Jebel Ali industrial zone in Dubai. Ultimately, it is expected that the pipeline will extend to Oman and on to Pakistan and India. Under current plans, gas sales to Abu Dhabi and Dubai are expected to start in 2005. The strongest centre for demand continues to be Dubai, which currently receives 500 mcf/d of gas from Abu Dhabi at $1.00/MBtu.

As stated above, gas pricing continues to be a sensitive issue. It is expected that Dolphin dry gas will be delivered at a discounted price of $1.30/MBtu cif (compared with the UAE domestic price of $1.00–1.20/MBtu) to al Taweelah in Abu Dhabi where it is to be piped to Jebel Ali (Dubai). It also remains unclear whether Abu Dhabi will subsidise the Qatari gas which will be piped to Dubai or whether Dubai will pay the market price ($1.30/MBtu plus transit costs). The Dolphin project highlights some of the issues associated with a planned expansion of an intra-regional gas export network in the Middle East. Ultimately, increased transparency as well as a reduction of subsidies for gas prices will be necessary for this project to succeed.

24. Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

2

PART

THE COUNTRY REPORTS

IN-DEPTH REVIEWS: SUMMARIES

This part contains summaries of the findings and full list of recommendations of the 2001/2002 In-depth Reviews for the following countries. Norway, reviewed in the 2000/2001 cycle, is included here because the report had not yet been published when the 2001 edition was released. The findings and recommendations reflect the situation when the report was drafted and finalised. The full reviews have been published separately.

DENMARK

(team visit: October 2001; approval at the Standing Group on Long-term Co-operation (SLT): February 2002)

GERMANY

(team visit: January 2002; approval at the SLT: June 2002)

GREECE

(team visit: November 2001; approval at the SLT: April 2002)

KOREA

(team visit: April 2001; approval at the SLT: February 2002)

NORWAY

(team visit: March 2001; approval at the SLT: October 2001)

UNITED KINGDOM

(team visit: January 2002; approval at the SLT: June 2002)

UNITED STATES

(team visit: October 2001; approval at the SLT: February 2002)

DENMARK

Throughout the last few decades, Danish energy policy has been strongly influenced by environmental policy objectives. Until November 2001, one minister was responsible for both energy and environmental policy. Denmark also has many policy goals that are inspired by both energy and environmental considerations. The country promotes energy efficiency, renewables and combined heat and power production (CHP). It has set itself the target of producing 20% of its electricity from renewables. Denmark also has several greenhouse gas targets. Among them there is the Kyoto commitment to reduce greenhouse gas emissions (six gases) by 21% in the first budget period 2008-2012, compared to 1990. There is also the stringent national commitment to reduce CO_2 emissions by 20% by 2005, compared to 1988. Denmark's Parliament approved ratification of the Kyoto Protocol on 30 May 2001.

If these energy policies are measured against their objectives, Denmark has been very successful. Denmark has the highest share of electricity generated in combined heat and power plants in the world, as well as with one of the largest district heating systems. In 2000, 12.6% of electricity generation was from wind turbines, also the highest of any nation. According to government forecasts, Denmark will come very close to meeting its multiple CO_2 and greenhouse gas emissions commitments, provided a national system of tradable CO_2 quotas for power plants remains in place. The system was introduced on 1 January 2001 to render climate change abatement in the power industry market-compatible. The quota system will be in force provisionally until full retail competition becomes effective in 2003. Should the quota system lapse without replacement, electricity exports could soar after 2003, and national CO_2 emissions could fall short of the Kyoto target by more than 19%. The report recommends that a decision about the future of the quota system should be taken as soon as possible. The new government has announced its intention to extend the CO_2 quota system beyond 2003.

The decisive step towards full liberalisation of the Danish power industry was taken in 1999, when the Electricity Supply Act was adopted. Since 1 April 2000, final customers of 10 GWh or more per year have been eligible to choose their electricity supplier in the free market. On 1 January 2001 the threshold was lowered to 1 GWh. On 1 January 2003, all final consumers will become eligible. Electricity generation, ownership of the transmission grid, operation of the grid, distribution and electricity supply must each be organised in separate legal entities. Electricity market reform in Denmark goes beyond the requirements of the EU directive.

Disclaimer

The review visit on which this report is based took place in October 2001, before the new Danish government took office in November 2001. Most of the drafting of this report was completed before the details of the new government's policy were known. For this reason, the report reviews exclusively the policies of the previous government. Where policy changes became known before the publication, they are mentioned briefly in the body of the report.

However, the government requires CHP and wind energy to be given priority in dispatching. Therefore, only about 60% to 65% of the power market is governed by competitive price signals. This "priority" dispatch requirement causes excess generation during certain periods, a situation which may lead to losses for utilities. The Danish government should encourage more trade, competition and interconnection, and adapt environmental policies to the realities of the power market.

In the gas market, Denmark has opted for more restrictive provisions, in line with the minimum requirements of the EU Gas Directive. Since 10 August 2000, 30% of the market has been open to competition. This will increase to 38% in 2003 and 43% in 2008. The Danish government also reserves the right to deny access of some potential competitors to the gas grid if such access would cause serious financial difficulties for the state-owned natural gas pipeline company DONG. This right is permitted under a derogation in the directive. Originally, the Natural Gas Supply Act of 2000 provided for negotiated third party access, but this was changed to regulated third party access in October 2001. From 2003 onwards, network operation and gas trading activities will have to be separated.

Between July 1999 and July 2000, DONG acquired two of the five Danish gas distribution and supply companies, and also the right to supply the largest customers of two others. This consolidation was carried out partly in response to the high indebtedness of the Danish gas sector. But it means that DONG now directly controls nearly 95% of the Danish gas market. The Danish Competition Authority has taken note of this strong dominant position. The government should prevent DONG from becoming a monopoly supplier along the entire gas chain. It should create incentives for new suppliers, foreign and domestic, to enter the Danish market. The new government has decided that the gas market should be fully competitive by 2004 and that DONG should be privatised at a time to be determined in the future.

RECOMMENDATIONS

The Government of Denmark should:

Energy Market and Energy Policy

- ☐ Review the existing policy measures with a view to developing more cost-effective policies. Government interventions should be analysed on a continuing basis for cost-effectiveness and should be prioritised accordingly. Market-oriented approaches should receive priority.

- ☐ Ensure that both domestic and international policies are adequately assessed in order to meet environmental objectives cost-effectively.

- ☐ Further review the tax and subsidy system with a view to reducing its complexity and administrative costs.

- ☐ Work to reconcile free market rules and environmental policies to send the right investment signals to the market; in particular, develop as soon as possible a market-based successor mechanism to the CO_2 quota system for the period after 2003.

Energy and the Environment

- ☐ Finish the assessment of the economic implications of basing climate change policy almost exclusively on domestic mitigation strategies. In particular, consider the advantages that the Kyoto mechanisms and the expansion of the quota/trading system to other sectors may offer in closing the remaining emissions gap.

- ☐ Decide urgently the fate of the CO_2 quota system for the electricity sector beyond 2003; determine the quota levels; reassess the low penalty for non-compliance; and determine whether international trading and credits can be incorporated.

- ☐ Make further adjustments to the car registration fee and pursue road pricing and other cost-effective policy instruments in the transport sector.

Energy Efficiency and Renewables

- ☐ Continue to review the performance of existing energy efficiency programmes with a view to developing market-based and more cost-effective policies. Loan payback schemes could substitute for outright subsidies in some cases.

☐ Continue to place time limits on subsidy schemes, particularly on those to boost market penetration of new energy-efficient technologies.

☐ Improve the transparency of the costs and trade implications of the various renewables support measures, in particular "priority" production.

☐ Investigate the consequences of greater penetration of imported biomass in terms of CO_2-neutrality, cost, and Denmark's security of supply objectives.

☐ Take steps to move to market-based policies as soon as possible, including the introduction of the green certificates programme, or some other instrument to offset the costs of current subsidies for renewable energy. In the transitory period, subsidies need to be reduced further to reflect current market conditions for wind energy and CHP.

Fossil Fuels

☐ Review the hydrocarbon tax to eliminate distortions in upstream investment and to establish a clear and simple upstream taxation system.

☐ Facilitate effective competition in the Danish gas market by preventing DONG from becoming a monopoly supplier along the entire gas chain. The Competition Authority should monitor DONG's behaviour closely.

☐ Creates incentives for new suppliers to enter the Danish market.

Electricity and Heat

☐ Strive to increase competition by:
- Working towards further opening of Denmark's interconnection with other countries for competitive power trade, especially spot purchases.
- Encouraging the removal of internal bottlenecks in the transmission system and striving for a similar approach in Nordel.
- Encouraging more market-oriented behaviour among power companies, and especially among small distribution and supply companies.
- Encouraging the transformation of consumer co-operatives into commercial companies, and facilitating the privatisation of municipal utilities.

☐ Through the Competition Authority, monitor the electricity market and deal with abuses rapidly.

☐ Continue to adapt the environmental policies aimed at the power industry to the realities of competition.

Energy Research and Development

- ☐ Complete a comprehensive energy research strategy covering the full spectrum of innovation, and domestic and international programming.

- ☐ Clarify responsibilities and improve the co-ordination between the Danish Energy Agency and the electricity system operators that administer the Public Service Obligation. This also applies to the electricity end-use R&D requirement.

GERMANY

The German government has a challenging energy policy agenda. It has decided to phase out nuclear power and it has established ambitious targets to reduce greenhouse gas emissions. While it is not yet clear how nuclear power will be replaced, it is likely that energy efficiency and conservation, co-generation and renewables, as well as fossil fuels, will play a significant role in Germany's energy supply. To ensure that these policies will be cost-effective, their development and effectiveness will need to be closely monitored.

Energy security is an important issue for Germany as the country has limited indigenous energy resources. Moreover, the decision to gradually phase out nuclear power by 2025 will increase Germany's reliance on imports of coal and natural gas, which currently represent 27% and 78% of demand for these fuels. Germany will also continue to depend heavily on imported oil, at about 40% of its total primary energy supply. To address these energy security issues, Germany is focusing on the development of domestic fuels and renewables, energy end-use efficiency, and on good relations with energy exporting countries.

For a long time Germany has managed to significantly **reduce the emissions of greenhouse gases** (GHG) and air pollutants. These reductions have resulted partly from the so-called "fall-wall effect"[1] in the New Laender where industrial restructuring has taken place, but environmental impacts were reduced by environmental investments and better environmental management throughout the country. In 1995 Germany established a demanding national target of reducing CO_2 emissions from 1990 levels by 25% by 2005. To reach this target, Germany needs to reduce CO_2 emissions by a further 9.6 percentage points from the 2000 levels. To reach its Kyoto target for 2008-2012, Germany needs to reduce its GHG emissions by a further 1.9 percentage points (excluding the impact of carbon sinks). While Germany seems to be on the right track to meet its Kyoto target, reaching the national target will be a challenge. The remaining emissions reductions may prove more difficult to achieve over the coming years than in the last decade, and the associated costs are also likely to be higher.

The federal government introduced the **National Climate Protection Programme** in October 2000 to help meet the national CO_2 reduction target. The eco-tax, promotion of co-generation and renewables, fuel switching, energy efficiency improvements in buildings, and industrial voluntary agreements have made significant contributions to the programme. Cost-effectiveness was an important consideration when measures were chosen for the programme, and many

1. "Fall-wall effect" refers to the impacts of the restructuring and modernisation of the East German economy after reunification in 1990.

of these are subject to continuous monitoring. However, the marginal cost of emissions reduction is likely to increase and the current mixture of very specific measures may be expensive. One of the key instruments developed to internalise external costs is the eco-tax. A key objective of the eco-tax is to reduce greenhouse gas emissions, yet the tax does not reflect the carbon contents of fuels and it does not affect energy users in an equitable manner. As the cost of domestic measures is likely to increase, the government should consider relying on the Kyoto Protocol's "flexible mechanisms" to achieve compliance.

Energy efficiency has improved because energy consumption in the New Laender decreased in the early 1990s after the restructuring of industry, and because specific energy consumption in different sectors declined throughout the country. The German Energy Agency (DENA) was established in 2000 to promote sustainable energy, mainly through energy efficiency and renewables. The DENA works in close co-operation with the energy agencies of the Laender or with other local contact points that are active in energy efficiency. It is also constantly seeking opportunities for closer co-operation with the industrial and financial sectors in order to be able to provide technical and financial support for projects. The agency's scope of work should be clearly defined and the main criterion for choosing its projects should be their cost-effectiveness. At present, Germany uses a wide range of measures to improve energy efficiency. In the industrial sector the emphasis is on voluntary measures, such as voluntary agreements and third-party financing. The housing sector relies mainly on regulatory measures. One of the key challenges in this sector is to reduce energy consumption in existing buildings. Also, the policies for different kinds of heating (*e.g.* district heating) should be clarified. Gasoline consumption in the transport sector has decreased in past years. Both government and industry expect a further decrease thanks to voluntary agreements by the car industries, a shift from gasoline to diesel in passenger transport, a modal shift to rail transport, and decreasing mileage.

Oil accounts for almost 39% of the primary energy supply in Germany. Almost all oil is imported, but from diversified sources. There has been some consolidation in the downstream oil market, but the Federal Cartel Office (FCO) has worked to maintain an oil market where effective competition can take place. In 2003, Germany will introduce product standards that clearly exceed the EU requirements for 2005. The refining industry has already adopted most of these norms.

The German government wishes to maintain a significant **coal**-based electricity generation capacity to avoid over-dependence, and associated supply and price risks, on imported energies. The policy for hard coal is also closely related to social, regional and employment policies. Because of its poor competitiveness, domestic hard coal receives a significant, but declining, amount of subsidies. The IEA considers that these indefinite subsidies are not justified because the international market in hard coal is well established and offers secure and reliable sources of fuel at prices – both now and in the future – that German national production cannot match.

Lignite production does not receive subsidies. Lignite power plants, however, are currently protected by legislation prohibiting new entries in the New Laender. In

2001, the Swedish power company Vattenfall agreed with the federal government to generate 50 TWh/year from lignite until 2011. Following this agreement, the government will phase out the restrictions for new entrants in 2002.

Germany is the second-largest European **natural gas** market after the United Kingdom. These are the only European countries that have fully liberalised their gas markets. In 2000, gas consumption reached 88 bcm, representing a 21% share of primary energy supply. The supply base is diverse, with domestic production accounting for 22% of the supply, and preparations are under way to establish a gas-trading hub in Bunde, near the Dutch border. Currently there are about 750 companies operating in the German gas sector, but there is a trend of consolidation and mergers among gas companies, and between gas and electricity companies.

Gas-to-gas competition first arrived at the supra-regional transmission level when Wingas, one of Germany's largest supra-regional gas companies, installed its new pipeline system in the early 1990s. The EU Gas Directive of 1998 has been largely transposed to German legislation. A draft amendment to the Energy Industry Act was published by the Federal Ministry of Economics and Technology (BMWi) in December 2000, fully transposing the Gas Directive. This will be adopted in 2002. Germany has opted for negotiated third-party access. Industrial user and gas industry associations have signed the Associations Agreement of July 2000, and its amendments of March and September 2001 and May 2002, which are voluntary accords defining the framework for freely negotiated contracts and access conditions to gas networks and storage.

Only a small share of gas consumers have changed their suppliers, but larger consumers have managed to negotiate more favourable contracts. New entrants have experienced widespread access difficulties and consider the access process to be too complex, with rules being incomplete, access tariffs too high and tariff calculation methods non-transparent, making discriminatory behaviour possible. Also, the absence of a regulator has been criticised. Liquidity should be increased in the gas market as lower level operators are at present linked with suppliers through long-term take-or-pay contracts. The opening of the new trading hub may help in this respect. The user and supplier associations have negotiated a third amendment to their Agreement which addresses some of these issues; all parties, however, consider that the rules should be further clarified.

In 2000, the share of **renewables** (including hydropower) in primary energy supply was 3.4% and in electricity generation 7.3%. The Renewable Energies Act of April 2000 aims to double the share of renewables in total energy supply by 2010 compared to 2000 levels. The national policy on renewable energy is embedded in a European framework, according to which Germany should generate 12.5% of its electricity from renewable energy by 2010. During the 1990s, wind power was greatly developed and Germany has become the world leader in this area, with almost 9 GW of installed capacity. As the sites suitable for hydropower and onshore wind are becoming limited, Germany has announced ambitious targets for developing offshore wind power. Renewables are supported by both direct subsidies and feed-in tariffs; the latter were introduced by the 2000 act, and are in effect indirect subsidies. The level of these indirect subsidies was approximately €1 billion in 2001, and this annual expenditure is likely to grow as more renewable energy capacity is installed.

Germany is the largest **electricity** market in Europe, with 490 TWh of final electricity consumption in 2000. In legal terms the market has been fully open to competition since 1998. As a consequence, electricity prices for both industrial and domestic consumers decreased significantly between 1998 and 2000. Germany has chosen negotiated third-party access (TPA) as the primary means of network access. As in the gas sector, there is no sectoral regulator for electricity and the rules for network access have been established by the electricity industry and network users in Associations Agreements within the legal framework of the Energy Industry Act and the Competition Law. Over the past year there has been significant progress – especially through the Associations Agreements – in addressing the problems that consumers and suppliers face in their efforts to gain access to electricity networks. Furthermore, recent work by the FCO and the Task Force for Network Access in the BMWi has demonstrated considerable will on the part of German authorities to address remaining network access problems.

Nevertheless, problems in the electricity market persist. The levels of TPA tariffs and their high variation are still matters of concern. Another concern is the lack of unbundling of the retailing and distribution functions of companies operating at the lower voltage networks as this can permit abusive behaviour. The government expects the monitoring mechanism, which was introduced by the latest amendment to the Associations Agreement (December 2001), to help in this respect. The amendment also simplified the conditions under which small consumers can have access to the market. However, there is still a need to make access easier and suppliers are developing further improvements under the moderation of the Task Force.

Electricity produced in **combined heat and power** plants (CHP) accounts for about 12% of total electricity supply. The Co-generation Act of May 2000 guaranteed a minimum feed-in price for electricity produced by CHP plants operated by public utilities. This act was replaced by the Co-generation Act that came into force in April 2001. It allows CHP operators, who are feeding electricity into the public transmission network, to receive bonus payments in addition to the revenue at market prices, provided that requirements for the power-to-heat ratio are fulfilled. No direct subsidies are given to CHP. Whatever financial support to CHP is needed should be on a declining rate and eventually phased out. Furthermore, possibilities for connecting more consumers to existing district heating networks should be explored to improve their competitiveness.

Germany will gradually phase out **nuclear power** by closing down plants when they reach an average of 32 years of operation. Nuclear power now covers 30% of electricity generation and 13% of total primary energy supply. The negotiated agreement between the government and nuclear utilities to phase out nuclear power entails no direct cost to the government and provides industry with some level of certainty and flexibility in implementation. The national energy policy implications of the decision are significant. The magnitude of these implications makes it essential that necessary corrective action is taken and at the right time. The government thus needs to be well informed of developments in this area at all times, which will require a continuous assessment process. The nuclear phase-out policy will not relieve government and industry in the near future of the responsibilities they now carry for the ongoing nuclear programme. Competence in the nuclear sector will need to be maintained for decades. The ways and means for managing and disposing of radioactive materials will have to be maintained and developed, and nuclear power plants will need to be decommissioned safely.

The basic plan for **energy R&D** in Germany is set out in the 1996 "Fourth Programme on Energy Research and Energy Technologies", which runs until 2005. The primary objective of energy R&D is to support energy policy, and the secondary one is to support industrial development and economic growth. In most cases the two objectives can be achieved simultaneously, but a potential problem is that when many different policy objectives are sought at the same time, setting clear targets for projects may become obscured and consequently make it difficult to assess the performance of R&D programmes. R&D budgets have been declining over the past years. This is a concern as many different aspects of energy policy, such as the phase-out of nuclear power, large-scale use of renewables, continuing use of fossil fuels and ambitious climate goals, will demand technological innovation and create technology challenges.

RECOMMENDATIONS

The Government of Germany should:

General Energy Policy

- ☐ Evaluate the cost-effectiveness of the measures used to achieve all the energy and environment policy objectives simultaneously and publish the results. Monitor the consequences of the nuclear power phase-out, including the implications for the economy, the environment, security of supply and radioactive waste disposal.

- ☐ Put in place a long-term, stable energy policy framework, giving a higher priority to energy security, and implement as much of it as possible through the market mechanism. Encourage market participants to develop a strategy to substitute nuclear power with cost-effective alternatives that support energy security and climate change goals.

- ☐ Ensure that the federal and regional cartel authorities have enough resources to handle disputes and hand down decisions quickly.

Energy and the Environment

- ☐ Analyse further the various policy options and develop strategies for managing the evolution of GHG emissions beyond Kyoto target years.

- ☐ Pursue possibilities for supplementing domestic measures with Kyoto "flexible mechanisms".

- ☐ Develop and apply market-based instruments to give incentives for reducing emissions in cost-effective ways. Review and reform energy taxes and the eco-tax system to better reflect the externalities of each source of energy.

Energy Efficiency

- ☐ Ensure that energy intensity continues to decrease and energy efficiency to improve.

- ☐ Enhance measures to address energy efficiency in buildings, particularly in existing buildings.

- ☐ Develop a national energy efficiency strategy for the transport sector without delay and take into account the cost-effectiveness of measures.

- ☐ Ensure adequate funding for cost-effective DENA programmes, and support its co-operation with the private sector (industrial and financial sectors) and the Laender.

Coal and Lignite

- ☐ Continue to reduce coal subsidies with the aim of eliminating them, and set a clear deadline for this abolition. Compensate the loss of the subsidies and resulting decline of the coal industry with restructuring programmes to address social impacts.

Natural Gas

- ☐ Ensure that non-discriminatory, transparent and simple arrangements for access to gas transmission and distribution networks, and gas supply are put in place to speed up the development of competition in the gas market. Ensure that tariff calculation methods are transparent.

- ☐ Reinforce the resources and power of the Federal Cartel Office and the Task Force for Network Access in the Ministry of Economics and Technology to ensure that anti-competitive practices in the gas sector are abolished.
- ☐ Facilitate access to supply by promoting the liquidity of the gas market; in particular, encourage the development of spot markets and trading hubs.
- ☐ Continue to monitor concentration in the gas market to avoid further dominance of major players. In this regard, cross-shareholding between different network levels should be taken into account.

Renewable Energy Sources

- ☐ Take the economically feasible potential of renewables into account when promoting their use.
- ☐ Monitor closely the cost impact of policies that indirectly subsidise renewables through the feed-in mechanism; and take into account technological progress to reduce cost, and eventually phase out subsidies.

Electricity and Heat

- ☐ Reinforce efforts to make the rules for network access as fair, simple, rapidly applicable and widely usable as possible. Monitor the effectiveness of these procedures, including appeal mechanisms, and address remaining shortcomings.
- ☐ Consider options for separating network operation from other activities of vertically integrated companies at different network levels in order to ensure that system operation is effectively independent from generation and other activities.
- ☐ Monitor concentration in the electricity market and avoid dominance of market players. In this regard, cross-shareholding between different network levels should be taken into account.
- ☐ Put in place mechanisms to ensure that there will be no cross-subsidisation and discrimination between the distribution and retailing businesses of distribution network operators, and to demonstrate that access conditions are fair.
- ☐ Continue to monitor the prices, their components and the structural reasons for price differences for various groups of consumers, and compare these with those found in other countries.
- ☐ Encourage the development of adequate interconnection and transmission capacity to facilitate cross-border trade.

- Evaluate the cost-effectiveness of policy alternatives to promote combined heat and power (CHP) production – and aim to reduce unreasonable costs – by doing, for example, an analysis of the bonuses that are granted under the feed-in tariff system. Evaluate the feasibility of expanding district heating systems to create an effective use for more heat from CHP plants; and compare this with the feasibility of using smaller CHP plants without expanding district heating networks.

- Incite market forces to develop other energy sources in a timely, economically and environmentally sound way to replace nuclear energy.

- Maintain national capability to assess future nuclear technology options.

- Assure the safety and operational performance of existing nuclear plants.

- Continue efforts to implement the planned interim and permanent arrangements for the management of radioactive materials.

Research and Development

- Ensure that there is a good balance between short-term and long-term R&D programmes. In particular, clarify the role of R&D in light of the nuclear power phase-out, and ensure that adequate resources are made available by the government and industry to support R&D in this area as needed.

- Given the importance of coal in the German fuel mix and the likely expansion of coal-fired power to replace existing nuclear capacity, give higher priority to R&D for clean coal technologies, including carbon sequestration.

GREECE

Greece is geographically isolated from other IEA Member countries. It depends heavily on imported energy, especially oil. Lignite is the only major domestic fuel and is extensively used for power generation. Lignite is also a major source of CO_2 emissions and air pollutants. Electricity is expected to be in tight supply over the next three or four years. The Greek government has recognised these problems and is trying to diversify its supply sources. One approach is to increase interconnections of gas, oil and electricity transmission lines with neighbouring countries and the European Union. Another is to increase the use of gas for power generation and other activities. In order to attract investment to meet rapidly growing energy demand, well-designed markets need to be created in both the electricity and gas sectors.

Progress has been made on the institutional framework for market liberalisation. The Regulatory Authority for Energy (RAE) was established in July 2000 as an independent agency, with a mixed advisory and decision-making role. In electricity matters, such as codes, regulations, end-user tariffs and licensing for generation, the RAE gives an opinion. The Ministry of Development makes the final decisions. The RAE has full competence in supervising the Transmission System Operator on third-party access matters, setting end-use natural gas tariffs, unbundling, imposing fines and settling disputes. The RAE is to support the general goals of security of supply, environmental protection and national and regional economic competitiveness. The RAE also provides an opinion on long-term energy planning, which comes under of the Ministry of Development and must be approved by Parliament.

The energy markets in Greece are dominated by highly integrated state-owned enterprises. The government has used this situation to achieve social and economic policy objectives, such as lowering inflation, protecting the competitiveness of energy-intensive industry and indirectly supporting inhabitants in several geographic areas. The aim is achieved through price caps and identical tariffs for all captive electricity consumers. The government has also relied on state-owned enterprises because it lacks the personnel to do detailed planning and to monitor the market. The close relationship between government and the energy companies has resulted in a lack of transparency in the market and in a pattern of discretionary policy actions. Although the situation has improved gradually with market liberalisation and the privatisation of state companies, loosening the ties between the government and state enterprises has become increasingly important to ensure effective competition by new entrants.

In 1995, Greece introduced the "Hellenic Action Plan for the Abatement of CO_2 and Other Greenhouse Gas Emissions". The plan, which aimed to limit the increase in emissions of CO_2, N_2O and CH_4 from all sources, set a target for the year 2000 of between 12% and 18% above the 1990 level. In 2000, emissions of the three gases were 23.3% above the 1990 level. Under the EU "burden-sharing" agreement to meet the Kyoto Protocol target for 2008-2012, Greece's greenhouse gas emissions target is set at 25% above the 1990 level. CO_2 emissions are expected to grow fast in the future, and so strong additional measures will be needed to meet this target. At present, there is neither a national plan nor an approved package of policies and tools to achieve the target. The first version of a climate change mitigation plan has been completed, but it still needs to be approved by the Minister of Development and the Minister of Environment, Physical Planning and Public Works. This is expected to happen soon, since Greece is moving towards ratification of the Kyoto Protocol. To be effective, however, the plan will need to be supported by an adequate institutional framework and careful monitoring. Greece intends to use the "flexible mechanisms" of the Kyoto Protocol to supplement national measures.

Energy intensity in Greece is a serious concern. It exceeds the IEA Europe average and it is increasing. Significant potential for energy efficiency improvement has been identified. The cost-effectiveness of specific efficiency measures should be taken into account in setting policy priorities. Many specific measures are self-financing and can be taken without relying on subsidies. Measurable targets should be set. The effectiveness of policies should be carefully monitored.

Demand-side measures, to which not much attention has been paid, should be given priority since their energy-saving potential is as great as measures on the supply side. It is commendable that the government is making the effort to use such market-oriented instruments as third-party financing to improve energy efficiency in different sectors. It is also encouraging that the government intends to introduce voluntary agreements with industry as a means to exploit energy-saving potential with demand-side measures. Energy can also be saved in the residential sector. But recently proposed measures, such as tighter building codes and building energy certificates, will only reduce energy consumption in the long term. More immediate results could be achieved by modifying energy prices and taxes and by information campaigns. There has been significant progress in promoting the use of public transport, and the Athens subway system is continuously being expanded. But efforts need to be strengthened to curb sharply increasing energy demand in this sector, as well as to combat local environmental pollution.

Greek oil demand is forecast to grow by about 40% between 2000 and 2010. The long-term project of building an oil pipeline between Greece and Bulgaria is proceeding, albeit slowly. Although the oil market has been largely liberalised, products may be imported only by refineries, oil marketing companies and a few large oil users. The government justifies this policy by referring to its oil stockholding obligations under the IEA and the European Union. In October 2001, the EU Court of Justice ruled that the existing oil stock regime in Greece was distorting competition. Responding to increasing oil demand in the future will require more stock capacity. For these reasons, Greece is now reviewing its stock management policies. To avoid market distortion and to stimulate competition, direct imports of crude oil and oil products should be allowed, and non-discriminatory access to oil storage facilities should be ensured. The government has recognised that the oil market is also distorted by tax fraud. It is trying to rectify the situation by new legislation and more effective law enforcement. These problems will be given consideration in a proposed new oil market law. To improve transparency, the management of oil stocks has already been shifted from Hellenic Petroleum S.A. to the government.

Low-quality lignite accounts for 82% of Greece's indigenous energy production and 64% of its electricity supply. While lignite use contributes positively to energy supply security, it also does environmental damage. Programmes are in place to restore the land that has been mined for lignite, and investments have been made to reduce pollutant emissions from lignite-fired power plants. These efforts need to be continued. Even though the government favours the use of gas in power generation, new lignite-fired power plants are licensed, provided they use only state-of-the-art technologies and will not make it more difficult to Greece to meet its greenhouse gas emissions target. The Greek State owns all lignite deposits, and the Public Power Corporation (PPC) had exclusive rights to mine lignite until the electricity market was liberalised and a bidding process was established to lease them. But, as the bidding process was introduced only very recently, there have not yet been any bidders. Today, PPC mines 95% of all lignite in Greece, and uses it in its own lignite-fired power plants.

Greece successfully introduced natural gas into its energy mix in 1996. In 2000, natural gas accounted for 6.1% of the primary energy supply, and gas consumption is growing fast. It has already a good footing in power production and has replaced some oil use in the industrial sector. In the future, most growth in gas demand is expected to come in power generation and in the residential and services sectors. The current gas infrastructure is sufficient to meet demand for several years. Considering that an increase in gas demand by a factor of four has been forecast for 2010, the government will be wise to diversify supply sources, to increase liquefied natural gas (LNG) regasification capacity and storage capacity and to build supply links among Greece, Italy and Turkey. The next step should be the liberalisation of the natural gas market, which is still dominated by one incumbent supplier. Under the EU Gas Directive, Greece has a derogation as an emerging market until 2006, but the government is considering opening the market sooner than that date.

The 1995 Climate Action Plan established a target for increasing the share of renewable energy (including large-scale hydro) in primary energy supply to 10% by 2000. The target was not achieved, and the actual renewables share was 5.2% in 2000. A new indicative target has been set to generate 20.1% of electricity by renewables in 2010. The government recognises that the licensing procedures for renewables are still too complex, and it now plans to establish a "one-stop shop" for permits and licences. There is also an effort to identify the potential of new energy sources. The Centre for Renewable Energy Sources investigates their technical and economic aspects. Because of Greece's windy and sunny climate, this potential is significant. Today, renewables are mainly promoted through financial incentives, such as tax breaks, direct subsidies and an attractive feed-in tariff system. The government should explore possibilities of introducing a green certificate system to reduce the cost of promoting renewables.

Electricity supply is forecast to be tight over the coming three or four years, even if all currently planned power plants are in operation. A supply shortage may occur in dry years. Since transmission capacity is limited, imports can play only a marginal role here. It is, therefore, imperative to reform the electricity market promptly so that timely investments can be made by new entrants. Electricity supply is also becoming tight because the summer demand peak is becoming greater and the capacity-utilisation factor of generation is falling. These problems could be abated by tariff adjustments to discourage electricity use in peak times.

Approximately 34% of the Greek electricity market was opened to competition in February 2001. The regulator (RAE) and the Hellenic Transmission System Operator S.A. (HTSO) have been established, and market operators are now required by law to unbundle their accounts. Electricity market regulation thus meets the minimum requirements of the EU Electricity Directive. But much remains to be done to ensure effective competition in the Greek electricity market, which is one of the most concentrated in the European Union. For instance, the state-owned Public Power Corporation (PPC) holds the predominant share of the transmission system operator. When HTSO experienced difficulties in proposing third-party access tariffs, it was because the network owner, PPC, did not provide sufficient cost information. A new set of transmission network tariffs has now been approved by RAE, but it still needs final approval from the Ministry of Development. In the future, the government should ensure that tariffs are adjusted without delay when the network is reinforced.

In the near term, electricity trade with neighbouring countries can have only a very limited direct impact on competition in Greece owing to its limited interconnector capacity and to the higher prices in Italy. Not many new entrants are expected in the near future. Greece's aim to establish a south-east European electricity pool could, however, contribute to increased competition in the long term. The gas-fired power plants that are planned by new entrants will not be commissioned before 2005-2006, and there is a risk that these projects may be delayed. Finding financing for the projects can be difficult in the current climate of high gas prices and low electricity prices. As long as PPC maintains a predominant share in all market segments, the mere separation of its accounts may not be enough to provide a level playing field for new entrants. Additional measures should be taken if sufficient competition does not occur within two to three years.

Electricity prices are distorted. Tariffs in the past were too low to cover the cost of supply, so the government has now announced that it will base tariffs on long-run marginal cost. This may strengthen competition in the market. At the same time, cross-subsidisation should be eliminated for various consumer groups. Electricity prices are uniform throughout the country, including in geographical areas where supply cost is well above the average. Geographical tariff differentiation could promote energy efficiency and provide an incentive to invest in renewables. Aluminium and nickel companies have enjoyed electricity priced well below cost, but such subsidies are to be phased out in 2006 and 2003, respectively. Revenues collected from households have also been slightly lower than the cost of supply, but residential tariffs were increased recently. Agricultural customers are still paying too little compared to cost. Commercial and small industrial consumers pay prices well above the cost of supply. Specific social policy instruments, not energy prices, should be used to pursue social objectives.

The focus of government research and development programmes on renewables is sensible. More attention may need to be paid to lignite, which continues to play an important role in energy supply. Although Greece participates actively in the European Union's research programmes, there is still room for increasing its participation in IEA Implementing Agreements.

RECOMMENDATIONS

The Government of Greece should:

General Energy Policy

- ☐ Continue to diversify energy supply and energy sources, for example by increasing electricity, gas and oil links with other countries.

- ☐ Enhance efforts to ensure real competition in energy markets; continue the privatisation of energy enterprises, avoid further cross-shareholding in energy companies, and ensure that state involvement in them does not form a barrier for new entrants.

- ☐ Ensure that the Energy Administration has the resources to carry out its duties; clearly separate the functions of the Energy Administration and the Regulatory Authority for Energy so that regulatory decisions are left to the regulator and policy decisions to the Ministry of Development.

- ☐ Pursue social objectives by other means than energy taxation and pricing.

- ☐ Ensure that the objectives of the Operational Programme for Competitiveness are met; the programme should be assessed with measurable criteria.

- ☐ Continue to make and review supply-demand projections in light of the sharp expected growth in energy demand; improve data collection and processing to provide reliable and timely statistical information to all interested parties.

Energy and the Environment

- ☐ Complete and implement promptly the "National Programme for Reducing Greenhouse Gas Emissions" and monitor its policies and measures.

- Reduce greenhouse gas emissions by putting more focus on demand-side measures.
- Ensure that the environmental costs of energy are fully reflected in energy prices.
- Carry through with the use of economic instruments, including emissions trading, to reduce greenhouse gas emissions.
- Continue efforts to reduce the environmental impact of lignite mining and use.

Energy Efficiency

- Formulate a comprehensive and clearly structured policy framework for improving energy efficiency with measurable objectives and targets that can be monitored and verified.
- Choose measures based on their cost-effectiveness; give priority to market-oriented instruments. Ensure that government support programmes do not discourage market-oriented approaches.
- Give consumers detailed information on their energy use to help them save energy, for instance in connection with energy billing.
- Ensure good co-operation with and among all the ministries involved in energy efficiency.
- Establish an effective monitoring system to achieve energy efficiency targets; ensure that all programmes are evaluated objectively, preferably by a third party.

Oil

- Continue to diversify the sources of oil imports.
- Revise oil stock management practices in light of the expected sharp growth in consumption and of the need to stimulate competition; stock management should be revised so that access to stocks is adequate and does not limit import and competition.
- Eliminate the remaining price ceiling mechanism and instead develop monitoring of the market.
- Develop more effective policies to avoid tax fraud in the oil product market.

- ☐ Take immediate action with industry to fulfil the IEA emergency reserve obligation.

- ☐ Submit IEA Monthly Oil Statistics on time.

Natural Gas

- ☐ Encourage the development of gas infrastructures, including strengthening interconnections and expanding LNG terminal capacity and storage.

- ☐ Advance its commitment to liberalise the gas markets and encourage private investment; introduce a transparent, cost-effective and non-discriminatory transmission tariff and ensure third-party access.

- ☐ Allow the construction of private connection pipelines.

- ☐ Remove the “most favoured customer” contract between the Public Power Corporation (PPC) and the Public Gas Corporation (DEPA).

Renewable Energy

- ☐ Shift policies for renewables towards a market-oriented approach, including the introduction of portfolio standards and green certificates.

- ☐ Exploit the cost-effective potential of renewables, paying particular attention to this in the islands.

- ☐ Speed up the creation of a “one-stop shop” for licences for renewables.

- ☐ Ensure that adequate infrastructure is developed in order to exploit fully the potential of renewables in geographically isolated areas.

Electricity and Lignite

- ☐ Address the problem of capacity margin.

- ☐ Ensure that, when necessary, third-party access tariffs will be adjusted without delay.

- ☐ Ensure that electricity prices reflect costs; social pricing and cross-subsidisation should be phased out.

- Consider carefully the negative effects of geographically uniform tariffs.

- Ensure that the incumbent does not have access to confidential commercial information about new entrants.

- Allow the construction of private transmission lines for self-consumption.

- Continue efforts to develop the south-east European electricity market.

- Prepare to separate distribution and retailing from the other businesses of PPC; as a first step, examine the feasibility of transferring ownership of the transmission network from PPC to HTSO; if competition does not emerge, the government should not preclude splitting PPC's generation assets into several companies with different ownership.

- Ensure that captive consumers benefit from the efficiency gains achieved from market liberalisation. Study the benefits of extending market liberalisation to smaller consumers.

- With regard to security of supply, the environment and competition, clarify the government position on the future role of coal and lignite in electricity generation.

- Improve access to lignite for electricity generators by, for example, ensuring transparency in lignite production costs.

Research and Development

- Continue R&D in order to reduce the cost and improve the efficiency of renewables; ensure adequate support for the development and demonstration of clean coal technologies.

- Seek opportunities to join international collaboration projects within the European Union and other international organisations, such as the IEA.

- Continue to encourage the participation of industry in R&D.

KOREA

The objectives of the Republic of Korea's energy policy are coherent with IEA Shared Goals. They are to:

- Maintain a stable energy supply.
- Increase market efficiency through competition.
- Establish environment-friendly energy systems.

Since the IEA's last in-depth review in 1994, Korea's energy policies have changed significantly. The government has promoted greater use of natural gas, encouraged the development of nuclear capacity and initiated steps to launch renewable energy markets. Emergency oil reserves have now expanded. To increase the efficiency of the energy market, the government has begun to withdraw gradually from direct management of the energy sector through capital ownership, licences and control, leaving the market free to allocate resources for investment. The petroleum sector has been deregulated, the electricity sector has been restructured, reform of the gas sector has begun, and a new regulatory framework is emerging for electricity and gas. To develop a cleaner system, energy policies have promoted conservation and a more efficient use of energy. They have promoted renewable energy by requiring mandatory equipment procurement rules and funds for R&D; and they have pursued public financing of R&D to develop new energy technologies.

The review commends the government's efforts to diversify the supply of energy. It also commends the government's efforts to introduce competition into the electricity sector, and to withdraw gradually from direct operations in the petroleum, electricity, gas and coal sectors. Several issues must, however, still be resolved before competition becomes effective.

Korean energy policy has long focused on increasing the supply of energy to satisfy rapidly growing demand stemming from the strong economic growth of the last thirty years. This growth was spawned by the expansion of energy-intensive industries in the 1980s and 1990s. However, investments in energy-intensive industries are expected to fall sharply in the coming years, causing energy intensity to fall from its current levels, more quickly probably than the OECD average, particularly as energy prices increasingly reflect full costs. The review acknowledges Korea's efforts to give energy service companies incentives to implement energy conservation measures, and to promote public-private partnerships to develop labelling and to facilitate improvements in energy-efficient technology. Demand-side management should be a priority.

Since the last review, Korea's carbon dioxide emissions have grown more quickly than the IEA average. At the same time, the implementation of more stringent emission standards has kept the growth of local emissions from the energy sector (such as SO_x) relatively controlled. Korea retains its status as a "developing country" in international climate change negotiations on the basis of its low per capita income (half the OECD average). In the future, however, its role should reflect its high per capita energy consumption. Korea will need to reflect environmental costs in the price of energy or of energy-consuming equipment (such as private cars) in order to mitigate CO_2 emissions.

The review commends the Korean government for its achievements in restructuring Korea Electric Power Corporation (KEPCO), and for setting up an electricity exchange and a regulatory energy committee. It draws attention to the risks and advantages of having a single publicly-owned company holding nuclear plants and giving it a mandate to construct new baseload plants. This could distort competition. We emphasise the importance of continuing to monitor carefully the development of competition to ensure the security of supply of energy is maintained in a liberalised market. The review recommends that the government clarify and respect the implementation calendar for the remaining stages of the reform plan. In addition to greater independence for the regulator, this will require introducing more competition through a bid-based electricity market, competitive pricing of transmission and a competitive price for electricity.

The performance and safety records of Korea's nuclear power plants have been satisfactory. However, as in other countries, public concern about safety and waste disposal is growing in Korea. Greater efforts must be made to communicate with the public and to push forward plans for waste disposal.

Oil plays an essential and increasingly important role in the Korean energy sector: it represents more than half the energy supply. In 1998, the government deregulated the petroleum industry, surrendering its control over production. Today, a few large private companies constitute the refining sector and dominate the petroleum product market. There is some concern that they can artificially set prices and make it difficult for new players to enter the market. The review calls for competition in the oil sector to be more carefully monitored.

Korea has become an important player in the world gas market. The use of natural gas has grown sharply since the last in-depth review. Industry and households use natural gas increasingly for electricity production and for heating. All gas is imported in the form of liquefied natural gas (LNG), and Korea has become the second-largest world importer of LNG. KOGAS, the public monopoly, is the world's largest LNG importing company. Gas industry reform was launched after the reform of the electricity sector had begun. KOGAS is to be restructured completely, by splitting it into three trading companies that will later be privatised, by privatising its subsidiaries, by instituting open access to terminals and transmission networks, and by making the retail sector competitive. The review commends the efforts made to introduce competition and to increase the efficiency of the entire gas industry. However, it strikes a note of caution concerning the implications for energy security of restructuring KOGAS, especially as an importer, and draws attention to the risks if reform plans are not clarified rapidly. Like the electricity sector, the gas sector will require an independent regulator as soon as possible.

The review recognises the importance of coal for the Korean energy sector, but points out that domestic production cannot compete with imported coal. The government needs to review its policy of supporting domestic coal consumption. Any remaining subsidies will need reform. Since the use of coal for electricity production is expected to grow in the future, there is good reason to promote the use of clean coal combustion technologies.

RECOMMENDATIONS

The Government of Korea should:

General Energy Policy

- ☐ Continue to diversify energy and to improve energy efficiency.
- ☐ Establish an independent regulator for both the electricity and gas sectors; clarify the relationships between the energy regulator and the Fair Trade Commission.
- ☐ Eliminate ceilings and restrictions on foreign investment.
- ☐ Eliminate price distortions by removing price ceilings and cross-subsidisation and, where necessary, by adjusting taxation to reflect environmental costs.

Energy Efficiency

- ☐ Make energy efficiency a high priority; strengthen energy efficiency policy through additional measures.
- ☐ Facilitate the process of energy pricing so that fuel prices reflect costs.
- ☐ Ensure Korea's standards and energy efficiency norms comply with best international practice.
- ☐ Develop further energy efficiency policies as part of the effort to reduce greenhouse gas emissions.

Environment

- ☐ Seek to strike a better balance among economic, energy, and environmental objectives; implement the recommendations on transportation made in the 1994 IEA review: full cost pricing, increasing the use of smaller vehicles, and developing public transportation systems.

- ☐ Accept more international environmental responsibilities, including under the United Nations Framework Convention on Climate Change (UNFCCC). Strengthen bilateral and multilateral co-operation to enhance global efforts on tackling climate change.

Renewables

- ☐ Assess the potential of renewable energy resources.

- ☐ Assess the cost-effectiveness of renewables and define accordingly objectives for technology development, industrial expansion and market deployment.

- ☐ Consider pricing externalities, such as air and soil pollution, and the risks associated with conventional power plants, as a factor in developing renewable electricity options.

- ☐ Consider increasing public participation in public-private partnerships for R&D technology projects.

- ☐ Consider implementing "green pricing" as a first step to creating a market for green electricity; as a second step, consider establishing a target for renewable power generation using market mechanisms such as renewable portfolio standards and tradable certificates.

Electricity

- ☐ Set and adhere to a firm timetable for liberalising the market, establishing an independent regulator, and privatising the generating companies.

- ☐ In reforming the sector, take the following steps to enhance the security of electricity supply:
  - Proceed with the plan to introduce a competitive, bid-based electricity market, including demand-side bidding with regulatory oversight.
  - Ensure appropriate financial mechanisms for the electricity market so that suppliers are sure to meet their contractual obligations.
  - Consider developing financial instruments, such as electricity futures contracts, to enable potential investors to hedge against market risks.
  - Monitor the development of competition carefully and, if necessary, consider further measures to encourage market participants to invest in generation.

- ☐ Include regulatory incentives to distribution companies, including least-cost procurement of energy, to make them more efficient.

- ☐ Eliminate price distortions favouring industrial customers; eliminating regulated energy tariffs to liberalised industrial customers can facilitate this.

- ☐ Consider pricing transmission services by location.

- ☐ Ensure that electricity tariffs fully reflect time-of-use costs for generation.

Nuclear Energy

- ☐ At least maintain past standards of performance and safety of nuclear plants in the future; regularly assess the rationale for the target size of the nuclear energy component in the overall energy mix.

- ☐ Establish construction plans for Korea's future nuclear power plants early in the newly competitive electricity market, well in advance of the lead-times for building other types of plants.

- ☐ Pursue efforts to gain public acceptance of the future deployment of nuclear energy; increase active participation in OECD/NEA studies and workshops in this area.

- ☐ Make greater use of the international market for goods and materials for operating nuclear plants.

- ☐ Allocate more resources to research and development on nuclear waste management.

- ☐ Continue with plans to establish a disposal site for low- and medium-activity nuclear waste and formulate plans for disposing of irradiated nuclear fuel.

Oil

- ☐ Continue efforts to develop domestic and overseas investment in upstream activity; ensure that exploration projects are economically viable.

- ☐ Continue efforts to diversify oil supply sources; maintain good relations with oil-producing countries.

- ☐ Ensure effective competition in the domestic oil market; strengthen market monitoring to prevent unfair pricing by large companies.

- ☐ Continue efforts to ensure the immediate implementation of the Third Stockpiling Plan in order to enlarge the emergency oil stockpile.

Gas

- ☐ Consider the merit of a policy to co-ordinate LNG purchases made by private gas buyers under the KOGAS brand name as a contribution to effective gas purchasing and supply security.

- ☐ Set and adhere to a firm timetable to reform the gas industry and to establish a new gas regulatory institution.

- ☐ As a solution to privatise KOGAS, consider selling KOGAS stocks progressively to private investors, but in the knowledge that four separate companies will be created. The government could retain a golden share to preserve Korean interests.

- ☐ Ensure that gas prices reflect costs.

- ☐ Closely monitor costs in the monopoly areas of the gas industry after the privatisation of KOGAS.

- ☐ Ensure the regulator's independence after the privatisation of KOGAS; ensure that the regulator is given sufficient power to regulate the market.

- ☐ Address the issue of assigning LNG sales contracts with KOGAS to several buyers, in order to satisfy the needs of both LNG sellers and financiers, without unduly prejudicing the interests of existing KOGAS shareholders.

Coal

- ☐ Negotiate with mine operators and employees to set a firm target for ending all forms of government support for domestic coal production.

- ☐ Replace the ceiling on prices for domestic coal production with direct income support, where justified on social grounds.

- ☐ Ensure that coal consumers have no obligation to buy domestically-produced coal.

- ☐ Remove the import tariff and value-added tax (VAT) on imported coal or redesign them as measures to offset the environmental impacts of coal use.

- ☐ Assess the feasibility of clean coal technologies.

Energy Technology Research and Development Activities

- ☐ Develop effective monitoring and evaluation mechanisms to measure the effectiveness of R&D programmes; ensure that the monitoring mechanism is transparent and that public expenditures on energy R&D are more visible.

- ☐ Encourage private-sector commitment to R&D and actively develop new public-private research partnerships.

- ☐ Strengthen international R&D co-operation by playing a more active role in IEA Implementing Agreements.

NORWAY

Norway plays a central role in the IEA because it is a major producer and exporter of energy. Norway's successful integration into the European electricity and gas markets, and its continuing role in world energy supply, should be overriding considerations when decisions are made on Norwegian energy policy. It is important that Norwegian energy policy be coherent, and understood by consuming countries, particularly in Europe. Within Norway, transparent and independent regulation could play an important role in ensuring continued successful development of the energy sector.

Government involvement in the energy sector continues to be prominent in Norway. There are indications that government ownership and broad policy announcements, notably on environmental issues such as the future of hydro, may have affected, for example, the choice of technology for electricity generation. There is a need for clarification of government environmental objectives for the energy sector, and for greater separation of the roles of government as regulator and substantial owner of the sector. Closer attention should be given to defining the framework of environmental objectives and standards, as a means of ensuring consistent and predictable decisions.

ENERGY-ENVIRONMENT POLICY

Energy-related greenhouse gas emissions are projected to increase significantly in Norway. The Kyoto flexible mechanisms are important for Norway because of the limited opportunities for achieving domestic reductions in greenhouse gas emissions. Emissions trading and carbon dioxide taxation raise issues of competitiveness and trade impacts.

The development of an emissions quota system may suggest a major change of approach in Norwegian energy-environment policy. A firm decision needs to be made soon on the future of the carbon dioxide tax regime, and on its relationship to the quota system, to avoid uncertainty about the impact of government environmental policy on investments in the energy sector. If the quota system is to be implemented, an early decision should also be made on the allocation of the quotas based on an analysis of the costs and benefits of the range of options already identified.

Attention also needs to be given to the impact of other aspects of environmental policy on energy supply. Decisions restricting the choice of electricity generation technologies – notably large-scale hydro and gas-fired power – should take into account their possible impact on investment in new electricity capacity. Environmental standards should be stated clearly, and should take into account the cost of their achievement, to contribute to a stable and predictable investment climate in which companies can take decisions on the basis of relative economics, including the environmental costs.

ENERGY EFFICIENCY AND RENEWABLE ENERGY

Growth in energy consumption has been limited by a number of policies, principally taxation. Consumption of energy in the industry, residential/ commercial, and transport sectors has grown in Norway in recent years, driven by economic growth. Government policies should continue to promote changes in consumption habits.

The Norwegian government recognises that greater effort is necessary and has taken an important step by establishing a new energy efficiency agency for promoting energy efficiency and new renewables. This report recommends how the new agency might undertake its task.

Promotion policies for renewables should be fully compatible with the operation of the liberalised electricity market, and be developed in consultation with the electricity companies. Decisions on the level of support for the development of "new" renewables should take into account that large-scale hydro is also a renewable energy source and would generally be the most economic option for renewable electricity generation.

ELECTRICITY

Norwegian energy use per capita is similar to countries with similar climate and temperatures. The composition of energy consumption in Norway differs from other countries because of its large hydropower production. Norway has the highest electricity consumption per capita in the world, reflecting its large hydropower resource endowment, substantial energy-intensive industries, and its cold climate. Competition has developed in the electricity market, although public involvement is still strong.

Generation

Expansion of NordPool should provide more flexibility in responding to growing electricity demand. Nevertheless, there appears to be a consensus that Norway will need to consider substantial additions to its generating capacity over the next few years. International connections could also play an important role, but there is some concern about investment in international cables because of uncertainty about long-term contractual commitments to support their commercial viability.

The government has announced general limits to new large-scale hydro, and the future of gas-fired power continues to be uncertain. Wind generation is a supply option, but there are environmental considerations associated with its development. As a result of these considerations, few medium-term supply options exist. Electricity prices are low at present, but most market participants expect prices to rise as the gap between supply and demand narrows. If the supply side is excessively constrained, the result could be increasing price instability, price spikes, or even failure of supply in a dry year.

Transmission and Distribution

Investment in transmission has been declining over the past decade as efficiency gains have improved the capability of the system to meet growing demand. Limits to efficiency gains are likely to be reached within the next few years and major investments in expanding the capability of the system may be required. This will test the adequacy of incentives for investment in transmission. Related to this issue is the question of security and reliability of the transmission grid. System reliability is becoming more important as the transmission system approaches its capacity. Mandatory reliability standards do not currently exist. Penalties for supply failures may be used to provide incentives to the grid owners and operators to maintain reliability.

Forecasting the outlook for electricity supply could play an important role in guiding the development of government policies and by informing the market. The government no longer prepares forecasts of electricity because it no longer has a direct role in investment. However, forecasts could usefully inform the market of the need for investment in new electricity generation and transmission capacity. The government need not prepare forecasts. The transmission system operator, for example, could be encouraged to take on this task.

The revenue cap provides an incentive to merge smaller distribution systems. Current hydro generation concessions may discourage private and foreign participation in the generation and distribution of electricity. Publicly-owned Norwegian companies may have an advantage in acquiring municipal systems and further limit competition from private companies.

Alternatives to new transmission lines may be found by, for example, developing distributed power and gas. Mechanisms need to be put in place to ensure that decisions on the grid take into account a range of alternative economically-efficient options.

OIL AND GAS

Partial privatisation of Statoil and the restructuring of the State Direct Financial Interest (SDFI) are both positive developments that are likely to lead to further change. Experience with the changes currently proposed will be an important guide to the benefits of reducing government participation in the sector.

Norway's oil and gas supply industry is important internationally. Norway now has the opportunity to develop an oil and gas services industry that could help maintain economic activity as oil and gas reserves deplete. Norwegian policy must ensure an adequate level of investment in the petroleum sector, the optimisation of recovery, and the maintenance of an adequate level of research and development and of expertise. Wider participation by international players would help achieve these objectives. The fiscal regime has an important influence on the outlook for investment. Tax policy should be reviewed in a long-term perspective with this objective in mind.

Norway has on two occasions since 1998 reduced the level of oil production by government regulation with a view to stabilising oil prices at a higher level. The review team believes that Norway has an important role to play during periods of price volatility. Restricting oil production to influence oil prices is of concern to consuming countries. The review team believes that there are alternatives to production controls as a means of offsetting price volatility such as consumer-producer dialogue, where Norway has played a lead role for the benefit of all IEA Member countries. The Norwegian government considers that dialogue alone would have been an insufficient response when oil prices were at US$ 10 per barrel. Nevertheless, the review team considers production regulation to influence the market to be detrimental and suggests that every effort should be made to avoid its repetition.

The review team considers that obligations imposed by the EU gas directive have been an important influence on recent changes in Norway's policy on gas marketing. Norway should consider taking a proactive approach to its policy on gas marketing, in view of the maturity of its industry and the importance of promoting the integration of its industry into European energy supply. Abolition of the Gas Negotiations Committee (GFU) is an important step. In implementing a new policy approach, Norway should accept private marketing of gas as a leading principle. Depletion policies that are consistent with this principle should be developed in consultation with industry. Concerns over the future of long-term commitments, benefiting some consumers as well as producers, also need to be addressed.

Domestic use of gas for electricity generation and direct end use could be important in the future. The government could anticipate this development by preparing a policy framework, including regulation, for the sector.

COAL

Norway has subsidised the production of a very small quantity of coal to maintain a community in the dependency of Svalbard. A new, larger mine is to be developed. The government has paid a part of the capital cost of developing the mine, but the mine may make a surplus over operating costs.

RESEARCH AND DEVELOPMENT

Energy research and development funded through the Research Council is at present managed in three divisions: Energy and Industry, Science and Technology, and Environment and Development. Many of the programmes are directed at industry objectives, and in some cases are arguably more appropriate for full industry support. Clarification and better definition of energy research programmes are necessary to ensure that energy policy objectives are being achieved. Care is also necessary to ensure that *ad hoc* industry proposals are evaluated consistently to ensure balance and coherence in the energy research programme.

RECOMMENDATIONS

The Government of Norway should:

Environment

- Review the impact of environmental policies on the development of energy projects.

- Evaluate the efficiency and effectiveness of existing policies and measures, in particular the carbon dioxide tax.

- Base future policies and measures on market-based instruments, developed in consultation with industry and other energy market players, including neighbouring countries.
  - If an emissions quota system is adopted, make early decisions on the relationship of the quota system to the existing carbon dioxide tax, and on the mechanism for allocating quotas.

- In developing new policies and measures, give particular attention to the petroleum and transport sectors, which are both key emitters in Norway.
  - Ensure that policies and measures take into account the importance in Norway of greenhouse emissions other than carbon dioxide.

Energy Efficiency

- In establishing the new agency for promoting energy efficiency and new renewables:
  - Set clear objectives for the agency, along with clear time scales for achieving its objectives; require regular reports on the actions taken and progress towards the objectives; require the agency to develop a range of measures for improving energy efficiency, chosen according to their cost-effectiveness, with a particular focus on electricity consumption.

- Consider the continuation of existing programmes directed at improving energy efficiency in the industry and domestic sectors.

- ☐ Undertake public awareness programmes to complement energy taxation.

- ☐ Undertake an assessment of the effectiveness of the vehicle taxation regime to determine if it is contributing to improvement in the vehicle fleet as a whole; develop ways of improving overall fleet efficiency.

Electricity

Security of Supply

- ☐ Ensure that the market addresses security of supply by removing impediments to free operation of the market. In this context, consider using electricity forecasts to provide basic information on the outlook for electricity supply security in Norway as a guide for developing policy options, and to provide information for the market.

- ☐ Review the influence of the hydro concession on the level of private and foreign investment in hydro-based generation.

- ☐ Review the impact of small-scale and municipal ownership on efficiency and investment in the electricity sector.

- ☐ Allow the market to determine the choice of electricity generation technology within clear environmental regulations.

Regulation

- ☐ Review the electricity regulatory functions of the Water Resources and Energy Directorate with a view to improving the independence of the economic regulation function, including by giving consideration to:
  - Clarifying and simplifying the objectives of regulation, in consultation with electricity producers and consumers.
  - Establishing a separate division within the Water Resources and Energy Directorate (or a separate organisation) responsible solely for economic regulation of the electricity industry.
  - Establishing independent lines of reporting by the head of the economic regulation division to the minister.

- ☐ As part of its five-year review of its incentive regulations, the Water Resources and Energy Directorate should:
  - Seek market-based solutions to issues such as investment in transmission and system reliability.

- Accommodate alternatives to new transmission capacity including distributed generation, direct use of natural gas, and gas-fired generation and co-generation.

Market Development

- ☐ In consultation with Sweden, Finland and Denmark, consider the merits of promoting the development of a single Transmission System Operator in the Nordic market.

- ☐ Continue to work towards harmonisation of taxation and other factors influencing the operation of the Nordic electricity market.

Oil and Gas

- ☐ Maintain the momentum for privatising Statoil by early follow-up to the initial public offering.

- ☐ Review the level of exploration in the Norwegian continental shelf, and give close consideration to the influence of taxation on the level of exploration.

- ☐ In consultation with industry, develop a new policy approach to balancing the goals of optimising oil and gas depletion, and of ensuring competition in marketing.

- ☐ Proactively encourage the private marketing of gas as a means of assisting the closer integration of the Norwegian gas industry with the European market.

- ☐ Give priority to developing the proposed action plan for the domestic use of natural gas. Direct the Ministry of Petroleum and Energy to take responsibility for the promotion of gas in direct end uses and in electricity generation. Specific tasks might include, for example:
  - Working in consultation with the Department for the Environment to analyse and report on the environmental and economic implications of any proposed domestic gas developments.
  - Anticipating the development of a domestic gas industry in Norway by developing proposals for economic regulation of the domestic gas industry. Consider expanding the role of the electricity regulator to include responsibility for regulating the domestic gas industry.

Coal

- ☐ Ensure that the proposed new mine in Svalbard is genuinely economic. If economic viability cannot be achieved, seek alternative means to maintain the Norwegian community in Svalbard.

Research and Development

- ☐ Review the way in which priorities for energy research and development are established and individual projects selected. Consider:
  - Better definition of the energy programme within the Research Council.
  - Aligning energy research development priorities more closely with current government energy policy priorities.
  - Commissioning projects in key policy areas.
  - Ensuring close co-ordination of the activities of the Research Council and the activities of the new agency responsible for energy efficiency and promoting "new" renewables.

UNITED KINGDOM

Over the past four years, the United Kingdom has continued its process of liberalising its energy industries. Since 1998, all natural gas consumers have been free to choose their supplier, and since 1999, all electricity consumers have enjoyed the same right. Both markets have become highly competitive. Some 15 million domestic gas and electricity customers have switched suppliers since the markets were opened. Currently, about 67 000 gas customers and 100 000 electricity consumers switch suppliers every week. Residential customers have enjoyed reductions in their gas bills of 25% in real terms since 1990.

The British natural gas and electricity supply industries have gone through a phase of intense restructuring in these last years. The overwhelming majority of these acquisitions, mergers and de-mergers were the result of commercial considerations, as the industries are almost exclusively privately owned. The only exception to this is BNFL Magnox Generation, a state-owned company that retains the magnox nuclear power plants.

Today the UK has eight major gas suppliers, including Centrica, which developed from the trading arm of British Gas, the former public gas monopoly. England and Wales have 38 major power producers, as well as seven large and many smaller companies supplying electricity. The restructuring also has resulted in closer integration of the gas and electricity markets, as gas suppliers increasingly also sell electricity and other services such as water, telecommunication services and financial services. In recognition of this trend, the separate regulatory authorities for electricity and gas were merged in 2000 to form Ofgem.

The decisive breakthrough towards a fully competitive electricity generation market was achieved through the introduction of the New Electricity Trading Arrangements (NETA) in March 2001. NETA replaced the Electricity Pool, the mandatory electricity trading mechanism, that had been at the core of the power market in England and Wales for ten years following the first reforms in 1990/91. NETA is a very flexible, voluntary mechanism for electricity trading. It has led to a decline in electricity wholesale prices of 20-25%.

Liberalisation of the gas and electricity markets was highly successful and is now nearly complete. Industry restructuring continues, based on private-sector decisions; at the end of April 2002, Lattice, the UK's gas transportation company, and National Grid Company which runs the electricity transmission grid, announced their intention to merge.

A few areas need to be addressed nevertheless. The electricity markets in Scotland and Northern Ireland are not as competitive as the market in England and Wales. In Scotland, competition still only occurs in the form of third party access to the networks of two vertically integrated companies, ScottishPower and Scottish & Southern Energy. In Northern Ireland, the market has been opened only partially. But the situation is set to improve as NETA is to be extended to Scotland by April 2004.

In the gas market, capacity auctions at the St. Fergus (Scotland) beach entry point into the UK's onshore pipeline system run by the monopoly operator Transco have fetched very high bid prices in recent years. This has revealed bottlenecks at the St. Fergus terminal itself and further afield in the pipeline network. But so far the high prices have not directly resulted in Transco increasing its capacity. The government and Ofgem must review this situation and adjust the regulatory regime in order to give Transco and potential private investors stronger incentives for new pipeline construction and the removal of bottlenecks.

This is important because the operation and construction of offshore infrastructure might otherwise decline. That could dampen the prospects for importing natural gas from Norway. Ultimately, that could have a crucial, negative impact on the exploitation of the declining North Sea hydrocarbons reserves.

The North Sea part of the UK continental shelf is now a mature province, characterised by a large number of small discoveries and undeveloped finds close to existing pipeline infrastructure. The existing infrastructure has a limited remaining lifetime and increasing spare capacity as the large old fields have become depleted. If this infrastructure is not now used to develop and exploit the large number of small new fields, these fields may never be developed. The UK gas industry, meanwhile, estimates that the UK will become a net gas importer again as of 2005. To make optimal use of the remaining resources, the government should fine-tune the fiscal regime for upstream hydrocarbons. It should improve regulation and address the bottlenecks in Transco's system to ensure optimal conditions for the marketing of the remaining gas.

The UK has two targets relating to greenhouse gas emissions. It is subject to a binding international target under the 1997 Kyoto Protocol and the European Union's burden-sharing agreement. This requires a 12.5% reduction in greenhouse gas emissions (six gases) compared with 1990 levels by 2008-2012. In addition, the country has a national target of cutting its carbon dioxide emissions by 20% below 1990 levels by 2010. Largely as a consequence of energy market reform and the resulting "dash for gas" in power generation (the massive construction of gas-fired power plants replacing coal generation), the UK is in the fortunate position of probably being able to meet the Kyoto target. However, meeting the national target will require extra efforts.

To address the potential emissions gap, the government published a new Climate Change Programme in November 2000. This programme contains a large number of additional measures including a Climate Change Levy and a domestic Emissions Trading Scheme. The programme could cut greenhouse gas emissions by 23% below 1990 levels by 2010. Carbon dioxide emissions could be reduced by an estimated 19% in the same period, close to the national target.

The Climate Change Levy has a number of questionable design features. The most important such features are that it is based on the energy content of fuels, and that it applies to the business and public sectors, but not to the residential sector. However, the government has a strong commitment to reducing the problem of fuel poverty that affects low-income households in old, poorly insulated buildings. This commitment provides a justification for exempting the residential sector from the tax, in particular since there are energy efficiency programmes in place for the fuel-poor. In addition, the government is implementing a Renewables Obligation that will raise the contribution of renewable sources of energy to England and Wales' electricity supply to 10% by 2010. It expects a voluntary green certificates market to emerge on the basis of this obligation.

To a large degree these measures address the same issues, but their combined application could lead to excessive internalisation of external cost in some areas and insufficient internalisation in others. This could increase the cost of compliance with the government's greenhouse gas objectives. The government should look again at whether the levy is really achieving the government's original objectives and, in particular, should consider including residential consumers into its scope. In future, it should focus on fewer but more forceful greenhouse gas emissions abatement schemes.

As of June 2001 the prime minister's Performance and Innovation Unit (PIU) carried out a review of the strategic energy policy issues affecting the UK in the future. Both the PIU review and a recent report by the House of Lords note that electricity output from nuclear power is expected to decline in the coming years if no measures are taken. The report of the House of Lords recommends that the UK maintain its present ability to produce no less than 20% of domestic electricity demand from nuclear.

RECOMMENDATIONS

The Government of the United Kingdom should:

Energy Market and Energy Policy

- ☐ In an ever-changing world, reaffirm its general energy policy objectives, i.e. to ensure secure, diverse, sustainable supplies of energy at competitive prices for the future.

- ☐ Stabilise to a greater degree the structure of governmental organisations and the definition of the remit of government and the market.

- ☐ Under this stable equilibrium, align the various energy policy institutions with the government's energy policy, eliminate overlap and strengthen co-ordination.

- ☐ Avoid, where possible, using energy policy measures to pursue social and other policy objectives. If this is unavoidable, clearly delineate the trade-offs and costs of such measures.

Environment, Energy Efficiency and Renewables

- ☐ For the industrial and power generation sectors, consider again using either emissions trading or carbon taxation. Consider introducing carbon taxation for households.

- ☐ Consider again modifying the Climate Change Levy to reflect the carbon content of fuels.

- ☐ Consider again eliminating restrictive definitions limiting the eligibility of industries for voluntary climate change agreements, as well as incentives and possibilities for free-riding.

- ☐ Pursue its involvement in the residential/commercial sector to promote energy efficiency while avoiding duplication. Reinforce the energy efficiency measures targeted at the commercial sector, in particular offices.

- ☐ Consider again extending voluntary agreements to cover all larger industries, and consider including small and medium-sized industries.

- ☐ Review carefully the practical potential of energy efficiency policies to curb energy consumption. Clarify the costs of specific policy measures.

- ☐ Continue the systematic monitoring and evaluation of energy efficiency programmes and use the results to enhance the quality of new and existing measures and programmes.

- ☐ Enhance the efforts to curb the energy consumption and CO_2 emissions from the transport sector. To achieve this, the government should implement its 10-year Transport Plan swiftly and according to schedule, with an emphasis on reducing greenhouse gas emissions and improving energy efficiency.

- ☐ Implement the reforms relating to renewables effectively and efficiently as anticipated, and closely monitor the results.

- ☐ Review regularly the complex system of support mechanisms for renewables and streamline it into a simpler system as soon as an opportunity to do so appears.

- ☐ Pursue the current attempts to bundle intermittent generators into more predictable units. In doing so, the government and the regulator should take utmost care that whatever bundling is chosen does not result in cross-subsidies.

Fossil Fuels

Upstream Hydrocarbons

- ☐ In view of the ageing infrastructure and the limited window of opportunity, revise the upstream taxation system to ensure an optimal exploitation of the North Sea resources.
- ☐ Standardise offshore regulation and make it more transparent.
- ☐ Encourage exploration in new promising frontier areas to maintain the UK's position as a net exporter of hydrocarbons as long as possible.
- ☐ For the gas from the UK North Sea to be developed, organise the interface with the regulated downstream sector in such a way as to avoid non-economic constraints on the marketing of the gas.

Natural Gas

- ☐ Implement soon an incentive scheme for Transco to invest in upgrading its infrastructure and eliminating bottlenecks in a timely manner. This may call for the regulator to define which individual pipeline projects are needed to "de-bottleneck" the infrastructure.
- ☐ Consider placing the security of supply obligation on the gas suppliers, not on Transco.
- ☐ Continue to leave as many parts of the gas industry as possible open to competition. Continue to concentrate the regulation of prices and conditions on the monopoly part of the industry.

Electricity

- ☐ Continue to allow the electricity market to settle into the smooth and fully competitive operation of NETA by refraining from intervention.
- ☐ Encourage full participation of the demand side in the balancing market (load shedding).
- ☐ Seek consistency in the regulation of the gas and electricity networks.
- ☐ Provide incentives for the transmission owner to build over the long term the infrastructure needed to secure supply.

Nuclear

- ☐ Take a more proactive attitude in the design and implementation of a comprehensive national policy for the decommissioning of nuclear power plants and fuel cycle facilities, and for the disposal of radioactive waste.

- ☐ In order to ensure the safe operation of existing nuclear facilities, continue to monitor the availability of adequate infrastructure, equipment and manpower.

- ☐ Clarify how it intends to keep the nuclear option open.

Energy R&D

- ☐ Clarify the priority among technology areas and revise the R&D programmes accordingly.

- ☐ Clarify the roles of the government and industry in specific technology areas to facilitate the deployment of technologies.

UNITED STATES

The National Energy Policy places increased emphasis on domestic energy production and economic growth. It will influence the formation of energy and energy-environment policy worldwide. US policy debate needs to be widened to include a realistic strategy for addressing the US contribution to global environmental problems.

US energy policy is in transition. Priorities have been redirected by the National Energy Policy to increasing energy production and to supporting economic growth. They will undergo change in response to reactions to the policy and as the Administration seeks to translate general policy guidance into concrete proposals. Many of the proposals will take time to develop and will require congressional approval. What emerges in legislation is likely to be a consensus reflecting stakeholder views that could become the foundation of a longer-term policy. The US government should persevere in the process that the National Energy Policy has started and continue its efforts to ensure that a new and coherent policy emerges.

The new policy approach is likely to influence the formation of energy and energy-environment policy worldwide. The focus on energy security is timely, as is the attention directed to regulatory policies, including environmental regulation, and their impact on economic development. The report comprehensively covers all areas of energy policy, but its greatest impact is likely to be on supply-side measures, particularly measures to encourage domestic energy production. The role of energy demand-side measures is fully acknowledged, but the recommendations that flow from the discussion of these may have less impact than the measures aimed at increasing energy production, notably of fossil fuels. The most important areas on the demand side requiring aggressive action are energy use in transport and energy efficiency in buildings.

Throughout this report, recurring questions arise concerning:

- The weighting that should be given to international energy trade, rather than domestic production, as a means of ensuring energy security.

- The use of such economic instruments as energy pricing, taxation and emissions trading to value the environmental externalities of different fuels and to find market solutions to many policy issues.

- The realism of expecting cost-effective and timely deployment of new technology to protect the environment, and to improve end-use efficiency, in the absence of strong price signals in the energy market.

In some areas, the US policy debate is too narrowly based on current economic benefits and costs. Insufficient weight is given to external environmental costs. Adjusting energy prices to reflect environmental costs is a key means of achieving cost-effective changes in energy end-use and of encouraging the development of new and cleaner energy sources, including renewables. A transition to sustainable development will be made more difficult if environmental costs are not valued by the market.

In almost every policy area, federal-state relations will influence the outcome. Development of the regional energy market, notably between the US, Canada and Mexico, will also be important[2].

ENERGY AND THE ENVIRONMENT

The US has withdrawn from the Kyoto Protocol, but the National Energy Policy does not set any target or timetable for achieving reductions in emissions or incentives adequate to deliver them.

The US is the world's largest emitter of greenhouse gases; it is the highest emitter of energy-related carbon dioxide per capita among the OECD countries. By 2020, carbon dioxide emissions from fossil fuel use in the US are projected to be 54% higher than in 1990, despite a reduction in the share of coal in total power generation. The relatively high growth in US carbon dioxide emissions, when compared with other OECD countries, is due to a high growth in demand for services delivered by energy and a more carbon-intensive electricity mix, offset in part by reductions in energy intensity.

The US has withdrawn from the Kyoto Protocol, but is committed to the United Nations Framework Convention on Climate Change that aims to stabilise greenhouse gas concentrations in the longer term. Difficult economic and sectoral issues will be at stake in any US programme on greenhouse gas emissions. These include the wish of the public to keep energy prices low, to exercise free choice in the composition of the automobile fleet, and the pivotal role of coal in securing energy supply. The US government should nevertheless carry forward the debate on greenhouse gas emissions to define its aims and to develop a strategy for achieving them.

The US has played a leading role in developing many advanced energy technologies, often through federal research and development programmes. Its strategic approach to the control of greenhouse gas emissions should include market-based incentives for the take-up of advanced energy technologies and energy efficiency measures. But complementary policies, including the broader use of economic instruments, will almost certainly be required to achieve worthwhile reductions in

2. The US, Canada and Mexico are parties to the North American Free Trade Agreement (NAFTA). NAFTA is a comprehensive agreement that came into effect on 1 January 1994, creating the world's largest free trade area. Article 102 of the agreement details the objectives of NAFTA. Among its main objectives is the liberalisation of trade between Canada, Mexico and the US, to stimulate economic growth and give the NAFTA countries equal access to each other's markets.

greenhouse gas emissions. Because the government is postponing its decision on carbon dioxide, energy-using companies face the risk of having to prematurely retire productive capital stock put in place to comply with the three-pollutants bill when action is taken to reduce carbon dioxide levels. It would be in the interests of both the US and the IEA as a whole to ensure policies are developed in a manner consistent with future participation in an international trading system for greenhouse gases.

US policy is geared towards long-term technological development and international efforts to encourage climate-friendly technology and practices. There is a risk that as international efforts develop in other parts of the world, the US technology industry may not be able to make its full contribution.

ENERGY EFFICIENCY

Energy efficiency is considered by the National Energy Policy to be an important complement to expanding energy supply, but insufficient to match rising demand.

The National Energy Policy acknowledges the role of energy efficiency. But it considers that efficiency improvement will not suffice to cope with the scale of projected growth in US energy demand. It judges that the population will not tolerate reductions in energy supplies and services nor higher energy prices. This viewpoint limits the scope for proactive promotion of energy efficiency policies and programmes. Important measures are announced in the National Energy Policy, but it is unclear how vigorously they will be pursued. It is equally unclear how inevitable conflicts between improving efficiency for environmental goals on the one hand and meeting consumer demands for low-price energy services on the other, will be resolved.

US policy on energy efficiency lacks sufficient incentives to deliver its full potential. The policy envisages the combined efforts of industry, consumers and governments at all levels, but does not identify the mechanisms by which this would be achieved.

There are important recommendations in the National Energy Policy on energy conservation that could curb the negative environmental effects of energy consumption, and produce benefits for the economy and the security of energy supply. They include more stringent and expanded energy efficiency standards, the promotion of combined heat and power, the extension of the Energy Star labelling scheme and the revision of Corporate Average Fuel Economy (CAFE) standards for automobiles. But little may be achieved in the near term. It will be important to quantify the expected and actual impact of these measures, and to monitor their progress.

The proposal to consider strengthening CAFE standards is an encouraging approach to energy issues in transport. The efficient use of US light-duty vehicle fuel could have a large influence on world oil demand and oil markets. The US gasoline sector accounts for a significant share of world oil demand, and the US market could affect fuel economy performance around the world. Resources should be made available as soon as possible to ensure that the Department of Transportation can issue new CAFE standards by 2004, and then strengthen them progressively. Different CAFE standards for cars and light trucks, which have encouraged the growing use of sport utility vehicles and resulted in a fall in fuel economy, should be addressed as a priority.

ELECTRICITY

The US is seeking to improve the operation of the electricity market nationwide. Federal-state co-operation is necessary to harmonise standards and regulations and promote competition, and could work to ensure sufficient investment in generation and transmission. The challenge is to create a small number of regional markets operating under consistent regulatory regimes.

Continued liberalisation of US energy markets could enhance the efficiency of the sector and benefit electricity and gas consumers. US policy should take as its objective the establishment of robust, competitive markets where price mechanisms can operate without undue distortion to provide transparent signals for efficiently timed new capacity to meet growing energy demands. Competitive energy markets should be supported by efficient, consistent and transparent market structures and regulatory arrangements.

The power crisis in California has reversed or delayed progress on market reform in several states. Damaged confidence should be restored to promote reform and to create certainty for new investment. In light of the California experience, it is important that electricity and gas suppliers be free to use financial instruments, for example portfolios of bilateral contracts, to enable them to manage their exposure to market volatility. Decisions on the electricity sector should be taken bearing in mind the large projected increase in energy demand to 2020. The US government estimates that 355 000 MW of new capacity will be needed to meet demand. Benefits from competition should be passed through to end-users, including householders and small businesses, enabling them to participate actively in the free markets where they can exercise effective choice.

The Federal Energy Regulatory Commission's proposal to establish Regional Transmission Operators appears to be a sensible means of ensuring access to transmission and the functioning of a competitive market at the wholesale level. Progress in market reform is uneven among the states. Progress has been made through consultation and co-operation between regulators. These positive efforts should be complemented by broader discussions on market reform between the federal and state governments with a view to encouraging greater consistency in market arrangements within the new transmission regions.

The California crisis had multiple causes that are now being addressed by market-based means.

The crisis in California's electricity market brought rolling blackouts during the winter of 2000-2001, retail price spikes in San Diego during the summer of 2000 and financial difficulties for the state's two largest utilities, Pacific Gas and Electric, and Southern California Edison. The utilities were compelled to pay market-based wholesale prices for electricity but had to resell at regulated retail rates. Underlying causes of the crisis were:

- Failure to build new generating supply in the face of steadily increasing demand because traditional rate regulation did not provide sufficient profit incentives for new supply. Siting regulations delayed building power plants. With stronger incentives and political pressure, substantial new capacity is now being built.

- Market design flawed by restrictions on the use of long-term contracts, and flaws in spot market operating rules. Utilities and consumers were left extremely vulnerable to short-term price increases at times of high demand. Elsewhere, this problem has been avoided by allowing forward hedging contracts that allow consumers to secure a stable longer-term price. Restrictions on long-term contracts have now been lifted.

- Rising natural gas prices added 3 cents per kWh to the average cost of gas-fired generation between the spring of 1999 and the autumn of 2000. Spot gas price spikes were much higher. Permits to emit nitrogen oxide raised the cost of coal-fired generation by about 4 cents per kWh. Widespread drought in the western states and Canada reduced the amount of hydroelectricity available to the state, raising electricity prices across the board.

RENEWABLES

Renewables could play an important role in US energy policy with direct economic benefits through technology exports.

Objectives for developing renewables should be defined carefully to ensure cost-effectiveness and consistency with other policy goals. As a general rule, market-based incentives are likely to be the most efficient means of delivering those objectives. Renewable portfolio standards could be a neutral way of creating a secure but competitive market for promoting renewables in general.

OIL

Oil exploration is limited on environmental grounds. Refineries are operating at full capacity and new investment is deterred by low profitability. Product standards need to be made more consistent.

The focus in the National Energy Policy on improving domestic oil supplies should be balanced by continuing efforts to diversify supply through trade with politically stable and friendly nations, participation in consumer-producer dialogue, improving the efficiency of energy use in transport and the promotion of alternatives to oil.

There is, nevertheless, considerable scope for expanding domestic supplies, provided there is public confidence that exploration and production can be undertaken in an environmentally acceptable manner. Extensive areas of federal lands have been barred from leasing or drilling by congressionally-imposed restrictions, despite strong industry interest.

The US refining industry is running at nearly 100% of capacity during the peak gasoline consumption season. It is producing record amounts of needed products at other times. No major refineries have been built in the last twenty-five years because of low profitability and heavy environmental regulation. So-called boutique fuels, produced to meet local environmental standards, may be raising the cost of fuels in some regions and reducing the ability of petroleum product markets to respond to supply interruptions or unexpected demand. Consideration should be given to the possible economic benefits and costs of reducing the number of region-specific petroleum product requirements.

NATURAL GAS

US prospectivity may be too low for exploration incentives to bring about a sufficient supply response.

The National Energy Policy argues that domestic supply must fill the gap in meeting energy demand after efficiency improvements are made. Otherwise, imported supply will grow to a level judged unacceptable by the US government. A supply response to higher prices has been delayed by low prospectivity, despite a high level of exploration. Drilling is currently focused on areas adjacent to existing developments and finds are often shallow and quickly depleted. To meet demand growth, more aggressive drilling in new onshore and offshore areas will be necessary, or larger volumes will have to be imported from Canada, Mexico or as liquefied natural gas. The increase in imports required would be very large and could create network bottlenecks.

Price spikes, already noted with concern in the National Energy Policy, result in part from regional transmission bottlenecks. The federal government needs to work with the Federal Energy Regulatory Commission (FERC) and state regulators to ensure that the planning and regulatory framework creates the right incentives for necessary new investment in transmission capacity and storage.

COAL

Although high domestic demand is forecast, production and exports of coal are falling; despite higher international coal prices, the US is not acting as the swing producer. High domestic consumption could be

environmentally sustainable provided advanced clean coal technology is deployed.

US coal production declined for the second consecutive year in 2000. Imports rose and are expected to continue growing. Exports are forecast to remain subdued to 2020. US producers have historically increased coal exports when international prices have risen, effectively capping any rising price trend. This situation has changed in recent years. Fundamental changes in the way the international market operates may be developing.

Policies to control carbon emissions may be perceived as a threat to the coal industry. However, their impact could be managed provided that carbon regimes include opportunity for national and international trading and that incentives exist for the implementation of clean coal technologies, including technologies for carbon sequestration.

NUCLEAR

The National Energy Policy promotes nuclear energy, but no specific policies are proposed to encourage construction of new plants. Re-licensing of existing plants would ensure that nuclear power plays a continuing role. The decision on the Yucca Mountain repository will be important for the future of nuclear power worldwide.

The National Energy Policy promotes nuclear power. New nuclear plants using existing technology would almost certainly be uncompetitive with fossil alternatives at current prices. There are few specific policies to encourage new nuclear plants other than extension of the Price-Anderson Act to limit liability in the event of an accident, and research and development programmes. Relicensing of existing reactors is likely to be more effective than new construction in maintaining a role for nuclear.

Yucca Mountain represents a strategically important development for the nuclear sector in the US. The decision on the project will influence confidence in nuclear power worldwide. A firm decision on its future should be taken as soon as possible. The facility would not start operation until 2010 at the earliest.

RESEARCH AND DEVELOPMENT

The most recent budget allocations have brought research and development expenditures into line with priorities set out in the National Energy Policy. Deployment of new technologies will be difficult in the absence of market incentives to put a value on carbon emissions. Many of the new technologies would reduce levels of carbon emissions, but have higher capital and operating costs than existing technologies.

RECOMMENDATIONS

The Government of the United States should:

General Energy Policy

- ☐ Persevere with the development and implementation of the National Energy Policy to ensure that the eventual outcome is a new and coherent expression of US energy policies, instruments and programmes.

- ☐ Broaden the use of economic instruments to achieve energy policy goals.

- ☐ Develop constructive federal-state dialogue on a wide range of energy policy issues, with a view to bringing a more consistent national approach to many issues where jurisdictional boundaries may be inhibiting progress.

- ☐ Continue the process of energy market liberalisation with federal government leadership.

Environment

- ☐ Acknowledge the influence of US emissions on global greenhouse gas emission levels and climate.
  - Quantify the impact of current energy-environment policies on projected greenhouse gas emissions at the national and global levels.
  - Develop specific targets for the control of US greenhouse gas emissions.

- ☐ Complement current research and development efforts on climate-friendly technologies with a policy framework, including economic instruments, designed to achieve significant reductions in greenhouse gas emissions over a specified period.

- ☐ Take action on carbon dioxide to complement the three-pollutants bill, or announce its intentions on carbon dioxide, so that companies can take carbon dioxide into account when investing in new capital stock to comply with any new environmental goals.

- ☐ Develop greenhouse policies consistent with the flexibility mechanisms of the Kyoto Protocol so that US industry has the option of participating in a future international market in emissions.

- ☐ Continue to develop and apply market-based policy responses to local pollutants.

Energy Efficiency

- Establish a stronger foundation for energy efficiency programmes by continuing to:
  - Improve the statistical basis for developing policies and programmes.
  - Assess improvements in energy efficiency that are being achieved without government intervention to set benchmarks for evaluating the cost-effectiveness of existing and proposed policies.
  - Improve transparency of information on energy consumption, energy costs, and efficiency-enhancing products for consumers.
  - Give attention to the potential energy security benefits of energy efficiency measures.

- Develop a comprehensive package of measures to achieve quantified targets for efficiency of energy end-use, including:
  - The use of economic instruments wherever possible.
  - Mandatory standards.
  - Information programmes to raise public awareness of the benefits of energy efficiency and conservation strategies.
  - Deployment programmes to ensure appropriate advanced technology enters the market in a timely manner.

- Give priority to enhancing energy efficiency in the transport and building sectors, notably by:
  - Strengthening CAFE standards.
  - Reviewing the range of options available to improve the fuel economy of personal and light-duty vehicles, including the possibility of increased reliance on diesel engines following the introduction in 2006 of low-sulphur diesel.
  - Continuing to work with the states to strengthen building codes.
  - Continuing to provide federal leadership through standards and guidelines on appliances, buildings and systems designed to improve efficiency in buildings.

Electricity

- Establish a formal process to develop overall policy goals for the electricity industry. The states should be encouraged to introduce competition in electricity markets, including retail competition and customer choice. Conditions for effective competition to be addressed include:
  - Encouraging new market entrants.
  - Acknowledging the role of spot price spikes in a normally operating competitive market, for example to ensure sufficient investment in peak-load capacity, while protecting final consumers by market means.
  - Guarding against undue market influence.
  - Taking a regional approach to price-capping to ensure that market power and the value of lost load are addressed appropriately, but interstate trade in electricity is not discouraged.

- Ensuring stranded cost payments are calculated accurately and their reimbursement does not adversely affect the development of competition.
- Including demand response measures in market designs.

☐ Strengthen existing dialogue between regulators to develop consistent, transparent wholesale market structures, rules, and regulatory arrangements within interconnected regions. The aim should be to ensure that a regional approach is taken that reflects the economic boundaries of the markets rather than the jurisdictional boundaries of existing regulatory bodies. Issues to be addressed in this context should include:
- Structural reform of incumbent state-based and government-owned utilities to ensure competitive neutrality and market access.
- Cost-reflective network pricing.
- The potential for competitive delivery of network services and improved market-based reliability arrangements.
- Integrated network planning arrangements and information dissemination on market operations.
- Market governance and institutional arrangements, including clarification of the rights and responsibilities of market participants and governments.
- The capacity of financial derivatives markets to deliver innovative and efficient market management products.

☐ Address regulatory barriers to new investment in generation and transmission:
- Ensure the independent collection, analysis and distribution of information on investment needs for new generation and transmission capacity as a means of avoiding market failure by timely and objective forecasting of capacity needs.
- With the states, streamline licensing arrangements.

Renewables

☐ Consider the use of a federal renewable portfolio standard as an alternative to tax credits on electricity produced from renewable sources.

☐ Develop a standardised national approach to encouraging renewable energy, compatible with the operation of competitive electricity markets. Issues for consideration include net-metering and interconnection standards.

☐ Facilitate the development of a commercially-oriented and viable renewables sector:
- Encourage the development of innovative commercial arrangements such as strategic alliances between different players in the renewables market to strengthen their ability to compete.

Nuclear

☐ Assess the extent to which proposals in the National Energy Policy will encourage the construction of new nuclear plants.

- ☐ Assess public opinion on nuclear power and develop information strategies to respond to public concerns.

- ☐ Make a firm decision on the Yucca Mountain repository, bearing in mind the impact the decision will have in the US and worldwide on future investment in nuclear power.

Oil

- ☐ Remove undue obstacles to oil and gas exploration both onshore and offshore, particularly on federal territory.

- ☐ Work with industry to reduce barriers to new investment in refinery capacity.

- ☐ Develop consistent standards for "boutique" fuels.

Natural Gas

- ☐ Maintain the momentum for opening the downstream gas market, giving particular attention to customer choice in the residential sector.

- ☐ Review the outlook for the gas supply and demand balance.

- ☐ Review the adequacy of investment in gas transmission, distribution and storage.

Coal

- ☐ Review policies for the deployment of clean coal technologies, including carbon dioxide sequestration.

Research and Development

- ☐ Give priority to the development of economic incentives for the deployment of advanced technologies.

- ☐ Ensure that the level and distribution of funding for energy research and development matches the expectations for technology to meet environmental and energy policy goals.

STANDARD REVIEWS

This part contains the 2001/2002 standard reviews for the following six countries, updating the situation since these countries underwent the In-depth Reviews of the 1999/2000 review cycle. The report reflects the situation when they were drafted from July to September 2002.

Canada

France

Luxembourg

Netherlands

Portugal

Sweden

CANADA

GENERAL POLICY DEVELOPMENT[1]

As outlined in the 2000 in-depth review, Canada's energy policy continues to be market-based and oriented towards sustainable development. Canada remains an energy-intensive economy as a primary producer and exporter of vast quantities of natural resources (the energy, mineral and forestry sectors generate around 11% of GDP). Canadian policy-making is guided by the necessity of ensuring continued growth of a competitive and innovative energy sector; of maintaining a secure, reliable and safe supply of energy for all; of ensuring energy production and use that respects the environment and that is sustainable for future generations; and of promoting continued co-operation with all stakeholders in addressing key issues. Energy policy is implemented by Natural Resources Canada (NRCan), the federal government department specialising in sustainable development and the use of natural resources.

Energy policy in Canada is also shaped by Canada's domestic and international commitments. A key commitment includes the one made at Kyoto in 1997 to reduce GHG emissions. Other important commitments include the North American Free Trade Agreement (NAFTA) and similar national and international agreements that set the rules for global and regional free trade. Domestically, Canada has key federal-provincial agreements, which shape Canada's energy markets.

In April 2001, Canada, the United States and Mexico established a North American Energy Working Group, the goals of which are to foster communication and co-operation among the governments and energy sectors of the three countries on energy-related matters of common interest, and to enhance North American energy trade and interconnections consistent with the goal of sustainable development, for the benefit of all. The working group consists of four expert groups focusing on energy demand, electricity regulation, energy efficiency, and natural gas trade and interconnections. Informal discussions also occur on critical infrastructure protection.

ENERGY SUPPLY AND DEMAND[2]

In 2000, total primary energy supply (TPES) was 251 Mtoe, representing a growth of 20% over the 1990 figure. There was no substantial change in the share of each

1. All $ figures are Canadian dollars. Unless a different source is quoted, all data are from IEA.
2. The IEA publishes summaries of Member country energy policies in *IEA Energy Efficiency Update*, see http://www.iea.org/pubs/newslett/eneeff/table.htm.

energy source in the course of that decade. In 2000, oil represented 35%, gas 30%, coal 12%, hydro 12% and nuclear 8%. About three-quarters of Canada's TPES was derived from fossil fuels.

Canada's total energy production substantially grew by 37%, from 274 Mtoe in 1990 to 375 Mtoe in 2000. Canada's net export almost doubled from 61 Mtoe in 1990 to 133 Mtoe in 2000. About 30% and 61% of net energy exports are gas and oil respectively.

After negative growth in 1999, the total final energy consumption rebounded by 3.1% in 2000, reaching 192.5 Mtoe in 2000, which exceeded GDP growth of 1.1%. This was led largely by the industry and residential/commercial sectors where energy consumption grew by 5% and 4.7% respectively from 1999 to 2000.

ENERGY EFFICIENCY

In June 2002, the Office of Energy Efficiency (OEE) published *Energy Efficiency Trends in Canada: An Update*, its seventh annual review of energy efficiency in Canada, covering the period 1990–2000. This review tracks national trends in energy efficiency and their contribution to changes in energy use and related carbon dioxide emissions. The OEE Index, which measures performance in energy efficiency on a sectoral basis – separating the actual efficiency gains from the structural and physical changes affecting energy consumption – shows an improvement of 9.4% between 1990 and 2000 (about 1% per year).

In 2000, the Office of the Auditor-General (OAG) conducted an evaluation of the OEE's performance and concluded that NRCan had made satisfactory progress in energy efficiency programmes in accordance with the previous OAG recommendations in 1997. The follow-up report by the OAG also noted improvements in the evaluation of energy efficiency performance (both projections and achievements). This has also improved the quality of NRCan's Report to Parliament on energy efficiency and alternative energy initiatives implemented under the authority of the Energy Efficiency Act.

On 1 April 1998, NRCan launched the following three new energy efficiency initiatives with total funding of $48 million over three years, and the OEE as the implementing organisation. The federal budget of February 2000 extended these initiatives for another three years from April 2001 with the same volume of funding. These initiatives are:

- The Commercial Building Incentive Program, which promotes the diffusion of energy-efficient technology in new commercial and institutional buildings through financial incentives.

- The Energy Innovators Initiative, which helps commercial businesses and public institutions explore energy efficiency options and strategies by offering members access to tools, services and financial incentives.

- EnerGuide for Houses, which gives guidance to owners on how to improve the energy performance of their houses through labelling and certification programmes.

The Government of Canada Action Plan 2000 on Climate Change was implemented in 2001–2 (see also Energy and the Environment below). The plan expanded some existing programmes and included funding for:

- The adoption and use of the internationally accepted Energy Star labelling programme to encourage purchase of "best in class" energy-efficient products.
- An Industrial Buildings Incentive Program patterned on the Commercial Building Incentive Program.
- New urban and freight transportation measures.

OIL

Canadian crude oil production for 2000 reached 125.3 Mtoe (2.5 mb/d), growing by 4.5% from 1999. Net oil exports represent almost 30% of Canada's production.

The offshore segment began producing in 1997, with the start-up of the Hibernia field. Production from Hibernia in 2001 was 149 kb/d (up 45% from 1999) and is estimated to grow to 190 kb/d in 2002. In spite of delays and cost overruns, Terra Nova project began delivering 20 kb/d in January 2002 and reached 95 kb/d in March. In March 2002, the Regional Infrastructure Working Group (RIWG) of the Athabasca Oil Sands Developers assessed the amount of cumulated proposed investments in oil sands at approximately $84 billion to develop projects producing an incremental 3.8 mb/d over the period 1995–2010. In March 2002, $20 billion had been commercially approved, of which over $9 billion had already been spent.

Planned investment in the refinery sector amounts to approximately $4 billion from 2000 to 2006, 50% of which would be for meeting low-sulphur gasoline standards. The regulation requires a shift from approximately 300–500 parts per million (ppm) of sulphur for a typical operation to an average of 150 ppm over the period July 2002 to December 2005 and then an annual average of 30 ppm, with a single-batch maximum of 80 ppm. A similar amount could be spent to reduce the sulphur content of diesel fuel used for transport.

The government is promoting RD&D of technologies to advance the capture and geological storage of CO_2, because they simultaneously contribute to enhanced oil recovery and to the reduction of GHG emissions.

To increase the company's access to domestic and foreign capital, the Government of Canada liberalised the ownership rules for Petro-Canada, which was created as a government enterprise in the 1970s.

NATURAL GAS

Though the growth in natural gas production has slowed down somewhat since the mid-1990s, it reached 180.6 bcm in 2000, up 2.7% from 1999. Canada's net gas exports represent more than half of its production. In 2000, Canada exported close to 100 bcm, entirely to the United States. Canadian gas represents 93% of US gas imports in 2000 and 16% of the total US gas supply. However, in 2001, some analysts expressed warnings that Canadian natural gas production may have reached a plateau.

There are approximately 80 000 km of transmission pipeline in Canada that carry gas from the processing plants to the consuming regions and export points at the international border. Canadian pipeline capacity is expanding as required. The capacity of existing systems (e.g., TransCanada Pipelines) is augmented through annual applications to the National Energy Board. Strong demand in the US Mid-west and North-west has driven major pipeline construction to these regions in recent years. The Northern Border Pipelines, which is an extension of the Nova Pipeline, reaching Chicago, came on stream in 1999 and the Maritimes and Northeast Pipeline from Sable Island to New England followed in January 2000. Several pipeline projects were suspended in 2002 following a decrease in natural gas prices.

North American gas demand fell by nearly 5% in 2001 as a result of high prices and a weakening economy. Most of the demand loss occurred in the industrial sector, particularly in the ammonia and methanol industries, where companies temporarily, or in some cases permanently, shut down plants to move to areas providing low-cost gas supply. Canadian natural gas prices have risen from an average of $2.77/GJ in 1999 to average $5.91/GJ in 2001. Prices were particularly high during the winter 2000–1, reaching a high of $13.78/GJ in January 2001. Extremely high gas prices in that winter were the result of numerous events, which occurred simultaneously: low storage inventories, very cold weather and higher demand – especially for power generation. Prices have since moderated, averaging $3.48/GJ to date in 2002 (January–August). Although prices have fallen, they have not fallen back to the positions seen in 1998 and before, mainly because of structural changes that have modified the market for natural gas in 1998–2000, leading to an increased connection between Canadian and US natural gas prices.

In 2001, to compensate consumers for high energy prices, the Government of Canada introduced a $1.3 billion heating rebate programme, which offered a rebate of $125 per individual and $250 per household, assisting the Canadians who were most vulnerable: those on low incomes, seniors and those living in rural areas.

COAL

Coal production started to decline in 1997 and this trend carried on in 2000. On the one hand, coal production was 37 Mtoe in 2000, 5.3% less than in 1999. On the other hand, coal increased by 9% in total supply to 30.4 Mtoe in 2000, the difference with internal production of lower quality being supplied through imports of higher quality, which grew by 15% to 14 Mtoe.

In April 2001, Luscar Coal Income Fund, owner of Canada's largest coal company, agreed a take-over offer of $962.8 million from Sherritt International Corp. and a unit of Ontario Teachers' Pension Plan Board. In February 2001, Canadian Pacific Ltd. announced it would split its five business segments – Rail, CP Ships, PanCanadian Petroleum Ltd., Fording Coal, and Canadian Pacific Hotels & Resorts – into stand-alone companies. These business developments are not expected to affect production or exports.

In June 2000, the Cape Breton Development Corporation (Devco) Divestiture and Dissolution Act, providing for the sales of assets and the eventual liquidation of the corporation, was approved by Parliament. In November 2001, Devco's last mine, the Prince mine, was closed.

ELECTRICITY

Reaching 605 TWh in 2000, electricity output grew by 4.6% from 1999. Hydro is the dominant fuel used, followed by coal, nuclear, gas and oil. Gas shows the fastest growth. Since 1990, there has been a rise in the share of coal (from 17% in 1990 to 20% in 2000) and gas (from 2.0% to 5.5%), in part replacing a fall in hydro (from 62% to 59%), nuclear (from 15% to 12%) and oil (from 3.4% to 2.5%).

Canada's electricity industry is organised along provincial lines. Electricity generation and transport within a province fall under provincial jurisdiction. Most electricity utilities are owned by the provincial governments, although the transition to competitive markets is proceeding in several jurisdictions.

Alberta's retail market was opened to competition in January 2001, after opening in the wholesale sector in 1996. Ontario launched wholesale and retail competition in May 2002. New Brunswick is planning to commence wholesale competition by 2003. Little information is yet available to draw conclusions on the long-term impacts of the expansion of competition in Canada.

NUCLEAR

On 31 May 2000, the Canadian Nuclear Safety Commission (CNSC) was created when the Nuclear Safety and Control Act and its accompanying regulations came into force. The CNSC replaced the former Atomic Energy Control Board (AECB). The Nuclear Safety and Control Act represents the first major overhaul of the enabling legislation for Canada's nuclear regulatory regime since the 1946 AECB.

On 12 May 2001, Bruce Power Inc. leased the Bruce nuclear power stations from Ontario Power Generation (OPG) until 2018 with an option to extend the lease for an additional 25 years. This is the first lease of a Canadian nuclear generating station to a private operator.

To ensure the long-term and efficient production of electricity from existing units, the nuclear energy industry in Canada is actively addressing issues related to refurbishment, life extension, operation and management practices. For example, Ontario Hydro, now known as OPG, initiated the Nuclear Asset Optimization Program (NAOP) in 1997, in which it indicated that it would evaluate the economic viability of restarting the seven laid-up nuclear reactors, including a review of other generation options. The following two projects were worked out under the NAOP:

- The Bruce "A" Restart Project, to restore 1 500 MW of generating capacity by summer 2003.

- The Pickering "A" Restart Project, to restore 2 000 MW of power by 2003.

In April 2001, the Nuclear Fuel Waste Act was introduced in the House of Commons by the minister, as a key component of the 1996 Policy Framework for Radioactive Waste of the Government of Canada. The purpose of this law was to ensure the long-term management of radioactive waste in a comprehensive, integrated and economically sound manner. Establishing a waste management organisation (WMO) is a cornerstone of this new law. The law received Royal Assent on 13 June 2002, although it has not yet entered into force because of some outstanding federal-provincial issues that first have to be resolved. At the time of writing this review, it is still uncertain when the WMO will be established.

ENERGY AND THE ENVIRONMENT[3]

Under the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change, Canada committed to reduce its GHG emissions to 6% below 1990 figures by the 2008–2012 commitment period. Canada's overall energy-related GHG (CO_2) emissions reached 527 Mt in 2000, up 22.4% over 1990 and 4.2% between 1999 and 2000, driven mostly by an increase in electricity, transport and industry emissions.

Canada's set of national circumstances poses challenges to energy use related to geography, weather, economic structure and population (with an 11% growth over the past decade) generating higher GHG emissions. During the 1990s, a third of Canada's annual increase in GHG emissions was due to expanded energy exports (up to 46 Mt CO_2). Energy-related CO_2 emissions from the construction sector grew by more than 12% since 1990. Emissions from the residential and manufacturing sectors have stabilised at roughly 1990 figures.

3. The IEA publishes summaries of Member country policies to mitigate climate change in the annual publication *Dealing with Climate Change*.

In response to the Kyoto Protocol, Canada's federal, provincial and territorial governments instituted a broad participatory National Climate Change Process (NCCP). This process, which included more than four years of consultations, led to the National Implementation Strategy on Climate Change and the institution of an annual business planning process to implement policies and measures related to climate change.

Since 2000, the Government of Canada on its own has invested $1.5 billion in direct climate change initiatives, releasing in November 2001 the details of policies and measures arising from its cornerstone Action Plan 2000 on Climate Change. The Action Plan will provide $500 million over five years for various measures in key sectors of the economy – in, for example, energy, transportation, industry, forestry and technology. These measures are designed to promote more effective and efficient use of energy and the development of alternative and renewable resources. The oil sands sector itself is projected to achieve a 45% reduction in CO_2 emissions per barrel by 2010 over 1990.

Canada is currently working with provincial and territorial governments and stakeholders to develop a workable plan to meet its Kyoto objectives. On 2 September 2002, Prime Minister Jean Chrétien indicated that a parliamentary vote on ratification of the Kyoto Protocol would take place before the end of 2002 and after further consultations with Canadians on its implementation.

RESEARCH AND DEVELOPMENT

The national energy research, development and demonstration agenda is comprised of two main activities: the Federal Program on Energy R&D (PERD) and the CANMET Energy Technology Centres (CETC) and contracted programmes. A number of other federal programmes, although not focused on energy, also support some energy-related R&D.

Since the 2000 review of Canada, the restructuring of PERD has been completed to improve its efficiency and also increase its focus on long-term activities.

The government is expanding its support to R&D within the overarching policy framework of sustainable development and reduction of GHG emissions. Initiatives include the Climate Change Action Fund, the Climate Change Action Plan 2000 and the Sustainable Development Technology Fund (SDTF).

FRANCE

ENERGY MARKET AND ENERGY POLICY OVERVIEW

French energy policy aims at maintaining an equilibrium between several different objectives. Among these are:

- Security, continuity and diversity of energy supply, especially in the long term. France seeks the optimal level of energy independence through the development of the most cost-effective national network, both at present and in the future. IEA statistics show that in 2000 France imported one-half of its energy needs, with imports of 129.3 Mtoe[4] out of a total primary energy supply (TPES) of 257.1 Mtoe. The government estimates that the country must continue its use of nuclear to maintain this level of energy independence, given France's relatively sparse domestic fossil fuel resources. Promotion of renewables also plays a role in the country's diversification strategy.

- An economically and socially optimal equilibrium between private-sector activity and competitive markets on the one hand, and government involvement in the form of regulation and long-term investment planning on the other.

- Sustainable and environmentally benign energy supply, especially with respect to climate change. In the context of commitments under the Kyoto Protocol and the EU burden-sharing mechanism, France is required to stabilise its CO_2-equivalent emissions (six gases) by 2008–12.

At the end of 2001, the Directorate-General of Energy and Primary Resources (Direction générale de l'énergie et des matières premières, DGEMP) within the Ministry of Economic Affairs was split into an upstream section, the Division for Energy and Mineral Resources (Direction des ressources énergétiques et minérales, DIREM), and a downstream section, the Division for Energy Demand and Markets (Direction de la demande et des marchés énergétiques, DIDEME). The objective of this reorganisation was to reflect more accurately the recent developments in the French energy market.

A new strategy for regional energy use was developed in 2000–1 in the context of the Framework Law on Regional Planning and Sustainable Development (loi d'orientation pour l'aménagement et le développement durable du territoire, LOADT) of 25 June 1999. This strategy, confirmed by Decree No. 2002-560 of 18 April 2002, improves co-ordination among the national government and regional

4. The energy content of uranium is counted as indigenous French production, even though some of it may be imported uranium.

and local authorities about strategic choices relating to energy use and conservation.

ENERGY SUPPLY AND DEMAND

The lion's share of French energy production – 108.2 Mtoe out of 131.4 Mtoe – is nuclear energy (2000 figures). The only other significant contributions came from combustible renewables and hydropower, at 11.4 Mtoe and 5.8 Mtoe, respectively.

In 2000, TPES in France reached 257.1 Mtoe, 14% above the 1990 figure. Nuclear energy contributed 42%, followed by oil (34%), natural gas (14%) and coal (6%). From 1990 to 2000, both oil and coal slightly reduced their contributions, with nuclear and, to a lesser extent, natural gas making up the difference. The most widespread use of oil in France is in the transport sector, which consumed 60% of the total supply, nearly all of which is imported.

The total final consumption (TFC) of energy in France in 2000 was 168.7 Mtoe, an increase of 15% from 1990. The demand was met primarily by oil and oil products (52%), electricity (20%) and natural gas (19%). Since 1990, both natural gas and electricity have increased their shares slightly, coming at the expense of oil and coal, which have fallen both by more than 2 percentage points between 1990 and 2000.

Electricity generation continued its upward trend, reaching 535.8 TWh or 46.1 Mtoe in 2000. Nuclear generation oscillates between 75% and 80% of gross electricity output. The exact share depends on the contribution of other fuels, and in particular hydropower, the second-largest contributor. In 2000, nuclear contributed 77.5% and hydro 12.5%.

CLIMATE CHANGE

France adopted a National Programme to Combat Climate Change (Programme national de lutte contre le changement climatique, PNLCC) in January 2000. According to this document, France has to bring its emissions down to 143.5 million tonnes of carbon equivalent around 2010. The report quotes a reference scenario that projects GHG emissions rising to 175 million tonnes of carbon equivalent in 2010. Taking into account a number of response measures decided later but not incorporated into the projections, emissions in 2010 are estimated at 159.58 million tonnes of carbon equivalent, 16.08 million tonnes above the 1990 figure. To reach the stabilisation target, France has to reduce emissions at the end of the first budget period by 10%.

The country's Third National Communication under the UN Framework Convention on Climate Change was published in November 2001. It states that France's total emissions of GHGs, including land-use changes and forestry, fell between 1998 and

1999 (–2.1%). Partial data available for 2000 confirm this trend. On the basis of these estimates, France has fulfilled its Rio Convention commitment to stabilise GHG emissions in 2000 at 1990 volumes. Total emissions of GHGs, excluding changes in land use and in forestry, slightly diminished between 1998 and 1999 (–0.8%), This is mainly due to the fall in GHG emissions other than CO_2 and, in particular, to action to reduce emissions of nitrous oxide from the chemical industry.

The PNLCC contains three types of measure. "Category 1" measures are traditional regulatory and energy management measures to encourage energy efficiency and renewables. Among them is a programme to replace France's ageing thermal power plants with combined-cycle gas turbines, where possible as co-generation plants, taking into account economical and environmental performance. "Category 2" measures are economic instruments, where the French government is looking for a balanced policy mix, including energy taxes in the context of a European directive on energy taxation, tradable permits for GHGs and voluntary agreements for industry to curtail GHG emissions. A third category of longer-term structural measures will tackle the supply side, in particular in the building and the transport industries.

ENERGY EFFICIENCY AND RENEWABLES

According to French statistics, the energy intensity of the French economy has declined noticeably over the last few years. This effect was especially visible between 1997 and 2001, when GDP grew rapidly. In this time span, average primary energy intensity declined by 1.7% per year, whereas final energy intensity declined by 1.9% per year. As in most other IEA countries, this decline was largely due to improvements within the industrial sector; energy intensity in transport increased between 1973 and 2001.

In order to improve energy efficiency, to reduce dependency on energy imports and to contribute to France's CO_2 stabilisation goal, the government launched a National Energy Efficiency Plan (Plan national d'amélioration de l'efficacité énergétique, PNAEE) on 6 December 2000. It comprises regulatory measures to promote energy efficiency and renewables. These provisions consist of a set of thermal energy regulations for new buildings adopted in November 2000 which considerably reinforce the requirements previously in force. They ensure a 15% increase in the energy efficiency requirement for residential buildings, as compared with the 1988 regulations, and a 40% increase for non-residential buildings. Moreover, progressive reinforcement of this regulation is planned every five years. Inspection will also be stricter. The PNAEE also contains a broad array of information schemes, not least including a year-long information campaign throughout 2001 with TV advertisements and a national network of Energy Information Points.

Between 1998 and 2001, France's main energy efficiency institution, the Agency for the Environment and Energy Management (Agence de l'environnement et de la maîtrise de l'énergie, ADEME), has been strengthened considerably as part of the national climate change plan. In particular, ADEME's budget for energy was increased tenfold, reaching €137 million in 2001.

In May 2001, the French prime minister introduced a target for the development of renewable energy whereby 21% of French electricity will be generated from renewable sources by 2010. This objective was also fixed in the EU Renewables Directive (2001/77/CE) adopted in the same year. According to the first report on the Pluriannual Programmation of Investments for electricity production (PPI), this objective would lead to 7 000–14 000 MW of wind capacity being installed in France by 2010. The cost to electricity consumers for the development of this capacity is estimated to be €900–1 300 million a year in 2010, resulting in direct charges to consumers of €0.002 to €0.003/kWh.

OIL

In early 1999, the French oil company Total merged with the Belgian oil company Petrofina to create TotalFina, the world's sixth-largest oil company and the third-largest in Europe. Shortly afterwards, TotalFinaElf was formed by TotalFina's acquisition of Elf Aquitaine. After the merger was completed in 2000, TotalFinaElf became the world's fourth-largest publicly listed oil company measured by market capitalisation, and the fifth-largest based on global production and reserves. As of year-end 2001, TotalFinaElf had proven reserves of about 11.0 billion barrels of oil equivalent and, in the year 2001, produced approximately 2.2 million barrels/day. The largest source of this output was Africa, representing 45% of the total for the year, followed by Europe (35%), the Middle East (8%) and South America (8%). The company announced that it had raised hydrocarbon output by 3.4% in 2001. It has plans to raise production by 10% in 2002 as new resources come on stream. TotalFinaElf owns more than 50% of the refinery capacity in France, and is the seventh-largest refiner in the world.

NATURAL GAS

France's state-owned gas company Gaz de France (GDF) has the largest underground storage capacity in western Europe, equivalent to about three months of national supply. The company is making efforts to move upstream.

Over the past years, GDF has increased its holdings in North Sea natural gas, including interests in two Norwegian fields. The company acquired holdings in twelve exploration licences in the UK North Sea in June 2001. By 2003, Gaz de France aims to possess sufficient reserves to produce at least 15% of the natural gas it sells.

Adaptation of EU member countries' national law to the EU Gas Directive (98/30/CE) was due on 10 August 2000. However, France did not meet this deadline, since the draft "Bill on the Modernisation of the Public Service of Gas Supply and the Development of Gas Companies" (Projet de loi de la modernisation du service public du gaz et de développement des entreprises gazières) was approved by the French government on 17 May 2000 but was not discussed or examined by the Parliament. As a consequence, the European Commission referred France to the European Court of Justice in May 2001. The French government has stated its intention to adopt a new bill by the end of the year to implement the directive. In addition, France is establishing a gas branch within the electricity regulator, CRE (Commission de régulation de l'électricité).

Although the gas directive has not been formally applied, there have been some changes in the natural gas market in France. For example, all three French operators (GDF, compagnie française de méthane, CFM, and Gaz du Sud-Ouest, GSO) opened their grids to third-party access in August 2000. About 100 of the country's largest industrial consumers were then able to choose their suppliers, amounting to the 20% market opening required by the EU directive. The government estimates that some 25% of these eligible customers had changed their supplier by 2002. Four new suppliers have entered the French market: the UK companies BP, TFE-UK and Centrica, and the Belgian supplier Distrigaz.

In response to this competition, Gaz de France has adapted its distribution and trading activities for professional customers, and intends to do the same for residential users. As a first step, Gaz de France created a dedicated operating structure, a Gas Sales Division, in January 2002. Moreover, the government has decided to sell the transport network to current operators and to put an end to the transport regime by "concession", which will accelerate competition within France. The prime minister confirms government plans to change the status of GDF from a wholly state-owned enterprise to a joint company by 2003 and to open its capital to private investors.

ELECTRICITY

France opened its electricity market to competition through the "Act relating to the Modernisation and the Development of the Public Service of Electricity" (Loi de modernisation et de développement du service public de l'électricité no. 2000-108) of 10 February 2000, as required under the EU electricity directive[5]. Since it was adopted, some 30 pieces of secondary legislation were issued, as required under the law, to determine the detailed functioning of the market. Also as required under the law, the Regulatory Commission for Electricity (Commission de régulation de l'électricité, CRE) was established in 2000, as was an independent grid operator within France's state-owned power company EDF, the Réseau de transport de l'électricité (RTE). EDF has acquired major stakes in power companies abroad in recent years, and has become one of the largest players in the UK electricity market

5. Council and Parliament Directive 96/92/EC of 19 December 1996 concerning common rules for the internal market in electricity.

through its stake in the gas and electricity utility LE Group (comprising London Electricity and SWEB).

The French power exchange, Powernext, was founded in November 2001. It was created by the Euronext stock exchange (34%), RTE/EDF (27%) and others to manage the French electricity daily spot market based in Paris. This market is organised on the basis of standardised hourly contracts allowing day-ahead exchange of electricity.

Electricity customers consuming 16 GWh or more per year, corresponding to 30% of the market, are free to choose their electricity supplier. According to government estimates, the French market comprised some 1 500 consumers eligible to switch suppliers in early 2002. Some 13% of the market is supplied by new entrants, including the German utilities HEW (now part of Vattenfall Europe AG) and RWE.

Competition can also arise from two domestic operators. One is the Société nationale d'électricité thermique (SNET), which owns five power generators using coal (total generation capacity of 2 600 MW). In December 2000, Endesa purchased a 30% stake with the option of later increasing its shareholding. The other potential domestic competitor is the Compagnie nationale du Rhône (CNR), which owns 18 dams on the Rhône river (with a total generation capacity of 3 000 MW). In 2000, a joint venture was formed between CNR (51%) and Electrabel (49%) to sell electricity produced by CNR and Electrabel to eligible French customers. To increase competition in the French power market, the regulator CRE required EDF to divest 6 000 MW of mid-merit capacity to other operators in 2001.

In September 2001, France's nuclear industry saw the merger between Framatome, Cogéma and CEA-Industries to form the new company Areva. Cogéma undertook activities relating to the nuclear fuel cycle. Framatome was France's nuclear reactor construction company. The fully state-owned Commissariat à l'énergie atomique (CEA) was the country's national nuclear R&D organisation. The CEA played a crucial role in designing French nuclear reactors but also holds stakes in the nuclear industry, especially through its subsidiary CEA-Industries.

The new company Areva is one of the largest operators in the nuclear industry worldwide. In the field of nuclear energy, Areva's services range from uranium mining, fuel fabrication and reprocessing to nuclear plant construction, decommissioning and clean-up. But it is also one of the largest manufacturer of connectors and components for mobile phones, satellites, high-speed trains, and cars.

R&D

In 1999, the French government devoted €617 million to energy-related R&D. Of this amount, by far the largest part (91%) was spent on nuclear research, with smaller amounts spent on fossil fuels (5%), conservation (2%) and renewable energy (2%). Nuclear's share of the R&D budget has grown from 86% in 1990.

In July 2001, the US Secretary of Energy and the Commissariat à l'énergie atomique (CEA) signed a bilateral agreement to jointly fund and carry out research in advanced reactors and fuel cycle development; the US Department of Energy (DOE) and CEA then awarded research grants for this purpose. The agreement is part of the DOE's International Nuclear Energy Research Initiative. This programme is intended to promote international collaborative research and development of nuclear technology, focusing on the development of Generation IV advanced nuclear system technologies. The joint research awarded through this agreement will enable the United States and France to extend the range of future reactor and fuel cycle designs. In the framework of this agreement, both countries are developing a "Generation IV Technology Roadmap" that will serve as the R&D plan for advanced reactor and fuel cycle system development.

Additional activity in nuclear R&D from 2000 to 2002 included a reorganisation of the CEA in 2000 and the creation of the Institut de radioprotection et de sûreté nucléaire (IRSN) in 2002. All research activities relating to nuclear safety will take place in the IRSN.

In 2001, a new contract was agreed upon between the French government and the Agence nationale pour la gestion des déchets radioactifs (ANDRA) which fixed the mission of ANDRA very precisely. The first stage of the contract was the publication of "HAVL Argile 2001", a report describing completed research relating to deep burial and storage of nuclear waste. This report, along with a previous analysis of this subject, suggests that such a storage option is viable. The contract requires that ANDRA submit a feasibility report on this storage option to the French government by the end of 2005.

LUXEMBOURG

OVERVIEW

The major changes in the Luxembourg energy sector since the last in-depth review in 2000 are the partial liberalisation of the electricity and gas markets and the increase in indigenous electricity generation. These developments are described in more detail below.

ENERGY SUPPLY AND DEMAND

Luxembourg depends on imports for almost all of its energy supply. Total primary energy supply in 2000 was 3.68 Mtoe, 3.1% over the 1990 figure. The natural gas supply increased by 56% in 1990–2000, replacing oil use in the industry and in the residential and commercial sectors – although total oil demand did increase by 43% because of increasing energy demand in the transport sector. Coal demand has declined from 1.13 Mtoe in 1990 to 0.13 Mtoe in 2000, mainly because Arbed, a steel company and the main coal user, replaced its blast furnaces with electric ones in 1993.

Final energy consumption increased by 22% in 1990–2000. Growth was strongest in the transport sector (87%), which reflects the widening difference of excise taxes on fuel between Luxembourg and its neighbours, increasing car ownership and the growing number of larger cars. The gap in excise taxes on diesel in commercial use has increased between Luxembourg and all its neighbouring countries in the second half of the decade. The gap in excise taxes on fuels in non-commercial use has widened in the second half of the decade between Luxembourg and Germany for both gasoline and diesel, between Luxembourg and Belgium for gasoline, and between Luxembourg and France for diesel. Final consumption increased in the household and service sectors by 23%, partly induced by the 16% growth in population. Industrial consumption declined by 27% owing to the restructuring of the iron and steel industry.

ENERGY AND ENVIRONMENT AND ENERGY EFFICIENCY

In keeping with the Kyoto Protocol of December 1997 and the Burden-Sharing Agreement of the EU of June 1998, Luxembourg is committed to reducing its total GHG emissions by 28% between 1990 and 2008–12. Energy-related CO_2 emissions have decreased and were 23% under the 1990 figure in 2000, although the commissioning of a new combined cycle gas turbine (CCGT) in 2002 will increase the energy-related CO_2 emissions; the government forecasts them to be 18.4% under the 1990 figure in 2005 and 21.6% in 2010.

The key areas of action to reduce GHG emissions are improvement of energy efficiency in buildings, information dissemination for households, and promotion of renewable energy sources and the use of natural gas. Luxembourg intends to rely on the "flexible mechanisms" allowed by the Kyoto Protocol.

Energy demand per capita in Luxembourg continues to be among the highest in the IEA; in 1999 it was 7.88 toe (8.2 toe in 2000) compared to the 5.1 toe IEA average. The legal framework for energy efficiency is defined in the 1993 Energy Efficiency Law. The "National Plan for Sustainable Development" of 1998 set an objective to reduce energy intensity by 20% between 1993 and 2010. It also introduced several measures in each sector to achieve the target.

OIL

Oil demand increased rapidly in the 1990s, from 1.64 Mtoe in 1990 to 2.34 Mtoe in 2000. The share of oil in TPES increased from 46% in 1990 to 63.5% in 2000. One of the key factors in this growth was the lower taxes on oil products in Luxembourg compared to its neighbouring countries, leading to increased purchases of car fuel by foreigners. The oil market consists only of retailing. All oil products are imported, mostly from Belgium (90% in 2000). The government continues to set a ceiling on gasoline, automotive diesel, heating oil and LPG prices.

NATURAL GAS

In 2000, natural gas supply was 0.67 Mtoe, up 56% from 1990. Some 61% of gas was used in the industry, 31% in the household sector and 7% in power and heat generation. Gas demand has increased substantially because of the new CCGT plant, and the government estimates that demand will reach 1.47 Mtoe by 2010. In 2000, the supply sources were Belgium (92%), France (5%) and Germany (3%). Supplies from Germany started in September 2000 at the completion of the 114 km Mittelbrunn-Remich and the 28 km Remich-Leudelange gas pipelines.

On 6 April 2001, the Parliament adopted a new gas law to implement the EU gas directive. Market access was opened immediately for all consumers consuming at least 15 million m^3 a year; such consumers, nine in total, represent 51% of the market. The next step will be opening the markets to consumers with a minimum consumption of 5 million m^3 a year (74% of the market) in October 2003. In October 2006, the natural gas distribution companies will become eligible for one-third of their sales to their consumers, increasing the market opening to about 82%. In October 2008, the eligibility threshold will be reduced to 2 million m^3 (84% market opening). In October 2010, the threshold will still be 2 million m^3 but the distribution companies will be fully eligible to choose their supplier, increasing the market opening to 99.2%. As of June 2002, only one consumer had changed suppliers, but all other eligible consumers have negotiated better contracts with their old suppliers.

There have been no major changes in the industry structure over the last couple of years. The Société de transport de gaz (SOTEG) – which is 21% owned by the State, 20% by Arbed and 20% by Ruhrgas, 19% by CEGEDEL, 10% by SNCI and 10% by Saarfengas – remains the main gas import and transmission company. Account unbundling is required between these sales and transmission operations of SOTEG. There are four distribution companies with a *de facto* monopoly in their concession area. These entities are owned and managed directly by municipalities.

Network access is based on regulated access tariffs. The tariffs are proposed by SOTEG but they are subject to approval by the Minister of the Economy after consultation with the regulator.

The main regulatory responsibility lies with the Ministry of the Economy, which is assisted by the regulator, the Institut luxembourgeois de régulation, an independent but advisory body regulating electricity, gas and telecommunications markets. The regulator gives advice to the ministry, settles disputes arising from contracts and negotiations or refusal of access to the network. Its decisions are open to appeal to the district court. It is also empowered to order fines, which are open to appeal to the administrative tribunal.

ELECTRICITY

Electricity consumption in 2000 was 5.7 TWh, compared to 4.1 TWh in 1990. Domestic production was 1.0 to 1.3 TWh per year (including pumped storage) in the 1990s and imports accounted for the major part of the supply. Renewables, particularly hydropower, provided for the major part of domestic electricity generation.

The domestic supply structure changed when a 350 MW CCGT power plant – a project initiated by the government to reduce dependency on imports – came into operation in Esch-sur-Alzette in May 2002. With the new CCGT, domestic gross generation is estimated to increase from 0.43 TWh in 2000 to 3.48 TWh by 2010. The power plant is owned by Twinerg S.A., which is owned by Électrabel (65%), CEGEDEL (17.5%), and Arbed (17.5%). The CCGT is estimated to produce 2.8 TWh/year. It will be operated according to an operation schedule established by the Belgian electricity production dispatcher, with about 57% of electricity supplied to the Luxembourg market and the rest destined for the Belgian market. Half of the electricity supplied to the local market is consumed by Arbed and the rest is supplied to CEGEDEL.

There have been no major changes in the industry structure over the last couple of years. The market players are Société électrique de l'Our (SEO), Compagnie grand-ducale de l'électricité (CEGEDEL), Société de transport de l'électricité (SOTEL) and eleven companies which operate only in electricity distribution and retailing. Account unbundling is required between the generation, transmission and sales operations but not between distribution and retailing.

In May 2000, the Parliament adopted a new electricity law to implement the EU electricity directive. At present, clients consuming at least 20 GWh/year (26 consumers, or 57% of the market) can choose their supplier. The next step, to be implemented at the beginning of 2003, gives eligibility to all consumers with annual consumption of at least 9 GWh/year. There are 30 such consumers representing 72% of the market. By 2005, all consumers with annual consumption of at least 1 GWh/year (about 200 customers, or 75% of the market) will be able to choose their suppliers. After the beginning of market liberalisation, four consumers have changed their supplier and all other eligible consumers have renegotiated their contracts.

Network access both to transmission and distribution networks is based on regulated third-party access tariffs set by the network operators, although the tariffs are subject to approval by the Minister of the Economy after consultation with the regulator.

Following the market liberalisation, the government has concluded an agreement with CEDEGEL on tariffs for the captive consumers. The distribution companies have aligned their tariffs accordingly.

RENEWABLES

Renewables are the only indigenous energy source in Luxembourg. In 2000, biomass and waste amounted to 44 ktoe (1.2%) of TPES, hydropower 10 ktoe (0.3%) and solar and wind energy 2 ktoe (0.1%). In spite of their small share in TPES, renewables have been an important source of domestic electricity generation – 47% of the total in 2000. The share dropped to approximately 5% when the CCGT came into operation.

The "National Plan for Sustainable Development" of 1998 established the following targets for renewables: to increase the share of electricity produced from renewables in CEGEDEL's supplies from 2.5% in 1997 to 5% by 2010 and to double the share of wood in final energy consumption from 0.5% to 1% in 2010. The indicative target established in the context of the EU Renewables Directive (77/2002/EC) is to increase the share of electricity generated from renewables to 5.7% of the total by 2010. The key measures to promote renewables are investment subsidies and minimum feed-in tariffs.

NETHERLANDS

ENERGY MARKET AND ENERGY POLICY OVERVIEW

The key objectives for Dutch energy policy are set out in the Third White Paper on Energy Policy (Parliamentary Document II 1995/1996, 24,525, Nos. 1 and 2). The overall goal is to reach sustainable energy economy within competitive energy markets, to be achieved by:

- Improving energy efficiency by one-third by 2020.
- Increasing the share of renewable energy in total primary energy supply from 1% in 1995 to 10% in 2020, with an intermediate goal of 3% in 2000.
- Shifting policy instruments from the supply to the demand side.
- Liberalising the electricity and gas markets for all consumers, while protecting captive customers during the period of transition.
- Liberalising energy imports and exports as required by the EU.

This broad policy strategy was updated in February 2002 when the Ministry of Economic Affairs published its Energy Report 2002, entitled *Investing in Energy, Choices for the Future*. This report focuses on four topics:

- Security of supply is one of the main issues in the 2002 Energy Report, mainly as a consequence of the electricity supply crisis in California in 2000–1, and also of the terrorist attacks of 11 September 2001. The report analyses the vulnerability of the Netherlands to a crisis in energy supply and concludes that neither gas nor electricity supply are subject to a specific risk. It does, however, underline the importance of staying alert, improving monitoring and creating the necessary instruments in case of future problems. The report suggests two lines of policy. The first focuses on facilitating energy imports through good relations with producer countries, elaboration of the transit protocol of the Energy Charter Treaty and enhanced attention to energy matters in EU and Dutch foreign policy. The second involves increased emphasis on (European and Dutch) indigenous energy sources – natural gas and renewables.
- Economic efficiency through market liberalisation. The government has undertaken evaluation of the new Gas and Electricity Acts, with the result that some adjustments will be made. The date of complete liberalisation has been brought forward from 2004 to 2003.

- Environmental quality is to be achieved through energy conservation, renewables and clean use of fossil fuels. Further improvement of the effectiveness of fiscal instruments and the removal of regulatory impediments for the building of wind turbines has been announced. A white paper on clean use of fossil fuels is under preparation.

- Transition to a sustainable energy system. The government considers that a fully sustainable energy system combines security of supply, economic efficiency (including the internalisation of external effects), and high environmental standards. The government intends to reach such a sustainable system in the coming decades and has declared its intention to develop the technologies, organisational principles and new ways of life through an interactive way of policy-making.

Institutional reorganisation has remained limited in the last few years. The only exception to this is the fact that the Directorate-General for Energy merged with the Directorate for Competition in 2001.

The Netherlands has two main energy taxes in place at present, the Regulatory Energy Tax and the Environmental Tax on Fuels. In 1998, the government had decided to double these energy taxes, with total receipts increasing from 3.4 billion guilders in 1998 to G6.8 billion in 2001. In practice, the increase was solely applied to the Regulatory Energy Tax and was realised between 1999 and 2001. The only change after this occurred in 2002, when the taxes were indexed to inflation.

In the summer of 2002, a new government took office, which could mean changes in energy policies, although any details have yet to be seen. For example, in the light of the Netherlands' climate change commitments, the new government overruled the earlier decision to close down the nuclear plant in Borssele in 2004. The plant will stay in operation during its economic and safety lifespan. The exact year of closure is yet unknown.

ENERGY SUPPLY AND DEMAND

Total oil and gas production in the Netherlands declined somewhat in 2000. As a result, total production stood at 57.2 Mtoe in 2000, as compared to 59.5 Mtoe in 1999. Net imports, mainly of oil but also of coal, rose from a total of 13.3 Mtoe in 1999 to 21.1 Mtoe. Total primary energy supply was 75.8 Mtoe in 2000, up from 74.6 Mtoe in 1999.

Fuel shares remained virtually unchanged. At 45.8% of TPES, natural gas is still the dominant fuel, followed by oil with 37.7%. The contribution of renewables was 2.4% both in 1999 and 2000. The government still expects the contribution of renewables to grow to 3.6% in 2020, and especially the contribution of wind energy to reach 0.7%, compared to 0.1% in 2000. Electricity generation continued its gradual upward trend, reaching 89.6 TWh in 2000, with a slight increase in the contribution of renewables.

Total final consumption (TFC) of energy rose to 60.4 Mtoe in 2000. The main fuels continue to be gas (38.2%) and oil (40.5%). The share of electricity is stable at around 14%.

ENERGY DEMAND AND ENERGY EFFICIENCY

In 2001, the government released a new reference case scenario for the time period up to 2010 according to which total primary energy use will increase to 79.8 Mtoe and electricity use to 10.7 Mtoe. The share of renewable energy sources is expected to lie between 3.5% and 4.5%, and the government anticipates a share of renewables in electricity generation of 11% or more.

The government regularly publishes figures on the energy efficiency gains of the Dutch economy. In the period 1990–2000, the aggregate figure for energy efficiency gains was 1.2% per annum. For the ten years to come, a percentage of 1.2%–1.4% is expected. Total energy use in the Netherlands increased in 1990–2000 by 1% per annum; for the next ten years, an annual increase of 0.6% is expected[6].

The new Energy Report 2002 also sets the agenda for energy efficiency policy. New policy elements comprise:

- Increased efforts to reduce free-riding in the allocation of subsidies.
- More focus on the reduction of CO_2 emissions, not least through energy conservation.
- More emphasis on the long-term importance of a profound transition to a sustainable energy system.

OIL

To improve the economic efficiency of the downstream oil market, the Dutch government has altered the licensing procedure for filling stations on motorways. Licences are now allocated only for fifteen years. All filling stations on motorways will be reallocated by means of auctions, the first of which is due in summer 2002. In addition, the four biggest oil companies agreed to reduce their presence on motorways from 200 to 150 stations within the next four years.

6. It should be noted that in 2001 a change was made to the way in which the use of renewables is accounted for. Savings of fossil fuels resulting from the increased use of renewables, imports, dematerialisation or fuel switching are no longer counted as energy savings; 0.2 percentage points should be subtracted from earlier energy efficiency figures to make the two sets of figures comparable.

Simultaneously, cleaner motor fuels are being phased in. Facilitated by tax incentives, the Dutch market had shifted for 100% to low-sulphur diesel (50 ppm) in January 2001. In November 2002, a similar shift to 50 ppm gasoline is expected.

NATURAL GAS

Reform of the Dutch gas market continues. The government intends to reform the Dutch gas structure (also known as the "Gasgebouw"), and in particular the upstream structure that operates the concession of the vast Groningen gas field. On 18 November 2001, the government and DSM (De StaatsMijnen, a privatised chemicals group) reached agreement that the government would purchase all of DSM's financial stakes in the upstream structure. The acquisition, worth €1.243 billion, became effective on 28 December 2001. As a result, half of the Groningen concession now belongs directly to the state-owned energy company EBN (Energie Beheer Nederland B.V.) and half to NAM (Nederlandse Aardolie Maatschappij B.V., itself owned 50% by Shell and 50% by ExxonMobil).

This action is the first step towards reducing the government's role in the management of the Dutch gas industry and towards a bigger role for commercial decisions, in order to adapt the Dutch gas industry to the requirements of future energy market liberalisation. Negotiations for further reform are under way between Shell, ExxonMobil, EBN and the government. Progress has been made in the discussions with Shell and ExxonMobil, but a future structure has not yet been set out in concrete terms. Among the various public interest principles that are applied in the discussions on the future structure, continuation of the Dutch small-fields policy and enhanced transparency of the new structure are particularly important. Parliament is currently discussing the reform of the Dutch gas structure as well as reform of the Natural Gas Act and the Mining Bill. The new Mining Act is expected to be in force from January 2003.

Meanwhile, the Dutch downstream gas company Gasunie (N.V. Nederlandse Gasunie) is being unbundled. Gasunie was reorganised into a transport and a trading arm on 1 January 2002 as an interim step towards the full legal separation of the company. Strict segregation of trading and transport activities is necessary in connection with the further deregulation of the gas market. Since 1 January 2002, Gasunie (short for Gasunie Trade & Supply) is involved solely in the supply of gas. The network operations in the Netherlands are conducted by Gastransport Services.

On 1 January 2002, competition was introduced for the second group of eligible customers. Customers consuming over 1 million cubic metres of natural gas per year are now eligible for competition. This has resulted in a market opening of over 60%. In 2000 and 2001, the Dutch energy regulator DTe (Dienst uitvoering en toezicht energie) issued binding rules for terms and tariffs of access to gas networks and storage (gasrichtlijnen). DTe strives to improve the cost-reflectiveness of these tariffs and conditions.

ELECTRICITY

On 1 January 2002, the second group of customers became eligible for competition in the Dutch electricity market, resulting in a market opening of 62.5%. The third group that is not yet eligible for competition comprises only those customers with a grid connection of 3.80 ampère or less. These customers will become eligible after 31 December 2003. Since 1 July 2001, all customers (including households) are free to choose their supplier of sustainable (green) electricity.

With the liberalisation of the energy market, the Parliament demanded that the national high-voltage grid (TenneT) be brought under government control. Negotiations since 1998 between the Ministry of Economic Affairs and the electricity producers resulted in the Electricity Production Sector Transition Act of 21 December 2000 (the so-called OEPS Act). Among other things, the act stipulated the dissolution of SEP (Samenwerkende Elektriciteits-Productiebedrijven), the former co-operation organisation of Dutch electricity producers. It set out rules for the assignment of rights and obligations after the termination of SEP and compensation of related costs. The act also obliged the State to buy TenneT from SEP. After protracted negotiations, the government bought TenneT at the end of November 2001. On 25 July 2001, the European Commission decided that the Transition Act was in accordance with the European Treaty. Currently an amendment to the Transition Act is being developed to facilitate the financial transfer.

TenneT currently makes interconnector capacity of 3 900 MW available for competitive electricity imports, exports and transit. Since 1 January 2001, the distribution of available cross-border import capacity has taken place by means of an auction, which TenneT organises in co-operation with the German and Belgian grid administrators involved. The auction is a regulated activity prescribed by Dutch legislation and the codes derived from it. Yearly, monthly and daily capacity is sold by auction.

Nevertheless, the Netherlands' interconnections with surrounding countries are often congested. The European Commission identified the Belgium-Netherlands interconnection as one of seven major bottlenecks in the European transmission network. That is partly because some 25% of Dutch incoming capacity is reserved for long-term supply arrangements.

There is no obligation to privatise the power industry in the Netherlands, but there are plans to sell off some of the regional distribution companies. For this reason the Minister of Economic Affairs issued guidelines regarding privatisation on 10 July 2001. On the basis of these policy rules – which are not yet binding law – 49% of the shares in the regional network companies can be privatised up to 1 January 2004. Draft legislation containing these rules was submitted to

Parliament on 18 January 2002. The Bill establishes rules for the independence of regional grid operators, sets out criteria for the privatisation of regional distribution companies and lays down the powers of the Minister of Economic Affairs in case regional grid operators neglect their duties. Under this Bill, companies require permission from the Minister of Economic Affairs for privatisation.

Green Electricity and Co-generation

In 2001, the Dutch government liberalised the green electricity market. From 1 July 2001, all consumers are free to choose their supplier of green electricity. To support the free market, the Dutch government implemented a system of green certificates. These certificates function as guarantees of origin, so there can be no doubt about the source of the electricity. TenneT, the national grid manager, issues the certificates. The certificates can be traded separately from the electricity. Eventually, suppliers of green electricity transfer the certificates to the Tax Agency in order to apply for the exemption from the Regulatory Energy Tax (REB). From 1 January 2002, Dutch green certificates are also awarded to renewable electricity generated in other countries, but the electricity must meet certain criteria to qualify. The liberalisation of the market brought a new focus on green electricity and caused a rise in demand from 150 000 households consuming green electricity at the beginning of 2001 to 700 000 in early 2002.

A covenant (voluntary agreement) is under preparation between the government, the owners of coal-fired power plants and regional (environmental) authorities regarding the use of biomass as a substitute for coal. This agreement aims at a substantial reduction of CO_2 emissions (6 million tonnes) by 2012. Technical details are expected to be determined before the end of 2002.

Almost half of Dutch electricity is generated in co-generation plants. On the energy market, high prices of natural gas and low prices of coal-based electricity have strained the competitiveness of co-generation plants. To prevent a major reduction of co-generation output, a temporally limited tax refund of Regulatory Energy Tax revenues was introduced for CHP plants. For the years 2001 and 2002, the refund is €0.0057 for each kWh supplied to the grid. To be entitled to the refund, the plant must have a minimum thermal efficiency of 60%. A maximum of €5.7 million is refunded per installation. As a result, the operation of the co-generation plants is almost unchanged.

RENEWABLE ENERGY SOURCES

According to Dutch statistics, renewable energy sources contributed 1.3% to the Netherlands' primary energy use in the year 2000 (2.4% of total primary energy supply, according to IEA statistics). The government's target for the contribution of renewables in year 2000 was 3%. In the light of this shortfall, the portfolio of policy measures geared at the promotion of renewable energy was evaluated, resulting in a new strategy.

The evaluation showed that, as well as stimulating the rise in demand (from 100 000 customers at end-1999 to 700 000 at the beginning of 2002), the liberalisation of the green electricity market also led to the admission of new suppliers into the power market. It is expected that, since the energy tax on fossil electricity (REB) does not apply to renewables, the green electricity market will grow further. As noted above, the REB on fossil electricity has continued to rise in 2001, to reach €0.06/kWh in 2002, making production and trade in green electricity a profitable business on average.

On the other hand, the production of electricity from renewable sources in the Netherlands has not risen enough to meet demand. Integration and spatial planning issues still hinder investments in renewables, especially for wind turbines.

As national production of electricity from renewables is lagging behind targets, imports of green electricity from other EU countries are expected to become more important in the coming years. The Renewable Electricity Directive (2001/77/EG) of the European Commission reinforces this tendency. Nevertheless, since the Netherlands does not want to become overly dependent on imports of renewables-based electricity, the government is seeking ways of stimulating national production in a more effective way.

The new strategy focuses more on removing obstacles to the implementation of wind energy, both offshore and onshore, and biomass, both options having a large potential in the Netherlands. Renewable energy options with only a small expected contribution to the 2020 target of 10%, like solar-photovoltaic and residential heat pumps, will no longer be stimulated by specific technology programmes. Instead, the approach focuses on generic demand-side programmes, like the Energy Investment Scheme for households (EPR), which subsidises 50% of investments in renewable energy systems.

At the end of 2003, the first offshore wind park will be launched. It will be a 100 MW demonstration facility. Offshore wind is expected to be able to grow to 6 000 MW of power in 2020. Onshore wind is expected to grow to 1 500 MW in the year 2010, as a result of a strong and concrete commitment made by the twelve provinces to the national government at the end of 2001 in the “Blow” Covenant. As biomass has a large variety of applications and technologies, an in-depth implementation strategy will be developed in 2002.

PORTUGAL

ENERGY POLICY OVERVIEW

During the last two years, the Portuguese government has initiated liberalisation of the electricity market, continued the privatisation of energy companies, worked towards the creation of an Iberian electricity market, and introduced new policies and programmes to reduce energy intensity and to mitigate environmental problems. A National Plan for Climate Change is currently under development. The government is also trying to reduce the dependency on imported energies.

In 2000, a new Economic Operational Plan (OPE) was launched under the European Community Support Framework for the development of economic activities. The OPE contains two sub-programmes for the energy sector with a €1.6 billion budget for the period 2000–6:

- The "Measure to Support Modernisation and Development of Electricity and Gas Infrastructures for Public Use" (budget €0.7 billion).
- The "Measure to Support the Harnessing of Energy Potential[7] and Rationalisation of Consumption" (budget €0.9 billion).

The Energy Conservation Centre, created in 1984, was transformed into the Agency for Energy (ADENE) by Decree-Law 223 of 2000. The main tasks of ADENE will be to prepare studies on energy efficiency and renewables, to propose standards for electrical applications and to disseminate information on these topics.

ENERGY SUPPLY AND DEMAND

In 2000, total primary energy supply (TPES) was 24.6 Mtoe in 2000, representing rapid growth of 43% over the 1990 figure. In spite of the strong growth, TPES per capita in 2000 was still 2.46 toe, far below the average of the OECD Europe, 3.39 toe. Since the introduction of natural gas in 1997, its share in TPES has been increasing and reached 8.3% in 2000. Gas has partly replaced oil in electricity generation and the share of oil in TPES decreased from 68.2% in 1990 to 63.2% in 2000. Because of its limited domestic energy resources, Portugal imported 87% of the energy it consumed in 2000.

7. The objective is to promote the use of renewables and co-generation.

The government expects TPES to grow much more slowly in this decade, by only 6.3% by 2010. The share of gas in TPES is expected to reach 20% whereas the share of oil is expected to decrease further to about 51%.

Final energy consumption increased by 45% between 1990 and 2000. Growth was strongest in the transport sector (75%), followed by the residential, services and other sectors (47%) and industry (27%). Final consumption of fossil fuels increased by 49% and that of electricity by 63%.

ENERGY AND THE ENVIRONMENT

Under the Kyoto Protocol and the EU "burden-sharing" agreement, Portugal agreed to limit the net increase in GHG emissions to 27% above 1990 volumes by 2008–12. In spite of this target, energy-related CO_2 emissions in 2000 were 50% higher than those in 1990.

The government is preparing a National Plan for Climate Change (PNAC). A working version of the plan was published in March 2002 and the government expects it to be finalised during 2002. The working version quantifies the emissions reductions required to achieve the Kyoto target under the most probable socio-economic development and aims at opening public discussion on the measures and their implementation. It also defines some immediate measures and their potential for reducing emissions and their cost. One of the conclusions made in the working version is that Portugal will rely heavily on domestic measures to meet the emissions reduction target. The plan is currently under public consultation and it has been criticised for not providing a detailed analysis on the emissions reduction potential, and the cost, of many prospective measures. The government plans to introduce sectoral emissions reduction targets, new measures and monitoring programmes in the final version of the plan.

To reduce GHG emissions, Portugal has been relying on energy efficiency regulations in the industry and in the household sectors, voluntary agreements with some industrial sectors, development of public transport and tax credits on photovoltaic equipment. A new measure introduced in 2001 was the E4 Programme (see Energy Efficiency, below) which promotes energy efficiency, renewables and co-generation. Other measures introduced in 2001 are tax relief for new cars which replace vehicles over ten years old, and for cars using LPG or natural gas. The restructuring of transport fuel taxation is also being discussed.

ENERGY EFFICIENCY

The government's policy is to promote energy efficiency through sector-specific legislative instruments and fiscal incentives. The Energy Efficiency and Endogenous Energies Programme (the E4 Programme) was launched in October 2001 as part of the energy activities in the OPE. It provides financing for energy efficiency, co-generation and wind power projects. In addition to this programme, the government has established several co-operation programmes with the private sector aiming at efficient energy use. Furthermore, the government gives financial support to local municipal authorities for optimisation of water supply installations, sewage systems and street lighting; and for using energy potential from waste and residues.

In the industrial sector, the government continues monitoring of the results of the "Management Regulations for Energy Consumption" (RGCE) which was introduced in 1982. The regulation applies to industrial installations whose energy consumption exceeds 1 000 toe per year and to industrial equipment with a power rating (or nominal energy consumption) of more than 0.3 toe per hour. In the transport sector, the "Regulation for the Management of Energy Consumption in Transport" (RGCT) was introduced in 1991. It applies to the public and private transport companies whose energy consumption exceeds 500 toe per year. The RGCT requires these companies to carry out energy auditing and to publish a plan for the rationalisation of their energy use every three years. The Directorate-General for Energy monitors the audit results and the plans when the companies apply for financial support.

The use of natural gas in vehicles began in the public transport systems of Braga and Porto in 2000 and in Lisbon in 2001. The extra cost involved in purchasing buses that use natural gas is partially financed through the OPE Programme.

The E4 Programme contains a sub-programme for the building sector, the "National Energy Efficiency in Buildings Programme". One of the activities within this programme is to review the "Regulation on the Characteristics of the Thermal Behaviour of Buildings" (RCCTE) of 1990 and the "Regulation on the Energy Systems for Air Conditioning of Buildings" (RSECE) of 1998. Other activities include the promotion of energy efficiency measures in public buildings and the promotion of the use of renewable energies in buildings. Portugal also considers introducing building energy certification.

OIL

Total oil supply increased from 11.7 Mtoe in 1990 to 15.6 Mtoe in 2000. Whereas final consumption of oil increased rapidly, particularly in the transport sector, oil use declined in power generation. Price ceilings are still maintained for gasoline and diesel.

The Portuguese oil sector was dominated by Petrogal, which owned the two refineries in the country and accounted for about half of the distribution market. In 1999, the State created a new holding company, GALP Petróleos and Gás de Portugal SGPS SA, which combined all the operations of Petrogal (oil), Gás de Portugal (gas distribution) and its subsidiary Transgas (gas import, transmission and sales); the name of the new company has been GALP Energia since 2000. The main owners of GALP Energia are the State (with 34.8%), ENI, the Italian oil and gas group (33.3%), Electricidade de Portugal (14.3%), Caixa Geral de Depósitos SA, a Portuguese public bank (13.5%) and the Spanish utility Iberdrola SA (4%). In addition to normal shares, the government still holds a "golden share" with the power of veto; it has planned a public offering of 20% of GALP Energia for 2003.

As Portugal has been having difficulties complying with the 90-day stockholding obligation over the past years, the Portuguese Administration hopes to improve the stock situation by institutional and legal reforms. The EU directive on oil stocks and the IEA stockholding rules were transposed to the Portuguese legislation in January 2001 (Decree-Law 10/2001) and revised in December 2001 (Decree-Law 339-D/2001), which provided for the establishment of a stockholding agency Entidade Gestora de Reservas Estratégicas de Produtos Petrolíferos (EGREP) responsible for at least one-third of the total obligation of reserves of petroleum products. It is planned that the EGREP should be fully established by the end of 2002.

NATURAL GAS

Natural gas use in Portugal began in 1997 and has increased rapidly. In 2000, some 59% of gas was used for power generation in two power plants; the rest was consumed mainly by industry. In 2000, all supplies came via Spain by pipeline from Algeria. Portugal signed a twenty-year contract for LNG imports from Nigeria in 1999. These imports have begun this year through the Spanish terminal at Huelva from where they are piped into Portugal. A domestic LNG terminal will be commissioned in Sines in 2003.

The high-pressure transmission network has already been completed. Because the gas market is developing, the networks do not yet fully cover the country. At present, the government intends to introduce natural gas in the inner part of the country. GALP Transgas is building an underground storage facility at Carriço, near Pombal, close to the coast. Regulations were developed to ensure safe operation of all gas facilities.

The dominant player in the gas market is GALP Energia through its subsidiaries, GALP Transgas (supply, transmission and sales to large consumers) and GALP Gas (sub-holding of most of the regional distribution companies).

The EU gas directive allows Portugal to delay the introduction of competition in the gas market until 2007 because it is still emerging. The directive was transposed into the Portuguese legislation by Decree-Law 14/2001 in January 2001 according to which liberalisation should start at the end of the derogation.

ELECTRICITY

In 2000, electricity consumption was 38.4 TWh, compared to 23.5 TWh in 1990. This corresponds to an average growth rate of 5% per year. Coal stations accounted for 33.9% of total gross electricity generation in 2000, followed by hydro (26.1%), oil (19.4%), gas (16.5%) and combustible renewables and waste (3.6%). Since its introduction in 1997, the share of natural gas has expanded sharply, replacing oil in power generation. The share of oil dropped from 27.5% while the share of gas increased substantially from 5.2% and coal slightly increased from 31% between 1998 and 2000.

Electricidade de Portugal (EDP) generated 62% of electricity in 2000 and controls all electricity distribution. With the conclusion of the fourth phase of the privatisation of EDP, at the end of October 2000, the government stake was reduced to 32.6% but the government still holds a "golden share" with a power of veto. The National Electricity Grid (REN), the transmission system operator, was legally separated from EDP in November 2000 and the government now owns 70% of its shares.

There are two electricity systems in Portugal, the Public Electricity System (PES) and the Independent Electricity System (IES); generators and consumers are either in one or the other. The PES is characterised by capacity planning and purchasing power agreements between generators and REN. The IES consists of the Non-Binding System (NBS), characterised by free contracts between generators and eligible consumers, and the Special Regime which includes co-generators and generators using renewable sources of energy. The PES is organised on the basis of long-term contracts linking producers and the transmission system operator (TSO) and an obligation to supply to captive consumers. Legal unbundling is required between the generation, transmission and distribution activities in both systems.

The net maximum electricity generating capacity was 9.8 GW in the PES and 1.1 GW in the IES at the end of 2000. Sales to the grid in the Special Regime are forecast to increase from 3.1 TWh in 2002 to 11.1 TWh by 2010, and in the PES/NBS from 37.3 TWh to 42.9 TWh over the same period. Generation from natural gas in the PES/NBS and from wind power and co-generation in the IES is forecast to increase significantly, whereas not much change is expected in the use of other fuels.

In 1999, the consumers with annual consumption above 30 GWh within the IES became eligible to choose their suppliers and the distribution companies become eligible for 8% of their supplies, corresponding to 27% market opening. The threshold for large consumers was reduced to 20 GWh in 2000 and to 9 GWh/year in 2001, bringing the market opening to 33%. In 2002, 45% of the market was opened as all medium- and high-voltage consumers became eligible. There has been no change for the eligibility of the distribution companies after 1999. The large consumers who want to leave PES and change their supplier have to give a one-year notice.

Regulation of the electricity sector is split between the Ministry of Economic Affairs and an independent regulatory agency, the Entidade Reguladora dos Servicios Energeticos (ERSE). The ministry is responsible for the formulation of the regulatory framework and licensing based on recommendations from ERSE. ERSE is responsible for issuing codes for tariffs, commercial relations, network and interconnection access, dispatch, and for defining consumer eligibility thresholds within the limits established in the legislation. ERSE is also responsible for setting the regulated prices of electricity and network services.

The government is trying to improve the efficiency and quality of service in the whole electricity system. The government separated REN from EDP to increase its independence and to improve the access of independent producers, including those in the Special Regime (co-generation and renewables), to the national networks. Decree-Law 312/2001 was issued in December 2001 to define the conditions for managing the reception of electricity from independent producers into the transmission network and the Public Electricity System.

The total volume of electricity trade has increased from 7.7 TWh in 1998 to 8.5 TWh in 2000 but imports and exports almost offset each other. The volume of trade is expected to increase by the establishment of the Iberian Electricity Market (IBELM): on 14 November 2001, the governments of Portugal and Spain signed a protocol to create the Market by 1 January 2003 at the latest. According to the protocol, IBELM should "guarantee all agents established in both countries access to the Iberian Market Operator and to the interconnections with third countries under free and equal trading conditions". The Iberian Market Operator will be a new entity with owners from both countries.

Electricity prices decreased in the late 1990s for both industrial and small consumers. For household consumers, the average price in Portugal in 2000 was US$ 1 390 per toe compared to an average of US$ 1 225 per toe in the OECD. Portugal does not collect price data for larger industries, which should be taken into account when comparing the average electricity price for small industrial consumers, US$ 779.1 per toe, to the OECD average price for all industries of US$ 545.7 per toe.

RENEWABLES

Portugal's domestic energy production stems only from renewable sources. In 2000, the contribution of all renewables, including hydropower, to the total primary energy supply was 12.7%. Electricity production from renewables was 13 TWh, representing 30.3% of total gross generation in 2000. Although hydropower remains the most important renewable source for electricity generation, the generation capacity of wind power is also increasing. In 2000–1, twelve wind farms began operation, increasing total generating capacity by 54 MW to 109 MW. Nine wind farms with a total capacity of 77.5 MW are currently under construction and are expected to come into operation in 2002.

In September 2001, the EU adopted a new directive (2001/77/EC) to promote electricity production from renewables. Following the directive, Portugal adopted an indicative target to generate 39% of its electricity from renewables, including large-scale hydro, by 2010. In addition to minimum feed-in tariffs with power purchase obligations, renewable energies are promoted through interest-free loans for large-scale projects, direct investment subsidies for small projects, reduced VAT on equipment and R&D.

Because of such promotion schemes, private companies have showed considerable interest in developing more wind power under the Special Regime after access to the network was simplified by Decree-Law 312/2001 and after new feed-in tariffs were established as part of the E4 Programme. In January 2002 alone, the potential generators applied for a license for 7 000 MW of wind power capacity and 600 MW of other renewable and co-generation capacity. The energy administration is concerned about the security of supply if a large amount of electricity comes from such an energy source as easily interrupted as wind, and about the technical difficulties in connecting a lot of wind power to the transmission network.

RESEARCH AND DEVELOPMENT

In 2001, the public budget for R&D in energy was €1.08 million, of which 64% was used for R&D on renewable energy, 24% on fossil fuels and 12% on energy transmission grids. EU funding accounts for about two-thirds of the national energy R&D budget. The principal research institution is the National Institute for Engineering and Industrial Technology (INETI), which uses 80% of the energy R&D budget.

SWEDEN

GENERAL ENERGY POLICY

On 21 March 2002, the Swedish government presented its Energy Policy Bill "Co-operation for a Secure, Efficient and Environment-Friendly Energy Supply" (2001/02:143). This report, approved by Parliament on 11 June 2002, re-affirmed the country's established energy policy objectives:

- Create the conditions for efficient energy use and a cost-efficient Swedish energy supply with low adverse impact on health, the environment and the climate.
- Facilitate the transformation into an ecologically sustainable society, promoting sound economic and social development in Sweden.
- Contribute to the creation of stable conditions for a competitive business sector, and to the renewal and development of Swedish industry.
- Contribute to broadening co-operation within the Baltic region with regard to energy, the environment and the climate.

The Energy Policy Bill also contained three main proposals:

- A new method to promote environment-friendly and renewable electricity production through a quota-based trading programme for green electricity certificates.
- Measures designed to encourage more efficient energy consumption through the rationalisation of existing policy measures and the national and regional dissemination of knowledge.
- A strengthening of the competitiveness of combined heat and power (CHP) by exempting such plants from certain taxes on energy products. The issue is to be decided in connection with the budget decision for 2003.

The Energy Bill also addressed the country's planned phase-out of nuclear power. In particular, it discussed a recent German agreement for the controlled closure of nuclear reactors and proposed that the issue be further explored.

There is currently no systematic set of indicators to measure progress in achieving the country's energy policy objectives, although the government has instructed the Swedish Energy Agency to develop a set of indicators that can serve as a basis for the follow-up of energy policy objectives. A report from the agency containing proposals for these indicators was expected by 31 October 2002.

Sweden has three different levies on energy products: energy tax, carbon dioxide tax, and sulphur tax. Certain industries have been granted complete exemption from the energy tax and a partial reduction in the carbon tax. These exemptions had applied to the manufacturing sector and, on 1 July 2000, the exemption was extended to the agriculture, forestry and aquaculture sectors (Government Bill 1999/2000:105).

Sweden is implementing a "green tax exchange" whereby taxes on environment-harmful activities are raised, while taxes on labour are reduced by a roughly equal amount. A step in the green tax exchange was performed in 2001, when taxation on energy products was increased by about SKr 3 billion[8]. The CO_2 tax rate was raised from SKr 370 per tonne to SKr 530 per tonne. The energy tax on diesel went up by SKr 0.1 per litre and the energy tax on electricity was raised by SKr 0.018 per kWh. In accordance with the principles of the green tax exchange, the bulk of this increase was offset by a higher tax-free allowance and a reduction in employer's levies. A further green tax exchange was carried out in 2002 when taxation on energy products was raised by about SKr 1.7 billion. The tax rate on CO_2 was raised from SKr 530 per tonne to SKr 630 per tonne, and the energy tax on electricity went up by SKr 0.012 per kWh; taxes on labour were reduced by a compensatory amount. The rises in the tax on CO_2 and electricity affect only consumers. Taxes on the transport sector have been left largely unchanged. The reductions in CO_2 tax that apply to the industries with exemptions (i.e., manufacturing, agriculture, forestry and aquaculture) have been adjusted from 50% to 70%. This adjustment largely offsets the higher CO_2 tax and keeps the overall tax position of these sectors unchanged.

In April 2001, the government appointed a Parliamentary Delegation (Directive 2001:29) to investigate the taxation of energy used for heating and stationary engines in sectors open to international competition. The results of this investigation, due 31 December 2002, will form the basis for future proposals on the green tax exchange. Also in April 2001, the government appointed a Commission of Inquiry with the mandate to revise the taxation of road traffic. Although the final report is not due until 31 December 2003, an interim report was published in June 2002, in which the commission addresses environment, traffic safety and competition. The advantages and disadvantages of a kilometre tax are discussed, and special attention is paid to taxation in the haulage industry.

ENERGY SUPPLY AND DEMAND

In 2000, Swedish TPES was 47.5 Mtoe, representing a 2% rise from the 1990 figure. In 2000, nuclear power was the largest single contributor to TPES, with 31.5% of the total, followed by oil with 28.1%, biomass with 17.5%, and hydropower with 14.3%. Since 1990, the share of nuclear energy in TPES has dropped from 38.1%; even in 1999, the share was 37.8%. The drop in nuclear TPES in 2000 was due to above-

8. On 31 July 2002, SKr 1 = € 0.10823.

average rainfall (making inexpensive hydropower more readily available) and, to a lesser extent, the closure of the Barsebäck 1 reactor in November 1999. The loss in energy has been made up with additional hydropower, electricity imports and biomass.

TFC for Sweden in 2000 was 35.7 Mtoe, an increase of 11% since 1990. Oil is the dominant contributor to national TFC with 40.3% of the total, followed by electricity with 30.9%, biomass with 15.4%, and heat with 10%. While all of these energy sources have risen in absolute terms since 1990, heat has risen the most over that period, almost doubling its contribution since 1990.

Sweden imported 35.2% of its TPES in 2000, with the remainder coming from indigenous sources. This is the same share of imports as in 1990. From 1999 to 2000, the share of imports in the TPES rose by 2.1%, largely as a result of the closure of Barsebäck 1.

ENERGY AND THE ENVIRONMENT

At the EU Council of Environment Ministers in June 1998, Sweden agreed to a national target to limit GHG emissions to a volume 4% above that of 1990 during the target period 2008–12. In 1998, the Swedish government appointed a Parliamentary Committee of Inquiry to present proposals for a Swedish climate strategy. The committee presented its report in April 2000. Building upon the findings of this report, the Swedish Parliament, in March 2002, adopted a climate strategy in accordance with the Government Bill, "A Swedish Climate Change Strategy" (2001/02:55), presented on 30 November 2001. The new strategy builds on existing decisions in energy and transport policy as well as on the Government Bill on Infrastructure and the Energy Policy Bill presented in spring 2002.

The Climate Change Strategy aims to lower Swedish emissions by 4% from 1990 figures by 2010, a target substantially more stringent than that required by the country's Kyoto commitments. Emissions of CO_2 in Sweden were 1.6% higher in 2000 than they were in 1990. The strategy includes a diverse array of measures to achieve the goals in reductions. The primary such tool will be climate investment programmes undertaken by municipalities, which can apply for funds to be used to make investments to reduce emissions. Funding is projected to be SKr 200 million in 2002, SKr 300 million in 2003, and SKr 400 million in 2004. Additional measures include a system of green electricity certificates for production from renewable sources, a strategy for alternative fuels and more dissemination of public information on climate change. Furthermore, a commission will be established to analyse fossil fuel efficiency improvements as well as alternatives to fossil fuel use. The Environmental Objectives Council was established on 1 January 2002 and will co-ordinate the country's emissions reduction activities.

The Climate Change Strategy does not include the use of carbon sinks or flexible mechanisms to reach Sweden's emissions reduction targets. However, in July 2001, the government appointed a Parliamentary Commission of Inquiry to draft a proposal for a regulatory framework for the use of the flexible mechanisms allowed under the Kyoto Protocol. The proposal is to be submitted on 31 December 2002.

ENERGY EFFICIENCY

In 2000, Sweden had an energy intensity[9] of 0.2688 – a slight improvement over the 1990 figure of 0.2892. To seek further reductions in energy intensity, the government appointed an inter-ministerial Working Group for Rational Energy Consumption on 1 March 2001 with a brief to propose measures for the promotion of energy efficiency. The working group presented its report, "More Efficient Energy Consumption: Proposals for the Market-Based Measures", in October 2001.

Among the measures it proposed was the establishment of long-term voluntary agreements between government and energy-intensive companies, whereby companies undertake to introduce energy management systems as a way of identifying potential energy-saving initiatives and technologies. The extent to which economic incentives can be offered by the government to encourage the realisation of these savings is still under examination.

The extensive use of district heating in Sweden contributes to the country's efficient use of energy. As part of a 2001 Bill, "Energy Markets in Transition – Better Regulations and Supervision", the government emphasised the importance of stimulating competition in this sector in order to increase productivity and lower prices. The appointment of a Commission of Inquiry to study this issue further is in the planning stages.

RENEWABLE ENERGY

Although still modest, contributions from wind, solar, geothermal and biogas have grown rapidly in Sweden over the last ten years. From a total contribution to TPES of 4.6 ktoe in 1990, production from these renewable sources increased nearly twentyfold to 2000, when they supplied 71.5 ktoe, or 0.2% of Swedish TPES. Wind power production went from 1.1 ktoe in 1990 to 38.4 ktoe in 2000. The government has announced a national planning objective of producing 10 TWh (860 ktoe) from wind power in 2015. Solar thermal production rose from 3.2 ktoe (1990) to 5.1 ktoe (2000), while biogas went from no production in 1990 to 27.9 ktoe in 2000. Sweden currently has no generation from geothermal plants. In addition to the aforementioned renewable energy technologies, Sweden has considerable biomass and hydropower resources. In 2000, biomass contributed 8.3 Mtoe to national TPES (17.5%) while hydropower contributed 6.8 Mtoe (14.3%).

9. Defined as the country's TPES over its GDP, in units of toe/1995 US$ (PPP).

Currently Sweden has a support scheme of environmental bonus tax exemptions for electricity coming from wind power, small-scale hydro (<1.5 MW), or biofuel-fired CHP plants, in value the equivalent of SKr 0.181/kWh. The country also has a support scheme for small-scale electricity production plants (<1.5 MW, which includes many renewable energy facilities). These plants receive a supplement for their power from the government equal to SKr 0.09/kWh. In addition, the government allocated SKr 40 million per annum in 2001 and 2002 towards public support for investments in wind power, although the support cannot exceed 10% of the total cost of installing the facility.

Sweden will be replacing much of this support mechanism with the new green electricity certificate trading mechanism. Under this system, power plants generating electricity from renewable resources would be given certificates for every MWh of electricity produced. Wind power, biofuels, wave, hydroelectric, solar and geothermal facilities would be eligible to receive these certificates. Households and companies from selected industries would be required to purchase these green certificates in proportion[10] to their electricity consumption, thus creating a market for the certificates which would aid renewable energy facilities. The government also plans to create a floor for the value of the certificates, guaranteeing to buy them at a certain minimum price should the market for such certificates fall below that amount. Certain energy-intensive industries – such as pulp and paper, chemical and steel – would be exempted from the requirement to purchase certificates, so as to ensure that Swedish industries do not operate at an international disadvantage; the exemption will remain in place since competitors in other countries do not operate under similar requirements.

To ensure that consumers receive adequate information about the costs of the new system, the price component of the green electricity certificate will be included as a separate entry on all electricity bills. The government estimates that the cost for household customers will be SKr 0.005/kWh. For a typical customer living in an apartment, this amounts to approximately SKr 100 per year, and for a home-owner with electrical heating, it amounts to approximately 200 SKr per year. The government was scheduled to present its detailed proposals for this system to Parliament in the autumn of 2002, with the system entering into force on 1 January 2003.

FOSSIL FUELS

In 2000, oil contributed 13.4 Mtoe to Sweden's TPES, or 28.1% of the total. This percentage share is down from 1990 when oil contributed 29.6% to Swedish TPES. The bulk of oil demand in Sweden comes from transport, which, in 2000, consumed 55.7% of the TFC of oil in Sweden. Road transport alone accounted for 47.7% of oil

10. The exact proportion between electricity consumption and purchase of green certificates is still being debated. It is expected that Parliament will decide on this matter at the end of 2002.

consumption. Although industry and residences have decreased their oil consumption since 1990, down by 4.9% and 25.9% respectively, oil consumption in the transport sector has risen by 11.3% over the same period of time.

Sweden has no oil reserves and no exploration is currently being undertaken. In 2001, 46% of crude oil imports came from Norway, 22% from other OECD countries, 27% from OPEC countries, and 6% from the former Soviet Union. Sweden has substantial refining capacity and acts as a net exporter of petroleum products. In 2000, the country had net exports equal to 23% of its domestic production of refined products. The largest export markets are in diesel fuel and heavy fuel oil.

Natural gas makes a modest contribution to Sweden's energy sector. In 2000, it contributed 0.7 Mtoe to Swedish TPES, or 1.5% of the total. Gas use has increased by 32% from 1990 to 2000. The majority of gas demand in the country comes from industry (64%) and residences (22%).

On 1 August 2000, the Natural Gas Act implementing the EU gas directive was introduced. This act gave supplier choice to power producers and all customers with annual demand higher than 25 million m^3. Supplier choice will be expanded to customers using more than 15 million m^3 in 2003 and to all customers in 2007. Non-discriminatory third-party access to pipelines must be provided at regulated rates.

ELECTRICITY

In 2000, Sweden consumed 11.0 Mtoe of electricity (128.4 TWh), accounting for 30.9% of the country's TFC. Since 1990, absolute electricity demand has risen by 6.6% and its share of TFC has fallen from 32.2% to 30.9%. Demand from the industrial sector is highest, accounting for 44.1% of the electricity TFC in 2000, followed by the residential sector, which consumed 32.8% of the power in the same year. Hydro and nuclear power are the dominant forms of power generation. In 2000, hydropower facilities generated 54.1% of the country's power while nuclear generated 39.3%. In 1990, hydropower and nuclear shares were 49.7% and 46.7%, respectively, while on average throughout the 1990s, hydropower generated 46.6% of the country's electricity and nuclear 46.9%. Variations in these percentage shares from year to year result from precipitation patterns and the availability of the nuclear facilities, and are not part of significant long-term trends.

The electricity market in Sweden has been liberalised since 1 January 1996, with all customers free to choose their supplier. Since then, wholesale electricity prices have fallen, coming as a result of both keener competition and good availability of inexpensive hydropower thanks to above-average precipitation. On the retail level, industrial and residential price trends have diverged. Average end-use prices for a medium-sized industrial plant have fallen from SKr 34.6/MWh in 1996 to SKr 24.1/MWh in 2001. For residential customers, however, end-user prices have risen from SKr 63.5/kWh in 1996 to SKr 74.7/MWh in 2001,with much of this increase coming from a higher tax on electricity.

Sweden is part of the NordPool, an electricity-trading pool comprising Sweden, Norway, Finland and Denmark, which conducts substantial international power trading. In 2000, Sweden had both imports and exports with Denmark, Finland, Germany, Norway and Poland. This trade produced gross imports of 18 308 GWh (1.6 Mtoe), an amount equivalent to 15% of electricity final consumption. Sweden also exported 13 630 GWh (1.2 Mtoe) in the same year, for total net imports of 4 687 MWh (0.4 Mtoe). Electricity imports have risen by 220% since 1990 and exports by 200%. Sweden recently took steps to increase the ease of international power transactions. As of 1 March 2002, the country abolished a tariff which had been applied to cross-border power sales with Denmark.

In 2001, domestic end-users saw dramatic increases in electricity prices, with the energy components of their bills at times rising by between 30% and 40% compared to 2000. In response to this price movement and the public and media attention it attracted, the government established the Commission on Competition in Electricity Supply, whose final report, "Competition in the Electricity Market" (SOU 2002:7), was released in January 2002. The report concluded that the price increases were not a result of market manipulation by electricity supply companies, but rather a legitimate pass-through of price increases seen in the NordPool wholesale market resulting from low hydro reserves. However, the report also raised several concerns about the market, noting the decreasing number of market suppliers and the resulting potential for non-competitive pricing levels. To mitigate this factor, the report proposed new equipment requirements for suppliers to improve the ease and reliability of customer switching, and an increase in price transparency. The report also proposed a review of the electricity balancing market in order to encourage more large users to participate actively in NordPool and thus stimulate competition.

In April 2002, the association of Scandinavian transmission operators, Nordel, published their Nordic Grid Master Plan. The plan noted that Sweden, Norway and Finland may face a combined shortage of electricity in the years ahead. Specifically, the plan analysed the period 2002–4 and found risks of power shortages in unfavourable conditions, particularly during years of low hydropower production. The plan advised either increasing generating capacity or augmenting transmission connections, chiefly between Denmark and central Sweden, between central Sweden and central Norway, and between central Sweden and southern Sweden. However, other market participants, such as Vattenfall, have stated that peak-shaving measures offer the lowest cost alternative to addressing potential electricity shortages. The government and relevant market players are currently debating the best course of action.

NUCLEAR POWER

Nuclear power continues to be an important component of Sweden's national energy mix. Throughout the 1990s it accounted for nearly 50% of electricity generation, and in 2000, contributed 14.9 Mtoe to the country's TPES, 31.5% of the total. Sweden has eleven nuclear reactors at four sites around the country with combined generating capacity of 9.4 GW.

In 1980, the country passed a non-binding public referendum which led to a decision in the Parliament calling for closure of all nuclear stations by 2010. A 1997 government bill abandoned the 2010 deadline but gave the government permission to revoke the operating license of any nuclear reactor. In November 1999, Barsebäck 1 was the first reactor shut down through this process. Barsebäck 2 was also scheduled to be shut down, although the date for this closure has been twice postponed, in October 2000 and again in October 2001. A condition for the closure of the reactor is that electricity supply from other sources and a reduction in electricity use must compensate the loss of generation from Barsebäck 2 and, thus far, this condition has not been met. However, the Swedish government has made the assessment that Barsebäck 2 could be decommissioned by the end of 2003. A new analysis of whether the required conditions can be met by that time is in progress. The owners of the closed nuclear plants are entitled to compensation from the government. The total cost to the government for the closure of the Barsebäck 1 reactor was about SKr 7 billion.

In March 2002, the government proposed a new framework for the phase-out of nuclear power. Under such a system, the government would negotiate with plant owners to determine the total volume of electricity generation that may be produced in the existing reactors during their remaining lifespans. The spread of the production volume between the various plants and over time would be negotiated among the utilities concerned, without direct government participation. The plant owners would themselves decide when to decommission a particular reactor. The new system was likened to the plan for nuclear phase-out in Germany, which does not envisage any substantial plant shut-down until after the first commitment period of the Kyoto Protocol. The owners of nuclear plants have so far reacted favourably to the proposal, although negotiations between them and the government are only beginning.

The main alternative for disposal of spent nuclear fuel suggested by SKB Svensk Kärnbränslehantering AB (SKB, the Swedish Nuclear Fuel and Waste Management Co.) is a repository where the spent fuel is placed in copper capsules, surrounded by a bentonite layer, and buried 500m deep in the crystalline bedrock. A full-scale test research facility (Äspö Hard Rock Laboratory) is in operation close to Oskarshamn nuclear power plant. The site selection process, which has a very important democratic dimension, has now reached a point where, with local acceptance, site investigations have started in two municipalities, Östhammar (Forsmark) and Oskarshamn (Simpevarp), respectively.

ENERGY TECHNOLOGY R&D

In 2000, the Swedish government devoted about SKr 646 million to energy-related R&D, making its energy R&D budget one of the largest in Europe. Of the total budget, 36% was spent on conservation, 34% was spent on renewable energy technologies, and 10% on power and storage systems. Total energy-related government R&D expenditures in 2000 were approximately 9% higher than they were in 1990. Over that time, conservation has consistently received the majority of funding. Nuclear research has fallen most, going from 17% of the budget in 1990 to 7% of the budget in 2000.

The Swedish Energy Policy Programme of 1997 contains a seven-year energy R&D initiative running from 1998 through 2004. In December 2001, the government appointed a committee to examine and evaluate the measures taken as a result of the 1997 Energy Policy Programme, to analyse the need for change and to submit proposals on guidelines for the long-term programme before the new planning period, which begins in 2003. The committee will also give an account of measures that can lead to a sustainable, long-term realignment of the energy system.

In view of the crucial role energy plays in the development of society, in 2001 the Royal Swedish Academy of Engineering Sciences (IVA) initiated a special Energy Foresight project, which will examine the Swedish energy system in both a European and a global perspective. The project is intended to facilitate discussion of energy systems and energy-related activities in industry and society, provide a forum for sectoral participants to learn from one another, and examine Sweden's role in the international development of long-term energy technology. The final report is due on 1 February 2003.

Energy Balances and Key Statistical Data of IEA Countries

AUSTRALIA

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**68.0**	**157.7**	**211.9**	**232.6**	**271.2**	**303.8**	**350.2**
Coal[1]		40.3	106.3	153.3	163.2	193.8	208.5	228.9
Oil		19.8	29.0	25.1	33.9	30.3	31.9	34.0
Gas		3.4	17.1	27.1	28.5	39.3	53.7	76.1
Comb. Renewables & Wastes[2]		3.5	4.0	5.0	5.4	6.3	7.8	9.1
Nuclear		–	–	–	–	–	–	–
Hydro		1.0	1.2	1.4	1.4	1.5	1.6	1.6
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.1	0.1	0.1	0.2	0.3	0.4
TOTAL NET IMPORTS[4]		**–10.3**	**–65.7**	**–108.3**	**–121.2**	**–137.5**	**–154.4**	**–166.8**
Coal[1]	Exports	17.6	67.7	109.5	114.6	142.8	153.7	168.1
	Imports	–	–	–	–	–	–	–
	Net Imports	–17.6	–67.7	–109.5	–114.6	–142.8	–153.7	–168.1
Oil	Exports	3.4	9.3	17.2	22.8	26.6	28.1	31.9
	Imports	12.5	14.2	28.0	26.3	46.1	51.9	68.3
	Bunkers	1.8	0.6	0.8	0.9	0.9	1.0	1.3
	Net Imports	7.4	4.3	10.1	2.6	18.5	22.8	35.1
Gas	Exports	–	2.3	8.9	9.2	13.3	23.4	33.8
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–2.3	–8,9	–9.2	–13.3	–23.4	–33.8
Electricity	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
TOTAL STOCK CHANGES		**–0.1**	**–4.5**	**4.1**	**–1.1**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**57.6**	**87.5**	**107.7**	**110.2**	**133.7**	**149.4**	**183.4**
Coal[1]		22.6	35.0	47.4	47.4	51.0	54.8	60.7
Oil		27.1	32.5	35.6	36.5	48.8	54.6	69.1
Gas		3.4	14.8	18.2	19.3	26.0	30.3	42.4
Comb. Renewables & Wastes[2]		3.5	4.0	5.0	5.4	6.3	7.8	9.1
Nuclear		–	–	–	–	–	–	–
Hydro		1.0	1.2	1.4	1.4	1.5	1.6	1.6
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.1	0.1	0.1	0.2	0.3	0.4
Electricity Trade[5]		–	–	–	–	–	–	–
Shares (%)								
Coal		*39.2*	*39.9*	*44.0*	*43.1*	*38.1*	*36.7*	*33.1*
Oil		*47.1*	*37.2*	*33.1*	*33.2*	*36.5*	*36.6*	*37.7*
Gas		*5.9*	*16.9*	*16.9*	*17.5*	*19.4*	*20.3*	*23.1*
Comb. Renewables & Wastes		*6.1*	*4.5*	*4.6*	*4.9*	*4.7*	*5.2*	*5.0*
Nuclear		–	–	–	–	–	–	–
Hydro		*1.7*	*1.4*	*1.3*	*1.3*	*1.1*	*1.0*	*0.9*
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other		–	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*
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.

Unit:Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1998	1999	2005	2010	2020
TFC	**19.99**	**40.20**	**53.74**	**52.00**	**90.79**	**120.32**	**214.13**
Coal[1]	2.94	7.57	9.05	7.36	18.65	29.62	75.99
Oil	9.70	20.80	26.05	25.92	36.59	42.74	60.70
Gas	0.04	0.72	4.11	4.04	14.47	18.03	23.12
Comb. Renewables & Wastes[2]	6.45	7.21	6.90	6.71	5.33	4.42	3.93
Geothermal	–	0.02	0.15	0.13	1.82	3.74	8.17
Solar/Wind/Other	–	0.02	0.10	0.11	0.22	0.43	0.83
Electricity	0.85	3.87	7.38	7.72	13.71	21.35	41.39
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*14.7*	*18.8*	*16.8*	*14.2*	*20.5*	*24.6*	*35.5*
Oil	*48.5*	*51.7*	*48.5*	*49.8*	*40.3*	*35.5*	*28.3*
Gas	*0.2*	*1.8*	*7.7*	*7.8*	*15.9*	*15.0*	*10.8*
Comb. Renewables & Wastes	*32.3*	*17.9*	*12.8*	*12.9*	*5.9*	*3.7*	*1.8*
Geothermal	–	–	*0.3*	*0.3*	*2.0*	*3.1*	*3.8*
Solar/Wind/Other	–	*0.1*	*0.2*	*0.2*	*0.2*	*0.4*	*0.4*
Electricity	*4.3*	*9.6*	*13.7*	*14.9*	*15.1*	*17.7*	*19.3*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**4.30**	**13.71**	**21.45**	**19.03**	**40.81**	**60.53**	**128.04**
Coal[1]	1.14	4.52	7.06	5.71	14.38	24.99	67.42
Oil	2.60	6.16	8.65	7.84	10.15	12.06	19.24
Gas	0.00	0.67	1.92	1.64	8.45	10.40	14.20
Comb. Renewables & Wastes[2]	–	–	–	–	–	–	–
Geothermal	–	–	–	–	0.40	0.64	1.47
Solar/Wind/Other	–	0.01	0.02	0.02	0.14	0.25	0.52
Electricity	0.55	2.35	3.80	3.82	7.29	12.19	25.20
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*26.5*	*33.0*	*32.9*	*30.0*	*35.2*	*41.3*	*52.7*
Oil	*60.5*	*44.9*	*40.3*	*41.2*	*24.9*	*19.9*	*15.0*
Gas	*0.1*	*4.9*	*8.9*	*8.6*	*20.7*	*17.2*	*11.1*
Comb. Renewables & Wastes	–	–	–	–	–	–	–
Geothermal	–	–	–	–	*1.0*	*1.1*	*1.1*
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.3*	*0.4*	*0.4*
Electricity	*12.9*	*17.2*	*17.7*	*20.1*	*17.9*	*20.1*	*19.7*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**4.49**	**9.58**	**11.37**	**11.87**	**19.58**	**23.26**	**32.47**
TOTAL OTHER SECTORS[8]	**11.21**	**16.91**	**20.92**	**21.10**	**30.40**	**36.54**	**53.61**
Coal[1]	1.28	3.03	1.99	1.65	4.27	4.63	8.58
Oil	3.15	5.11	6.10	6.29	7.01	7.67	9.46
Gas	0.04	0.05	2.16	2.37	6.02	7.62	8.91
Comb. Renewables & Wastes[2]	6.45	7.21	6.90	6.71	5.33	4.42	3.93
Geothermal	–	0.02	0.15	0.13	1.42	3.10	6.70
Solar/Wind/Other	–	0.01	0.08	0.09	0.08	0.18	0.31
Electricity	0.29	1.49	3.55	3.87	6.27	8.92	15.73
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*11.4*	*17.9*	*9.5*	*7.8*	*14.0*	*12.7*	*16.0*
Oil	*28.1*	*30.2*	*29.2*	*29.8*	*23.1*	*21.0*	*17.7*
Gas	*0.3*	*0.3*	*10.3*	*11.2*	*19.8*	*20.9*	*16.6*
Comb. Renewables & Wastes	*57.5*	*42.6*	*33.0*	*31.8*	*17.5*	*12.1*	*7.3*
Geothermal	–	*0.1*	*0.7*	*0.6*	*4.7*	*8.5*	*12.5*
Solar/Wind/Other	–	*0.1*	*0.4*	*0.4*	*0.3*	*0.5*	*0.6*
Electricity	*2.6*	*8.8*	*16.9*	*18.3*	*20.6*	*24.4*	*29.3*
Heat	–	–	–	–	–	–	–

Unit:Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**16.0**	**35.1**	**47.0**	**47.1**	**54.5**	**59.0**	**68.1**
OUTPUT (Mtoe)	**5.5**	**13.3**	**17.5**	**17.9**	**20.2**	**22.4**	**27.8**
(TWh gross)	64.4	154.3	203.0	208.1	234.4	260.6	323.4
Output Shares (%)							
Coal	*74.9*	*77.1*	*78.0*	*77.2*	*77.2*	*76.6*	*71.4*
Oil	*2.6*	*2.7*	*1.3*	*1.3*	*1.1*	*1.1*	*1.2*
Gas	*4.3*	*10.6*	*11.9*	*12.6*	*12.4*	*12.2*	*18.4*
Comb. Renewables & Wastes	*0.5*	*0.4*	*0.5*	*0.8*	*1.3*	*2.2*	*2.1*
Nuclear	–	–	–	–	–	–	–
Hydro	*17.7*	*9.2*	*8.2*	*8.1*	*7.5*	*6.9*	*5.9*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.0*	*0.0*	*0.4*	*1.0*	*1.0*
TOTAL LOSSES	**17.8**	**29.3**	**39.9**	**39.1**	**49.4**	**55.1**	**65.8**
of which:							
Electricity and Heat Generation[10]	10.5	21.7	29.5	29.2	34.4	36.5	40.2
Other Transformation	5.5	0.6	1.5	0.9	5.7	7.0	10.3
Own Use and Losses[11]	1.7	7.0	8.9	9.0	9.4	11.5	15.3
Statistical Differences	**–0.1**	**0.2**	**–2.1**	**–0.5**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	195.83	317.96	443.05	451.61	536.37	637.04	898.60
Population (millions)	13.51	17.09	18.94	19.16	20.40	21.50	23.60
TPES/GDP[12]	0.29	0.28	0.24	0.24	0.25	0.23	0.20
Energy Production/TPES	1.18	1.80	1.97	2.11	2.03	2.03	1.91
Per Capita TPES[13]	4.27	5.12	5.69	5.75	6.55	6.95	7.77
Oil Supply/GDP[12]	0.14	0.10	0.08	0.08	0.09	0.09	0.08
TFC/GDP[12]	0.20	0.18	0.16	0.16	0.16	0.15	0.13
Per Capita TFC[13]	2.96	3.40	3.69	3.74	4.13	4.39	4.98
Energy–related CO_2 Emissions (Mt CO_2)[14]	157.9	259.7	327.5	329.3	376.3	412.9	494.2
CO_2 Emissions from Bunkers (Mt CO_2)	7.3	6.3	9.7	9.2	9.3	9.6	10.4

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	3.0	2.2	2.3	2.3	3.9	2.2	2.1
Coal	1.5	3.2	3.4	0.1	1.5	1.4	1.0
Oil	2.9	0.1	1.0	2.6	5.9	2.3	2.4
Gas	12.7	7.1	2.3	6.0	6.1	3.1	3.4
Comb. Renewables & Wastes	0.1	1.0	2.5	7.8	3.2	4.5	1.6
Nuclear	–	–	–	–	–	–	–
Hydro	5.1	–0.7	1.8	0.6	0.9	0.6	0.6
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	17.3	2.1	4.1	12.6	12.5	2.1
TFC	2.5	2.1	2.1	2.5	3.3	2.3	2.2
Electricity Consumption	6.3	5.0	3.0	2.5	3.2	2.2	2.2
Energy Production	3.9	5.7	3.3	9.7	3.1	2.3	1.4
Net Oil Imports	4.2	–6.9	10.0	–74.2	48.0	4.2	4.4
GDP	2.6	3.1	3.8	1.9	3.5	3.5	3.5
Growth in the TPES/GDP Ratio	0.4	–0.8	–1.4	0.4	0.4	–1.2	–1.4
Growth in the TFC/GDP Ratio	–0.1	–0.9	–1.6	0.5	–0.2	–1.2	–1.2

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

AUSTRIA

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**7,9**	**8.3**	**9.7**	**9.7**	**9.7**	**9.9**	**..**
Coal[1]		1.0	0.6	0.3	0.3	0.1	0.1	..
Oil		2.7	1.2	1.0	1.0	0.7	0.6	..
Gas		2.0	1.1	1.5	1.5	1.3	1.0	..
Comb. Renewables & Wastes[2]		0.7	2.7	3.4	3.2	3.9	4.4	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.5	3.6	3.5	3.6	..
Geothermal		–	–	0.0	0.0	–	–	..
Solar/Wind/Other[3]		–	–	0.1	0.1	0.2	0.3	..
TOTAL NET IMPORTS[4]		**14.0**	**17.2**	**18.7**	**18.7**	**21.1**	**22.9**	**..**
Coal[1]	Exports	0.1	0.0	–	0.0	–	–	..
	Imports	3.1	3.1	2.8	3.0	2.0	1.8	..
	Net Imports	3.0	3.1	2.8	3.0	2.0	1.8	..
Oil	Exports	0.1	0.4	1.7	1.5	0.9	0.9	..
	Imports	9.9	10.0	12.6	12.1	11.4	11.6	..
	Bunkers	–	–	–	–	–	–	..
	Net Imports	9.7	9.6	11.0	10.6	10.5	10.7	..
Gas	Exports	–	–	–	0.0	0.0	0.0	..
	Imports	1.3	4.5	5.2	5.3	8.7	10.5	..
	Net Imports	1.3	4.5	5.2	5.3	8.7	10.4	..
Electricity	Exports	0.4	0.6	1.2	1.3	0.8	0.8	..
	Imports	0.3	0.6	1.0	1.2	0.7	0.8	..
	Net Imports	–0.1	–0.0	–0.2	–0.1	–0.1	–0.0	..
TOTAL STOCK CHANGES		**–0.3**	**–0.3**	**0.2**	**0.2**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**21.7**	**25.2**	**28.6**	**28.6**	**30.8**	**32.8**	**..**
Coal[1]		3.9	4.1	3.1	3.6	2.1	1.9	..
Oil		12.3	10.4	11.9	11.8	11.1	11.2	..
Gas		3.3	5.2	6.8	6.5	10.0	11.5	..
Comb. Renewables & Wastes[2]		0.7	2.8	3.3	3.1	4.0	4.5	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.5	3.6	3.5	3.6	..
Geothermal		–	–	0.0	0.0	–	–	..
Solar/Wind/Other[3]		–	–	0.1	0.1	0.2	0.3	..
Electricity Trade[5]		–0.1	–0.0	–0.2	–0.1	–0.1	–0.0	..
Shares (%)								
Coal		*17.9*	*16.4*	*10.9*	*12.6*	*6.8*	*5.6*	..
Oil		*56.7*	*41.3*	*41.8*	*41.3*	*36.2*	*34.2*	..
Gas		*15.3*	*20.8*	*23.9*	*22.8*	*32.3*	*34.9*	..
Comb. Renewables & Wastes		*3.3*	*10.9*	*11.6*	*10.9*	*12.9*	*13.7*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*7.4*	*10.7*	*12.2*	*12.6*	*11.3*	*11.0*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	*0.2*	*0.2*	*0.7*	*0.8*	..
Electricity Trade		*–0.6*	*–0.2*	*–0.6*	*–0.4*	*–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	1998	1999	2005	2010	2020
TFC	**16.8**	**20.9**	**24.2**	**24.8**	**26.6**	**28.4**	**..**
Coal[1]	2.0	1.6	1.1	1.2	1.5	1.4	..
Oil	10.2	9.3	11.0	11.0	10.3	10.4	..
Gas	1.8	3.1	4.1	4.5	6.1	6.9	..
Comb. Renewables & Wastes[2]	0.7	2.5	2.6	2.5	2.7	2.9	..
Geothermal	–	–	0.0	0.0	–	–	..
Solar/Wind/Other	–	–	0.0	0.0	0.1	0.1	..
Electricity	2.2	3.7	4.4	4.5	4.7	5.3	..
Heat	–	0.6	1.1	1.0	1.3	1.4	..
Shares (%)							
Coal	*11.8*	*7.5*	*4.4*	*4.7*	*5.6*	*5.0*	..
Oil	*60.4*	*44.8*	*45.4*	*44.6*	*38.8*	*36.7*	..
Gas	*10.8*	*14.8*	*16.9*	*18.0*	*22.8*	*24.4*	..
Comb. Renewables & Wastes	*4.1*	*12.2*	*10.6*	*10.0*	*10.1*	*10.0*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.2*	*0.2*	*0.2*	*0.2*	..
Electricity	*12.9*	*17.8*	*18.0*	*18.2*	*17.8*	*18.7*	..
Heat	–	*2.9*	*4.6*	*4.2*	*4.7*	*4.9*	..
TOTAL INDUSTRY[6]	**6.4**	**7.0**	**7.5**	**8.0**	**8.8**	**9.4**	**..**
Coal[1]	0.7	0.9	0.8	0.9	1.1	1.0	..
Oil	3.3	2.3	2.0	2.0	2.5	2.5	..
Gas	1.2	1.8	2.1	2.3	2.8	3.2	..
Comb. Renewables & Wastes[2]	0.0	0.4	0.7	0.7	0.5	0.6	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	1.0	1.6	1.9	2.0	1.8	2.1	..
Heat	–	–	–	–	0.1	0.1	..
Shares (%)							
Coal	*11.6*	*12.6*	*10.4*	*11.0*	*11.9*	*10.6*	..
Oil	*52.3*	*33.2*	*26.8*	*25.7*	*28.0*	*26.2*	..
Gas	*19.2*	*26.5*	*28.1*	*29.2*	*31.9*	*33.9*	..
Comb. Renewables & Wastes	*0.5*	*5.4*	*8.9*	*9.2*	*5.9*	*5.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.3*	*22.4*	*25.8*	*24.8*	*20.9*	*22.0*	..
Heat	–	–	–	–	*1.4*	*1.5*	..
TRANSPORT[7]	**4.0**	**5.5**	**6.8**	**7.2**	**6.2**	**6.3**	**..**
TOTAL OTHER SECTORS[8]	**6.4**	**8.4**	**9.9**	**9.6**	**11.6**	**12.7**	**..**
Coal[1]	1.1	0.7	0.3	0.3	0.4	0.4	..
Oil	3.1	1.8	2.6	2.4	2.1	2.1	..
Gas	0.6	1.2	1.8	1.9	3.2	3.7	..
Comb. Renewables & Wastes[2]	0.7	2.2	1.9	1.7	2.2	2.3	..
Geothermal	–	–	0.0	0.0	–	–	..
Solar/Wind/Other	–	–	0.0	0.0	0.1	0.1	..
Electricity	1.0	1.9	2.1	2.2	2.6	2.9	..
Heat	–	0.6	1.1	1.0	1.1	1.3	..
Shares (%)							
Coal	*17.6*	*8.1*	*2.8*	*2.9*	*3.6*	*3.2*	..
Oil	*47.8*	*21.2*	*26.6*	*24.5*	*17.6*	*16.4*	..
Gas	*9.2*	*14.6*	*18.2*	*19.7*	*27.7*	*29.2*	..
Comb. Renewables & Wastes	*10.2*	*25.9*	*19.2*	*18.1*	*18.6*	*18.1*	..
Geothermal	–	–	–	*0.1*	–	–	..
Solar/Wind/Other	–	–	*0.5*	*0.5*	*0.5*	*0.6*	..
Electricity	*15.3*	*23.0*	*21.7*	*23.3*	*22.1*	*22.8*	..
Heat	–	*7.3*	*11.1*	*10.9*	*9.8*	*9.9*	..

Unit:Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.9**	**7.3**	**8.7**	**8.1**	**9.2**	**10.1**	**..**
OUTPUT (Mtoe)	**2.7**	**4.2**	**5.1**	**5.2**	**5.1**	**5.6**	**..**
(TWh gross)	30.9	49.4	59.3	60.3	59.8	64.9	..
Output Shares (%)							
Coal	*10.3*	*14.8*	*9.2*	*11.1*	*2.3*	*1.4*	..
Oil	*14.1*	*4.4*	*4.5*	*3.3*	*1.5*	*1.2*	..
Gas	*14.3*	*14.8*	*14.9*	*13.0*	*20.9*	*23.3*	..
Comb. Renewables & Wastes	*0.7*	*2.3*	*3.0*	*2.8*	*7.0*	*8.3*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*60.6*	*63.7*	*68.3*	*69.6*	*68.2*	*65.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	–	–	..
TOTAL LOSSES	**4.7**	**4.2**	**4.4**	**3.8**	**4.1**	**4.5**	**..**
of which:							
Electricity and Heat Generation[10]	2.2	2.4	2.4	1.8	2.6	2.9	..
Other Transformation	1.3	0.3	0.4	0.4	0.3	0.3	..
Own Use and Losses[11]	1.2	1.5	1.7	1.6	1.2	1.2	..
Statistical Differences	**0.1**	**0.1**	**–0.0**	**0.1**	**–**	**–**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	138.55	212.47	259.35	267.02	294.81	325.50	..
Population (millions)	7.57	7.72	8.09	8.11	8.15	8.20	..
TPES/GDP[12]	0.16	0.12	0.11	0.11	0.10	0.10	..
Energy Production/TPES	0.37	0.33	0.34	0.34	0.31	0.30	..
Per Capita TPES[13]	2.86	3.27	3.53	3.52	3.77	4.00	..
Oil Supply/GDP[12]	0.09	0.05	0.05	0.04	0.04	0.03	..
TFC/GDP[12]	0.12	0.10	0.09	0.09	0.09	0.09	..
Per Capita TFC[13]	2.22	2.70	2.99	3.05	3.27	3.46	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	54.2	56.9	62.3	62.8	62.2	64.8	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	0.9	1.5	1.7	1.7	1.7	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.6	0.5	1.4	0.0	1.5	1.3	..
Coal	–1.1	1.2	–3.1	15.0	–10.2	–2.4	..
Oil	0.7	–1.9	1.5	–1.0	–1.2	0.1	..
Gas	4.6	1.7	3.0	–4.6	8.8	2.8	..
Comb. Renewables & Wastes	6.3	9.3	2.1	–5.9	5.1	2.4	..
Nuclear	–	–	–	–	–	–	..
Hydro	6.7	1.2	2.8	3.7	–0.8	0.7	..
Geothermal	–	–	–	16.7	–	–	..
Solar/Wind/Other	–	–	–	1.9	2.5	3.1	..
TFC	2.2	0.8	1.7	2.2	1.5	1.3	..
Electricity Consumption	3.9	2.8	1.8	3.4	1.0	2.3	..
Energy Production	0.2	0.3	1.7	0.0	–0.0	0.5	..
Net Oil Imports	2.7	–1.6	1.5	–3.3	–0.2	0.4	..
GDP	3.0	2.3	2.2	3.0	2.0	2.0	..
Growth in the TPES/GDP Ratio	–1.3	–1.8	–0.8	–2.8	–0.5	–0.7	..
Growth in the TFC/GDP Ratio	–0.8	–1.5	–0.6	–0.7	–0.5	–0.7	..

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

BELGIUM

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**6.5**	**12.8**	**13.6**	**13.4**	**12.5**	**12.9**	**..**
Coal[1]		6.4	1.2	0.2	0.2	–	–	..
Oil		–	–	–	–	–	–	..
Gas		0.0	0.0	–	0.0	–	–	..
Comb. Renewables & Wastes[2]		0.0	0.4	0.6	0.6	0.2	0.6	..
Nuclear		0.0	11.1	12.8	12.6	12.3	12.3	..
Hydro		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	..
TOTAL NET IMPORTS[4]		**39.8**	**35.5**	**44.2**	**45.2**	**41.9**	**44.4**	**..**
Coal[1]	Exports	0.8	1.1	1.0	1.2	0.9	0.9	..
	Imports	5.3	10.3	8.3	8.8	8.6	8.6	..
	Net Imports	4.6	9.2	7.4	7.6	7.7	7.7	..
Oil	Exports	15.1	19.2	22.5	23.7	16.0	16.4	..
	Imports	46.4	41.7	50.1	52.9	41.8	42.9	..
	Bunkers	3.1	4.1	4.4	5.4	4.0	4.0	..
	Net Imports	28.2	18.4	23.2	23.8	21.8	22.5	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	7.1	8.2	13.5	13.3	12.4	14.2	..
	Net Imports	7.1	8.2	13.5	13.3	12.4	14.2	..
Electricity	Exports	0.2	0.7	0.7	0.6	..	..	..
	Imports	0.1	0.4	0.8	1.0	..	..	..
	Net Imports	–0.1	–0.3	0.1	0.4	..	..	..
TOTAL STOCK CHANGES		**–0.0**	**0.1**	**0.8**	**0.6**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**46.3**	**48.4**	**58.6**	**59.2**	**54.4**	**57.3**	**..**
Coal[1]		11.2	10.2	7.5	8.4	7.7	7.7	..
Oil		28.0	18.7	24.2	23.8	21.8	22.5	..
Gas		7.1	8.2	13.3	13.4	12.4	14.2	..
Comb. Renewables & Wastes[2]		0.0	0.4	0.7	0.7	0.2	0.6	..
Nuclear		0.0	11.1	12.8	12.6	12.3	12.3	..
Hydro		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	..
Electricity Trade[5]		–0.1	–0.3	0.1	0.4	–	–	..
Shares (%)								
Coal		*24.1*	*21.1*	*12.8*	*14.1*	*14.2*	*13.4*	..
Oil		*60.5*	*38.7*	*41.3*	*40.1*	*40.1*	*39.3*	..
Gas		*15.4*	*16.9*	*22.8*	*22.6*	*22.8*	*24.7*	..
Comb. Renewables & Wastes		–	*0.9*	*1.2*	*1.2*	*0.3*	*1.0*	..
Nuclear		–	*23.0*	*21.8*	*21.2*	*22.6*	*21.4*	..
Hydro		–	–	–	*0.1*	*0.1*	*0.1*	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other		–	–	–	–	–	–	..
Electricity Trade		*–0.1*	*–0.7*	*0.1*	*0.6*	–	–	..

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	1999	2000	2005	2010	2020
TFC	**34.6**	**33.0**	**41.2**	**42.3**	**39.5**	**41.0**	**..**
Coal[1]	5.7	3.5	2.5	2.7	3.7	3.7	..
Oil	21.0	17.3	22.0	22.0	20.1	20.8	..
Gas	4.6	6.8	9.7	10.2	8.8	9.0	..
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.3	..	..	..
Geothermal	–	0.0	0.0	0.0	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	–	–	..
Electricity	2.9	5.0	6.4	6.7	6.0	6.4	..
Heat	0.3	0.2	0.4	0.5	0.9	1.1	..
Shares (%)							
Coal	*16.5*	*10.5*	*6.0*	*6.3*	*9.4*	*9.0*	..
Oil	*60.7*	*52.5*	*53.3*	*52.0*	*50.8*	*50.7*	..
Gas	*13.3*	*20.7*	*23.6*	*24.1*	*22.3*	*22.0*	..
Comb. Renewables & Wastes	–	*0.6*	*0.5*	*0.7*	..	..	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*8.5*	*15.1*	*15.6*	*15.8*	*15.1*	*15.7*	..
Heat	*0.9*	*0.7*	*0.9*	*1.2*	*2.3*	*2.6*	..
TOTAL INDUSTRY[6]	**16.8**	**13.4**	**17.1**	**18.6**	**15.7**	**16.1**	**..**
Coal[1]	3.5	3.0	2.3	2.4	3.4	3.4	..
Oil	7.9	4.3	6.3	6.9	4.1	4.1	..
Gas	3.2	3.3	4.9	5.3	3.9	3.9	..
Comb. Renewables & Wastes[2]	–	0.0	0.1	0.1	..	..	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	1.9	2.6	3.2	3.4	3.4	3.7	..
Heat	0.3	0.2	0.3	0.4	0.8	0.9	..
Shares (%)							
Coal	*21.1*	*22.2*	*13.3*	*13.1*	*21.8*	*21.3*	..
Oil	*46.8*	*32.2*	*36.5*	*36.9*	*26.4*	*25.6*	..
Gas	*18.7*	*24.6*	*28.9*	*28.6*	*25.1*	*24.5*	..
Comb. Renewables & Wastes	–	*0.1*	*0.4*	*0.7*	..	..	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*11.5*	*19.5*	*18.9*	*18.4*	*21.8*	*23.0*	..
Heat	*1.9*	*1.4*	*2.0*	*2.3*	*4.8*	*5.5*	..
TRANSPORT[7]	**5.0**	**7.9**	**9.8**	**9.9**	**9.4**	**9.7**	**..**
TOTAL OTHER SECTORS[8]	**12.7**	**11.7**	**14.2**	**13.8**	**14.4**	**15.2**	**..**
Coal[1]	2.2	0.5	0.2	0.2	0.3	0.3	..
Oil	8.1	5.2	6.0	5.4	6.6	7.2	..
Gas	1.5	3.5	4.8	4.8	4.9	5.1	..
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.2	..	..	..
Geothermal	–	0.0	0.0	0.0	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	–	–	..
Electricity	0.9	2.3	3.1	3.1	2.4	2.6	..
Heat	–	0.0	0.1	0.1	0.2	0.2	..
Shares (%)							
Coal	*17.0*	*4.1*	*1.3*	*1.6*	*2.1*	*1.6*	..
Oil	*64.2*	*44.6*	*42.1*	*39.0*	*46.1*	*47.0*	..
Gas	*11.4*	*30.1*	*33.5*	*35.2*	*34.0*	*33.2*	..
Comb. Renewables & Wastes	–	*1.6*	*1.1*	*1.1*	..	..	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*7.4*	*19.3*	*21.5*	*22.7*	*16.7*	*16.9*	..
Heat	–	*0.3*	*0.4*	*0.5*	*1.2*	*1.2*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**10.0**	**17.5**	**19.9**	**20.1**	**20.0**	**22.0**	**..**
OUTPUT (Mtoe)	**3.5**	**6.0**	**7.2**	**7.1**	**6.7**	**7.3**	**..**
(TWh gross)	40.6	70.2	83.4	82.7	78.3	84.9	..
Output Shares (%)							
Coal	*21.7*	*28.3*	*15.0*	*19.4*	*11.5*	*8.7*	..
Oil	*53.7*	*1.9*	*1.2*	*1.0*	*2.3*	*2.3*	..
Gas	*23.7*	*7.7*	*23.1*	*19.3*	*24.7*	*29.6*	..
Comb. Renewables & Wastes	*0.3*	*0.9*	*1.4*	*1.5*	*1.0*	*3.5*	..
Nuclear	*0.2*	*60.8*	*58.8*	*58.3*	*60.1*	*55.5*	..
Hydro	*0.4*	*0.4*	*0.4*	*0.6*	*0.4*	*0.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	..
TOTAL LOSSES	**11.8**	**16.0**	**16.6**	**16.7**	**14.9**	**16.3**	**..**
of which:							
Electricity and Heat Generation[10]	6.2	11.3	12.4	12.4	12.3	13.6	..
Other Transformation	4.2	2.1	1.7	1.6	1.3	1.3	..
Own Use and Losses[11]	1.4	2.7	2.6	2.7	1.3	1.5	..
Statistical Differences	**–0.1**	**–0.6**	**0.8**	**0.3**	**–**	**–**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	174.37	257.86	305.64	317.96	356.24	399.14	..
Population (millions)	9.73	9.97	10.22	10.25	10.00	10.00	..
TPES/GDP[12]	0.27	0.19	0.19	0.19	0.15	0.14	..
Energy Production/TPES	0.14	0.26	0.23	0.23	0.23	0.23	..
Per Capita TPES[13]	4.76	4.86	5.73	5.78	5.44	5.73	..
Oil Supply/GDP[12]	0.16	0.07	0.08	0.07	0.06	0.06	..
TFC/GDP[12]	0.20	0.13	0.13	0.13	0.11	0.10	..
Per Capita TFC[13]	3.55	3.31	4.03	4.12	3.95	4.10	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	133.6	107.3	116.3	120.3	108.4	114.4	..
CO_2 Emissions from Bunkers (Mt CO_2)	11.3	16.0	18.5	21.7	17.2	17.2	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	0.7	0.0	2.1	1.1	–1.7	1.0	..
Coal	–1.0	–0.3	–3.4	12.0	–1.7	–	..
Oil	–1.5	–2.8	2.9	–1.7	–1.7	0.6	..
Gas	4.5	–1.2	5.6	0.3	–1.5	2.7	..
Comb. Renewables & Wastes	41.7	17.8	4.8	9.0	–27.3	31.5	..
Nuclear	130.2	12.8	1.5	–1.8	–0.5	–	..
Hydro	4.9	1.3	2.6	34.5	–5.1	–	..
Geothermal	–	–	4.6	–	–	–	..
Solar/Wind/Other	–	–	4.6	–	–19.7	–	..
TFC	0.3	–0.6	2.5	2.7	–1.3	0.7	..
Electricity Consumption	4.2	2.6	2.8	4.1	–2.2	1.5	..
Energy Production	2.4	5.0	0.6	–1.0	–1.5	0.7	..
Net Oil Imports	–0.8	–3.4	2.6	2.7	–1.7	0.6	..
GDP	2.4	2.3	1.9	4.0	2.3	2.3	..
Growth in the TPES/GDP Ratio	–1.6	–2.3	0.2	–2.8	–3.9	–1.2	..
Growth in the TFC/GDP Ratio	–2.0	–2.8	0.6	–1.3	–3.6	–1.5	..

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**198.0**	**273.7**	**366.6**	**374.9**	**439.1**	**462.3**	**506.6**
Coal[1]		11.7	37.9	39.2	37.1	38.7	39.9	38.7
Oil		96.3	94.1	123.0	128.5	163.1	170.9	193.5
Gas		61.4	88.6	144.4	148.3	165.2	179.5	199.9
Comb. Renewables & Wastes[2]		7.8	8.1	11.2	11.2	17.0	18.0	20.4
Nuclear		4.1	19.4	19.2	19.0	23.4	20.3	19.0
Hydro		16.7	25.5	29.7	30.8	31.4	33.2	34.6
Geothermal		–	–	–	–	0.4	0.4	0.4
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.0	0.1	0.1
TOTAL NET IMPORTS[4]		**–35.4**	**–60.6**	**–128.1**	**–132.8**	**–166.9**	**–177.9**	**–194.0**
Coal[1]	Exports	7.6	21.4	23.3	22.3	21.2	23.1	23.1
	Imports	10.5	9.5	12.2	14.0	10.0	8.7	2.1
	Net Imports	2.8	–11.9	–11.1	–8.3	–11.2	–14.4	–21.0
Oil	Exports	63.1	49.7	86.4	93.4	123.6	128.2	143.9
	Imports	48.8	34.5	50.3	54.3	51.7	54.3	60.0
	Bunkers–	0.9	1.0	1.1	0.7	0.7	0.8	
	Net Imports	–14.3	–16.1	–37.2	–40.1	–72.6	–74.6	–84.7
Gas	Exports	23.1	33.0	77.9	82.7	81.0	88.0	88.0
	Imports	0.3	0.5	0.7	1.3	1.0	1.0	1.0
	Net Imports	–22.8	–32.5	–77.3	–81.3	–80.0	–86.9	–86.9
Electricity	Exports	1.4	1.6	3.9	4.4	6.8	5.4	4.7
	Imports	0.2	1.5	1.4	1.3	3.6	3.4	3.3
	Net Imports	–1.2	–0.0	–2.5	–3.1	–3.2	–2.0	–1.4
TOTAL STOCK CHANGES		**–1.6**	**–4.0**	**4.5**	**8.9**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**161.0**	**209.1**	**243.0**	**251.0**	**272.1**	**284.4**	**312.7**
Coal[1]		15.3	24.3	27.8	30.4	27.4	25.5	17.7
Oil		81.0	77.1	86.5	88.0	90.6	96.3	108.9
Gas		37.3	54.7	71.1	74.6	85.2	92.6	113.0
Comb. Renewables & Wastes[2]		7.8	8.1	11.2	11.2	17.0	18.0	20.4
Nuclear		4.1	19.4	19.2	19.0	23.4	20.3	19.0
Hydro		16.7	25.5	29.7	30.8	31.4	33.2	34.6
Geothermal		–	–	–	–	0.4	0.4	0.4
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.0	0.1	0.1
Electricity Trade[5]		–1.2	–0.0	–2.5	–3.1	–3.2	–2.0	–1.4
Shares (%)								
Coal		*9.5*	*11.6*	*11.5*	*12.1*	*10.1*	*9.0*	*5.7*
Oil		*50.3*	*36.9*	*35.6*	*35.1*	*33.3*	*33.9*	*34.8*
Gas		*23.2*	*26.2*	*29.3*	*29.7*	*31.3*	*32.5*	*36.1*
Comb. Renewables & Wastes		*4.9*	*3.9*	*4.6*	*4.5*	*6.2*	*6.3*	*6.5*
Nuclear		*2.5*	*9.3*	*7.9*	*7.6*	*8.6*	*7.1*	*6.1*
Hydro		*10.4*	*12.2*	*12.2*	*12.3*	*11.5*	*11.7*	*11.1*
Geothermal		–	–	–	–	*0.2*	*0.2*	*0.1*
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		*–0.7*	–	*–1.0*	*–1.2*	*–1.2*	*–0.7*	*–0.4*

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

Please note: All forecast data are based on the 2000 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**133.2**	**161.3**	**186.7**	**192.5**	**210.0**	**221.3**	**250.2**
Coal[1]	5.2	3.1	3.3	3.6	4.5	4.7	5.4
Oil	77.6	70.6	81.0	82.2	81.6	86.8	98.2
Gas	23.7	43.3	51.0	54.1	60.0	62.2	69.8
Comb. Renewables & Wastes[2]	7.6	7.8	10.5	10.5	15.7	16.7	18.9
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	18.9	36.0	40.1	41.3	47.4	50.2	57.0
Heat	0.1	0.6	0.8	0.8	0.7	0.7	0.9
Shares (%)							
Coal	*3.9*	*1.9*	*1.8*	*1.8*	*2.2*	*2.1*	*2.2*
Oil	*58.3*	*43.7*	*43.4*	*42.7*	*38.9*	*39.2*	*39.2*
Gas	*17.8*	*26.8*	*27.3*	*28.1*	*28.6*	*28.1*	*27.9*
Comb. Renewables & Wastes	*5.7*	*4.8*	*5.6*	*5.5*	*7.5*	*7.5*	*7.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*14.2*	*22.3*	*21.5*	*21.5*	*22.6*	*22.7*	*22.8*
Heat	*0.1*	*0.4*	*0.4*	*0.4*	*0.3*	*0.3*	*0.3*
TOTAL INDUSTRY[6]	**52.8**	**63.2**	**74.1**	**77.0**	**92.1**	**98.6**	**112.5**
Coal[1]	4.7	3.0	3.3	3.5	4.5	4.6	5.3
Oil	21.4	18.7	21.8	21.9	23.2	24.9	27.6
Gas	11.9	20.2	22.6	24.7	29.0	31.2	36.2
Comb. Renewables & Wastes[2]	5.7	6.2	8.7	8.7	13.8	14.7	16.8
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	9.1	14.4	16.9	17.5	20.8	22.4	25.8
Heat	0.1	0.6	0.8	0.7	0.7	0.7	0.9
Shares (%)							
Coal	*8.9*	*4.8*	*4.5*	*4.5*	*4.9*	*4.7*	*4.7*
Oil	*40.4*	*29.5*	*29.5*	*28.4*	*25.2*	*25.3*	*24.5*
Gas	*22.5*	*32.0*	*30.5*	*32.1*	*31.5*	*31.6*	*32.2*
Comb. Renewables & Wastes	*10.8*	*9.8*	*11.7*	*11.3*	*15.0*	*14.9*	*14.9*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*17.2*	*22.9*	*22.8*	*22.7*	*22.6*	*22.7*	*22.9*
Heat	*0.2*	*1.0*	*1.1*	*1.0*	*0.8*	*0.8*	*0.8*
TRANSPORT[7]	**35.3**	**44.2**	**54.0**	**53.5**	**59.2**	**63.1**	**72.8**
TOTAL OTHER SECTORS[8]	**45.1**	**54.0**	**58.6**	**62.0**	**58.7**	**59.7**	**64.8**
Coal[1]	0.4	0.1	0.0	0.1	0.1	0.1	0.1
Oil	21.3	10.9	10.9	12.0	6.2	6.5	6.9
Gas	11.9	20.2	23.1	24.6	25.0	24.5	25.7
Comb. Renewables & Wastes[2]	1.9	1.6	1.8	1.8	1.9	2.0	2.2
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	9.5	21.2	22.7	23.5	25.5	26.7	30.0
Heat	–	0.0	0.0	0.0	–	–	–
Shares (%)							
Coal	*0.9*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Oil	*47.4*	*20.2*	*18.5*	*19.3*	*10.6*	*10.8*	*10.7*
Gas	*26.3*	*37.4*	*39.5*	*39.7*	*42.6*	*41.0*	*39.6*
Comb. Renewables & Wastes	*4.2*	*3.0*	*3.1*	*3.0*	*3.2*	*3.3*	*3.3*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*21.2*	*39.3*	*38.8*	*37.9*	*43.5*	*44.7*	*46.2*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**36.1**	**70.7**	**82.9**	**86.1**	**90.0**	**91.8**	**97.1**
OUTPUT (Mtoe)	**23.2**	**41.4**	**49.8**	**52.0**	**55.8**	**59.5**	**66.3**
(TWh gross)	270.1	481.9	578.6	605.1	649.2	691.3	771.5
Output Shares (%)							
Coal	*12.9*	*17.1*	*18.7*	*19.5*	*15.4*	*13.8*	*8.5*
Oil	*3.4*	*3.4*	*2.8*	*2.5*	*0.7*	*0.7*	*0.6*
Gas	*6.0*	*2.0*	*4.8*	*5.5*	*11.7*	*16.1*	*27.2*
Comb. Renewables & Wastes	–	*0.8*	*1.3*	*1.2*	*2.1*	*2.0*	*2.1*
Nuclear	*5.6*	*15.1*	*12.7*	*12.0*	*13.8*	*11.3*	*9.5*
Hydro	*72.1*	*61.6*	*59.7*	*59.2*	*56.2*	*55.9*	*52.1*
Geothermal	–	–	–	–	*0.1*	*0.1*	*0.1*
Solar/Wind/Other	–	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*
TOTAL LOSSES	**31.2**	**48.7**	**56.3**	**58.0**	**62.1**	**63.1**	**62.5**
of which:							
Electricity and Heat Generation[10]	12.8	28.6	32.3	33.3	33.5	31.6	29.9
Other Transformation	1.9	–1.3	–3.4	–3.1	9.3	9.8	11.0
Own Use and Losses[11]	16.5	21.4	27.4	27.8	19.4	21.6	21.6
Statistical Differences	**–3.5**	**–0.9**	**–0.0**	**0.5**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	320.43	536.20	674.83	704.88	810.04	897.42	1122.16
Population (millions)	22.49	27.70	30.49	30.75	32.60	34.00	35.60
TPES/GDP[12]	0.50	0.39	0.36	0.36	0.34	0.32	0.28
Energy Production/TPES	1.23	1.31	1.51	1.49	1.61	1.63	1.62
Per Capita TPES[13]	7.16	7.55	7.97	8.16	8.35	8.36	8.78
Oil Supply/GDP[12]	0.25	0.14	0.13	0.12	0.11	0.11	0.10
TFC/GDP[12]	0.42	0.30	0.28	0.27	0.26	0.25	0.22
Per Capita TFC[13]	5.92	5.82	6.12	6.26	6.44	6.51	7.03
Energy–related CO_2 Emissions (Mt CO_2)[14]	379.9	430.2	505.5	526.8	513.7	537.0	583.9
CO_2 Emissions from Bunkers (Mt CO_2)	1.5	5.6	6.4	6.4	5.4	5.4	5.6

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	2.9	0.8	1.7	3.3	1.6	0.9	1.0
Coal	4.4	1.9	1.5	9.1	–2.0	–1.4	–3.6
Oil	2.1	–1.6	1.3	1.8	0.6	1.2	1.2
Gas	2.7	2.1	2.9	5.0	2.7	1.7	2.0
Comb. Renewables & Wastes	–1.6	1.2	3.6	–0.1	8.6	1.2	1.3
Nuclear	15.7	6.4	–0.1	–0.9	4.2	–2.7	–0.7
Hydro	3.8	1.8	1.7	3.7	0.3	1.2	0.4
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	29.2	–	–	24.6	–
TFC	2.4	0.4	1.6	3.1	1.8	1.1	1.2
Electricity Consumption	4.7	3.4	1.2	3.2	2.8	1.2	1.3
Energy Production	1.0	2.4	3.3	2.3	3.2	1.0	0.9
Net Oil Imports	–	–	9.7	7.9	12.6	0.6	1.3
GDP	3.9	2.6	2.6	4.5	2.8	2.1	2.3
Growth in the TPES/GDP Ratio	–1.0	–1.7	–0.9	–1.1	–1.2	–1.2	–1.3
Growth in the TFC/GDP Ratio	–1.4	–2.1	–0.9	–1.3	–1.0	–1.0	–1.0

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

CZECH REPUBLIC

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**38.51**	**38.52**	**28.02**	**29.87**	**27.35**	**25.66**	**21.46**
Coal[1]		38.01	34.71	23.08	25.00	19.00	17.00	12.00
Oil		0.04	0.21	0.38	0.38	0.40	0.40	0.40
Gas		0.36	0.20	0.18	0.17	0.10	0.10	0.30
Comb. Renewables & Wastes[2]		–	–	0.76	0.63	1.00	1.30	1.90
Nuclear		–	3.28	3.48	3.54	6.70	6.70	6.70
Hydro		0.09	0.12	0.14	0.15	0.15	0.16	0.16
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	–	–	–
TOTAL NET IMPORTS[4]		6.99	7.63	9.65	9.41	13.00	16.40	22.50
Coal[1]	Exports	2.56	7.26	6.21	5.78	5.60	4.10	1.10
	Imports	0.15	1.57	0.84	1.04	0.90	1.20	1.40
	Net Imports	–2.41	–5.69	–5.37	–4.74	–4.70	–2.90	0.30
Oil	Exports	0.04	6.56	1.32	1.09	1.50	1.60	1.60
	Imports	8.91	15.16	9.17	8.63	9.60	10.20	10.60
	Bunkers	–	–	–	–	–	–	–
	Net Imports	8.87	8.60	7.85	7.54	8.10	8.60	9.00
Gas	Exports	0.01	–	0.00	0.00	–	–	–
	Imports	0.73	4.78	7.44	7.48	10.00	11.00	13.00
	Net Imports	0.72	4.78	7.44	7.48	10.00	11.00	13.00
Electricity	Exports	0.44	0.76	1.05	1.61	0.70	0.70	0.40
	Imports	0.25	0.70	0.77	0.75	0.30	0.40	0.60
	Net Imports	–0.19	–0.06	–0.28	–0.86	–0.40	–0.30	0.20
TOTAL STOCK CHANGES		**–0.08**	**1.25**	**0.58**	**1.10**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**45.42**	**47.40**	**38.24**	**40.38**	**40.35**	**42.06**	**43.96**
Coal[1]		35.59	29.84	18.15	21.53	14.30	14.10	12.30
Oil		8.91	8.96	8.26	7.89	8.50	9.00	9.40
Gas		1.01	5.26	7.73	7.50	10.10	11.10	13.30
Comb. Renewables & Wastes[2]		–	–	0.76	0.63	1.00	1.30	1.90
Nuclear		–	3.28	3.48	3.54	6.70	6.70	6.70
Hydro		0.09	0.12	0.14	0.15	0.15	0.16	0.16
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	–	–	–
Electricity Trade[5]		–0.19	–0.06	–0.28	–0.86	–0.40	–0.30	0.20
Shares (%)								
Coal		*78.4*	*63.0*	*47.5*	*53.3*	*35.4*	*33.5*	*28.0*
Oil		*19.6*	*18.9*	*21.6*	*19.5*	*21.1*	*21.4*	*21.4*
Gas		*2.2*	*11.1*	*20.2*	*18.6*	*25.0*	*26.4*	*30.3*
Comb. Renewables & Wastes		–	–	*2.0*	*1.6*	*2.5*	*3.1*	*4.3*
Nuclear		–	*6.9*	*9.1*	*8.8*	*16.6*	*15.9*	*15.2*
Hydro		*0.2*	*0.3*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		*–0.4*	*–0.1*	*–0.7*	*–2.1*	*–1.0*	*–0.7*	*0.5*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**33.07**	**35.30**	**24.79**	**25.30**	**26.70**	**28.30**	**30.70**
Coal[1]	20.66	17.43	3.58	4.72	2.80	2.70	2.30
Oil	8.06	8.09	7.72	7.55	8.00	8.40	8.70
Gas	1.81	4.19	6.12	5.94	8.10	9.00	10.50
Comb. Renewables & Wastes[2]	–	–	0.27	0.22	0.50	0.70	1.00
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	2.54	4.14	4.14	4.25	4.30	4.45	5.10
Heat	–	1.45	2.96	2.62	3.00	3.05	3.10
Shares (%)							
Coal	*62.5*	*49.4*	*14.4*	*18.7*	*10.5*	*9.5*	*7.5*
Oil	*24.4*	*22.9*	*31.1*	*29.9*	*30.0*	*29.7*	*28.3*
Gas	*5.5*	*11.9*	*24.7*	*23.5*	*30.3*	*31.8*	*34.2*
Comb. Renewables & Wastes	–	–	*1.1*	*0.9*	*1.9*	*2.5*	*3.3*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.7*	*11.7*	*16.7*	*16.8*	*16.1*	*15.7*	*16.6*
Heat	–	*4.1*	*11.9*	*10.4*	*11.2*	*10.8*	*10.1*
TOTAL INDUSTRY[6]	**19.42**	**18.63**	**11.13**	**11.47**	**11.75**	**12.25**	**13.55**
Coal[1]	12.06	10.06	2.70	3.57	1.90	1.80	1.60
Oil	5.30	4.23	3.02	2.75	3.40	3.50	3.60
Gas	0.46	2.02	2.63	2.60	3.80	4.10	5.10
Comb. Renewables & Wastes[2]	–	–	0.25	0.14	0.05	0.10	0.20
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.61	2.32	1.62	1.63	1.60	1.70	1.95
Heat	–	–	0.92	0.79	1.00	1.05	1.10
Shares (%)							
Coal	*62.1*	*54.0*	*24.3*	*31.1*	*16.2*	*14.7*	*11.8*
Oil	*27.3*	*22.7*	*27.1*	*24.0*	*28.9*	*28.6*	*26.6*
Gas	*2.4*	*10.9*	*23.6*	*22.7*	*32.3*	*33.5*	*37.6*
Comb. Renewables & Wastes	–	–	*2.2*	*1.2*	*0.4*	*0.8*	*1.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.3*	*12.4*	*14.5*	*14.2*	*13.6*	*13.9*	*14.4*
Heat	–	–	*8.3*	*6.8*	*8.5*	*8.6*	*8.1*
TRANSPORT[7]	**2.46**	**2.86**	**4.79**	**4.88**	**4.45**	**4.80**	**5.20**
TOTAL OTHER SECTORS[8]	**11.18**	**13.81**	**8.87**	**8.94**	**10.50**	**11.25**	**11.95**
Coal[1]	8.47	7.37	0.88	1.15	0.90	0.90	0.70
Oil	0.60	1.27	0.14	0.19	0.50	0.60	0.70
Gas	1.35	2.17	3.47	3.31	4.20	4.70	5.00
Comb. Renewables & Wastes[2]	–	–	0.02	0.04	0.45	0.60	0.80
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.76	1.56	2.33	2.42	2.45	2.45	2.75
Heat	–	1.45	2.04	1.84	2.00	2.00	2.00
Shares (%)							
Coal	*75.7*	*53.3*	*9.9*	*12.9*	*8.6*	*8.0*	*5.9*
Oil	*5.4*	*9.2*	*1.6*	*2.1*	*4.8*	*5.3*	*5.9*
Gas	*12.1*	*15.7*	*39.1*	*37.0*	*40.0*	*41.8*	*41.8*
Comb. Renewables & Wastes	–	–	*0.2*	*0.5*	*4.3*	*5.3*	*6.7*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*6.8*	*11.3*	*26.3*	*27.0*	*23.3*	*21.8*	*23.0*
Heat	–	*10.5*	*23.0*	*20.6*	*19.0*	*17.8*	*16.7*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**9.70**	**16.54**	**19.14**	**20.39**	**20.25**	**20.56**	**20.26**
OUTPUT (Mtoe)	**3.54**	**5.38**	**5.52**	**6.27**	**5.70**	**5.75**	**5.90**
(TWh gross)	41.17	62.56	64.16	72.91	66.25	66.85	68.60
Output Shares (%)							
Coal	*85.1*	*71.8*	*69.9*	*73.1*	*50.1*	*49.5*	*43.0*
Oil	*11.3*	*4.8*	*0.7*	*0.5*	*0.9*	*1.4*	*2.3*
Gas	*0.9*	*1.0*	*4.7*	*4.3*	*6.2*	*6.5*	*11.7*
Comb. Renewables & Wastes	–	–	*1.3*	*1.0*	*1.4*	*1.4*	*2.9*
Nuclear	–	*20.1*	*20.8*	*18.6*	*38.8*	*38.4*	*37.5*
Hydro	*2.6*	*2.3*	*2.6*	*2.4*	*2.6*	*2.7*	*2.7*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.0*	–	–	–	–
TOTAL LOSSES	**13.62**	**13.54**	**13.79**	**14.77**	**13.65**	**13.76**	**13.26**
of which:							
Electricity and Heat Generation[10]	6.16	9.34	10.13	10.79	10.85	11.01	10.51
Other Transformation	5.90	1.73	1.08	1.15	0.50	0.40	0.30
Own Use and Losses[11]	1.57	2.48	2.58	2.83	2.30	2.35	2.45
Statistical Differences	**–1.27**	**–1.45**	**–0.34**	**0.32**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	40.52	54.61	53.00	54.56	66.38	84.72	138.01
Population (millions)	9.92	10.36	10.29	10.27	10.20	10.10	10.10
TPES/GDP[12]	1.12	0.87	0.72	0.74	0.61	0.50	0.32
Energy Production/TPES	0.85	0.81	0.73	0.74	0.68	0.61	0.49
Per Capita TPES[13]	4.58	4.57	3.72	3.93	3.96	4.16	4.35
Oil Supply/GDP[12]	0.22	0.16	0.16	0.14	0.13	0.11	0.07
TFC/GDP[12]	0.82	0.65	0.47	0.46	0.40	0.33	0.22
Per Capita TFC[13]	3.33	3.41	2.41	2.46	2.62	2.80	3.04
Energy–related CO_2 Emissions (Mt CO_2)[14]	153.0	153.8	109.2	118.8	99.8	102.8	102.2
CO_2 Emissions from Bunkers (Mt CO_2)	0.7	0.7	0.4	0.5	0.5	0.5	0.5

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.2	–0.2	–2.4	5.6	–0.0	0.8	0.4
Coal	–0.3	–1.4	–5.4	18.6	–7.9	–0.3	–1.4
Oil	4.2	–2.2	–0.9	–4.5	1.5	1.1	0.4
Gas	14.3	8.0	4.4	–3.0	6.1	1.9	1.8
Comb. Renewables & Wastes	–	–	–	–17.6	9.8	5.4	3.9
Nuclear	–	–	0.7	1.8	13.6	–	–
Hydro	13.3	–4.1	1.7	4.9	–0.1	0.7	0.3
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
TFC	2.8	–0.9	–3.9	2.0	1.1	1.2	0.8
Electricity Consumption	3.4	2.6	–0.0	2.6	0.2	0.7	1.4
Energy Production	2.0	–1.0	–3.5	6.6	–1.7	–1.3	–1.8
Net Oil Imports	3.9	–2.4	–1.0	–4.0	1.5	1.2	0.5
GDP	2.5	1.4	–0.3	2.9	4.0	5.0	5.0
Growth in the TPES/GDP Ratio	–1.3	–1.6	–2.0	2.6	–3.9	–4.0	–4.3
Growth in the TFC/GDP Ratio	0.3	–2.2	–3.5	–0.9	–2.8	–3.6	–4.0

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**0.43**	**10.30**	**23.89**	**27.87**	**27.67**	**14.69**	**..**
Coal[1]		–	–	–	–	–	–	..
Oil		0.07	5.85	14.86	18.26	16.24	8.05	..
Gas		–	2.77	7.02	7.41	8.56	3.55	..
Comb. Renewables & Wastes[2]		0.35	1.62	1.66	1.72	2.12	2.23	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.00	0.00	0.00	0.00	0.00	0.00	..
Geothermal		–	0.00	0.00	0.00	0.00	0.00	..
Solar/Wind/Other[3]		–	0.06	0.35	0.48	0.74	0.86	..
TOTAL NET IMPORTS[4]		**19.85**	**7.60**	**–4.98**	**–8.87**	**–6.39**	**6.87**	**..**
Coal[1]	Exports	0.04	0.03	0.12	0.07	..	..	..
	Imports	1.91	6.25	4.28	3.86	5.24	5.29	..
	Net Imports	1.87	6.22	4.16	3.79	5.24	5.29	..
Oil	Exports	2.89	5.56	15.45	18.47	5.60	–	..
	Imports	21.58	8.22	10.38	9.97	–	2.78	..
	Bunkers	0.69	0.96	1.31	1.34	1.40	1.40	..
	Net Imports	18.00	1.70	–6.37	–9.84	–7.00	1.38	..
Gas	Exports	–	0.93	2.57	2.88	3.19	..	..
	Imports	–	–	–	–	–	1.69	..
	Net Imports	–	–0.93	–2.57	–2.88	–3.19	1.69	..
Electricity	Exports	0.11	0.42	0.63	0.67	1.44	1.48	..
	Imports	0.09	1.03	0.43	0.72	..	..	..
	Net Imports	–0.02	0.61	–0.20	0.06	–1.44	–1.48	..
TOTAL STOCK CHANGES		**–0.44**	**0.18**	**1.05**	**0.46**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**19.83**	**18.07**	**19.97**	**19.46**	**21.28**	**21.56**	**..**
Coal[1]		1.93	6.10	4.61	4.02	5.24	5.29	..
Oil		17.57	7.86	9.05	8.74	9.25	9.43	..
Gas		–	1.82	4.49	4.45	5.37	5.24	..
Comb. Renewables & Wastes[2]		0.35	1.62	1.66	1.72	2.12	2.23	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.00	0.00	0.00	0.00	0.00	0.00	..
Geothermal		–	0.00	0.00	0.00	0.00	0.00	..
Solar/Wind/Other[3]		–	0.06	0.35	0.48	0.74	0.86	..
Electricity Trade[5]		–0.02	0.61	–0.20	0.06	–1.44	–1.48	..
Shares (%)								
Coal		*9.7*	*33.8*	*23.1*	*20.6*	*24.6*	*24.5*	..
Oil		*88.6*	*43.5*	*45.3*	*44.9*	*43.4*	*43.7*	..
Gas		–	*10.1*	*22.5*	*22.9*	*25.2*	*24.3*	..
Comb. Renewables & Wastes		*1.8*	*9.0*	*8.3*	*8.8*	*9.9*	*10.3*	..
Nuclear		–	–	–	–	–	–	..
Hydro		–	–	–	–	–	–	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	*0.3*	*1.8*	*2.5*	*3.5*	*4.0*	..
Electricity Trade		*–0.1*	*3.4*	*–1.0*	*0.3*	*–6.8*	*–6.9*	..

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
For forecast years, electricity exports may be lower when the CO_2 quota system is taken into account.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**16.26**	**13.88**	**15.43**	**15.03**	**15.94**	**16.23**	**..**
Coal[1]	0.34	0.41	0.32	0.31	0.27	0.27	..
Oil	14.26	7.55	7.69	7.42	7.61	7.76	..
Gas	0.12	1.16	1.77	1.67	2.24	2.25	..
Comb. Renewables & Wastes[2]	0.16	0.56	0.56	0.58	0.54	0.55	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.00	0.01	0.01	0.01	0.01	..
Electricity	1.39	2.44	2.77	2.79	2.77	2.84	..
Heat	–	1.76	2.32	2.25	2.50	2.55	..
Shares (%)							
Coal	2.1	2.9	2.1	2.1	1.7	1.7	..
Oil	87.7	54.4	49.8	49.4	47.8	47.8	..
Gas	0.7	8.3	11.4	11.1	14.0	13.9	..
Comb. Renewables & Wastes	1.0	4.1	3.6	3.9	3.4	3.4	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	8.5	17.6	18.0	18.6	17.4	17.5	..
Heat	–	*12.7*	*15.1*	*14.9*	*15.7*	*15.7*	..
TOTAL INDUSTRY[6]	**4.10**	**3.01**	**3.33**	**3.22**	**3.44**	**3.49**	**..**
Coal[1]	0.21	0.33	0.30	0.28	0.25	0.26	..
Oil	3.41	1.23	1.09	1.04	1.04	1.05	..
Gas	0.02	0.54	0.84	0.79	1.09	1.10	..
Comb. Renewables & Wastes[2]	0.06	0.11	0.10	0.09	0.09	0.09	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.40	0.73	0.85	0.86	0.87	0.89	..
Heat	–	0.07	0.15	0.15	0.10	0.10	..
Shares (%)							
Coal	*5.2*	*10.9*	*9.0*	*8.8*	*7.3*	*7.3*	..
Oil	*83.3*	*40.8*	*32.8*	*32.4*	*30.2*	*30.0*	..
Gas	*0.4*	*17.9*	*25.2*	*24.6*	*31.8*	*31.6*	..
Comb. Renewables & Wastes	*1.4*	*3.8*	*2.9*	*2.9*	*2.6*	*2.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.7*	*24.1*	*25.6*	*26.7*	*25.2*	*25.5*	..
Heat	–	*2.5*	*4.6*	*4.7*	*2.9*	*2.9*	..
TRANSPORT[7]	**3.52**	**4.11**	**4.91**	**4.87**	**5.14**	**5.37**	**..**
TOTAL OTHER SECTORS[8]	**8.65**	**6.77**	**7.19**	**6.94**	**7.37**	**7.38**	**..**
Coal[1]	0.13	0.08	0.02	0.03	0.02	0.02	..
Oil	7.34	2.24	1.71	1.54	1.46	1.37	..
Gas	0.10	0.62	0.93	0.88	1.14	1.15	..
Comb. Renewables & Wastes[2]	0.10	0.45	0.46	0.49	0.45	0.46	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.00	0.01	0.01	0.01	0.01	..
Electricity	0.98	1.70	1.89	1.90	1.89	1.94	..
Heat	–	1.68	2.17	2.09	2.40	2.45	..
Shares (%)							
Coal	*1.4*	*1.2*	*0.3*	*0.4*	*0.2*	*0.2*	..
Oil	*84.9*	*33.1*	*23.8*	*22.2*	*19.8*	*18.5*	..
Gas	*1.2*	*9.2*	*12.9*	*12.7*	*15.5*	*15.6*	..
Comb. Renewables & Wastes	*1.2*	*6.7*	*6.5*	*7.1*	*6.1*	*6.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
Electricity	*11.3*	*25.1*	*26.3*	*27.4*	*25.7*	*26.3*	..
Heat	–	*24.9*	*30.2*	*30.2*	*32.6*	*33.2*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.60**	**7.57**	**9.13**	**8.49**	**10.82**	**10.99**	**..**
OUTPUT (Mtoe)	**1.64**	**2.23**	**3.35**	**3.12**	**4.43**	**4.54**	**..**
(TWh gross)	19.12	25.98	38.90	36.24	51.47	52.80	..
Output Shares (%)							
Coal	*35.8*	*90.3*	*51.6*	*46.0*	*42.8*	*42.0*	..
Oil	*64.1*	*3.7*	*12.5*	*12.2*	*9.8*	*9.6*	..
Gas	–	*2.7*	*23.3*	*24.3*	*22.9*	*21.5*	..
Comb. Renewables & Wastes	–	*0.8*	*4.6*	*5.1*	*7.9*	*8.2*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*2.3*	*7.8*	*12.3*	*16.6*	*18.7*	..
TOTAL LOSSES	**3.66**	**4.13**	**4.66**	**4.41**	**5.35**	**5.33**	**..**
of which:							
Electricity and Heat Generation[10]	2.96	3.12	2.83	2.52	3.34	3.34	..
Other Transformation	0.44	–0.40	–0.08	–0.04	–	–	..
Own Use and Losses[11]	0.26	1.41	1.91	1.93	2.01	1.99	..
Statistical Differences	**–0.08**	**0.06**	**–0.12**	**0.02**	**–**	**–**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	128.44	163.49	199.67	206.08	224.53	241.52	..
Population (millions)	5.02	5.14	5.32	5.34	5.40	5.44	..
TPES/GDP[12]	0.15	0.11	0.10	0.09	0.09	0.09	..
Energy Production/TPES	0.02	0.57	1.20	1.43	1.30	0.68	..
Per Capita TPES[13]	3.95	3.52	3.75	3.64	3.94	3.96	..
Oil Supply/GDP[12]	0.14	0.05	0.05	0.04	0.04	0.04	..
TFC/GDP[12]	0.13	0.08	0.08	0.07	0.07	0.07	..
Per Capita TFC[13]	3.24	2.70	2.90	2.82	2.95	2.98	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	56.6	50.6	54.1	50.1	58.8	59.2	..
CO_2 Emissions from Bunkers (Mt CO_2)	4.5	4.8	6.4	6.6	6.8	6.8	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.2	–1.5	1.1	–2.6	1.8	0.3	..
Coal	14.4	3.2	–3.1	–12.9	5.5	0.2	..
Oil	–1.4	–6.3	1.6	–3.4	1.1	0.4	..
Gas	–	–	10.6	–0.9	3.8	–0.5	..
Comb. Renewables & Wastes	6.9	10.8	0.3	3.1	4.3	1.0	..
Nuclear	–	–	–	–	–	–	..
Hydro	–	–	4.6	–33.3	–	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	44.0	22.8	37.4	9.2	2.9	..
TFC	0.7	–1.8	1.2	–2.6	1.2	0.4	..
Electricity Consumption	4.9	2.5	1.4	0.7	–0.1	0.5	..
Energy Production	14.7	23.9	9.8	16.6	–0.1	–11.9	..
Net Oil Imports	–2.6	–18.1	–	54.3	–6.6	–	..
GDP	1.5	1.4	2.2	3.2	1.7	1.5	..
Growth in the TPES/GDP Ratio	–0.3	–2.8	–1.1	–5.6	0.1	–1.2	..
Growth in the TFC/GDP Ratio	–0.9	–3.1	–1.0	–5.6	–0.5	–1.1	..

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

FINLAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**4.9**	**11.7**	**15.4**	**15.1**	**15.4**	**15.7**	**16.4**
Coal[1]		–	–	–	–	–	–	–
Peat		0.1	1.8	2.0	1.2	1.4	0.9	0.9
Oil		–	–	0.1	0.1	–	–	–
Gas		–	–	–	–	–	–	–
Comb. Renewables & Wastes[2]		3.9	4.0	6.3	6.7	7.1	7.9	8.6
Nuclear		–	5.0	6.0	5.9	5.7	5.7	5.5
Hydro		0.9	0.9	1.1	1.3	1.1	1.2	1.2
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.1	0.2
TOTAL NET IMPORTS[4]		**16.6**	**17.7**	**16.8**	**18.1**	**17.9**	**17.5**	**18.0**
Coal[1]	Exports	0.0	0.0	–	–	–	–	–
	Imports	2.4	4.4	2.7	3.6	3.2	1.3	1.1
	Net Imports	2.4	4.4	2.7	3.6	3.2	1.3	1.1
Peat	Exports	–	–	0.0	0.0	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–0.0	–0.0	–	–	–
Oil	Exports	0.2	1.7	5.2	5.2	–	–	–
	Imports	14.0	12.5	15.7	16.0	8.1	7.9	7.6
	Bunkers	0.1	0.6	0.6	0.7	–	–	–
	Net Imports	13.8	10.2	9.9	10.1	8.1	7.9	7.6
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	2.2	3.3	3.4	6.0	7.9	8.8
	Net Imports	–	2.2	3.3	3.4	6.0	7.9	8.8
Electricity	Exports	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Imports	0.4	0.9	1.0	1.1	0.6	0.5	0.5
	Net Imports	0.4	0.9	1.0	1.0	0.6	0.5	0.5
TOTAL STOCK CHANGES		**–0.1**	**–0.6**	**1.1**	**–0.1**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**21.3**	**28.8**	**33.4**	**33.1**	**33.3**	**33.2**	**34.4**
Coal[1]		2.5	4.1	3.6	3.6	3.2	1.3	1.1
Peat		0.0	1.2	1.6	1.4	1.4	0.9	0.9
Oil		13.6	10.3	10.4	9.8	8.1	7.9	7.6
Gas		–	2.2	3.3	3.4	6.0	7.9	8.8
Comb. Renewables & Wastes[2]		3.9	4.2	6.3	6.7	7.1	7.9	8.6
Nuclear		–	5.0	6.0	5.9	5.7	5.7	5.5
Hydro		0.9	0.9	1.1	1.3	1.1	1.2	1.2
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.1	0.2
Electricity Trade[5]		0.4	0.9	1.0	1.0	0.6	0.5	0.5
Shares (%)								
Coal		*11.8*	*14.2*	*10.8*	*10.9*	*9.7*	*3.8*	*3.2*
Peat		*0.2*	*4.2*	*4.9*	*4.4*	*4.3*	*2.7*	*2.7*
Oil		*63.6*	*35.6*	*31.3*	*29.5*	*24.4*	*23.7*	*22.2*
Gas		*–*	*7.6*	*10.0*	*10.3*	*18.1*	*23.8*	*25.5*
Comb. Renewables & Wastes		*18.5*	*14.6*	*18.9*	*20.3*	*21.4*	*23.8*	*25.1*
Nuclear		*–*	*17.4*	*18.0*	*17.7*	*17.0*	*17.1*	*16.1*
Hydro		*4.2*	*3.2*	*3.3*	*3.8*	*3.4*	*3.5*	*3.3*
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other		*–*	*–*	*–*	*–*	*0.1*	*0.3*	*0.6*
Electricity Trade		*1.7*	*3.2*	*2.9*	*3.1*	*1.7*	*1.4*	*1.3*

0 is negligible, – is nil, .. is not available.
Please note: Forecast data are based on the policy option of substitution of coal with natural gas in electricity production.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**19.4**	**22.4**	**24.9**	**24.8**	**26.3**	**26.4**	**27.7**
Coal[1]	1.0	1.2	0.9	0.8	1.1	0.8	0.9
Peat	0.0	0.4	0.4	0.3	0.3	0.2	0.2
Oil	11.5	9.7	8.7	8.3	7.8	7.5	7.3
Gas	0.0	1.0	1.3	1.0	2.5	2.6	3.0
Comb. Renewables & Wastes[2]	3.9	3.2	4.6	5.0	5.2	5.5	6.0
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	2.3	5.1	6.4	6.5	7.0	7.3	7.9
Heat	0.6	1.9	2.8	2.8	2.5	2.5	2.5
Shares (%)							
Coal	*5.3*	*5.2*	*3.5*	*3.4*	*4.0*	*3.1*	*3.2*
Peat	*0.1*	*1.8*	*1.4*	*1.3*	*1.2*	*0.7*	*0.7*
Oil	*59.2*	*43.2*	*34.7*	*33.7*	*29.5*	*28.5*	*26.2*
Gas	*0.1*	*4.4*	*5.2*	*4.0*	*9.4*	*9.9*	*10.7*
Comb. Renewables & Wastes	*20.3*	*14.1*	*18.5*	*20.2*	*19.9*	*20.7*	*21.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.9*	*22.7*	*25.6*	*26.2*	*26.7*	*27.7*	*28.5*
Heat	*3.1*	*8.6*	*11.1*	*11.2*	*9.4*	*9.4*	*9.1*
TOTAL INDUSTRY[6]	**7.6**	**10.5**	**12.2**	**12.2**	**13.4**	**13.6**	**15.0**
Coal[1]	0.9	1.2	0.9	0.8	1.1	0.8	0.9
Peat	0.0	0.4	0.3	0.3	0.3	0.2	0.2
Oil	5.0	2.6	2.0	1.8	1.3	1.3	1.3
Gas	0.0	0.9	1.2	0.9	2.4	2.5	2.9
Comb. Renewables & Wastes[2]	–	2.5	3.5	3.9	4.2	4.4	4.9
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.6	2.8	3.6	3.7	4.0	4.2	4.6
Heat	0.1	0.2	0.6	0.7	0.3	0.3	0.2
Shares (%)							
Coal	*12.1*	*11.0*	*7.1*	*6.8*	*7.9*	*5.9*	*5.8*
Peat	*0.2*	*3.6*	*2.8*	*2.4*	*2.1*	*1.3*	*1.2*
Oil	*66.2*	*24.7*	*16.8*	*15.0*	*9.4*	*9.5*	*8.6*
Gas	*0.1*	*9.0*	*9.9*	*7.6*	*18.0*	*18.6*	*19.2*
Comb. Renewables & Wastes	–	*23.4*	*28.8*	*32.1*	*31.1*	*32.1*	*32.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*20.4*	*26.6*	*29.4*	*30.1*	*29.6*	*30.6*	*30.8*
Heat	*1.0*	*1.7*	*5.3*	*6.0*	*1.9*	*1.8*	*1.6*
TRANSPORT[7]	**2.6**	**4.4**	**4.6**	**4.5**	**4.2**	**4.1**	**4.1**
TOTAL OTHER SECTORS[8]	**9.3**	**7.5**	**8.2**	**8.1**	**8.8**	**8.7**	**8.6**
Coal[1]	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Peat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	3.9	2.7	2.1	2.1	2.4	2.2	2.0
Gas	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Comb. Renewables & Wastes[2]	3.9	0.7	1.1	1.1	1.1	1.1	1.1
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.8	2.2	2.8	2.8	3.0	3.1	3.2
Heat	0.5	1.7	2.1	2.0	2.2	2.2	2.3
Shares (%)							
Coal	*1.1*	*0.1*	–	–	–	*0.1*	*0.2*
Peat	*0.1*	*0.2*	*0.3*	*0.3*	*0.2*	*0.2*	*0.2*
Oil	*42.3*	*36.7*	*25.8*	*25.6*	*27.2*	*25.2*	*22.9*
Gas	–	*0.6*	*0.8*	*0.8*	*0.7*	*0.7*	*0.8*
Comb. Renewables & Wastes	*42.6*	*9.3*	*13.5*	*13.5*	*12.3*	*12.6*	*12.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.2*	*29.9*	*33.6*	*34.4*	*34.3*	*35.6*	*37.2*
Heat	*5.7*	*23.2*	*26.0*	*25.4*	*25.3*	*25.6*	*26.2*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.5**	**11.9**	**14.6**	**14.8**	**15.9**	**16.1**	**16.6**
OUTPUT (Mtoe)	**2.2**	**4.7**	**6.0**	**6.0**	**6.7**	**7.1**	**7.7**
(TWh gross)	26.1	54.4	69.4	70.0	78.1	82.6	89.4
Output Shares (%)							
Coal	*18.7*	*18.5*	*13.9*	*13.2*	*13.9*	*3.4*	*2.4*
Peat	*9.4*	*14.6*	*7.0*	*5.7*	*5.0*	*3.0*	*2.8*
Oil	*31.6*	*3.1*	*1.3*	*0.9*	*1.9*	*2.0*	*2.1*
Gas	–	*8.6*	*13.7*	*14.4*	*21.1*	*32.0*	*34.1*
Comb. Renewables & Wastes	–	–	*12.5*	*12.7*	*13.0*	*15.8*	*17.3*
Nuclear	–	*35.3*	*33.1*	*32.1*	*27.9*	*26.3*	*23.8*
Hydro	*40.3*	*20.0*	*18.4*	*20.9*	*16.7*	*16.2*	*15.0*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.4*	*1.3*	*2.5*
TOTAL LOSSES	**2.0**	**7.2**	**8.1**	**8.3**	**7.0**	**6.8**	**6.7**
of which:							
Electricity and Heat Generation[10]	0.6	5.1	5.7	5.8	6.5	6.3	6.2
Other Transformation	0.5	0.6	0.9	0.8	–	–	–
Own Use and Losses[11]	0.9	1.4	1.6	1.6	0.5	0.5	0.5
Statistical Differences	**–0.1**	**–0.7**	**0.3**	**0.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	81.40	133.73	156.61	165.54	181.88	199.82	248.40
Population (millions)	4.67	4.99	5.17	5.18	5.22	5.26	5.29
TPES/GDP[12]	0.26	0.22	0.21	0.20	0.18	0.17	0.14
Energy Production/TPES	0.23	0.41	0.46	0.46	0.46	0.47	0.48
Per Capita TPES[13]	4.57	5.78	6.46	6.40	6.38	6.32	6.50
Oil Supply/GDP[12]	0.17	0.08	0.07	0.06	0.04	0.04	0.03
TFC/GDP[12]	0.24	0.17	0.16	0.15	0.14	0.13	0.11
Per Capita TFC[13]	4.16	4.48	4.83	4.78	5.04	5.03	5.24
Energy–related CO_2 Emissions (Mt CO_2)[14]	48.4	55.0	56.2	54.8	56.1	49.7	50.4
CO_2 Emissions from Bunkers (Mt CO_2)	0.5	2.8	2.9	3.2	1.1	1.1	1.1

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	2.3	1.5	1.6	–0.6	0.1	–0.0	0.3
Coal	7.4	0.6	–1.4	0.5	–2.3	–17.1	–1.4
Peat	48.1	10.6	3.3	–11.9	–0.2	–8.9	0.3
Oil	–0.5	–2.3	0.2	–6.3	–3.6	–0.6	–0.3
Gas	–	9.4	4.8	2.5	12.0	5.5	1.1
Comb. Renewables & Wastes	–2.4	1.9	4.6	7.2	1.1	2.1	0.9
Nuclear	–	10.0	2.0	–2.2	–0.7	–	–0.2
Hydro	0.6	–0.0	1.8	14.7	–2.3	0.5	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	75.0	32.0	27.7	7.2
TFC	0.4	1.1	1.2	–0.7	1.2	0.1	0.5
Electricity Consumption	4.7	4.7	2.6	1.7	1.6	0.8	0.8
Energy Production	4.7	5.6	3.1	–1.7	0.3	0.4	0.4
Net Oil Imports	1.1	–3.3	–0.4	2.1	–4.3	–0.6	–0.3
GDP	2.4	3.3	1.8	5.7	1.9	1.9	2.2
Growth in the TPES/GDP Ratio	–0.1	–1.7	–0.1	–6.0	–1.8	–1.9	–1.8
Growth in the TFC/GDP Ratio	–1.9	–2.1	–0.5	–6.1	–0.6	–1.8	–1.7

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**36.1**	**110.7**	**127.5**	**131.4**	**..**	**129.3**	**118.6**
Coal[1]		18.0	8.2	3.4	2.5	..	–	–
Oil		2.1	3.5	1.9	1.8	..	–	–
Gas		6.3	2.5	1.7	1.5	..	–	–
Comb. Renewables & Wastes[2]		1.7	9.8	11.4	11.4	..	11.4	12.5
Nuclear		3.8	81.9	102.7	108.2	..	111.4	99.5
Hydro		4.1	4.6	6.2	5.8	..	6.5	6.5
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**	**117.1**	**128.6**	**129.3**	**..**	**178.5**	**215.7**
Coal[1]	Exports	1.3	0.6	0.4	0.5	..	–	–
	Imports	10.8	13.7	12.7	13.5	..	10.8	11.5
	Net Imports	9.5	13.0	12.3	13.0	..	10.8	11.5
Oil	Exports	13.7	14.8	19.8	23.0	..	6.3	5.6
	Imports	145.1	100.9	109.6	112.9	..	121.3	135.1
	Bunkers	5.3	2.5	2.9	3.0	..	2.7	3.4
	Net Imports	126.0	83.6	87.0	87.0	..	112.3	126.1
Gas	Exports	0.1	0.3	0.7	1.1	..	–	–
	Imports	7.6	24.7	35.5	36.4	..	59.7	82.4
	Net Imports	7.6	24.4	34.8	35.3	..	59.7	82.4
Electricity	Exports	0.6	4.5	5.9	6.3	..	4.3	4.3
	Imports	0.4	0.6	0.4	0.3	..	–	–
	Net Imports	–0.2	–3.9	–5.4	–6.0	..	–4.3	–4.3
TOTAL STOCK CHANGES		**–2.4**	**–1.7**	**–1.0**	**–3.6**	**..**	**–**	**–**
TOTAL SUPPLY (TPES)		**176.6**	**226.0**	**255.2**	**257.1**	**..**	**307.8**	**334.2**
Coal[1]		29.2	20.2	15.5	15.0	..	10.8	11.5
Oil		124.3	87.3	90.1	87.2	..	112.3	126.1
Gas		13.6	26.0	34.5	35.3	..	59.7	82.4
Comb. Renewables & Wastes[2]		1.7	9.8	11.4	11.4	..	11.4	12.5
Nuclear		3.8	81.9	102.7	108.2	..	111.4	99.5
Hydro		4.1	4.6	6.2	5.8	..	6.5	6.5
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	–5.4	–6.0	..	–4.3	–4.3
Shares (%)								
Coal		*16.6*	*8.9*	*6.1*	*5.8*	..	*3.5*	*3.4*
Oil		*70.4*	*38.6*	*35.3*	*33.9*	..	*36.5*	*37.7*
Gas		*7.7*	*11.5*	*13.5*	*13.7*	..	*19.4*	*24.7*
Comb. Renewables & Wastes		*1.0*	*4.3*	*4.5*	*4.4*	..	*3.7*	*3.7*
Nuclear		*2.2*	*36.2*	*40.3*	*42.1*	..	*36.2*	*29.8*
Hydro		*2.3*	*2.0*	*2.4*	*2.2*	..	*2.1*	*2.0*
Geothermal		–	*0.1*	–	–	..	..	..
Solar/Wind/Other		–	–	–	–	..	..	..
Electricity Trade		*–0.1*	*–1.7*	*–2.1*	*–2.3*	..	*–1.4*	*–1.3*

0 is negligible, – is nil, .. is not available.
Please note: Forecast data for combustible renewables and waste include final consumption of solar. Forecasts do not include inputs and outputs from geothermal, solar, wind and combustible renewables and waste to electricity and heat generation. All forecast data are based on the 1999 submission.

Unit:Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**138.1**	**146.3**	**168.6**	**168.7**	**..**	**204.5**	**231.2**
Coal[1]	13.1	7.5	4.6	4.4	..	7.9	7.9
Oil	99.4	79.5	88.8	88.1	..	105.2	118.8
Gas	11.2	23.9	32.6	32.9	..	40.5	45.8
Comb. Renewables & Wastes[2]	1.7	8.5	9.7	9.4	..	11.4	12.5
Geothermal	–	–	–	–	..	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	..	..	..
Electricity	12.8	26.0	32.2	33.1	..	39.5	46.1
Heat	–	0.8	0.7	0.8	..	..	..
Shares (%)							
Coal	*9.5*	*5.1*	*2.7*	*2.6*	..	*3.9*	*3.4*
Oil	*72.0*	*54.3*	*52.7*	*52.2*	..	*51.5*	*51.4*
Gas	*8.1*	*16.4*	*19.3*	*19.5*	..	*19.8*	*19.8*
Comb. Renewables & Wastes	*1.2*	*5.8*	*5.8*	*5.6*	..	*5.6*	*5.4*
Geothermal	–	–	–	–	..	–	–
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*9.3*	*17.7*	*19.1*	*19.6*	..	*19.3*	*20.0*
Heat	–	*0.6*	*0.4*	*0.5*	..	..	..
TOTAL INDUSTRY[6]	**55.7**	**46.2**	**50.8**	**51.1**	**..**	**63.6**	**70.5**
Coal[1]	7.2	5.9	3.8	3.8	..	6.3	5.6
Oil	35.3	18.0	19.5	19.5	..	26.3	28.9
Gas	5.8	11.1	14.2	14.5	..	15.1	16.5
Comb. Renewables & Wastes[2]	0.2	1.4	1.8	1.6	..	2.0	2.6
Geothermal	–	–	–	–	..	–	–
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	7.2	9.9	11.4	11.6	..	13.8	16.9
Heat	–	–	–	–	..	..	..
Shares (%)							
Coal	*12.9*	*12.7*	*7.5*	*7.4*	..	*10.0*	*8.0*
Oil	*63.4*	*38.9*	*38.3*	*38.1*	..	*41.4*	*41.0*
Gas	*10.4*	*24.0*	*28.0*	*28.5*	..	*23.8*	*23.4*
Comb. Renewables & Wastes	*0.4*	*3.1*	*3.6*	*3.2*	..	*3.1*	*3.7*
Geothermal	–	–	–	–	..	–	–
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*13.0*	*21.3*	*22.5*	*22.8*	..	*21.7*	*24.0*
Heat	–	–	–	–	..	..	..
TRANSPORT[7]	**27.1**	**42.8**	**51.4**	**52.8**	**..**	**62.4**	**75.4**
TOTAL OTHER SECTORS[8]	**55.4**	**57.2**	**66.5**	**64.9**	**..**	**78.5**	**85.2**
Coal[1]	5.8	1.7	0.8	0.6	..	1.6	2.3
Oil	37.6	19.5	19.2	17.1	..	17.9	16.1
Gas	5.4	12.8	18.3	18.3	..	25.4	29.3
Comb. Renewables & Wastes[2]	1.5	7.1	7.7	7.5	..	9.1	9.6
Geothermal	–	–	–	–	..	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	..	..	..
Electricity	5.0	15.3	19.9	20.5	..	24.6	27.9
Heat	–	0.8	0.7	0.8	..	..	..
Shares (%)							
Coal	*10.5*	*2.9*	*1.1*	*0.9*	..	*2.0*	*2.7*
Oil	*68.0*	*34.0*	*28.8*	*26.4*	..	*22.7*	*18.9*
Gas	*9.7*	*22.4*	*27.6*	*28.2*	..	*32.3*	*34.4*
Comb. Renewables & Wastes	*2.7*	*12.4*	*11.5*	*11.6*	..	*11.6*	*11.3*
Geothermal	–	–	–	–	..	–	–
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*9.0*	*26.8*	*29.9*	*31.6*	..	*31.3*	*32.8*
Heat	–	*1.5*	*1.1*	*1.2*	..	..	..

Unit:Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**35.9**	**98.5**	**121.2**	**126.2**	**..**	**137.6**	**142.9**
OUTPUT (Mtoe)	**15.7**	**35.8**	**44.7**	**46.1**	**..**	**52.7**	**57.8**
(TWh gross)	182.5	416.8	519.3	535.8	..	612.7	672.1
Output Shares (%)							
Coal	*19.4*	*8.5*	*6.2*	*5.8*	..	*1.5*	*1.9*
Oil	*40.2*	*2.1*	*1.9*	*1.4*	..	*0.2*	*0.1*
Gas	*5.5*	*0.7*	*1.3*	*2.1*	..	*16.3*	*29.8*
Comb. Renewables & Wastes	*0.4*	*0.4*	*0.6*	*0.6*	..	..	..
Nuclear	*8.1*	*75.4*	*75.9*	*77.5*	..	*69.8*	*56.8*
Hydro	*26.1*	*12.8*	*13.9*	*12.5*	..	*12.3*	*11.3*
Geothermal	–	*0.0*	–	–	..	–	–
Solar/Wind/Other	*0.3*	*0.1*	*0.1*	*0.1*	..	..	..
TOTAL LOSSES	**37.6**	**75.2**	**89.9**	**93.6**	**..**	**103.2**	**103.1**
of which:							
Electricity and Heat Generation[10]	20.2	61.8	75.8	79.4	..	86.4	85.7
Other Transformation	5.4	1.6	0.5	0.9	..	..	..
Own Use and Losses[11]	12.0	11.8	13.5	13.4	..	16.9	17.4
Statistical Differences	**0.9**	**4.5**	**–3.3**	**–5.2**	**..**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	961.43	1473.22	1702.85	1755.62	1967.01	2203.87	2766.57
Population (millions)	53.42	58.03	60.16	60.43	60.80	61.70	63.50
TPES/GDP[12]	0.18	0.15	0.15	0.15	..	0.14	0.12
Energy Production/TPES	0.20	0.49	0.50	0.51	..	0.42	0.35
Per Capita TPES[13]	3.31	3.90	4.24	4.25	..	4.99	5.26
Oil Supply/GDP[12]	0.13	0.06	0.05	0.05	..	0.05	0.05
TFC/GDP[12]	0.14	0.10	0.10	0.10	..	0.09	0.08
Per Capita TFC[13]	2.58	2.52	2.80	2.79	..	3.31	3.64
Energy–related CO_2 Emissions (Mt CO_2)[14]	489.0	352.7	376.7	373.3	..	461.9	554.0
CO_2 Emissions from Bunkers (Mt CO_2)	22.7	17.7	25.0	25.3	..	24.3	26.5

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.0	1.7	1.4	0.8	..	..	0.8
Coal	1.7	–4.2	–2.9	–3.5	..	..	0.6
Oil	–1.4	–2.4	0.4	–3.2	..	..	1.2
Gas	7.4	2.0	3.2	2.4	..	..	3.3
Comb. Renewables & Wastes	7.6	12.7	1.7	0.5	..	..	0.9
Nuclear	18.1	20.6	2.6	5.3	..	..	–1.1
Hydro	5.7	–2.0	3.4	–7.5	..	..	0.1
Geothermal	–	–	–1.0	6.0	..	..	–
Solar/Wind/Other	–1.8	3.2	1.7	14.1	..	..	..
TFC	0.7	0.2	1.6	0.1	..	..	1.2
Electricity Consumption	5.4	3.7	2.4	2.8	..	..	1.6
Energy Production	2.1	9.5	1.6	3.0	..	..	–0.9
Net Oil Imports	–1.4	–2.9	0.4	0.0	..	..	1.2
GDP	2.8	2.4	1.6	3.1	2.3	2.3	2.3
Growth in the TPES/GDP Ratio	–1.8	–0.6	–0.3	–2.3	..	..	–1.4
Growth in the TFC/GDP Ratio	–2.1	–2.2	–0.0	–3.0	..	..	–1.0

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**171.7**	**185.5**	**136.5**	**134.3**	**124.3**	**116.9**	**..**
Coal[1]		141.4	121.8	62.2	59.2	52.6	51.0	..
Oil		6.8	4.7	3.4	3.9	2.0	1.6	..
Gas		16.4	13.5	16.7	15.8	14.4	13.1	..
Comb. Renewables & Wastes[2]		2.5	4.1	7.7	8.4	7.8	8.3	..
Nuclear		3.2	39.8	44.3	44.2	44.2	39.1	..
Hydro		1.3	1.5	1.7	1.9	1.8	1.9	..
Geothermal		–	0.0	0.0	0.0	–	–	..
Solar/Wind/Other[3]		–	0.0	0.6	0.9	1.4	2.0	..
TOTAL NET IMPORTS[4]		**167.3**	**165.4**	**202.1**	**201.1**	**226.6**	**233.5**	**..**
Coal[1]	Exports	18.3	8.2	0.4	0.4	0.2	0.1	..
	Imports	15.2	11.5	17.8	19.2	23.7	23.1	..
	Net Imports	–3.1	3.3	17.3	18.8	23.5	23.0	..
Oil	Exports	9.9	10.2	18.7	22.2	14.8	14.6	..
	Imports	171.1	132.9	148.1	149.6	155.4	154.7	..
	Bunkers	4.1	2.5	2.1	2.2	1.9	1.8	..
	Net Imports	157.1	120.2	127.4	125.2	138.7	138.4	..
Gas	Exports	0.1	0.9	4.3	4.2	2.7	2.9	..
	Imports	12.4	42.7	61.6	61.1	66.2	74.1	..
	Net Imports	12.3	41.7	57.3	56.8	63.5	71.2	..
Electricity	Exports	0.7	2.6	3.4	3.6	1.9	1.7	..
	Imports	1.7	2.7	3.5	3.9	2.8	2.6	..
	Net Imports	1.0	0.1	0.1	0.3	0.9	0.9	..
TOTAL STOCK CHANGES		**–1.1**	**4.7**	**2.4**	**4.3**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**337.9**	**355.5**	**341.0**	**339.6**	**350.8**	**350.4**	**..**
Coal[1]		139.4	128.5	79.7	80.6	76.1	74.0	..
Oil		161.9	126.5	135.1	131.6	140.7	140.0	..
Gas		28.7	55.0	72.0	71.8	78.0	84.2	..
Comb. Renewables & Wastes[2]		2.5	4.1	7.7	8.4	7.8	8.3	..
Nuclear		3.2	39.8	44.3	44.2	44.2	39.1	..
Hydro		1.3	1.5	1.7	1.9	1.8	1.9	..
Geothermal		–	0.0	0.0	0.0	–	–	..
Solar/Wind/Other[3]		–	0.0	0.6	0.9	1.4	2.0	..
Electricity Trade[5]		1.0	0.1	0.1	0.3	0.9	0.9	..
Shares (%)								
Coal		*41.2*	*36.2*	*23.4*	*23.7*	*21.7*	*21.1*	..
Oil		*47.9*	*35.6*	*39.6*	*38.7*	*40.1*	*39.9*	..
Gas		*8.5*	*15.5*	*21.1*	*21.1*	*22.2*	*24.0*	..
Comb. Renewables & Wastes		*0.7*	*1.2*	*2.2*	*2.5*	*2.2*	*2.4*	..
Nuclear		*0.9*	*11.2*	*13.0*	*13.0*	*12.6*	*11.2*	..
Hydro		*0.4*	*0.4*	*0.5*	*0.6*	*0.5*	*0.5*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	*0.2*	*0.3*	*0.4*	*0.6*	..
Electricity Trade		*0.3*	–	–	*0.1*	*0.3*	*0.3*	..

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

Please note: All data include the new Laender of Germany.In the forecast data. Gas works gas is included with coal instead of with gas.Statistical differences in both coal and gas are due to differences between production and consumption in the German "Energiebilanzen". Forecasts are based on the 1999 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**246.6**	**246.6**	**243.7**	**244.9**	**260.0**	**261.7**	**..**
Coal[1]	53.1	37.3	10.6	10.3	13.2	11.6	..
Oil	138.2	117.7	125.3	122.8	131.0	130.3	..
Gas	21.1	41.0	54.3	57.3	59.6	61.7	..
Comb. Renewables & Wastes[2]	1.7	2.3	5.0	5.4	4.3	4.3	..
Geothermal	–	0.0	0.0	0.0	–	–	..
Solar/Wind/Other	–	0.0	0.1	0.1	0.3	0.5	..
Electricity	26.9	39.1	40.2	42.2	42.9	44.6	..
Heat	5.5	9.1	8.2	6.8	8.6	8.6	..
Shares (%)							
Coal	*21.5*	*15.1*	*4.3*	*4.2*	*5.1*	*4.4*	..
Oil	*56.0*	*47.7*	*51.4*	*50.2*	*50.4*	*49.8*	..
Gas	*8.6*	*16.6*	*22.3*	*23.4*	*22.9*	*23.6*	..
Comb. Renewables & Wastes	*0.7*	*0.9*	*2.0*	*2.2*	*1.6*	*1.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	*0.1*	*0.2*	..
Electricity	*10.9*	*15.9*	*16.5*	*17.2*	*16.5*	*17.1*	..
Heat	*2.2*	*3.7*	*3.4*	*2.8*	*3.3*	*3.3*	..
TOTAL INDUSTRY[6]	**105.9**	**88.7**	**76.9**	**81.0**	**86.4**	**88.8**	**..**
Coal[1]	28.7	20.7	9.2	9.0	12.2	11.0	..
Oil	46.9	27.3	28.0	27.9	30.9	31.8	..
Gas	13.3	19.7	20.9	23.4	23.3	25.1	..
Comb. Renewables & Wastes[2]	0.0	–	–	–	0.3	0.3	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	15.3	18.6	17.7	19.7	18.1	18.9	..
Heat	1.6	2.4	1.1	0.9	1.6	1.7	..
Shares (%)							
Coal	*27.1*	*23.3*	*11.9*	*11.2*	*14.1*	*12.3*	..
Oil	*44.3*	*30.8*	*36.4*	*34.5*	*35.7*	*35.9*	..
Gas	*12.6*	*22.2*	*27.2*	*28.9*	*27.0*	*28.3*	..
Comb. Renewables & Wastes	–	–	–	–	*0.3*	*0.3*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*14.5*	*21.0*	*23.0*	*24.4*	*21.0*	*21.3*	..
Heat	*1.5*	*2.7*	*1.4*	*1.1*	*1.9*	*1.9*	..
TRANSPORT[7]	**39.7**	**60.0**	**68.3**	**67.2**	**67.3**	**67.4**	**..**
TOTAL OTHER SECTORS[8]	**101.0**	**97.9**	**98.5**	**96.7**	**106.2**	**105.5**	**..**
Coal[1]	22.7	16.6	1.4	1.3	1.0	0.7	..
Oil	54.2	31.6	30.4	29.1	34.5	33.0	..
Gas	7.8	21.3	33.4	33.9	36.3	36.6	..
Comb. Renewables & Wastes[2]	1.7	2.3	5.0	5.4	3.9	3.9	..
Geothermal	–	0.0	0.0	0.0	–	–	..
Solar/Wind/Other	–	0.0	0.1	0.1	0.3	0.5	..
Electricity	10.7	19.3	21.1	21.1	23.2	24.0	..
Heat	3.9	6.7	7.1	5.9	7.0	6.9	..
Shares (%)							
Coal	*22.5*	*16.9*	*1.4*	*1.3*	*1.0*	*0.6*	..
Oil	*53.6*	*32.3*	*30.9*	*30.0*	*32.5*	*31.3*	..
Gas	*7.7*	*21.8*	*33.9*	*35.1*	*34.2*	*34.6*	..
Comb. Renewables & Wastes	*1.7*	*2.3*	*5.1*	*5.6*	*3.7*	*3.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.3*	*0.5*	..
Electricity	*10.6*	*19.8*	*21.4*	*21.8*	*21.8*	*22.8*	..
Heat	*3.9*	*6.9*	*7.2*	*6.1*	*6.6*	*6.5*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**98.6**	**141.2**	**132.0**	**132.4**	**129.3**	**128.8**	**..**
OUTPUT (Mtoe)	**32.2**	**47.1**	**47.3**	**48.8**	**49.4**	**51.4**	**..**
(TWh gross)	374.4	547.6	550.3	567.1	574.9	598.0	..
Output Shares (%)							
Coal	*69.0*	*58.8*	*52.0*	*52.7*	*51.9*	*50.5*	..
Oil	*12.0*	*1.9*	*1.1*	*0.8*	*0.8*	*0.8*	..
Gas	*10.9*	*7.4*	*10.0*	*9.3*	*9.8*	*14.5*	..
Comb. Renewables & Wastes	*0.8*	*0.9*	*1.5*	*1.8*	*2.2*	*2.7*	..
Nuclear	*3.2*	*27.8*	*30.9*	*29.9*	*29.5*	*25.1*	..
Hydro	*4.1*	*3.2*	*3.6*	*3.8*	*3.6*	*3.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.0*	*1.0*	*1.7*	*2.2*	*2.9*	..
TOTAL LOSSES	**90.7**	**112.0**	**98.6**	**99.6**	**89.1**	**86.5**	**..**
of which:							
Electricity and Heat Generation[10]	60.0	83.4	75.6	76.1	71.4	69.3	..
Other Transformation	7.0	8.0	5.1	5.8	1.0	0.9	..
Own Use and Losses[11]	23.7	20.5	17.8	17.7	16.7	16.3	..
Statistical Differences	**0.5**	**–3.0**	**–1.2**	**–4.9**	**1.8**	**2.2**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	1574.08	2270.26	2608.14	2686.50	2966.11	3274.83	..
Population (millions)	78.96	79.36	82.09	82.17	79.70	78.60	..
TPES/GDP[12]	0.21	0.16	0.13	0.13	0.12	0.11	..
Energy Production/TPES	0.51	0.52	0.40	0.40	0.35	0.33	..
Per Capita TPES[13]	4.28	4.48	4.15	4.13	4.40	4.46	..
Oil Supply/GDP[12]	0.10	0.06	0.05	0.05	0.05	0.04	..
TFC/GDP[12]	0.16	0.11	0.09	0.09	0.09	0.08	..
Per Capita TFC[13]	3.12	3.11	2.97	2.98	3.26	3.33	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	1058.7	964.1	830.7	833.0	838.6	838.5	..
CO_2 Emissions from Bunkers (Mt CO_2)	21.8	22.1	27.1	28.6	27.7	27.5	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.5	–0.4	–0.5	–0.4	0.7	–0.0	..
Coal	–0.2	–0.6	–5.2	1.2	–1.1	–0.6	..
Oil	–0.1	–2.2	0.7	–2.6	1.4	–0.1	..
Gas	10.2	0.6	3.0	–0.2	1.6	1.6	..
Comb. Renewables & Wastes	6.2	1.2	7.2	9.9	–1.5	1.3	..
Nuclear	27.5	10.3	1.2	–0.2	–0.0	–2.4	..
Hydro	3.2	–0.5	1.3	10.6	–0.9	0.8	..
Geothermal	–	–	4.0	–	–	–	..
Solar/Wind/Other	–	–	49.3	62.7	9.5	6.9	..
TFC	1.2	–0.7	–0.1	0.5	1.2	0.1	..
Electricity Consumption	3.8	1.4	0.3	5.0	0.3	0.8	..
Energy Production	1.0	0.2	–3.3	–1.6	–1.5	–1.2	..
Net Oil Imports	0.2	–2.5	0.6	–1.7	2.1	–0.0	..
GDP	2.4	2.1	1.6	3.0	2.0	2.0	..
Growth in the TPES/GDP Ratio	–0.8	–2.4	–2.0	–3.3	–1.3	–2.0	..
Growth in the TFC/GDP Ratio	–1.1	–2.7	–1.7	–2.4	–0.8	–1.8	..

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

GREECE

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**2.33**	**8.77**	**9.54**	**9.99**	**10.76**	**11.14**	**..**
Coal[1]		1.69	7.12	8.04	8.22	8.75	8.82	..
Oil		–	0.84	0.02	0.26	0.30	0.30	..
Gas		–	0.14	0.00	0.04	0.05	0.04	..
Comb. Renewables & Wastes[2]		0.45	0.46	0.98	1.01	1.00	1.14	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.19	0.15	0.40	0.32	0.33	0.33	..
Geothermal		–	0.00	0.00	0.00	–	0.11	..
Solar/Wind/Other[3]		–	0.06	0.11	0.14	0.33	0.40	..
TOTAL NET IMPORTS[4]		**11.12**	**12.74**	**16.43**	**18.13**	**25.29**	**29.40**	**..**
Coal[1]	Exports	0.02	–	0.05	0.04	–	–	..
	Imports	0.47	0.92	0.78	0.81	0.76	0.76	..
	Net Imports	0.45	0.92	0.73	0.77	0.76	0.76	..
Oil	Exports	4.95	7.56	3.84	4.17	6.00	6.00	..
	Imports	16.51	21.87	21.42	23.44	29.62	31.22	..
	Bunkers	0.89	2.55	3.12	3.60	3.60	3.60	..
	Net Imports	10.67	11.76	14.47	15.67	20.02	21.62	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	–	–	1.22	1.69	4.52	7.02	..
	Net Imports	–	–	1.22	1.69	4.52	7.02	..
Electricity	Exports	0.00	0.05	0.14	0.15	–	–	..
	Imports	0.01	0.11	0.16	0.15	–	–	..
	Net Imports	0.00	0.06	0.01	–0.00	–	–	..
TOTAL STOCK CHANGES		**–1.10**	**0.24**	**0.66**	**–0.29**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**12.36**	**21.75**	**26.62**	**27.82**	**36.06**	**40.54**	**..**
Coal[1]		2.10	8.07	8.56	9.04	9.51	9.58	..
Oil		9.61	12.81	15.34	15.61	20.32	21.92	..
Gas		–	0.14	1.22	1.70	4.57	7.06	..
Comb. Renewables & Wastes[2]		0.45	0.46	0.98	1.01	1.00	1.14	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.19	0.15	0.40	0.32	0.33	0.33	..
Geothermal		–	0.00	0.00	0.00	–	0.11	..
Solar/Wind/Other[3]		–	0.06	0.11	0.14	0.33	0.40	..
Electricity Trade[5]		0.00	0.06	0.01	–0.00	–	–	..
Shares (%)								
Coal		*17.0*	*37.1*	*32.2*	*32.5*	*26.4*	*23.6*	..
Oil		*77.7*	*58.9*	*57.6*	*56.1*	*56.4*	*54.1*	..
Gas		–	*0.6*	*4.6*	*6.1*	*12.7*	*17.4*	..
Comb. Renewables & Wastes		*3.6*	*2.1*	*3.7*	*3.6*	*2.8*	*2.8*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*1.5*	*0.7*	*1.5*	*1.1*	*0.9*	*0.8*	..
Geothermal		–	–	–	–	–	*0.3*	..
Solar/Wind/Other		–	*0.3*	*0.4*	*0.5*	*0.9*	*1.0*	..
Electricity Trade		–	*0.3*	*0.1*	–	–	–	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**9.21**	**15.03**	**18.97**	**19.51**	**24.15**	**29.53**	**..**
Coal[1]	0.52	1.20	0.75	0.88	0.76	0.76	..
Oil	7.15	10.75	13.33	13.46	16.37	19.87	..
Gas	0.00	0.11	0.35	0.38	1.11	1.88	..
Comb. Renewables & Wastes[2]	0.45	0.46	0.91	0.95	0.96	1.08	..
Geothermal	–	0.00	0.00	0.00	–	–	..
Solar/Wind/Other	–	0.06	0.10	0.10	0.13	0.14	..
Electricity	1.09	2.45	3.49	3.71	4.80	5.79	..
Heat	–	–	0.03	0.03	0.03	0.03	..
Shares (%)							
Coal	*5.6*	*8.0*	*4.0*	*4.5*	*3.1*	*2.6*	..
Oil	*77.6*	*71.5*	*70.3*	*69.0*	*67.8*	*67.3*	..
Gas	–	*0.7*	*1.9*	*1.9*	*4.6*	*6.4*	..
Comb. Renewables & Wastes	*4.9*	*3.1*	*4.8*	*4.9*	*4.0*	*3.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.4*	*0.5*	*0.5*	*0.5*	*0.5*	..
Electricity	*11.9*	*16.3*	*18.4*	*19.0*	*19.9*	*19.6*	..
Heat	–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
TOTAL INDUSTRY[6]	**3.49**	**4.62**	**4.75**	**5.19**	**6.02**	**7.32**	**..**
Coal[1]	0.46	1.18	0.73	0.85	0.72	0.72	..
Oil	2.39	2.18	2.37	2.57	2.76	3.54	..
Gas	–	0.10	0.34	0.37	0.80	0.99	..
Comb. Renewables & Wastes[2]	–	0.12	0.21	0.24	0.25	0.25	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.63	1.04	1.11	1.17	1.49	1.82	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*13.1*	*25.4*	*15.4*	*16.4*	*12.0*	*9.8*	..
Oil	*68.7*	*47.2*	*49.8*	*49.4*	*45.9*	*48.4*	..
Gas	–	*2.2*	*7.1*	*7.0*	*13.3*	*13.5*	..
Comb. Renewables & Wastes	–	*2.6*	*4.4*	*4.6*	*4.1*	*3.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*18.2*	*22.5*	*23.3*	*22.5*	*24.8*	*24.8*	..
Heat	–	–	–	–	–	–	..
TRANSPORT[7]	**2.70**	**5.95**	**7.62**	**7.36**	**9.31**	**11.44**	**..**
TOTAL OTHER SECTORS[8]	**3.03**	**4.46**	**6.59**	**6.95**	**8.83**	**10.78**	**..**
Coal[1]	0.04	0.03	0.02	0.03	0.04	0.04	..
Oil	2.08	2.63	3.36	3.56	4.36	4.98	..
Gas	0.00	0.01	0.01	0.01	0.30	0.86	..
Comb. Renewables & Wastes[2]	0.45	0.34	0.70	0.71	0.71	0.83	..
Geothermal	–	0.00	0.00	0.00	–	–	..
Solar/Wind/Other	–	0.06	0.10	0.10	0.13	0.14	..
Electricity	0.46	1.40	2.37	2.53	3.26	3.91	..
Heat	–	–	0.03	0.03	0.03	0.03	..
Shares (%)							
Coal	*1.4*	*0.6*	*0.3*	*0.4*	*0.4*	*0.3*	..
Oil	*68.6*	*58.9*	*51.0*	*51.1*	*49.4*	*46.2*	..
Gas	*0.1*	*0.2*	*0.2*	*0.2*	*3.4*	*8.0*	..
Comb. Renewables & Wastes	*14.9*	*7.7*	*10.6*	*10.1*	*8.1*	*7.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*1.3*	*1.5*	*1.4*	*1.5*	*1.3*	..
Electricity	*15.0*	*31.3*	*35.9*	*36.3*	*37.0*	*36.3*	..
Heat	–	–	*0.4*	*0.4*	*0.3*	*0.3*	..

Unit:Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.34**	**8.90**	**11.08**	**11.93**	**14.71**	**16.77**	**..**
OUTPUT (Mtoe)	**1.27**	**2.99**	**4.25**	**4.59**	**5.66**	**6.72**	**..**
(TWh gross)	14.82	34.78	49.38	53.43	65.86	78.12	..
Output Shares (%)							
Coal	*35.5*	*72.4*	*65.6*	*64.2*	*51.4*	*43.7*	..
Oil	*49.5*	*22.3*	*16.5*	*16.6*	*15.0*	*12.6*	..
Gas	–	*0.3*	*7.9*	*11.1*	*24.1*	*34.4*	..
Comb. Renewables & Wastes	–	–	*0.4*	*0.3*	*0.3*	*0.3*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*15.0*	*5.1*	*9.3*	*6.9*	*5.8*	*4.9*	..
Geothermal	–	–	–	–	–	*0.2*	..
Solar/Wind/Other	–	*0.0*	*0.3*	*0.8*	*3.5*	*4.0*	..
TOTAL LOSSES	**3.14**	**7.00**	**7.84**	**8.53**	**11.90**	**11.00**	**..**
of which:							
Electricity and Heat Generation[10]	2.07	5.91	6.81	7.31	8.98	10.00	..
Other Transformation	0.44	–0.23	–0.56	–0.70	0.90	–	..
Own Use and Losses[11]	0.64	1.31	1.58	1.92	2.02	1.00	..
Statistical Differences	**0.00**	**–0.28**	**–0.18**	**–0.21**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	84.54	110.50	133.32	139.07	169.20	205.86	..
Population (millions)	8.93	10.16	10.53	10.56	10.80	11.00	..
TPES/GDP[12]	0.15	0.20	0.20	0.20	0.21	0.20	..
Energy Production/TPES	0.19	0.40	0.36	0.36	0.30	0.27	..
Per Capita TPES[13]	1.38	2.14	2.53	2.64	3.34	3.69	..
Oil Supply/GDP[12]	0.11	0.12	0.12	0.11	0.12	0.11	..
TFC/GDP[12]	0.11	0.14	0.14	0.14	0.14	0.14	..
Per Capita TFC[13]	1.03	1.48	1.80	1.85	2.24	2.68	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	34.4	70.6	83.1	87.8	104.8	118.2	..
CO_2 Emissions from Bunkers (Mt CO_2)	4.5	10.5	12.7	13.9	13.9	13.9	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	4.4	2.8	2.3	4.5	5.3	2.4	..
Coal	8.7	8.0	0.7	5.5	1.0	0.1	..
Oil	3.5	0.7	2.0	1.8	5.4	1.5	..
Gas	–	–	27.4	39.9	21.8	9.1	..
Comb. Renewables & Wastes	–	0.3	8.6	3.4	–0.2	2.6	..
Nuclear	–	–	–	–	–	–	..
Hydro	8.2	–6.2	11.2	–19.5	0.8	–0.2	..
Geothermal	–	–	8.0	–	–	–	..
Solar/Wind/Other	–	–	7.6	25.5	18.9	4.2	..
TFC	4.0	2.4	2.6	2.8	4.4	4.1	..
Electricity Consumption	7.0	3.7	4.0	6.2	5.3	3.8	..
Energy Production	8.3	8.0	0.9	4.7	1.5	0.7	..
Net Oil Imports	2.5	–0.4	2.3	8.3	5.0	1.5	..
GDP	3.3	0.7	2.1	4.3	4.0	4.0	..
Growth in the TPES/GDP Ratio	1.1	2.1	0.2	0.2	1.3	–1.6	..
Growth in the TFC/GDP Ratio	0.7	1.7	0.5	–1.4	0.4	0.1	..

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

HUNGARY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**12.84**	**14.22**	**11.45**	**11.09**	**9.81**	**9.74**	**8.92**
Coal[1]		6.05	4.14	3.00	2.89	1.90	2.20	2.00
Oil		2.02	2.27	1.78	1.68	1.20	0.90	0.70
Gas		4.03	3.81	2.62	2.48	2.22	1.91	1.50
Comb. Renewables & Wastes[2]		0.73	0.40	0.35	0.38	0.61	0.84	0.84
Nuclear		–	3.58	3.67	3.64	3.78	3.78	3.75
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	–	0.00	0.01	0.08	0.10	0.11
Solar/Wind/Other[3]		–	–	–	–	0.00	0.00	0.00
TOTAL NET IMPORTS[4]		**8.66**	**14.17**	**13.69**	**13.90**	**16.01**	**17.39**	**20.35**
Coal[1]	Exports	0.11	–	0.11	0.13	0.13	–	–
	Imports	1.74	1.63	1.14	1.21	1.86	1.11	1.20
	Net Imports	1.63	1.63	1.02	1.08	1.73	1.11	1.20
Oil	Exports	0.92	1.52	1.95	1.73	1.60	1.60	1.71
	Imports	7.39	7.96	7.20	7.01	7.93	8.58	10.00
	Bunkers	–	–	–	–	–	–	–
	Net Imports	6.48	6.44	5.26	5.27	6.33	6.98	8.29
Gas	Exports	0.01	0.02	0.00	0.06	–	–	–
	Imports	0.17	5.19	7.32	7.31	7.78	9.15	10.55
	Net Imports	0.15	5.17	7.31	7.25	7.78	9.15	10.55
Electricity	Exports	0.09	0.19	0.28	0.52	0.16	0.16	0.16
	Imports	0.49	1.14	0.37	0.82	0.32	0.31	0.47
	Net Imports	0.40	0.96	0.09	0.30	0.16	0.16	0.31
TOTAL STOCK CHANGES		**–0.02**	**0.06**	**0.06**	**–0.20**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**21.47**	**28.44**	**25.20**	**24.78**	**25.82**	**27.13**	**29.27**
Coal[1]		7.91	6.12	4.16	3.96	3.63	3.31	3.20
Oil		8.21	8.51	7.00	6.87	7.53	7.88	8.99
Gas		4.17	8.91	9.90	9.62	10.01	11.06	12.05
Comb. Renewables & Wastes[2]		0.78	0.35	0.35	0.38	0.61	0.84	0.84
Nuclear		–	3.58	3.67	3.64	3.78	3.78	3.75
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	–	0.00	0.01	0.08	0.10	0.11
Solar/Wind/Other[3]		–	–	–	–	0.00	0.00	0.00
Electricity Trade[5]		0.40	0.96	0.09	0.30	0.16	0.16	0.31
Shares (%)								
Coal		*36.8*	*21.5*	*16.5*	*16.0*	*14.1*	*12.2*	*10.9*
Oil		*38.2*	*29.9*	*27.8*	*27.7*	*29.2*	*29.0*	*30.7*
Gas		*19.4*	*31.3*	*39.3*	*38.8*	*38.8*	*40.8*	*41.2*
Comb. Renewables & Wastes		*3.6*	*1.2*	*1.4*	*1.5*	*2.4*	*3.1*	*2.9*
Nuclear		–	*12.6*	*14.6*	*14.7*	*14.6*	*13.9*	*12.8*
Hydro		–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Geothermal		–	–	–	–	*0.3*	*0.4*	*0.4*
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		*1.9*	*3.4*	*0.4*	*1.2*	*0.6*	*0.6*	*1.1*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**17.28**	**20.93**	**17.09**	**17.35**	**18.22**	**19.54**	**21.68**
Coal[1]	4.17	2.68	0.70	0.70	0.75	0.76	0.75
Oil	6.71	7.41	5.38	5.54	5.81	6.10	7.00
Gas	3.08	6.20	6.71	6.82	6.73	7.46	8.20
Comb. Renewables & Wastes[2]	0.76	0.34	0.32	0.35	0.77	0.89	0.89
Geothermal	–	–	0.00	0.01	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.51	2.72	2.49	2.53	2.62	2.78	3.20
Heat	1.06	1.59	1.49	1.41	1.55	1.55	1.64
Shares (%)							
Coal	*24.1*	*12.8*	*4.1*	*4.0*	*4.1*	*3.9*	*3.5*
Oil	*38.8*	*35.4*	*31.5*	*31.9*	*31.9*	*31.2*	*32.3*
Gas	*17.8*	*29.6*	*39.2*	*39.3*	*36.9*	*38.2*	*37.8*
Comb. Renewables & Wastes	*4.4*	*1.6*	*1.9*	*2.0*	*4.2*	*4.5*	*4.1*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.7*	*13.0*	*14.6*	*14.6*	*14.4*	*14.2*	*14.8*
Heat	*6.1*	*7.6*	*8.7*	*8.1*	*8.5*	*7.9*	*7.5*
TOTAL INDUSTRY[6]	**7.90**	**8.06**	**4.66**	**4.94**	**5.21**	**5.33**	**5.73**
Coal[1]	1.87	0.80	0.43	0.46	0.50	0.50	0.50
Oil	2.34	2.11	1.37	1.54	1.62	1.50	1.80
Gas	2.29	3.76	1.68	1.70	1.80	2.00	2.00
Comb. Renewables & Wastes[2]	0.02	0.00	–	–	0.11	0.11	0.10
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.92	1.18	0.73	0.76	0.78	0.82	0.90
Heat	0.46	0.21	0.45	0.47	0.40	0.40	0.43
Shares (%)							
Coal	*23.6*	*9.9*	*9.2*	*9.4*	*9.6*	*9.4*	*8.7*
Oil	*29.6*	*26.2*	*29.4*	*31.3*	*31.1*	*28.2*	*31.4*
Gas	*29.0*	*46.6*	*35.9*	*34.5*	*34.6*	*37.6*	*34.9*
Comb. Renewables & Wastes	*0.2*	–	–	–	*2.0*	*2.0*	*1.8*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.7*	*14.7*	*15.7*	*15.3*	*15.0*	*15.4*	*15.7*
Heat	*5.9*	*2.6*	*9.7*	*9.6*	*7.7*	*7.5*	*7.5*
TRANSPORT[7]	**2.37**	**3.15**	**3.33**	**3.32**	**3.56**	**4.18**	**4.30**
TOTAL OTHER SECTORS[8]	**7.02**	**9.72**	**9.10**	**9.09**	**9.45**	**10.03**	**11.64**
Coal[1]	1.93	1.88	0.27	0.23	0.25	0.26	0.25
Oil	2.45	2.25	0.76	0.76	0.71	0.50	1.00
Gas	0.78	2.44	5.03	5.11	4.93	5.46	6.20
Comb. Renewables & Wastes[2]	0.74	0.34	0.32	0.35	0.66	0.78	0.79
Geothermal	–	–	0.00	0.01	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.52	1.43	1.67	1.69	1.75	1.88	2.20
Heat	0.60	1.38	1.04	0.93	1.15	1.15	1.21
Shares (%)							
Coal	*27.5*	*19.4*	*3.0*	*2.6*	*2.6*	*2.6*	*2.1*
Oil	*34.9*	*23.1*	*8.4*	*8.4*	*7.5*	*5.0*	*8.6*
Gas	*11.2*	*25.1*	*55.3*	*56.2*	*52.1*	*54.4*	*53.3*
Comb. Renewables & Wastes	*10.5*	*3.5*	*3.5*	*3.9*	*7.0*	*7.8*	*6.7*
Geothermal	–	–	–	*0.1*	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.4*	*14.7*	*18.4*	*18.6*	*18.5*	*18.7*	*18.9*
Heat	*8.5*	*14.2*	*11.4*	*10.3*	*12.2*	*11.5*	*10.4*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**6.37**	**10.21**	**11.49**	**10.03**	**10.69**	**11.26**	**11.76**
OUTPUT (Mtoe)	**1.52**	**2.45**	**3.25**	**3.01**	**3.26**	**3.46**	**3.73**
(TWh gross)	17.64	28.44	37.83	34.99	37.85	40.27	43.37
Output Shares (%)							
Coal	*66.0*	*30.5*	*27.2*	*27.7*	*22.2*	*20.9*	*18.4*
Oil	*17.2*	*4.8*	*14.0*	*12.6*	*16.4*	*16.1*	*19.6*
Gas	*16.2*	*15.8*	*20.7*	*18.9*	*21.9*	*25.8*	*27.7*
Comb. Renewables & Wastes	–	–	*0.3*	*0.3*	*0.5*	*0.5*	*0.5*
Nuclear	–	*48.3*	*37.3*	*40.0*	*38.3*	*36.0*	*33.2*
Hydro	*0.6*	*0.6*	*0.5*	*0.5*	*0.6*	*0.6*	*0.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.0*	*0.1*	*0.1*
TOTAL LOSSES	**4.87**	**7.97**	**8.76**	**7.45**	**7.60**	**7.59**	**7.59**
of which:							
Electricity and Heat Generation[10]	3.67	6.00	6.54	5.39	5.72	6.08	6.24
Other Transformation	0.21	–0.05	0.04	0.17	0.16	–0.24	–0.39
Own Use and Losses[11]	0.99	2.02	2.18	1.89	1.72	1.75	1.74
Statistical Differences	**–0.68**	**–0.45**	**–0.65**	**–0.02**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	34.03	50.35	51.71	54.41	66.82	83.27	129.32
Population (millions)	10.43	10.37	10.07	10.02	9.82	9.62	9.26
TPES/GDP[12]	0.63	0.56	0.49	0.46	0.39	0.33	0.23
Energy Production/TPES	0.60	0.50	0.45	0.45	0.38	0.36	0.30
Per Capita TPES[13]	2.06	2.74	2.50	2.47	2.63	2.82	3.16
Oil Supply/GDP[12]	0.24	0.17	0.14	0.13	0.11	0.09	0.07
TFC/GDP[12]	0.51	0.42	0.33	0.32	0.27	0.23	0.17
Per Capita TFC[13]	1.66	2.02	1.70	1.73	1.86	2.03	2.34
Energy–related CO_2 Emissions (Mt CO_2)[14]	69.1	70.5	60.7	55.2	54.9	58.5	63.6
CO_2 Emissions from Bunkers (Mt CO_2)	0.2	0.5	0.6	0.7	0.7	0.7	0.7

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	4.9	–0.1	–1.3	–1.6	0.8	1.0	0.8
Coal	1.2	–3.0	–4.2	–4.9	–1.7	–1.8	–0.3
Oil	5.6	–2.6	–2.1	–1.9	1.9	0.9	1.3
Gas	10.0	1.7	1.2	–2.8	0.8	2.0	0.9
Comb. Renewables & Wastes	0.9	–7.4	–0.1	7.1	10.2	6.5	–
Nuclear	–	–	0.3	–0.8	0.7	–	–0.1
Hydro	6.3	1.3	0.7	–6.3	5.9	–	–
Geothermal	–	–	–	25.0	75.8	2.7	1.1
Solar/Wind/Other	–	–	–	–	–	8.4	–
TFC	4.6	–0.7	–2.2	1.5	1.0	1.4	1.0
Electricity Consumption	6.0	2.2	–1.0	1.7	0.6	1.3	1.4
Energy Production	2.6	–0.4	–2.4	–3.2	–2.4	–0.2	–0.9
Net Oil Imports	7.1	–3.8	–2.2	0.3	3.7	2.0	1.7
GDP	4.3	1.3	0.3	5.2	4.2	4.5	4.5
Growth in the TPES/GDP Ratio	0.6	–1.3	–1.6	–6.5	–3.2	–3.4	–3.6
Growth in the TFC/GDP Ratio	0.3	–2.0	–2.5	–3.5	–3.1	–3.0	–3.3

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

IRELAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**1.120**	**3.359**	**2.503**	**2.197**	**2.299**	**2.494**	**..**
Coal[1]		0.045	0.016	–	–	–	–	..
Peat		1.020	1.411	1.153	0.981	0.909	0.909	..
Oil		–	–	–	–	–	–	..
Gas		–	1.872	1.103	0.958	0.980	0.960	..
Comb. Renewables & Wastes[2]		–	–	0.157	0.164	0.194	0.275	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.055	0.060	0.073	0.073	0.069	0.071	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	–	0.016	0.021	0.147	0.279	..
TOTAL NET IMPORTS[4]		**5.901**	**7.353**	**11.736**	**12.304**	**13.035**	**13.809**	**..**
Coal[1]	Exports	0.073	0.023	0.022	0.039	0.006	0.006	..
	Imports	0.578	2.286	1.581	1.738	1.770	1.710	..
	Net Imports	0.505	2.263	1.559	1.699	1.764	1.704	..
Peat	Exports	–	–	–	–	0.008	0.008	..
	Imports	–	–	–	–	–	–	..
	Net Imports	–	–	–	–	–0.008	–0.008	..
Oil	Exports	0.472	0.680	1.091	1.006	1.013	1.343	..
	Imports	5.956	5.788	9.529	9.278	9.297	9.638	..
	Bunkers	0.092	0.018	0.174	0.152	0.125	0.098	..
	Net Imports	5.392	5.090	8.264	8.120	8.159	8.197	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	–	–	1.893	2.477	3.120	3.916	..
	Net Imports	–	–	1.893	2.477	3.120	3.916	..
Electricity	Exports	0.002	–	0.004	0.006	–	–	..
	Imports	0.006	–	0.025	0.015	–	–	..
	Net Imports	0.004	–	0.021	0.009	–	–	..
TOTAL STOCK CHANGES		**0.168**	**–0.250**	**–0.303**	**0.121**	**0.131**	**–0.059**	**..**
TOTAL SUPPLY (TPES)		**7.189**	**10.463**	**13.936**	**14.623**	**15.464**	**16.244**	**..**
Coal[1]		0.565	2.371	1.601	1.857	1.808	1.559	..
Peat		1.020	1.288	0.887	0.800	0.901	0.901	..
Oil		5.545	4.871	8.184	8.264	8.245	8.283	..
Gas		–	1.872	2.996	3.435	4.100	4.876	..
Comb. Renewables & Wastes[2]		–	–	0.157	0.164	0.194	0.275	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.055	0.060	0.073	0.073	0.069	0.071	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	–	0.016	0.021	0.147	0.279	..
Electricity Trade[5]		0.004	–	0.021	0.008	–	–	..
Shares (%)								
Coal		*7.9*	*22.7*	*11.5*	*12.7*	*11.7*	*9.6*	..
Peat		*14.2*	*12.3*	*6.4*	*5.5*	*5.8*	*5.5*	..
Oil		*77.1*	*46.6*	*58.7*	*56.5*	*53.3*	*51.0*	..
Gas		–	*17.9*	*21.5*	*23.5*	*26.5*	*30.0*	..
Comb. Renewables & Wastes		–	–	*1.1*	*1.1*	*1.3*	*1.7*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*0.8*	*0.6*	*0.5*	*0.5*	*0.4*	*0.4*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	*0.1*	*0.1*	*1.0*	*1.7*	..
Electricity Trade		*0.1*	–	*0.2*	*0.1*	–	–	..

0 is negligible, – is nil, .. is not available.
Please note: Population and GDP forecast data are based on the 2000 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**5.416**	**7.732**	**10.555**	**11.102**	**12.187**	**11.997**	**..**
Coal[1]	0.520	1.137	0.442	0.451	0.423	0.177	..
Peat	0.408	0.427	0.134	0.117	0.130	0.080	..
Oil	3.856	4.149	6.782	7.070	7.727	7.695	..
Gas	0.103	0.998	1.444	1.587	1.637	1.364	..
Comb. Renewables & Wastes[2]	–	–	0.135	0.140	0.131	0.138	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.529	1.021	1.617	1.737	2.139	2.543	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*9.6*	*14.7*	*4.2*	*4.1*	*3.5*	*1.5*	..
Peat	*7.5*	*5.5*	*1.3*	*1.1*	*1.1*	*0.7*	..
Oil	*71.2*	*53.7*	*64.3*	*63.7*	*63.4*	*64.1*	..
Gas	*1.9*	*12.9*	*13.7*	*14.3*	*13.4*	*11.4*	..
Comb. Renewables & Wastes	–	–	*1.3*	*1.3*	*1.1*	*1.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.8*	*13.2*	*15.3*	*15.6*	*17.6*	*21.2*	..
Heat	–	–	–	–	–	–	..
TOTAL INDUSTRY[6]	**1.920**	**2.324**	**2.667**	**2.765**	**2.425**	**2.631**	**..**
Coal[1]	0.044	0.272	0.065	0.051	0.032	0.143	..
Peat	–	–	–	–	–	–	..
Oil	1.662	0.879	1.071	1.093	0.758	0.817	..
Gas	0.025	0.787	0.813	0.856	0.691	0.559	..
Comb. Renewables & Wastes[2]	–	–	0.092	0.100	0.088	0.095	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.189	0.386	0.625	0.665	0.856	1.017	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*2.3*	*11.7*	*2.4*	*1.8*	*1.3*	*5.4*	..
Peat	–	–	–	–	–	–	..
Oil	*86.6*	*37.8*	*40.2*	*39.5*	*31.3*	*31.1*	..
Gas	*1.3*	*33.9*	*30.5*	*31.0*	*28.5*	*21.2*	..
Comb. Renewables & Wastes	–	–	*3.4*	*3.6*	*3.6*	*3.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.8*	*16.6*	*23.4*	*24.1*	*35.3*	*38.7*	..
Heat	–	–	–	–	–	–	..
TRANSPORT[7]	**1.406**	**2.031**	**3.765**	**3.987**	**4.749**	**4.822**	**..**
TOTAL OTHER SECTORS[8]	**2.090**	**3.377**	**4.124**	**4.351**	**5.013**	**4.544**	**..**
Coal[1]	0.476	0.865	0.377	0.400	0.391	0.034	..
Peat	0.408	0.427	0.134	0.117	0.130	0.080	..
Oil	0.788	1.240	1.948	1.993	2.220	2.056	..
Gas	0.078	0.211	0.631	0.730	0.946	0.805	..
Comb. Renewables & Wastes[2]	–	–	0.043	0.040	0.043	0.043	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.340	0.634	0.990	1.071	1.283	1.526	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*22.8*	*25.6*	*9.1*	*9.2*	*7.8*	*0.7*	..
Peat	*19.5*	*12.6*	*3.2*	*2.7*	*2.6*	*1.8*	..
Oil	*37.7*	*36.7*	*47.2*	*45.8*	*44.3*	*45.2*	..
Gas	*3.7*	*6.2*	*15.3*	*16.8*	*18.9*	*17.7*	..
Comb. Renewables & Wastes	–	–	*1.0*	*0.9*	*0.9*	*0.9*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.3*	*18.8*	*24.0*	*24.6*	*25.6*	*33.6*	..
Heat	–	–	–	–	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**1.766**	**3.135**	**4.875**	**5.033**	**5.354**	**6.480**	**..**
OUTPUT (Mtoe)	**0.632**	**1.224**	**1.872**	**2.036**	**2.511**	**2.954**	**..**
(TWh gross)	7.348	14.229	21.765	23.673	29.196	34.345	..
Output Shares (%)							
Coal	*1.0*	*41.6*	*26.8*	*28.8*	*26.9*	*22.5*	..
Peat	*23.9*	*15.8*	*7.7*	*7.5*	*6.8*	*5.8*	..
Oil	*66.3*	*10.0*	*28.3*	*19.6*	*6.4*	*1.8*	..
Gas	–	*27.7*	*32.0*	*39.1*	*50.5*	*57.0*	..
Comb. Renewables & Wastes	–	–	*0.4*	*0.4*	*0.8*	*1.0*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*8.8*	*4.9*	*3.9*	*3.6*	*2.8*	*2.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.9*	*1.0*	*5.8*	*9.4*	..
TOTAL LOSSES	**1.649**	**2.259**	**3.447**	**3.459**	**3.277**	**4.247**	**..**
of which:							
Electricity and Heat Generation[10]	1.134	1.911	3.002	2.997	2.843	3.526	..
Other Transformation	0.329	0.041	0.021	0.014	–	–	..
Own Use and Losses[11]	0.186	0.307	0.424	0.448	0.434	0.721	..
Statistical Differences	**0.124**	**0.473**	**–0.067**	**0.061**	**–**	**–**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	26.92	52.88	95.67	106.63	135.77	167.34	..
Population (millions)	3.07	3.51	3.75	3.79	3.97	4.16	..
TPES/GDP[12]	0.27	0.20	0.15	0.14	0.11	0.10	..
Energy Production/TPES	0.16	0.32	0.18	0.15	0.15	0.15	..
Per Capita TPES[13]	2.34	2.98	3.72	3.86	3.90	3.90	..
Oil Supply/GDP[12]	0.21	0.09	0.09	0.08	0.06	0.05	..
TFC/GDP[12]	0.20	0.15	0.11	0.10	0.09	0.07	..
Per Capita TFC[13]	1.76	2.21	2.82	2.93	3.07	2.88	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	21.0	30.3	39.8	41.2	43.2	44.2	..
CO^2 Emissions from Bunkers (Mt CO^2)	1.1	1.1	2.1	2.1	2.1	2.0	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	3.6	1.5	3.2	4.9	1.1	1.0	..
Coal	6.9	9.9	–4.3	16.0	–0.5	–2.9	..
Peat	2.1	1.0	–4.1	–9.8	2.4	–	..
Oil	2.3	–2.4	5.9	1.0	–0.0	0.1	..
Gas	–	13.6	5.4	14.7	3.6	3.5	..
Comb. Renewables & Wastes	–	–	–	4.5	3.4	7.2	..
Nuclear	–	–	–	–	–	–	..
Hydro	4.3	–1.5	2.2	–	–1.1	0.6	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	31.3	47.6	13.7	..
TFC	4.3	0.9	3.5	5.2	1.9	–0.3	..
Electricity Consumption	5.8	2.9	5.2	7.4	4.3	3.5	..
Energy Production	4.6	7.8	–3.2	–12.2	0.9	1.6	..
Net Oil Imports	2.9	–2.0	5.5	–1.7	0.1	0.1	..
GDP	4.9	3.6	6.8	11.5	4.9	4.3	..
Growth in the TPES/GDP Ratio	–1.3	–2.0	–3.3	–5.9	–3.6	–3.1	..
Growth in the TFC/GDP Ratio	–0.6	–2.6	–3.1	–5.6	–2.9	–4.4	..

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

ITALY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**20.1**	**24.6**	**27.7**	**26.9**	**30.2**	**36.9**	**41.2**
Coal[1]		0.3	0.3	0.0	0.0	-	-	-
Oil		1.1	4.7	5.1	4.7	7.0	10.0	10.0
Gas		12.6	14.0	14.3	13.6	13.0	13.0	8.0
Comb. Renewables & Wastes[2]		0.2	0.8	1.5	1.7	3.0	5.0	12.0
Nuclear		0.8	-	–	–	–	–	–
Hydro		3.2	2.7	3.9	3.8	3.9	4.2	4.3
Geothermal		1.8	2.0	2.7	2.9	3.0	3.6	4.5
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.3	1.1	2.4
TOTAL NET IMPORTS[4]		**109.3**	**128.9**	**140.7**	**149.6**	**148.5**	**146.0**	**156.5**
Coal[1]	Exports	0.4	0.1	0.1	0.1	–	–	–
	Imports	8.2	13.9	11.9	13.2	14.5	20.0	21.0
	Net Imports	7.7	13.7	11.8	13.1	14.5	20.0	21.0
Oil	Exports	29.4	20.1	20.8	22.1	20.0	22.0	18.0
	Imports	136.4	109.5	107.6	110.0	96.0	76.5	70.0
	Bunkers	7.1	2.7	2.4	2.7	2.5	2.5	2.0
	Net Imports	99.9	86.7	84.4	85.2	73.5	52.0	50.0
Gas	Exports	–	0.0	0.0	0.0	–	–	–
	Imports	1.6	25.3	40.5	47.0	57.0	67.0	82.0
	Net Imports	1.6	25.3	40.5	47.0	57.0	67.0	82.0
Electricity	Exports	0.2	0.1	0.0	0.0	–	–	–
	Imports	0.3	3.1	3.7	3.9	3.0	6.0	3.0
	Net Imports	0.1	3.0	3.6	3.8	3.0	6.0	3.0
TOTAL STOCK CHANGES		**–0.9**	**–1.8**	**0.6**	**–4.9**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**128.6**	**151.6**	**169.0**	**171.6**	**178.7**	**182.9**	**197.7**
Coal[1]		8.1	14.6	11.8	12.6	14.5	20.0	21.0
Oil		100.1	89.3	89.4	88.2	80.5	62.0	60.0
Gas		14.2	39.0	55.6	57.9	70.0	80.0	90.0
Comb. Renewables & Wastes[2]		0.2	0.9	1.9	2.2	3.5	6.0	12.5
Nuclear		0.8	–	–	–	–	–	–
Hydro		3.2	2.7	3.9	3.8	3.9	4.2	4.3
Geothermal		1.8	2.0	2.7	2.9	3.0	3.6	4.5
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.3	1.1	2.4
Electricity Trade[5]		0.1	3.0	3.6	3.8	3.0	6.0	3.0
Shares (%)								
Coal		*6.3*	*9.6*	*7.0*	*7.3*	*8.1*	*10.9*	*10.6*
Oil		*77.9*	*58.9*	*52.9*	*51.4*	*45.1*	*33.9*	*30.3*
Gas		*11.1*	*25.7*	*32.9*	*33.8*	*39.2*	*43.8*	*45.5*
Comb. Renewables & Wastes		*0.2*	*0.6*	*1.1*	*1.3*	*2.0*	*3.3*	*6.3*
Nuclear		*0.6*	–	–	–	–	–	–
Hydro		*2.5*	*1.8*	*2.3*	*2.2*	*2.2*	*2.3*	*2.2*
Geothermal		*1.4*	*1.4*	*1.6*	*1.7*	*1.7*	*2.0*	*2.3*
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.2*	*0.6*	*1.2*
Electricity Trade		*0.1*	*2.0*	*2.1*	*2.2*	*1.7*	*3.3*	*1.5*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**98.7**	**117.6**	**131.8**	**131.4**	**139.0**	**146.5**	**153.3**
Coal[1]	3.3	3.4	2.5	2.2	3.0	3.0	3.0
Oil	72.1	64.2	66.7	65.1	62.0	55.0	53.5
Gas	12.8	30.6	38.6	38.6	45.2	54.0	58.0
Comb. Renewables & Wastes[2]	–	0.9	1.4	1.7	1.7	1.5	4.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.6	1.3
Electricity	10.6	18.5	22.5	23.5	26.7	31.8	32.0
Heat	–	0.2	0.2	0.2	0.4	0.6	1.0
Shares (%)							
Coal	*3.3*	*2.9*	*1.9*	*1.7*	*2.2*	*2.0*	*2.0*
Oil	*73.0*	*54.5*	*50.6*	*49.6*	*44.6*	*37.5*	*34.9*
Gas	*12.9*	*26.0*	*29.3*	*29.4*	*32.5*	*36.9*	*37.8*
Comb. Renewables & Wastes	–	*0.7*	*1.0*	*1.3*	*1.2*	*1.0*	*2.9*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	*0.4*	*0.8*
Electricity	*10.7*	*15.7*	*17.1*	*17.9*	*19.2*	*21.7*	*20.9*
Heat	–	*0.2*	*0.2*	*0.2*	*0.3*	*0.4*	*0.7*
TOTAL INDUSTRY[6]	**47.6**	**44.6**	**45.9**	**46.3**	**49.1**	**52.8**	**56.6**
Coal[1]	2.6	3.3	2.4	2.2	3.0	3.0	3.0
Oil	29.7	16.9	14.9	14.1	12.5	10.0	10.0
Gas	8.7	14.6	16.8	17.6	20.0	23.0	26.0
Comb. Renewables & Wastes[2]	–	0.2	0.3	0.3	0.5	0.5	1.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	0.5	0.5
Electricity	6.6	9.5	11.5	12.2	13.1	15.8	15.6
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*5.6*	*7.3*	*5.3*	*4.7*	*6.1*	*5.7*	*5.3*
Oil	*62.3*	*37.9*	*32.5*	*30.4*	*25.5*	*18.9*	*17.7*
Gas	*18.2*	*32.9*	*36.6*	*38.0*	*40.7*	*43.6*	*45.9*
Comb. Renewables & Wastes	–	*0.5*	*0.6*	*0.6*	*1.0*	*0.9*	*2.7*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	*0.9*	*0.9*
Electricity	*13.9*	*21.4*	*25.1*	*26.3*	*26.7*	*29.9*	*27.6*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**20.5**	**35.3**	**42.4**	**42.4**	**41.4**	**41.1**	**41.4**
TOTAL OTHER SECTORS[8]	**30.6**	**37.8**	**43.6**	**42.7**	**48.5**	**52.6**	**55.3**
Coal[1]	0.5	0.1	0.1	0.1	–	–	–
Oil	22.5	12.8	10.4	9.7	9.5	7.0	5.5
Gas	4.0	15.7	21.5	20.7	24.7	29.0	30.0
Comb. Renewables & Wastes[2]	–	0.6	1.1	1.4	1.2	1.0	3.0
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.1	0.8
Electricity	3.6	8.3	10.3	10.5	12.7	14.9	15.0
Heat	–	0.2	0.2	0.2	0.4	0.6	1.0
Shares (%)							
Coal	*1.5*	*0.3*	*0.2*	*0.2*	–	–	–
Oil	*73.5*	*33.8*	*23.8*	*22.8*	*19.6*	*13.3*	*9.9*
Gas	*13.1*	*41.6*	*49.4*	*48.4*	*50.9*	*55.1*	*54.2*
Comb. Renewables & Wastes	–	*1.7*	*2.6*	*3.4*	*2.5*	*1.9*	*5.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.1*	*0.2*	*1.4*
Electricity	*11.8*	*22.1*	*23.6*	*24.7*	*26.2*	*28.3*	*27.1*
Heat	–	*0.5*	*0.5*	*0.5*	*0.8*	*1.1*	*1.8*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**27.6**	**42.4**	**49.1**	**52.1**	**56.3**	**55.5**	**67.4**
OUTPUT (Mtoe)	**12.4**	**18.3**	**22.3**	**23.2**	**25.5**	**28.4**	**34.8**
(TWh gross)	143.9	213.2	259.2	269.9	296.7	330.0	405.0
Output Shares (%)							
Coal	*3.6*	*16.8*	*10.9*	*11.3*	*13.5*	*21.8*	*19.8*
Oil	*62.4*	*48.2*	*35.2*	*31.8*	*21.9*	*6.7*	*4.9*
Gas	*3.1*	*18.6*	*33.6*	*37.5*	*44.5*	*48.5*	*49.4*
Comb. Renewables & Wastes	*0.9*	*0.1*	*0.7*	*0.7*	*2.5*	*5.4*	*8.6*
Nuclear	*2.2*	–	–	–	–	–	–
Hydro	*26.1*	*14.8*	*17.5*	*16.4*	*15.0*	*14.2*	*12.3*
Geothermal	*1.7*	*1.5*	*1.7*	*1.7*	*1.7*	*1.8*	*1.7*
Solar/Wind/Other	–	*0.0*	*0.4*	*0.5*	*1.0*	*1.6*	*3.2*
TOTAL LOSSES	**29.5**	**34.0**	**37.3**	**40.3**	**39.7**	**36.4**	**44.4**
of which:							
Electricity and Heat Generation[10]	15.3	23.9	26.5	28.7	29.2	26.1	34.4
Other Transformation	6.0	1.0	1.0	2.2	0.7	1.5	1.0
Own Use and Losses[11]	8.3	9.2	9.7	9.4	9.8	8.8	9.0
Statistical Differences	**0.3**	**–0.0**	**–0.1**	**–0.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	647.03	1030.05	1170.75	1204.87	1395.42	1609.84	2060.73
Population (millions)	54.75	56.72	57.65	57.73	58.17	58.49	58.04
TPES/GDP[12]	0.20	0.15	0.14	0.14	0.13	0.11	0.10
Energy Production/TPES	0.16	0.16	0.16	0.16	0.17	0.20	0.21
Per Capita TPES[13]	2.35	2.67	2.93	2.97	3.07	3.13	3.41
Oil Supply/GDP[12]	0.15	0.09	0.08	0.07	0.06	0.04	0.03
TFC/GDP[12]	0.15	0.11	0.11	0.11	0.10	0.09	0.07
Per Capita TFC[13]	1.80	2.07	2.29	2.28	2.39	2.50	2.64
Energy–related CO_2 Emissions (Mt CO_2)[14]	334.4	400.1	423.1	425.7	438.9	428.9	451.8
CO_2 Emissions from Bunkers (Mt CO_2)	26.3	15.0	17.7	19.3	18.6	18.6	17.0

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.5	0.7	1.2	1.5	0.8	0.5	0.8
Coal	4.3	3.1	–2.4	6.8	2.9	6.6	0.5
Oil	–0.0	–1.0	0.0	–1.4	–1.8	–5.1	–0.3
Gas	8.1	5.1	4.0	4.3	3.9	2.7	1.2
Comb. Renewables & Wastes	23.4	0.8	8.2	16.0	9.5	11.4	7.6
Nuclear	–2.9	–	–	–	–	–	–
Hydro	3.4	–3.3	4.1	–2.5	0.5	1.5	0.2
Geothermal	0.1	1.2	3.3	6.3	0.6	3.7	2.3
Solar/Wind/Other	–	–	39.5	27.0	18.0	29.5	8.6
TFC	1.3	0.9	1.3	–0.3	1.1	1.1	0.5
Electricity Consumption	4.0	3.0	2.2	4.4	2.6	3.6	0.1
Energy Production	0.2	1.8	1.3	–3.2	2.4	4.1	1.1
Net Oil Imports	–0.4	–1.1	–0.3	0.9	–2.9	–6.7	–0.4
GDP	3.5	2.4	1.4	2.9	3.0	2.9	2.5
Growth in the TPES/GDP Ratio	–1.9	–1.7	–0.2	–1.4	–2.1	–2.4	–1.7
Growth in the TFC/GDP Ratio	–2.1	–1.5	–0.2	–3.2	–1.8	–1.8	–2.0

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

JAPAN

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**29.5**	**75.7**	**104.3**	**105.6**	**..**	**161.4**	**..**
Coal[1]		17.9	4.6	2.2	1.7	..	2.9	..
Oil		0.8	0.7	0.7	0.7	..	0.7	..
Gas		2.3	1.8	2.0	2.2	..	2.0	..
Comb. Renewables & Wastes[2]		–	6.7	5.4	5.6	..	6.0	..
Nuclear		2.5	52.7	82.5	83.9	..	125.1	..
Hydro		5.7	7.7	7.4	7.5	..	9.0	..
Geothermal		0.2	1.5	3.2	3.1	..	11.5	..
Solar/Wind/Other[3]		–	0.0	0.9	0.9	..	4.2	..
TOTAL NET IMPORTS[4]		**300.7**	**364.2**	**408.1**	**420.3**	**..**	**376.2**	**..**
Coal[1]	Exports	0.4	1.1	1.9	1.8	..	1.7	..
	Imports	41.3	70.0	86.9	94.1	..	77.6	..
	Net Imports	40.9	68.9	85.0	92.3	..	75.9	..
Oil	Exports	2.9	3.8	5.3	4.3	..	14.5	..
	Imports	276.7	262.6	273.4	274.6	..	255.0	..
	Bunkers	16.8	5.1	5.2	5.0	..	5.0	..
	Net Imports	257.0	253.6	262.9	265.4	..	235.5	..
Gas	Exports	–	–	–	–	..	..	..
	Imports	2.8	41.7	60.3	62.7	..	64.8	..
	Net Imports	2.8	41.7	60.3	62.7	..	64.8	..
Electricity	Exports	–	–	–	–	..	–	..
	Imports	–	–	–	–	..	–	..
	Net Imports	–	–	–	–	..	–	..
TOTAL STOCK CHANGES		**–6.6**	**–1.0**	**3.1**	**–1.2**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**323.6**	**438.8**	**515.6**	**524.7**	**..**	**537.6**	**..**
Coal[1]		57.9	74.0	87.6	93.7	..	78.9	..
Oil		252.2	253.0	266.4	265.2	..	236.2	..
Gas		5.1	43.3	62.1	64.8	..	66.8	..
Comb. Renewables & Wastes[2]		–	6.7	5.4	5.6	..	6.0	..
Nuclear		2.5	52.7	82.5	83.9	..	125.1	..
Hydro		5.7	7.7	7.4	7.5	..	9.0	..
Geothermal		0.2	1.5	3.2	3.1	..	11.5	..
Solar/Wind/Other[3]		–	0.0	0.9	0.9	..	4.2	..
Electricity Trade[5]		–	–	–	–	..	–	..
Shares (%)								
Coal		*17.9*	*16.9*	*17.0*	*17.9*	..	*14.7*	..
Oil		*77.9*	*57.6*	*51.7*	*50.5*	..	*43.9*	..
Gas		*1.6*	*9.9*	*12.0*	*12.3*	..	*12.4*	..
Comb. Renewables & Wastes		–	*1.5*	*1.0*	*1.1*	..	*1.1*	..
Nuclear		*0.8*	*12.0*	*16.0*	*16.0*	..	*23.3*	..
Hydro		*1.8*	*1.8*	*1.4*	*1.4*	..	*1.7*	..
Geothermal		*0.1*	*0.3*	*0.6*	*0.6*	..	*2.1*	..
Solar/Wind/Other		–	–	*0.2*	*0.2*	..	*0.8*	..
Electricity Trade		–	–	–	–	..	–	..

0 is negligible, – is nil, .. is not available.
Please note: In 2010, data for electricity generated, production and imports of coal, oil and gas, and bunkers are IEA Secretariat estimates.
All forecast data are based on the 2000 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**234.4**	**294.5**	**342.1**	**346.8**	**..**	**340.6**	**..**
Coal[1]	20.2	22.5	19.9	21.6	..	21.2	..
Oil	171.5	188.3	215.4	214.6	..	191.4	..
Gas	7.0	14.7	21.8	23.3	..	27.6	..
Comb. Renewables & Wastes[2]	–	3.7	2.3	2.5	..	2.9	..
Geothermal	–	–	0.2	0.2	..	0.7	..
Solar/Wind/Other	–	–	0.8	0.8	..	4.2	..
Electricity	35.7	65.1	81.1	83.2	..	91.7	..
Heat	0.0	0.2	0.5	0.5	..	0.9	..
Shares (%)							
Coal	*8.6*	*7.6*	*5.8*	*6.2*	..	*6.2*	..
Oil	*73.2*	*63.9*	*63.0*	*61.9*	..	*56.2*	..
Gas	*3.0*	*5.0*	*6.4*	*6.7*	..	*8.1*	..
Comb. Renewables & Wastes	–	*1.3*	*0.7*	*0.7*	..	*0.9*	..
Geothermal	–	–	*0.1*	*0.1*	..	*0.2*	..
Solar/Wind/Other	–	–	*0.2*	*0.2*	..	*1.2*	..
Electricity	*15.2*	*22.1*	*23.7*	*24.0*	..	*26.9*	..
Heat	–	*0.1*	*0.1*	*0.2*	..	*0.3*	..
TOTAL INDUSTRY[6]	**140.2**	**134.5**	**144.9**	**147.0**	**..**	**155.9**	**..**
Coal[1]	18.2	21.7	18.9	20.7	..	19.9	..
Oil	94.9	73.3	79.8	77.7	..	80.6	..
Gas	2.1	4.6	8.5	9.6	..	9.8	..
Comb. Renewables & Wastes[2]	–	2.5	2.3	2.5	..	2.9	..
Geothermal	–	–	0.1	0.1	..	0.4	..
Solar/Wind/Other	–	–	–	–	..	–	..
Electricity	25.1	32.4	35.4	36.3	..	42.4	..
Heat	–	–	–	–	..	–	..
Shares (%)							
Coal	*13.0*	*16.2*	*13.1*	*14.1*	..	*12.7*	..
Oil	*67.7*	*54.4*	*55.0*	*52.9*	..	*51.7*	..
Gas	*1.5*	*3.4*	*5.9*	*6.5*	..	*6.3*	..
Comb. Renewables & Wastes	–	*1.8*	*1.6*	*1.7*	..	*1.8*	..
Geothermal	–	–	*0.1*	*0.1*	..	*0.3*	..
Solar/Wind/Other	–	–	–	–	..	–	..
Electricity	*17.9*	*24.1*	*24.4*	*24.7*	..	*27.2*	..
Heat	–	–	–	–	..	–	..
TRANSPORT[7]	**42.6**	**74.3**	**93.6**	**94.1**	**..**	**83.2**	**..**
TOTAL OTHER SECTORS[8]	**51.6**	**85.7**	**103.5**	**105.8**	**..**	**101.5**	**..**
Coal[1]	1.8	0.8	0.9	0.9	..	1.3	..
Oil	35.3	42.5	43.9	44.6	..	33.3	..
Gas	5.0	10.1	13.3	13.7	..	14.2	..
Comb. Renewables & Wastes[2]	–	1.2	0.1	0.1	..	0.0	..
Geothermal	–	–	0.1	0.1	..	0.3	..
Solar/Wind/Other	–	–	0.8	0.8	..	4.2	..
Electricity	9.5	30.9	43.9	45.0	..	47.2	..
Heat	0.0	0.2	0.5	0.5	..	0.9	..
Shares (%)							
Coal	*3.4*	*0.9*	*0.9*	*0.9*	..	*1.3*	..
Oil	*68.5*	*49.6*	*42.4*	*42.2*	..	*32.9*	..
Gas	*9.6*	*11.8*	*12.8*	*13.0*	..	*14.0*	..
Comb. Renewables & Wastes	–	*1.4*	*0.1*	*0.1*	..	–	..
Geothermal	–	–	*0.1*	*0.1*	..	*0.3*	..
Solar/Wind/Other	–	–	*0.8*	*0.8*	..	*4.1*	..
Electricity	*18.4*	*36.1*	*42.4*	*42.6*	..	*46.6*	..
Heat	*0.1*	*0.2*	*0.5*	*0.5*	..	*0.9*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**90.6**	**170.6**	**215.6**	**219.4**	**..**	**252.9**	**..**
OUTPUT (Mtoe)	**40.0**	**73.2**	**90.9**	**93.0**	**..**	**100.1**	**..**
(TWh gross)	465.4	850.8	1057.0	1081.9	..	1163.6	..
Output Shares (%)							
Coal	*8.0*	*14.5*	*21.3*	*23.5*	..	*15.4*	..
Oil	*73.2*	*29.7*	*16.6*	*14.7*	..	*11.4*	..
Gas	*2.3*	*19.4*	*22.1*	*22.1*	..	*20.5*	..
Comb. Renewables & Wastes	–	*2.0*	*1.5*	*1.5*	..	*1.5*	..
Nuclear	*2.1*	*23.8*	*30.0*	*29.8*	..	*41.3*	..
Hydro	*14.3*	*10.5*	*8.2*	*8.1*	..	*9.0*	..
Geothermal	*0.1*	*0.2*	*0.3*	*0.3*	..	*1.0*	..
Solar/Wind/Other	–	*0.0*	*0.0*	*0.0*	..	–	..
TOTAL LOSSES	**94.6**	**143.2**	**175.8**	**179.3**	**..**	**197.0**	**..**
of which:							
Electricity and Heat Generation[10]	50.5	97.3	124.2	125.8	..	150.4	..
Other Transformation	25.1	23.3	26.9	28.7	..	23.9	..
Own Use and Losses[11]	19.0	22.6	24.7	24.8	..	22.6	..
Statistical Differences	**–5.4**	**1.1**	**–2.3**	**–1.5**	**..**	**–**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	2618.63	4935.97	5549.53	5680.57	6489.99	7342.83	..
Population (millions)	108.66	123.54	126.69	126.92	128.89	130.40	..
TPES/GDP[12]	0.12	0.09	0.09	0.09	..	0.07	..
Energy Production/TPES	0.09	0.17	0.20	0.20	..	0.30	..
Per Capita TPES[13]	2.98	3.55	4.07	4.13	..	4.12	..
Oil Supply/GDP[12]	0.10	0.05	0.05	0.05	..	0.03	..
TFC/GDP[12]	0.09	0.06	0.06	0.06	..	0.05	..
Per Capita TFC[13]	2.16	2.38	2.70	2.73	..	2.61	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	891.2	1018.7	1127.7	1154.8	..	984.2	..
CO_2 Emissions from Bunkers (Mt CO_2)	58.6	29.6	35.5	36.0	..	36.2	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.5	2.0	1.8	1.8	..	..	..
Coal	–2.0	3.4	1.9	7.0	..	..	..
Oil	0.4	–0.2	0.6	–0.5	..	..	..
Gas	24.2	8.0	4.1	4.3	..	..	..
Comb. Renewables & Wastes	–	–	–2.4	3.3	..	..	..
Nuclear	39.1	10.1	5.1	1.7	..	..	..
Hydro	3.2	0.9	–0.4	1.0	..	..	..
Geothermal	22.3	6.2	8.8	–3.1	..	..	..
Solar/Wind/Other	–	4.8	52.3	2.1	..	..	..
TFC	1.0	1.6	1.7	1.4	..	..	..
Electricity Consumption	3.9	3.4	2.5	2.6	..	..	..
Energy Production	4.9	6.1	3.6	1.3	..	..	..
Net Oil Imports	0.5	–0.4	0.4	0.9	..	..	..
GDP	3.5	4.0	1.3	2.4	2.7	2.5	..
Growth in the TPES/GDP Ratio	–1.9	–1.9	0.5	–0.6	..	..	..
Growth in the TFC/GDP Ratio	–2.4	–2.3	0.4	–0.9	..	..	..

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

KOREA

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**6.76**	**21.91**	**31.59**	**33.62**	**..**	**..**	**..**
Coal[1]		6.65	7.58	2.06	2.03	..	..	..
Oil		–	–	0.45	0.67	..	..	..
Gas		–	–	–	–	..	..	..
Comb. Renewables & Wastes[2]		–	–	1.79	2.12	..	..	..
Nuclear		–	13.78	26.86	28.40	..	..	..
Hydro		0.11	0.55	0.36	0.35	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.08	0.05	..	..	..
TOTAL NET IMPORTS[4]		**13.03**	**68.51**	**149.27**	**161.62**	**..**	**..**	**..**
Coal[1]	Exports	0.12	–	–	–	..	..	..
	Imports	0.45	15.73	34.97	40.68	..	..	..
	Net Imports	0.34	15.73	34.97	40.68	..	..	..
Oil	Exports	1.04	3.73	39.69	40.85	..	..	..
	Imports	14.28	55.41	145.33	150.78	..	..	..
	Bunkers	0.56	1.58	6.51	6.05	..	..	..
	Net Imports	12.69	50.10	99.13	103.88	..	..	..
Gas	Exports	–	–	–	–	..	..	..
	Imports	–	2.68	15.17	17.05	..	..	..
	Net Imports	–	2.68	15.17	17.05	..	..	..
Electricity	Exports	–	–	–	–	..	..	..
	Imports	–	–	–	–	..	..	..
	Net Imports	–	–	–	–	..	..	..
TOTAL STOCK CHANGES		**1.86**	**2.17**	**0.37**	**–1.61**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**21.64**	**92.58**	**181.23**	**193.63**	**..**	**..**	**..**
Coal[1]		8.13	25.49	37.30	41.93	..	..	..
Oil		13.40	50.04	99.69	103.79	..	..	..
Gas		–	2.72	15.16	16.99	..	..	..
Comb. Renewables & Wastes[2]		–	–	1.79	2.12	..	..	..
Nuclear		–	13.78	26.86	28.40	..	..	..
Hydro		0.11	0.55	0.36	0.35	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.08	0.05	..	..	..
Electricity Trade[5]		–	–	–	–	..	..	..
Shares (%)								
Coal		*37.6*	*27.5*	*20.6*	*21.7*	..	..	..
Oil		*61.9*	*54.0*	*55.0*	*53.6*	..	..	..
Gas		–	*2.9*	*8.4*	*8.8*	..	..	..
Comb. Renewables & Wastes		–	–	*1.0*	*1.1*	..	..	..
Nuclear		–	*14.9*	*14.8*	*14.7*	..	..	..
Hydro		*0.5*	*0.6*	*0.2*	*0.2*	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other		–	–	–	–	..	..	..
Electricity Trade		–	–	–	–	..	..	..

0 is negligible, – is nil, .. is not available.
Please note: Forecasts are not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**17.40**	**63.99**	**122.99**	**129.21**	**..**	**..**	**..**
Coal[1]	6.49	11.37	6.15	7.06	..	..	..
Oil	9.81	43.82	85.25	86.11	..	..	..
Gas	–	0.67	9.22	11.01	..	..	..
Comb. Renewables & Wastes[2]	–	–	0.10	0.11	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	0.00	0.07	0.04	..	..	..
Electricity	1.10	8.12	20.39	22.67	..	..	..
Heat	–	–	1.82	2.22	..	..	..
Shares (%)							
Coal	*37.3*	*17.8*	*5.0*	*5.5*	..	..	..
Oil	*56.4*	*68.5*	*69.3*	*66.6*	..	..	..
Gas	–	*1.1*	*7.5*	*8.5*	..	..	..
Comb. Renewables & Wastes	–	–	*0.1*	*0.1*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.1*	–	..	..	..
Electricity	*6.3*	*12.7*	*16.6*	*17.5*	..	..	..
Heat	–	–	*1.5*	*1.7*	..	..	..
TOTAL INDUSTRY[6]	**7.37**	**25.17**	**57.16**	**60.40**	**..**	**..**	**..**
Coal[1]	0.39	2.71	5.62	6.49	..	..	..
Oil	6.22	17.42	37.55	38.29	..	..	..
Gas	–	0.07	2.04	2.65	..	..	..
Comb. Renewables & Wastes[2]	–	–	–	–	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	0.76	4.97	11.96	12.98	..	..	..
Heat	–	–	–	–	..	..	..
Shares (%)							
Coal	*5.3*	*10.8*	*9.8*	*10.7*	..	..	..
Oil	*84.4*	*69.2*	*65.7*	*63.4*	..	..	..
Gas	–	*0.3*	*3.6*	*4.4*	..	..	..
Comb. Renewables & Wastes	–	–	–	–	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*10.3*	*19.7*	*20.9*	*21.5*	..	..	..
Heat	–	–	–	–	..	..	..
TRANSPORT[7]	**2.60**	**14.93**	**27.70**	**30.03**	**..**	**..**	**..**
TOTAL OTHER SECTORS[8]	**7.43**	**23.89**	**38.13**	**38.78**	**..**	**..**	**..**
Coal[1]	6.08	8.67	0.53	0.57	..	..	..
Oil	1.02	11.56	20.15	17.97	..	..	..
Gas	–	0.60	7.18	8.36	..	..	..
Comb. Renewables & Wastes[2]	–	–	0.10	0.11	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	0.00	0.07	0.04	..	..	..
Electricity	0.33	3.06	8.28	9.52	..	..	..
Heat	–	–	1.82	2.22	..	..	..
Shares (%)							
Coal	*81.9*	*36.3*	*1.4*	*1.5*	..	..	..
Oil	*13.7*	*48.4*	*52.8*	*46.3*	..	..	..
Gas	–	*2.5*	*18.8*	*21.6*	..	..	..
Comb. Renewables & Wastes	–	–	*0.2*	*0.3*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.2*	*0.1*	..	..	..
Electricity	*4.5*	*12.8*	*21.7*	*24.5*	..	..	..
Heat	–	–	*4.8*	*5.7*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.30**	**26.60**	**60.97**	**68.64**	**..**	**..**	**..**
OUTPUT (Mtoe)	**1.27**	**9.26**	**22.40**	**25.15**	**..**	**..**	**..**
(TWh gross)	14.83	107.67	260.44	292.50	..	..	..
Output Shares (%)							
Coal	*9.0*	*18.5*	*41.9*	*43.2*	..	..	..
Oil	*82.3*	*17.5*	*5.4*	*8.4*	..	..	..
Gas	–	*8.9*	*11.4*	*9.6*	..	..	..
Comb. Renewables & Wastes	–	–	*0.1*	*0.1*	..	..	..
Nuclear	–	*49.1*	*39.6*	*37.3*	..	..	..
Hydro	*8.7*	*5.9*	*1.6*	*1.4*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.0*	*0.0*	..	..	..
TOTAL LOSSES	**4.10**	**28.58**	**55.38**	**61.46**	**..**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	2.03	17.34	36.26	40.65	..	..	..
Other Transformation	1.06	6.64	7.94	8.73	..	..	..
Own Use and Losses[11]	1.01	4.61	11.18	12.09	..	..	..
Statistical Differences	**0.14**	**0.02**	**2.85**	**2.95**	**..**	**..**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	93.22	341.55	567.52	617.51	..	..	..
Population (millions)	34.10	42.87	46.86	47.28	..	..	..
TPES/GDP[12]	0.23	0.27	0.32	0.31	..	..	..
Energy Production/TPES	0.31	0.24	0.17	0.17	..	..	..
Per Capita TPES[13]	0.63	2.16	3.87	4.10	..	..	..
Oil Supply/GDP[12]	0.14	0.15	0.18	0.17	..	..	..
TFC/GDP[12]	0.19	0.19	0.22	0.21	..	..	..
Per Capita TFC[13]	0.51	1.49	2.62	2.73	..	..	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	65.8	226.2	402.9	433.6	..	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	2.1	5.9	22.1	21.0	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	10.8	7.9	7.7	6.8	..	..	..
Coal	6.9	7.0	4.3	12.4	..	..	..
Oil	12.3	5.8	8.0	4.1	..	..	..
Gas	–	–	21.0	12.1	..	..	..
Comb. Renewables & Wastes	–	–	–	18.7	..	..	..
Nuclear	–	29.2	7.7	5.7	..	..	..
Hydro	10.5	9.6	–4.6	–3.6	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	43.4	–37.7	..	..	..
TFC	9.8	7.0	7.5	5.1	..	..	..
Electricity Consumption	15.9	10.6	10.8	11.2	..	..	..
Energy Production	4.9	8.4	4.1	6.4	..	..	..
Net Oil Imports	13.3	5.8	7.9	4.8	..	..	..
GDP	8.5	7.6	5.8	8.8	..	..	..
Growth in the TPES/GDP Ratio	2.1	0.3	1.8	–1.8	..	..	..
Growth in the TFC/GDP Ratio	1.2	–0.6	1.6	–3.4	..	..	..

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**0.00**	**0.03**	**0.05**	**0.06**	**0.05**	**0.05**	**..**
Coal[1]		–	–	–	–	–	–	..
Oil		–	–	–	–	–	–	..
Gas		–	–	–	–	–	–	..
Comb. Renewables & Wastes[2]		–	0.03	0.04	0.04	0.04	0.04	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.00	0.01	0.01	0.01	0.01	0.01	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	–	0.00	0.00	0.00	0.00	..
TOTAL NET IMPORTS[4]		**4.51**	**3.55**	**3.40**	**3.68**	**3.74**	**3.67**	**..**
Coal[1]	Exports	–	–	–	–	–	–	..
	Imports	2.44	1.13	0.11	0.13	0.10	0.10	..
	Net Imports	2.44	1.13	0.11	0.13	0.10	0.10	..
Oil	Exports	0.01	0.01	0.02	0.02	–	–	..
	Imports	1.69	1.67	2.17	2.41	1.95	1.80	..
	Bunkers	–	–	–	–	–	–	..
	Net Imports	1.67	1.65	2.15	2.39	1.95	1.80	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	0.22	0.43	0.66	0.67	1.42	1.47	..
	Net Imports	0.22	0.43	0.66	0.67	1.42	1.47	..
Electricity	Exports	0.07	0.06	0.06	0.06	0.18	0.18	..
	Imports	0.24	0.40	0.53	0.56	0.46	0.48	..
	Net Imports	0.18	0.34	0.48	0.49	0.27	0.30	..
TOTAL STOCK CHANGES		**–0.01**	**–0.01**	**0.05**	**–0.05**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**4.51**	**3.57**	**3.49**	**3.68**	**3.79**	**3.72**	**..**
Coal[1]		2.44	1.13	0.11	0.13	0.10	0.10	..
Oil		1.67	1.64	2.20	2.34	1.95	1.80	..
Gas		0.22	0.43	0.66	0.67	1.42	1.47	..
Comb. Renewables & Wastes[2]		–	0.03	0.04	0.04	0.04	0.04	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.00	0.01	0.01	0.01	0.01	0.01	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	–	0.00	0.00	0.00	0.00	..
Electricity Trade[5]		0.18	0.34	0.48	0.49	0.27	0.30	..
Shares (%)								
Coal		*54.1*	*31.7*	*3.2*	*3.4*	*2.6*	*2.7*	..
Oil		*37.1*	*46.0*	*63.0*	*63.5*	*51.4*	*48.4*	..
Gas		*4.9*	*12.0*	*18.8*	*18.2*	*37.3*	*39.5*	..
Comb. Renewables & Wastes		–	*0.7*	*1.0*	*1.2*	*1.1*	*1.1*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*0.1*	*0.2*	*0.2*	*0.3*	*0.2*	*0.2*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
Electricity Trade		*3.9*	*9.5*	*13.7*	*13.4*	*7.2*	*8.0*	..

0 is negligible, – is nil, .. is not available.
Please note: All forecast data are based on the 1999 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**2.94**	**2.96**	**3.43**	**3.62**	**3.31**	**3.24**	**..**
Blast Furnace Gas	0.74	0.20	–	–	–	–	..
Other Coal[1]	0.24	0.35	0.11	0.13	0.10	0.10	..
Oil	1.54	1.64	2.20	2.34	1.95	1.80	..
Gas	0.18	0.42	0.61	0.62	0.67	0.72	..
Comb. Renewables & Wastes[2]	–	–	0.02	0.02	0.01	0.01	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.26	0.36	0.47	0.49	0.52	0.55	..
Heat	–	–	0.02	0.03	0.06	0.06	..
Shares (%)							
Blast Furnace Gas	*25.1*	*6.8*	–	–	–	–	..
Other Coal	*8.1*	*11.7*	*3.3*	*3.5*	*3.0*	*3.1*	..
Oil	*52.1*	*55.3*	*64.0*	*64.6*	*58.8*	*55.6*	..
Gas	*6.0*	*14.2*	*17.8*	*17.2*	*20.3*	*22.2*	..
Comb. Renewables & Wastes	–	–	*0.4*	*0.4*	*0.4*	*0.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*8.7*	*12.0*	*13.8*	*13.6*	*15.8*	*16.9*	..
Heat	–	–	*0.7*	*0.7*	*1.7*	*1.8*	..
TOTAL INDUSTRY[6]	**2.09**	**1.34**	**0.94**	**0.97**	**1.00**	**1.04**	**..**
Blast Furnace Gas	0.74	0.20	–	–	–	–	..
Other Coal[1]	0.20	0.34	0.11	0.13	0.10	0.10	..
Oil	0.81	0.30	0.10	0.09	0.10	0.09	..
Gas	0.14	0.28	0.40	0.41	0.42	0.45	..
Comb. Renewables & Wastes[2]	–	–	–	–	–	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.20	0.23	0.32	0.33	0.35	0.37	..
Heat	–	–	0.02	0.02	0.04	0.04	..
Shares (%)							
Blast Furnace Gas	*35.4*	*15.1*	–	–	–	–	..
Other Coal	*9.7*	*25.3*	*11.9*	*12.9*	*9.6*	*9.2*	..
Oil	*38.6*	*22.0*	*10.6*	*9.0*	*9.5*	*8.7*	..
Gas	*6.6*	*20.8*	*42.2*	*42.4*	*41.7*	*42.8*	..
Comb. Renewables & Wastes	–	–	–	–	–	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.7*	*16.8*	*33.7*	*34.1*	*34.8*	*35.1*	..
Heat	–	–	*1.8*	*1.7*	*4.3*	*4.2*	..
TRANSPORT[7]	**0.29**	**1.03**	**1.76**	**1.92**	**1.51**	**1.41**	**..**
TOTAL OTHER SECTORS[8]	**0.56**	**0.59**	**0.73**	**0.72**	**0.81**	**0.79**	**..**
Coal[1]	0.03	0.01	0.00	0.00	0.00	0.00	..
Oil	0.44	0.31	0.35	0.33	0.36	0.31	..
Gas	0.04	0.14	0.21	0.21	0.26	0.27	..
Comb. Renewables & Wastes[2]	–	–	0.02	0.02	0.01	0.01	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.05	0.13	0.15	0.15	0.17	0.17	..
Heat	–	–	0.01	0.01	0.01	0.02	..
Shares (%)							
Coal	*6.1*	*1.0*	*0.1*	*0.1*	*0.5*	*0.5*	..
Oil	*78.4*	*53.6*	*47.5*	*46.1*	*44.0*	*39.3*	..
Gas	*6.8*	*24.1*	*29.1*	*29.1*	*31.6*	*34.6*	..
Comb. Renewables & Wastes	–	–	*2.1*	*2.2*	*1.7*	*1.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*8.8*	*21.3*	*20.2*	*21.1*	*20.5*	*21.9*	..
Heat	–	–	*0.8*	*1.2*	*1.6*	*1.9*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**0.44**	**0.20**	**0.07**	**0.09**	**0.58**	**0.58**	**..**
OUTPUT (Mtoe)	**0.12**	**0.05**	**0.03**	**0.04**	**0.29**	**0.30**	**..**
(TWh gross)	1.39	0.62	0.36	0.43	3.35	3.48	..
Output Shares (%)							
Blast Furnace Gas	*58.8*	*76.4*	–	–	–	–	..
Other Coal	–	–	–	–	–	–	..
Oil	*27.6*	*1.4*	–	–	–	–	..
Gas	*10.2*	*5.4*	*57.0*	*53.1*	*94.6*	*94.8*	..
Comb. Renewables & Wastes	–	*5.4*	*14.2*	*12.9*	*1.5*	*1.4*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*3.4*	*11.2*	*23.7*	*27.7*	*2.8*	*2.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*5.0*	*6.2*	*1.1*	*1.1*	..
TOTAL LOSSES	**1.54**	**0.61**	**0.05**	**0.06**	**0.48**	**0.48**	**..**
of which:							
Electricity and Heat Generation[10]	0.32	0.14	0.02	0.02	0.23	0.23	..
Other Transformation	1.08	0.41	–	–	–	–	..
Own Use and Losses[11]	0.14	0.06	0.04	0.04	0.25	0.25	..
Statistical Differences	**0.02**	**0.00**	**0.01**	**0.00**	**–**	**–**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1990 US$)	8.24	13.88	22.91	24.63	27.60	30.92	..
Population (millions)	0.35	0.38	0.44	0.44	0.45	0.49	..
TPES/GDP[12]	0.55	0.26	0.15	0.15	0.14	0.12	..
Energy Production/TPES	0.00	0.01	0.01	0.02	0.01	0.01	..
Per Capita TPES[13]	12.83	9.37	8.01	8.35	8.43	7.65	..
Oil Supply/GDP[12]	0.20	0.12	0.10	0.09	0.07	0.06	..
TFC/GDP[12]	0.36	0.21	0.15	0.15	0.12	0.10	..
Per Capita TFC[13]	8.39	7.76	7.88	8.20	7.36	6.66	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	16.5	10.5	7.5	8.0	8.5	8.2	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.2	0.4	1.0	1.0	1.0	1.0	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	–2.5	–0.8	–0.2	5.5	0.6	–0.4	..
Coal	–4.6	–4.3	–22.6	10.6	–4.4	–	..
Oil	–4.0	2.1	3.3	6.3	–3.6	–1.6	..
Gas	13.6	–0.8	4.8	2.1	16.1	0.7	..
Comb. Renewables & Wastes	–	3.0	4.1	22.2	–0.9	–	..
Nuclear	–	–	–	–	–	–	..
Hydro	12.2	–2.6	1.7	42.9	–4.4	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	8.4	5.9	..
TFC	–0.1	0.1	1.7	5.4	–1.7	–0.5	..
Electricity Consumption	2.7	1.6	3.3	3.8	1.2	0.9	..
Energy Production	36.6	1.6	4.2	26.7	–1.4	0.4	..
Net Oil Imports	–3.5	1.8	3.0	11.0	–4.0	–1.6	..
GDP	1.3	4.1	5.7	7.5	2.3	2.3	..
Growth in the TPES/GDP Ratio	–3.7	–4.7	–5.7	–1.9	–1.7	–2.6	..
Growth in the TFC/GDP Ratio	–1.3	–3.9	–3.8	–2.0	–3.9	–2.7	..

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**56.8**	**60.0**	**59.5**	**57.2**	**58.0**	**60.2**	**64.8**
Coal[1]		1.1	–	–	–	–	–	–
Oil		1.6	4.1	2.6	2.4	1.1	0.8	0.8
Gas		53.7	54.6	54.1	51.9	54.7	56.6	60.9
Comb. Renewables & Wastes[2]		–	0.4	1.7	1.8	2.0	2.5	2.5
Nuclear		0.3	0.9	1.0	1.0	–	–	–
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.2	0.3	0.6
TOTAL NET IMPORTS[4]		**6.0**	**6.7**	**13.3**	**21.1**	**19.6**	**20.1**	**21.9**
Coal[1]	Exports	1.4	2.2	4.9	6.1	6.2	7.4	7.4
	Imports	2.9	11.6	12.1	14.2	14.4	15.5	16.7
	Net Imports	1.5	9.4	7.2	8.2	8.2	8.1	9.3
Oil	Exports	42.4	59.8	62.2	65.9	52.0	43.9	43.9
	Imports	83.8	91.0	99.0	107.8	92.3	93.3	93.5
	Bunkers	11.6	10.9	12.7	13.4	13.6	21.1	21.1
	Net Imports	29.8	20.3	24.1	28.5	26.8	28.3	28.5
Gas	Exports	25.3	25.8	27.3	29.7	31.1	33.9	33.9
	Imports	–	2.0	7.7	12.5	14.0	16.0	16.1
	Net Imports	–25.3	–23.8	–19.5	–17.2	–17.1	–17.9	–17.8
Electricity	Exports	0.1	0.0	0.3	0.3	–	–	–
	Imports	0.0	0.8	1.9	2.0	1.7	1.6	1.8
	Net Imports	–0.1	0.8	1.6	1.6	1.7	1.6	1.8
TOTAL STOCK CHANGES		**–0.3**	**–0.2**	**1.7**	**–2.5**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**62.4**	**66.5**	**74.6**	**75.8**	**77.6**	**80.3**	**86.7**
Coal[1]		2.9	8.9	7.5	8.0	8.2	8.1	9.3
Oil		30.9	24.7	28.1	28.6	27.9	29.0	29.3
Gas		28.5	30.8	34.6	34.7	37.7	38.7	43.1
Comb. Renewables & Wastes[2]		–	0.4	1.7	1.8	2.0	2.5	2.5
Nuclear		0.3	0.9	1.0	1.0	–	–	–
Hydro		–	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.2	0.3	0.6
Electricity Trade[5]		–0.1	0.8	1.6	1.6	1.7	1.6	1.8
Shares (%)								
Coal		*4.6*	*13.4*	*10.0*	*10.5*	*10.6*	*10.1*	*10.8*
Oil		*49.5*	*37.1*	*37.7*	*37.7*	*35.9*	*36.2*	*33.8*
Gas		*45.6*	*46.3*	*46.4*	*45.8*	*48.5*	*48.2*	*49.7*
Comb. Renewables & Wastes		*–*	*0.6*	*2.3*	*2.3*	*2.6*	*3.1*	*2.9*
Nuclear		*0.5*	*1.4*	*1.3*	*1.3*	*–*	*–*	*–*
Hydro		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Geothermal		*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other		*–*	*–*	*0.1*	*0.1*	*0.2*	*0.4*	*0.7*
Electricity Trade		*–0.2*	*1.2*	*2.1*	*2.1*	*2.1*	*2.0*	*2.1*

0 is negligible, – is nil, .. is not available.
The " – " for nuclear after 2005 reflects the policy of the previous government to close down the Borssele nuclear plant, which has been overruled by the new government.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**48.8**	**52.0**	**58.4**	**60.4**	**64.5**	**65.7**	**69.4**
Coal[1]	1.1	1.7	1.5	1.4	2.4	2.4	2.5
Oil	24.7	20.5	23.3	24.5	23.7	24.5	24.7
Gas	19.3	23.0	22.5	23.1	27.7	27.3	28.6
Comb. Renewables & Wastes[2]	–	0.2	0.8	0.8	0.4	0.4	0.4
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.0	0.1
Electricity	3.8	6.3	8.1	8.4	9.2	10.0	12.1
Heat	–	0.2	2.1	2.2	1.0	1.0	1.1
Shares (%)							
Coal	*2.2*	*3.3*	*2.5*	*2.3*	*3.8*	*3.7*	*3.6*
Oil	*50.5*	*39.5*	*39.9*	*40.5*	*36.8*	*37.3*	*35.6*
Gas	*39.5*	*44.2*	*38.6*	*38.2*	*43.0*	*41.5*	*41.3*
Comb. Renewables & Wastes	–	*0.3*	*1.4*	*1.3*	*0.7*	*0.6*	*0.6*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	*0.1*
Electricity	*7.8*	*12.2*	*14.0*	*13.9*	*14.2*	*15.2*	*17.4*
Heat	–	*0.5*	*3.7*	*3.7*	*1.5*	*1.6*	*1.5*
TOTAL INDUSTRY[6]	**21.2**	**21.7**	**21.8**	**23.6**	**28.0**	**28.7**	**31.7**
Coal[1]	0.8	1.7	1.4	1.4	2.4	2.4	2.4
Oil	10.4	8.4	7.7	9.2	10.3	10.4	10.9
Gas	8.1	8.8	8.2	8.2	11.2	11.7	13.4
Comb. Renewables & Wastes[2]	–	0.0	0.1	0.1	0.0	0.0	0.0
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	0.0	0.0
Electricity	2.0	2.9	3.4	3.5	3.6	3.8	4.5
Heat	–	–	0.9	1.2	0.5	0.4	0.4
Shares (%)							
Coal	*3.6*	*7.7*	*6.5*	*5.8*	*8.6*	*8.3*	*7.7*
Oil	*48.8*	*38.6*	*35.4*	*39.1*	*36.7*	*36.3*	*34.5*
Gas	*38.4*	*40.4*	*37.8*	*35.0*	*39.9*	*40.7*	*42.2*
Comb. Renewables & Wastes	–	*0.1*	*0.3*	*0.3*	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*9.2*	*13.1*	*15.7*	*14.8*	*12.8*	*13.1*	*14.3*
Heat	–	–	*4.3*	*5.0*	*1.9*	*1.5*	*1.4*
TRANSPORT[7]	**7.5**	**10.6**	**14.1**	**14.2**	**12.4**	**13.1**	**12.7**
TOTAL OTHER SECTORS[8]	**20.2**	**19.6**	**22.4**	**22.7**	**24.1**	**23.9**	**24.9**
Coal[1]	0.3	0.1	0.0	0.0	0.0	0.0	0.0
Oil	6.9	1.6	1.6	1.2	1.2	1.2	1.2
Gas	11.1	14.2	14.3	14.9	16.5	15.6	15.3
Comb. Renewables & Wastes[2]	–	0.1	0.7	0.7	0.4	0.4	0.4
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.0	0.1
Electricity	1.8	3.4	4.6	4.8	5.4	6.0	7.4
Heat	–	0.2	1.2	1.1	0.5	0.6	0.6
Shares (%)							
Coal	*1.6*	*0.3*	*0.2*	*0.1*	*0.1*	*0.2*	*0.1*
Oil	*34.2*	*8.3*	*7.1*	*5.4*	*4.9*	*5.0*	*4.7*
Gas	*55.3*	*72.4*	*63.7*	*65.5*	*68.7*	*65.2*	*61.3*
Comb. Renewables & Wastes	–	*0.7*	*3.2*	*3.2*	*1.8*	*1.7*	*1.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*0.1*	*0.1*	*0.2*
Electricity	*8.8*	*17.1*	*20.4*	*21.1*	*22.5*	*25.2*	*29.6*
Heat	–	*1.2*	*5.4*	*4.7*	*1.9*	*2.6*	*2.5*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**12.0**	**15.0**	**19.2**	**19.0**	**16.9**	**18.7**	**22.5**
OUTPUT (Mtoe)	**4.5**	**6.2**	**7.5**	**7.7**	**8.2**	**9.0**	**11.1**
(TWh gross)	52.6	71.9	86.7	89.6	94.8	105.2	129.0
Output Shares (%)							
Coal	*6.0*	*38.3*	*25.5*	*28.4*	*27.4*	*24.4*	*24.5*
Oil	*12.3*	*4.3*	*7.6*	*3.5*	*8.3*	*4.2*	*3.8*
Gas	*79.5*	*51.0*	*56.9*	*57.7*	*56.5*	*61.1*	*60.5*
Comb. Renewables & Wastes	–	*1.3*	*4.6*	*4.7*	*5.5*	*6.7*	*5.9*
Nuclear	*2.1*	*4.9*	*4.4*	*4.4*	–	–	–
Hydro	–	*0.2*	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.1*	*1.0*	*1.2*	*2.1*	*3.4*	*5.1*
TOTAL LOSSES	**14.3**	**15.2**	**17.0**	**16.4**	**13.1**	**14.6**	**17.3**
of which:							
Electricity and Heat Generation[10]	7.5	8.6	9.3	8.6	7.0	7.8	9.6
Other Transformation	1.6	0.9	1.4	1.5	4.1	4.7	4.9
Own Use and Losses[11]	5.2	5.7	6.3	6.3	2.0	2.1	2.8
Statistical Differences	**–0.7**	**–0.7**	**–0.8**	**–1.0**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	252.63	373.47	480.29	496.95	562.25	636.13	814.30
Population (millions)	13.44	14.95	15.81	15.92	15.99	16.09	17.00
TPES/GDP[12]	0.25	0.18	0.16	0.15	0.14	0.13	0.11
Energy Production/TPES	0.91	0.90	0.80	0.76	0.75	0.75	0.75
Per Capita TPES[13]	4.65	4.45	4.72	4.76	4.85	4.99	5.10
Oil Supply/GDP[12]	0.12	0.07	0.06	0.06	0.05	0.05	0.04
TFC/GDP[12]	0.19	0.14	0.12	0.12	0.11	0.10	0.09
Per Capita TFC[13]	3.64	3.48	3.69	3.79	4.03	4.08	4.08
Energy–related CO_2 Emissions (Mt CO_2)[14]	153.8	159.8	174.5	177.1	172.9	176.3	190.5
CO_2 Emissions from Bunkers (Mt CO_2)	39.3	39.0	50.3	52.4	53.2	77.0	77.0

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.7	–0.3	1.3	1.7	0.5	0.7	0.8
Coal	2.4	9.4	–2.0	7.3	0.5	–0.2	1.4
Oil	0.4	–2.2	1.5	1.5	–0.5	0.8	0.1
Gas	2.4	–0.6	1.3	0.4	1.6	0.5	1.1
Comb. Renewables & Wastes	–	4.0	18.5	2.8	2.4	4.4	0.2
Nuclear	21.0	0.0	1.0	2.4	–	–	–
Hydro	–	–	–2.4	50.0	10.8	–	0.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	34.4	27.9	10.7	13.1	6.1
TFC	2.0	–0.5	1.3	3.5	1.3	0.4	0.5
Electricity Consumption	4.4	2.3	2.9	3.4	1.7	1.7	1.9
Energy Production	4.4	–1.8	–0.1	–3.9	0.3	0.8	0.7
Net Oil Imports	1.0	–4.0	1.9	18.2	–1.2	1.1	0.1
GDP	2.6	2.2	2.8	3.5	2.5	2.5	2.5
Growth in the TPES/GDP Ratio	–0.9	–2.4	–1.5	–1.7	–2.0	–1.8	–1.7
Growth in the TFC/GDP Ratio	–0.6	–2.6	–1.5	0.0	–1.2	–2.1	–1.9

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

NEW ZEALAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**4.05**	**12.26**	**15.20**	**15.38**	**14.80**	**15.75**	**19.13**
Coal[1]		1.29	1.39	2.07	2.15	3.52	4.11	6.33
Oil		0.18	1.96	2.13	1.92	2.15	2.14	2.15
Gas		0.28	3.90	4.81	5.06	3.10	2.97	3.28
Comb. Renewables & Wastes[2]		–	0.68	1.22	1.22	1.32	1.49	1.62
Nuclear		–	–	–	–	–	–	–
Hydro		1.23	2.01	2.02	2.12	2.29	2.49	2.37
Geothermal		1.07	2.32	2.90	2.85	2.41	2.53	3.33
Solar/Wind/Other[3]		–	0.01	0.06	0.06	0.01	0.03	0.07
TOTAL NET IMPORTS[4]		**4.27**	**1.79**	**3.24**	**3.15**	**2.98**	**3.40**	**3.39**
Coal[1]	Exports	0.02	0.23	0.98	1.12	2.00	2.50	4.00
	Imports	–	0.01	–	–	–	–	–
	Net Imports	–0.02	–0.22	–0.98	–1.12	–2.00	–2.50	–4.00
Oil	Exports	–	1.47	1.61	1.42	–	–	–
	Imports	4.60	3.80	6.12	5.93	5.35	6.29	7.82
	Bunkers	0.31	0.32	0.28	0.23	0.37	0.39	0.43
	Net Imports	4.29	2.01	4.22	4.27	4.98	5.90	7.39
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
Electricity	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
TOTAL STOCK CHANGES		**–0.05**	**–0.03**	**–0.33**	**0.10**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**8.27**	**14.02**	**18.11**	**18.63**	**17.78**	**19.15**	**22.52**
Coal[1]		1.26	1.13	1.06	1.00	1.52	1.61	2.33
Oil		4.42	3.98	6.04	6.32	7.12	8.04	9.54
Gas		0.28	3.90	4.81	5.06	3.10	2.97	3.28
Comb. Renewables & Wastes[2]		–	0.68	1.22	1.22	1.32	1.49	1.62
Nuclear		–	–	–	–	–	–	–
Hydro		1.23	2.01	2.02	2.12	2.29	2.49	2.37
Geothermal		1.07	2.32	2.90	2.85	2.41	2.53	3.33
Solar/Wind/Other[3]		–	0.01	0.06	0.06	0.01	0.03	0.07
Electricity Trade[5]		–	–	–	–	–	–	–
Shares (%)								
Coal		*15.3*	*8.0*	*5.9*	*5.4*	*8.5*	*8.4*	*10.3*
Oil		*53.5*	*28.4*	*33.4*	*33.9*	*40.1*	*42.0*	*42.3*
Gas		*3.4*	*27.8*	*26.6*	*27.1*	*17.5*	*15.5*	*14.6*
Comb. Renewables & Wastes		–	*4.9*	*6.7*	*6.5*	*7.4*	*7.8*	*7.2*
Nuclear		–	–	–	–	–	–	–
Hydro		*14.9*	*14.3*	*11.2*	*11.4*	*12.9*	*13.0*	*10.5*
Geothermal		*12.9*	*16.5*	*16.0*	*15.3*	*13.6*	*13.2*	*14.8*
Solar/Wind/Other		–	*0.1*	*0.3*	*0.3*	*0.1*	*0.2*	*0.3*
Electricity Trade		–	–	–	–	–	–	–

0 is negligible, – is nil, .. is not available.
Please note: Forecast data, except GDP and population, refer to the fiscal year.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**6.05**	**9.98**	**13.29**	**13.79**	**13.87**	**14.44**	**16.96**
Coal[1]	0.87	1.01	0.85	0.83	1.00	1.04	1.09
Oil	3.67	4.43	5.69	5.84	6.85	7.48	8.94
Gas	0.14	1.30	2.62	2.83	1.78	1.30	1.51
Comb. Renewables & Wastes[2]	–	0.58	1.03	1.06	0.78	0.84	0.97
Geothermal	–	0.27	0.34	0.33	0.38	0.40	0.47
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.37	2.39	2.76	2.90	3.10	3.39	3.98
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*14.4*	*10.1*	*6.4*	*6.0*	*7.2*	*7.2*	*6.4*
Oil	*60.6*	*44.4*	*42.8*	*42.3*	*49.3*	*51.8*	*52.7*
Gas	*2.4*	*13.0*	*19.7*	*20.5*	*12.8*	*9.0*	*8.9*
Comb. Renewables & Wastes	–	*5.8*	*7.8*	*7.7*	*5.6*	*5.8*	*5.7*
Geothermal	–	*2.7*	*2.6*	*2.4*	*2.7*	*2.8*	*2.8*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*22.6*	*23.9*	*20.8*	*21.1*	*22.3*	*23.5*	*23.5*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**2.18**	**4.15**	**5.87**	**6.23**	**5.22**	**4.97**	**5.57**
Coal[1]	0.69	0.86	0.73	0.72	0.79	0.83	0.87
Oil	0.96	0.59	0.54	0.59	0.63	0.66	0.72
Gas	0.05	1.06	2.37	2.59	1.45	0.95	1.10
Comb. Renewables & Wastes[2]	–	0.46	0.88	0.91	0.62	0.67	0.78
Geothermal	–	0.22	0.28	0.27	0.30	0.32	0.38
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.48	0.96	1.07	1.15	1.43	1.53	1.74
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*31.5*	*20.7*	*12.4*	*11.5*	*15.2*	*16.6*	*15.6*
Oil	*43.9*	*14.1*	*9.3*	*9.5*	*12.1*	*13.4*	*13.0*
Gas	*2.4*	*25.5*	*40.4*	*41.6*	*27.7*	*19.2*	*19.6*
Comb. Renewables & Wastes	–	*11.2*	*14.9*	*14.5*	*11.9*	*13.5*	*13.9*
Geothermal	–	*5.3*	*4.8*	*4.3*	*5.8*	*6.5*	*6.7*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*22.2*	*23.2*	*18.2*	*18.5*	*27.4*	*30.9*	*31.2*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**2.15**	**3.54**	**4.83**	**4.96**	**5.73**	**6.29**	**7.60**
TOTAL OTHER SECTORS[8]	**1.72**	**2.30**	**2.59**	**2.60**	**2.92**	**3.19**	**3.78**
Coal[1]	0.19	0.15	0.12	0.11	0.21	0.21	0.22
Oil	0.57	0.37	0.36	0.32	0.50	0.54	0.63
Gas	0.09	0.18	0.23	0.23	0.32	0.34	0.41
Comb. Renewables & Wastes[2]	–	0.12	0.15	0.15	0.16	0.17	0.19
Geothermal	–	0.05	0.06	0.06	0.08	0.08	0.09
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.88	1.42	1.66	1.71	1.66	1.85	2.24
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*10.7*	*6.6*	*4.8*	*4.3*	*7.0*	*6.5*	*5.8*
Oil	*32.8*	*16.0*	*13.7*	*12.5*	*17.1*	*16.9*	*16.5*
Gas	*5.3*	*7.8*	*9.0*	*9.0*	*11.1*	*10.7*	*10.9*
Comb. Renewables & Wastes	–	*5.2*	*5.9*	*5.9*	*5.3*	*5.2*	*5.1*
Geothermal	–	*2.3*	*2.4*	*2.4*	*2.6*	*2.5*	*2.5*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*51.2*	*62.0*	*64.2*	*65.9*	*56.9*	*58.1*	*59.2*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.16**	**5.37**	**7.02**	**7.08**	**6.37**	**7.17**	**8.57**
OUTPUT (Mtoe)	**1.59**	**2.77**	**3.25**	**3.35**	**3.48**	**3.97**	**4.18**
(TWh gross)	18.53	32.27	37.76	39.01	40.46	46.17	48.66
Output Shares (%)							
Coal	*8.5*	*1.5*	*3.4*	*2.6*	*3.6*	*3.6*	*8.0*
Oil	*6.1*	*0.0*	–	–	–	–	*0.2*
Gas	*1.4*	*17.6*	*23.6*	*23.8*	*17.3*	*19.9*	*20.3*
Comb. Renewables & Wastes	–	*1.3*	*1.6*	*1.5*	*4.2*	*4.3*	*4.1*
Nuclear	–	–	–	–	–	–	–
Hydro	*77.3*	*72.3*	*62.3*	*63.1*	*65.9*	*62.6*	*56.5*
Geothermal	*6.7*	*6.8*	*7.4*	*7.1*	*8.7*	*8.7*	*9.2*
Solar/Wind/Other	–	*0.4*	*1.7*	*1.9*	*0.3*	*0.8*	*1.6*
TOTAL LOSSES	**2.35**	**4.06**	**4.80**	**4.69**	**3.91**	**4.71**	**5.57**
of which:							
Electricity and Heat Generation[10]	1.57	2.59	3.77	3.72	2.96	3.44	4.19
Other Transformation	0.36	0.60	–0.05	–0.08	0.15	0.44	0.44
Own Use and Losses[11]	0.43	0.87	1.07	1.04	0.79	0.84	0.94
Statistical Differences	**–0.13**	**–0.03**	**0.02**	**0.16**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	42.85	52.23	67.08	68.72	79.66	92.35	124.11
Population (millions)	2.97	3.36	3.81	3.83	3.87	4.03	4.39
TPES/GDP[12]	0.19	0.27	0.27	0.27	0.22	0.21	0.18
Energy Production/TPES	0.49	0.87	0.84	0.83	0.83	0.82	0.85
Per Capita TPES[13]	2.78	4.17	4.75	4.86	4.60	4.75	5.13
Oil Supply/GDP[12]	0.10	0.08	0.09	0.09	0.09	0.09	0.08
TFC/GDP[12]	0.14	0.19	0.20	0.20	0.17	0.16	0.14
Per Capita TFC[13]	2.04	2.97	3.49	3.60	3.59	3.58	3.86
Energy–related CO_2 Emissions (Mt CO_2)[14]	17.0	22.3	30.8	31.7	32.7	35.0	42.9
CO_2 Emissions from Bunkers (Mt CO_2)	1.6	2.4	2.9	2.5	3.0	3.0	3.1

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.5	4.1	2.9	2.9	–0.9	1.5	1.6
Coal	–4.5	1.5	–0.6	–5.7	8.6	1.2	3.7
Oil	–0.9	–0.5	4.7	4.7	2.4	2.4	1.7
Gas	20.3	14.7	2.4	5.2	–9.3	–0.9	1.0
Comb. Renewables & Wastes	–	3.1	6.7	0.2	1.6	2.5	0.9
Nuclear	–	–	–	–	–	–	–
Hydro	4.6	2.0	0.1	4.6	1.6	1.6	–0.5
Geothermal	–2.2	8.6	2.5	–1.6	–3.3	1.0	2.8
Solar/Wind/Other	–	12.5	19.8	10.7	–28.0	20.9	8.0
TFC	2.1	3.5	3.2	3.7	0.1	0.8	1.6
Electricity Consumption	3.0	3.5	1.6	5.1	1.3	1.8	1.6
Energy Production	4.6	7.9	2.4	1.2	–0.8	1.3	2.0
Net Oil Imports	–2.5	–5.4	8.6	1.2	3.1	3.5	2.3
GDP	0.0	1.8	2.8	2.5	3.0	3.0	3.0
Growth in the TPES/GDP Ratio	1.5	2.2	0.1	0.4	–3.8	–1.5	–1.3
Growth in the TFC/GDP Ratio	2.0	1.7	0.4	1.3	–2.8	–2.1	–1.3

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

NORWAY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**8.19**	**120.07**	**209.64**	**224.99**	..	..	..
Coal[1]		0.29	0.20	0.27	0.42	..	..	..
Oil		1.64	84.27	153.30	165.25	..	..	..
Gas		–	24.14	44.13	45.80	..	..	..
Comb. Renewables & Wastes[2]		–	1.03	1.49	1.34	..	..	..
Nuclear		–	–	–	–	..	..	..
Hydro		6.27	10.42	10.45	12.18	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.01	0.01	..	..	..
TOTAL NET IMPORTS[4]		**6.48**	**–96.75**	**–183.01**	**–199.02**	..	..	..
Coal[1]	Exports	0.09	0.17	0.20	0.39	..	..	..
	Imports	0.67	0.84	0.97	0.99	..	..	..
	Net Imports	0.58	0.67	0.77	0.60	..	..	..
Oil	Exports	3.69	77.90	148.66	159.49	..	..	..
	Imports	10.68	4.47	5.26	4.51	..	..	..
	Bunkers	0.64	0.45	0.86	0.83	..	..	..
	Net Imports	6.35	–73.88	–144.26	–155.81	..	..	..
Gas	Exports	–	22.17	39.37	42.17	..	..	..
	Imports	–	–	–	–	..	..	..
	Net Imports	–	–22.17	–39.37	–42.17	..	..	..
Electricity	Exports	0.45	1.40	0.76	1.77	..	..	..
	Imports	0.01	0.03	0.59	0.13	..	..	..
	Net Imports	–0.45	–1.37	–0.17	–1.64	..	..	..
TOTAL STOCK CHANGES		**0.44**	**–1.86**	**–0.00**	**–0.36**	..	..	..
TOTAL SUPPLY (TPES)		**15.11**	**21.45**	**26.62**	**25.62**	..	..	..
Coal[1]		0.91	0.86	1.06	1.08	..	..	..
Oil		8.38	8.53	9.02	9.02	..	..	..
Gas		–	1.98	4.76	3.63	..	..	..
Comb. Renewables & Wastes[2]		–	1.03	1.50	1.34	..	..	..
Nuclear		–	–	–	–	..	..	..
Hydro		6.27	10.42	10.45	12.18	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.01	0.01	..	..	..
Electricity Trade[5]		–0.45	–1.37	–0.17	–1.64	..	..	..
Shares (%)								
Coal		*6.0*	*4.0*	*4.0*	*4.2*	..	..	..
Oil		*55.5*	*39.8*	*33.9*	*35.2*	..	..	..
Gas		–	*9.2*	*17.9*	*14.2*	..	..	..
Comb. Renewables & Wastes		–	*4.8*	*5.6*	*5.2*	..	..	..
Nuclear		–	–	–	–	..	..	..
Hydro		*41.5*	*48.6*	*39.2*	*47.5*	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other		–	–	–	–	..	..	..
Electricity Trade		*–3.0*	*–6.4*	*–0.6*	*–6.4*	..	..	..

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

Please note: Forecasts are not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**13.73**	**18.03**	**20.43**	**20.29**	**..**	**..**	**..**
Coal[1]	0.81	0.78	0.99	0.99	..	..	..
Oil	7.68	7.96	8.59	7.98	..	..	..
Gas	0.01	–	–	0.59	..	..	..
Comb. Renewables & Wastes[2]	–	0.90	1.33	1.17	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	5.23	8.33	9.40	9.43	..	..	..
Heat	–	0.07	0.13	0.13	..	..	..
Shares (%)							
Coal	5.9	4.3	4.8	4.9	..	..	..
Oil	55.9	44.1	42.0	39.3	..	..	..
Gas	0.1	–	–	2.9	..	..	..
Comb. Renewables & Wastes	–	5.0	6.5	5.8	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	38.1	46.2	46.0	46.5	..	..	..
Heat	–	*0.4*	*0.7*	*0.6*	..	..	..
TOTAL INDUSTRY[6]	**6.96**	**7.90**	**8.48**	**9.01**	**..**	**..**	**..**
Coal[1]	0.76	0.77	0.98	0.99	..	..	..
Oil	3.01	2.79	2.48	2.45	..	..	..
Gas	0.00	–	–	0.59	..	..	..
Comb. Renewables & Wastes[2]	–	0.38	0.76	0.59	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	3.20	3.94	4.25	4.38	..	..	..
Heat	–	0.02	0.02	0.02	..	..	..
Shares (%)							
Coal	*10.9*	*9.7*	*11.6*	*11.0*	..	..	..
Oil	*43.2*	*35.3*	*29.2*	*27.2*	..	..	..
Gas	–	–	–	*6.5*	..	..	..
Comb. Renewables & Wastes	–	*4.8*	*8.9*	*6.6*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*45.9*	*49.9*	*50.1*	*48.6*	..	..	..
Heat	–	*0.2*	*0.2*	*0.2*	..	..	..
TRANSPORT[7]	**2.62**	**4.22**	**4.98**	**4.61**	**..**	**..**	**..**
TOTAL OTHER SECTORS[8]	**4.15**	**5.92**	**6.97**	**6.67**	**..**	**..**	**..**
Coal[1]	0.06	0.01	0.00	0.00	..	..	..
Oil	2.10	1.02	1.29	1.08	..	..	..
Gas	0.01	–	–	0.00	..	..	..
Comb. Renewables & Wastes[2]	–	0.52	0.57	0.58	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	1.98	4.31	5.00	4.90	..	..	..
Heat	–	0.06	0.11	0.11	..	..	..
Shares (%)							
Coal	*1.3*	*0.2*	–	–	..	..	..
Oil	*50.6*	*17.2*	*18.5*	*16.2*	..	..	..
Gas	*0.2*	–	–	–	..	..	..
Comb. Renewables & Wastes	–	*8.7*	*8.2*	*8.7*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*47.8*	*72.9*	*71.7*	*73.4*	..	..	..
Heat	–	*1.0*	*1.6*	*1.6*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**6.31**	**10.59**	**10.75**	**12.42**	**..**	**..**	**..**
OUTPUT (Mtoe)	**6.28**	**10.46**	**10.52**	**12.24**	**..**	**..**	**..**
(TWh gross)	73.03	121.61	122.29	142.36	..	..	..
Output Shares (%)							
Coal	*0.0*	*0.2*	*0.2*	*0.1*	..	..	..
Oil	*0.2*	*0.0*	*0.0*	*0.0*	..	..	..
Gas	–	–	*0.2*	*0.1*	..	..	..
Comb. Renewables & Wastes	–	*0.2*	*0.2*	*0.2*	..	..	..
Nuclear	–	–	–	–	..	..	..
Hydro	*99.8*	*99.6*	*99.3*	*99.5*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.0*	*0.0*	..	..	..
TOTAL LOSSES	**1.34**	**3.63**	**6.51**	**4.81**	**..**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	0.03	0.04	0.07	0.05	..	..	..
Other Transformation	0.57	–0.08	–0.29	–0.45	..	..	..
Own Use and Losses[11]	0.73	3.66	6.73	5.21	..	..	..
Statistical Differences	**0.05**	**–0.20**	**–0.32**	**0.52**	**..**	**..**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	70.07	122.33	166.67	170.45	..	..	..
Population (millions)	3.96	4.24	4.46	4.49	..	..	..
TPES/GDP[12]	0.22	0.18	0.16	0.15	..	..	..
Energy Production/TPES	0.54	5.60	7.87	8.78	..	..	..
Per Capita TPES[13]	3.82	5.06	5.97	5.70	..	..	..
Oil Supply/GDP[12]	0.12	0.07	0.05	0.05	..	..	..
TFC/GDP[12]	0.20	0.15	0.12	0.12	..	..	..
Per Capita TFC[13]	3.47	4.25	4.58	4.52	..	..	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	24.2	28.5	38.4	33.6	..	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	2.8	2.7	4.4	4.1	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	3.7	1.2	2.4	–3.8	..	..	..
Coal	1.4	–1.3	2.3	1.3	..	..	..
Oil	1.7	–0.8	0.6	0.0	..	..	..
Gas	–	9.8	10.3	–23.7	..	..	..
Comb. Renewables & Wastes	–	5.6	4.2	–10.4	..	..	..
Nuclear	–	–	–	–	..	..	..
Hydro	3.3	2.9	0.0	16.6	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	50.0	..	..	..
TFC	3.5	0.6	1.4	–0.7	..	..	..
Electricity Consumption	3.6	2.3	1.4	0.4	..	..	..
Energy Production	33.7	8.9	6.4	7.3	..	..	..
Net Oil Imports	–	19.9	7.7	8.0	..	..	..
GDP	4.6	2.6	3.5	2.3	..	..	..
Growth in the TPES/GDP Ratio	–0.9	–1.4	–1.0	–5.9	..	..	..
Growth in the TFC/GDP Ratio	–1.1	–2.0	–2.0	–2.9	..	..	..

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**1.40**	**2.81**	**2.66**	**3.13**	**3.41**	**4.07**	**..**
Coal[1]		0.13	0.12	–	–	–	–	..
Oil		–	–	–	–	–	–	..
Gas		–	–	–	–	–	–	..
Comb. Renewables & Wastes[2]		0.64	1.89	1.93	2.05	2.14	2.22	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.63	0.79	0.63	0.97	1.03	1.11	..
Geothermal		–	0.00	0.07	0.07	0.07	0.07	..
Solar/Wind/Other[3]		–	0.01	0.03	0.03	0.18	0.67	..
TOTAL NET IMPORTS[4]		**5.69**	**14.82**	**21.95**	**21.45**	**21.33**	**22.09**	**..**
Coal[1]	Exports	0.01	0.01	0.05	0.05	–	–	..
	Imports	0.28	3.00	3.79	3.97	3.40	3.44	..
	Net Imports	0.27	2.99	3.74	3.91	3.40	3.44	..
Oil	Exports	0.23	2.50	1.43	1.44	–	–	..
	Imports	6.44	14.93	18.35	17.51	15.24	14.81	..
	Bunkers	0.80	0.61	0.59	0.66	1.08	1.36	..
	Net Imports	5.42	11.82	16.33	15.41	14.16	13.45	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	–	–	1.95	2.04	3.77	5.20	..
	Net Imports	–	–	1.95	2.04	3.77	5.20	..
Electricity	Exports	0.01	0.15	0.39	0.32	–	–	..
	Imports	0.01	0.15	0.31	0.40	–	–	..
	Net Imports	–0.00	0.00	–0.07	0.08	–	–	..
TOTAL STOCK CHANGES		**0.14**	**–0.47**	**–0.26**	**0.04**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**7.23**	**17.16**	**24.34**	**24.61**	**24.74**	**26.16**	**..**
Coal[1]		0.51	2.76	3.79	3.81	3.40	3.44	..
Oil		5.45	11.71	16.03	15.57	14.16	13.45	..
Gas		–	–	1.94	2.03	3.77	5.20	..
Comb. Renewables & Wastes[2]		0.64	1.89	1.93	2.05	2.14	2.22	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.63	0.79	0.63	0.97	1.03	1.11	..
Geothermal		–	0.00	0.07	0.07	0.07	0.07	..
Solar/Wind/Other[3]		–	0.01	0.03	0.03	0.18	0.67	..
Electricity Trade[5]		–0.00	0.00	–0.07	0.08	–	–	..
Shares (%)								
Coal		*7.0*	*16.1*	*15.6*	*15.5*	*13.7*	*13.2*	..
Oil		*75.4*	*68.2*	*65.9*	*63.2*	*57.2*	*51.4*	..
Gas		–	–	*8.0*	*8.3*	*15.2*	*19.9*	..
Comb. Renewables & Wastes		*8.8*	*11.0*	*7.9*	*8.3*	*8.7*	*8.5*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*8.7*	*4.6*	*2.6*	*4.0*	*4.2*	*4.3*	..
Geothermal		–	–	*0.3*	*0.3*	*0.3*	*0.3*	..
Solar/Wind/Other		–	*0.1*	*0.1*	*0.1*	*0.7*	*2.6*	..
Electricity Trade		–	–	*–0.3*	*0.3*	–	–	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**6.11**	**13.42**	**18.54**	**19.51**	**19.10**	**20.73**	**..**
Coal[1]	0.19	0.59	0.37	0.43	0.50	0.54	..
Oil	4.59	8.97	12.71	13.10	11.24	11.63	..
Gas	0.05	0.05	0.56	0.83	1.46	1.80	..
Comb. Renewables & Wastes[2]	0.58	1.74	1.69	1.70	1.78	1.84	..
Geothermal	–	–	0.00	0.00	–	–	..
Solar/Wind/Other	–	0.01	0.02	0.02	0.04	0.06	..
Electricity	0.70	2.03	3.11	3.30	3.89	4.54	..
Heat	–	0.03	0.09	0.13	0.19	0.32	..
Shares (%)							
Coal	*3.1*	*4.4*	*2.0*	*2.2*	*2.6*	*2.6*	..
Oil	*75.1*	*66.8*	*68.6*	*67.1*	*58.8*	*56.1*	..
Gas	*0.8*	*0.4*	*3.0*	*4.3*	*7.6*	*8.7*	..
Comb. Renewables & Wastes	*9.5*	*13.0*	*9.1*	*8.7*	*9.3*	*8.9*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.2*	*0.3*	..
Electricity	*11.5*	*15.1*	*16.8*	*16.9*	*20.4*	*21.9*	..
Heat	–	*0.2*	*0.5*	*0.7*	*1.0*	*1.5*	..
TOTAL INDUSTRY[6]	**2.71**	**6.22**	**7.63**	**7.90**	**6.48**	**6.99**	**..**
Coal[1]	0.14	0.59	0.37	0.43	0.50	0.54	..
Oil	1.81	3.96	4.91	4.76	2.71	2.69	..
Gas	0.00	–	0.44	0.66	0.79	0.92	..
Comb. Renewables & Wastes[2]	0.32	0.59	0.54	0.55	0.57	0.59	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.44	1.05	1.30	1.37	1.72	1.93	..
Heat	–	0.03	0.08	0.13	0.19	0.32	..
Shares (%)							
Coal	*5.1*	*9.5*	*4.8*	*5.5*	*7.7*	*7.7*	..
Oil	*66.9*	*63.7*	*64.3*	*60.2*	*41.8*	*38.5*	..
Gas	*0.1*	–	*5.7*	*8.4*	*12.2*	*13.2*	..
Comb. Renewables & Wastes	*11.8*	*9.5*	*7.1*	*6.9*	*8.8*	*8.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.2*	*16.9*	*17.0*	*17.4*	*26.6*	*27.6*	..
Heat	–	*0.5*	*1.0*	*1.6*	*3.0*	*4.6*	..
TRANSPORT[7]	**1.95**	**3.82**	**6.19**	**6.67**	**6.97**	**7.44**	**..**
TOTAL OTHER SECTORS[8]	**1.46**	**3.37**	**4.72**	**4.95**	**5.65**	**6.30**	**..**
Coal[1]	0.04	0.00	–	–	–	–	..
Oil	0.87	1.21	1.65	1.70	1.60	1.55	..
Gas	0.05	0.05	0.12	0.17	0.67	0.88	..
Comb. Renewables & Wastes[2]	0.26	1.15	1.15	1.15	1.21	1.25	..
Geothermal	–	–	0.00	0.00	–	–	..
Solar/Wind/Other	–	0.01	0.02	0.02	0.04	0.06	..
Electricity	0.25	0.95	1.78	1.90	2.13	2.56	..
Heat	–	–	0.01	0.01	–	–	..
Shares (%)							
Coal	*2.4*	–	–	–	–	–	..
Oil	*59.7*	*35.9*	*34.9*	*34.4*	*28.3*	*24.6*	..
Gas	*3.2*	*1.5*	*2.6*	*3.5*	*11.9*	*14.0*	..
Comb. Renewables & Wastes	*17.9*	*34.1*	*24.4*	*23.2*	*21.4*	*19.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.3*	*0.4*	*0.4*	*0.7*	*1.0*	..
Electricity	*16.8*	*28.1*	*37.7*	*38.3*	*37.7*	*40.6*	..
Heat	–	–	*0.1*	*0.1*	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**1.33**	**5.10**	**7.95**	**7.62**	**9.06**	**9.63**	**..**
OUTPUT (Mtoe)	**0.84**	**2.44**	**3.69**	**3.73**	**4.45**	**5.19**	**..**
(TWh gross)	9.79	28.36	42.94	43.37	51.76	60.40	..
Output Shares (%)							
Coal	*3.9*	*32.1*	*35.2*	*33.9*	*25.3*	*21.7*	..
Oil	*19.2*	*33.1*	*25.6*	*19.4*	*18.7*	*7.9*	..
Gas	–	–	*18.8*	*16.5*	*26.2*	*33.7*	..
Comb. Renewables & Wastes	*2.0*	*2.4*	*2.9*	*3.6*	*3.5*	*3.3*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*74.8*	*32.3*	*17.0*	*26.1*	*23.1*	*21.4*	..
Geothermal	–	*0.0*	*0.2*	*0.2*	*0.2*	*0.1*	..
Solar/Wind/Other	–	*0.0*	*0.3*	*0.4*	*3.0*	*11.8*	..
TOTAL LOSSES	**1.23**	**3.21**	**5.69**	**5.16**	**5.64**	**5.44**	**..**
of which:							
Electricity and Heat Generation[10]	0.49	2.63	4.17	3.75	4.42	4.12	..
Other Transformation	0.23	–0.38	0.17	0.16	–	–	..
Own Use and Losses[11]	0.51	0.96	1.35	1.25	1.22	1.32	..
Statistical Differences	**–0.11**	**0.53**	**0.12**	**–0.06**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	57.68	98.55	125.06	129.32	153.59	182.42	..
Population (millions)	8.64	9.90	9.99	10.01	10.11	10.17	..
TPES/GDP[12]	0.13	0.17	0.19	0.19	0.16	0.14	..
Energy Production/TPES	0.19	0.16	0.11	0.13	0.14	0.16	..
Per Capita TPES[13]	0.84	1.73	2.44	2.46	2.45	2.57	..
Oil Supply/GDP[12]	0.09	0.12	0.13	0.12	0.09	0.07	..
TFC/GDP[12]	0.11	0.14	0.15	0.15	0.12	0.11	..
Per Capita TFC[13]	0.71	1.36	1.86	1.95	1.89	2.04	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	16.4	39.6	60.4	59.6	58.5	60.1	–
CO_2 Emissions from Bunkers (Mt CO_2)	3.5	3.5	3.5	3.9	5.2	6.1	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	5.5	5.1	4.0	1.1	0.1	1.1	..
Coal	–2.4	18.2	3.6	0.4	–2.2	0.2	..
Oil	6.1	3.8	3.6	–2.9	–1.9	–1.0	..
Gas	–	–	–	4.8	13.1	6.7	..
Comb. Renewables & Wastes	3.2	8.5	0.3	6.3	0.8	0.7	..
Nuclear	–	–	–	–	–	–	..
Hydro	7.3	–1.8	–2.5	55.3	1.1	1.6	..
Geothermal	–	–	41.9	–	–0.3	–	..
Solar/Wind/Other	–	–	11.4	13.8	39.6	30.9	..
TFC	4.7	4.8	3.7	5.3	–0.4	1.7	..
Electricity Consumption	8.5	5.3	4.9	6.2	3.3	3.1	..
Energy Production	4.4	4.1	–0.6	17.8	1.7	3.6	..
Net Oil Imports	8.1	2.9	3.7	–5.6	–1.7	–1.0	..
GDP	2.9	3.4	2.7	3.4	3.5	3.5	..
Growth in the TPES/GDP Ratio	2.5	1.6	1.2	–2.2	–3.3	–2.3	..
Growth in the TFC/GDP Ratio	1.8	1.3	0.9	1.8	–3.8	–1.8	..

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

SPAIN

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**11.3**	**34.0**	**30.7**	**31.9**	**..**	**..**	**..**
Coal[1]		6.5	11.9	8.6	8.0	7.0	4.7	..
Oil		0.7	1.2	0.3	0.2	..	..	..
Gas		0.0	1.3	0.1	0.1	..	..	..
Comb. Renewables & Wastes[2]		0.0	3.4	4.1	4.4	..	..	..
Nuclear		1.7	14.1	15.3	16.2	..	..	..
Hydro		2.5	2.2	2.0	2.4	..	..	..
Geothermal		–	–	0.0	0.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.3	0.4	..	..	..
TOTAL NET IMPORTS[4]		**42.5**	**56.6**	**89.3**	**94.2**	**..**	**..**	**..**
Coal[1]	Exports	0.0	0.0	0.3	0.5	0.3	0.1	..
	Imports	2.2	7.1	11.3	13.4	11.3	9.9	..
	Net Imports	2.2	7.1	11.0	12.8	11.1	9.8	..
Oil	Exports	4.3	12.3	7.1	7.6	..	..	..
	Imports	45.3	61.8	76.9	79.2	..	..	..
	Bunkers	1.4	3.7	5.9	6.0	..	..	..
	Net Imports	39.6	45.9	63.9	65.6	..	..	..
Gas	Exports	–	–	–	–	..	..	..
	Imports	0.9	3.7	13.9	15.5	..	..	..
	Net Imports	0.9	3.7	13.9	15.5	..	..	..
Electricity	Exports	0.2	0.3	0.5	0.7	..	..	..
	Imports	0.0	0.3	1.0	1.1	..	..	..
	Net Imports	–0.2	–0.0	0.5	0.4	..	..	..
TOTAL STOCK CHANGES		**–1.5**	**–0.1**	**–1.5**	**–1.2**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**52.4**	**90.5**	**118.5**	**124.9**	**144.4**	**167.6**	**..**
Coal[1]		9.0	19.4	19.3	20.9	18.1	14.5	..
Oil		38.4	46.5	63.8	64.9	74.3	84.0	..
Gas		0.9	5.0	13.3	15.2	25.9	36.8	..
Comb. Renewables & Wastes[2]		0.0	3.4	4.1	4.4	6.1	11.0	..
Nuclear		1.7	14.1	15.3	16.2	15.2	15.3	..
Hydro		2.5	2.2	2.0	2.4	3.2	3.3	..
Geothermal		–	–	0.0	0.0	0.0	0.0	..
Solar/Wind/Other[3]		–	0.0	0.3	0.4	1.2	2.4	..
Electricity Trade[5]		–0.2	–0.0	0.5	0.4	0.3	0.3	..
Shares (%)								
Coal		*17.2*	*21.5*	*16.3*	*16.7*	*12.5*	*8.7*	..
Oil		*73.3*	*51.3*	*53.8*	*51.9*	*51.5*	*50.1*	..
Gas		*1.8*	*5.5*	*11.2*	*12.2*	*17.9*	*22.0*	..
Comb. Renewables & Wastes		–	*3.7*	*3.4*	*3.5*	*4.3*	*6.6*	..
Nuclear		*3.3*	*15.6*	*12.9*	*13.0*	*10.6*	*9.1*	..
Hydro		*4.7*	*2.4*	*1.7*	*2.0*	*2.2*	*2.0*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	*0.2*	*0.4*	*0.8*	*1.4*	..
Electricity Trade		*–0.3*	–	*0.4*	*0.3*	*0.2*	*0.2*	..

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

Please note: Forecasts for 2005 are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**39.9**	**61.4**	**83.2**	**89.1**	**109.2**	**126.7**	**..**
Coal[1]	4.0	3.2	1.3	1.3	2.4	2.2	..
Oil	30.1	39.9	53.4	55.8	64.7	73.8	..
Gas	0.7	4.6	10.1	12.4	18.7	22.4	..
Comb. Renewables & Wastes[2]	–	2.8	3.0	3.4	4.0	4.9	..
Geothermal	–	–	0.0	0.0	0.0	0.0	..
Solar/Wind/Other	–	–	0.0	0.0	0.1	0.3	..
Electricity	5.1	10.8	15.2	16.2	19.3	23.0	..
Heat	–	0.0	0.1	0.1	–	–	..
Shares (%)							
Coal	*9.9*	*5.3*	*1.6*	*1.5*	*2.2*	*1.8*	..
Oil	*75.6*	*65.0*	*64.2*	*62.6*	*59.2*	*58.3*	..
Gas	*1.8*	*7.5*	*12.1*	*13.9*	*17.1*	*17.7*	..
Comb. Renewables & Wastes	–	*4.5*	*3.7*	*3.8*	*3.7*	*3.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	*0.1*	*0.3*	..
Electricity	*12.7*	*17.6*	*18.3*	*18.2*	*17.7*	*18.2*	..
Heat	–	–	*0.1*	*0.1*	–	–	..
TOTAL INDUSTRY[6]	**20.7**	**24.4**	**30.3**	**34.2**	**41.7**	**46.4**	**..**
Coal[1]	3.6	2.9	1.2	1.2	2.3	2.1	..
Oil	13.4	11.3	13.8	14.7	15.0	15.9	..
Gas	0.4	3.8	7.7	9.6	14.3	16.8	..
Comb. Renewables & Wastes[2]	–	0.9	1.0	1.2	1.8	2.3	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	3.3	5.4	6.6	7.4	8.2	9.2	..
Heat	–	–	0.1	0.1	–	–	..
Shares (%)							
Coal	*17.5*	*12.1*	*3.9*	*3.6*	*5.6*	*4.6*	..
Oil	*64.7*	*46.4*	*45.4*	*43.0*	*35.9*	*34.3*	..
Gas	*2.0*	*15.5*	*25.4*	*28.1*	*34.4*	*36.3*	..
Comb. Renewables & Wastes	–	*3.7*	*3.4*	*3.5*	*4.4*	*4.9*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*15.8*	*22.3*	*21.7*	*21.5*	*19.8*	*19.9*	..
Heat	–	–	*0.2*	*0.2*	–	–	..
TRANSPORT[7]	**11.9**	**22.8**	**32.7**	**33.6**	**39.9**	**48.6**	**..**
TOTAL OTHER SECTORS[8]	**7.2**	**14.2**	**20.2**	**21.3**	**27.7**	**31.7**	**..**
Coal[1]	0.3	0.3	0.1	0.1	0.1	0.1	..
Oil	4.9	6.1	7.3	7.8	10.8	10.9	..
Gas	0.3	0.8	2.4	2.7	4.4	5.6	..
Comb. Renewables & Wastes[2]	–	1.9	2.0	2.2	2.0	2.1	..
Geothermal	–	–	0.0	0.0	0.0	0.0	..
Solar/Wind/Other	–	–	0.0	0.0	0.1	0.3	..
Electricity	1.7	5.1	8.4	8.5	10.4	12.7	..
Heat	–	0.0	–	–	–	–	..
Shares (%)							
Coal	*4.3*	*2.1*	*0.7*	*0.3*	*0.3*	*0.3*	..
Oil	*68.2*	*43.0*	*36.0*	*36.7*	*38.9*	*34.5*	..
Gas	*4.1*	*5.9*	*11.8*	*12.9*	*15.8*	*17.7*	..
Comb. Renewables & Wastes	–	*13.3*	*10.0*	*10.1*	*7.2*	*6.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.4*	*1.1*	..
Electricity	*23.4*	*35.7*	*41.3*	*39.8*	*37.4*	*39.9*	..
Heat	–	–	–	–	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**12.6**	**33.4**	**42.9**	**45.6**	**49.1**	**59.0**	**..**
OUTPUT (Mtoe)	**6.5**	**13.0**	**17.7**	**19.1**	**22.0**	**26.8**	**..**
(TWh gross)	*75.7*	151.2	206.3	221.7	255.5	312.1	..
Output Shares (%)							
Coal	*18.9*	*40.1*	*36.6*	*36.5*	*25.5*	*16.2*	..
Oil	*33.2*	*5.7*	*11.8*	*10.2*	*9.3*	*8.0*	..
Gas	*1.0*	*1.0*	*9.2*	*9.1*	*20.2*	*32.5*	..
Comb. Renewables & Wastes	*0.1*	*0.5*	*1.4*	*1.3*	*2.9*	*5.2*	..
Nuclear	*8.7*	*35.9*	*28.5*	*28.1*	*22.9*	*18.8*	..
Hydro	*38.2*	*16.8*	*11.1*	*12.8*	*14.3*	*12.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.0*	*1.3*	*2.1*	*4.8*	*7.1*	..
TOTAL LOSSES	**12.5**	**28.8**	**34.2**	**35.9**	**35.1**	**40.9**	**..**
of which:							
Electricity and Heat Generation[10]	6.1	20.4	25.0	26.5	26.4	32.1	..
Other Transformation	2.7	2.3	1.4	1.4	4.8	4.6	..
Own Use and Losses[11]	3.7	6.1	7.8	8.1	4.0	4.2	..
Statistical Differences	**0.0**	**0.3**	**1.1**	**–0.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	350.50	546.53	676.34	704.05	820.16	955.41	..
Population (millions)	34.81	38.85	39.63	39.93	41.50	42.30	..
TPES/GDP[12]	0.15	0.17	0.18	0.18	0.18	0.18	..
Energy Production/TPES	0.22	0.38	0.26	0.26	..	..	..
Per Capita TPES[13]	1.50	2.33	2.99	3.13	3.48	3.96	..
Oil Supply/GDP[12]	0.11	0.09	0.09	0.09	0.09	0.09	..
TFC/GDP[12]	0.11	0.11	0.12	0.13	0.13	0.13	..
Per Capita TFC[13]	1.15	1.58	2.10	2.23	2.63	2.99	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	141.6	206.5	267.5	284.7	282.2	323.9	..
CO_2 Emissions from Bunkers (Mt CO_2)	7.0	15.0	26.4	27.4	27.4	27.4	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	4.1	2.8	3.0	5.4	2.9	3.0	..
Coal	3.0	5.5	–0.1	8.6	–2.9	–4.3	..
Oil	4.1	–0.5	3.6	1.7	2.8	2.5	..
Gas	6.7	12.3	11.5	14.5	11.2	7.3	..
Comb. Renewables & Wastes	24.8	47.0	2.1	8.3	6.8	12.3	..
Nuclear	0.4	20.9	0.9	5.7	–1.2	0.0	..
Hydro	8.2	–5.3	–1.2	24.1	5.2	0.8	..
Geothermal	–	–	–	20.0	–12.9	–	..
Solar/Wind/Other	–	–	72.1	65.7	22.2	14.8	..
TFC	4.1	1.7	3.4	7.1	4.2	3.0	..
Electricity Consumption	6.4	3.6	3.9	6.3	3.6	3.6	..
Energy Production	5.5	7.3	–1.1	3.8	..	..	..
Net Oil Imports	3.2	–0.4	3.7	2.6	..	..	..
GDP	2.3	2.8	2.4	4.1	3.1	3.1	..
Growth in the TPES/GDP Ratio	1.8	–0.0	0.6	1.3	–0.2	–0.1	..
Growth in the TFC/GDP Ratio	1.8	–1.1	1.0	2.9	1.0	–0.1	..

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**9.3**	**29.8**	**33.8**	**30.7**	**31.6**	**33.1**	**..**
Coal[1]		0.0	0.0	–	–	–	–	..
Peat		–	0.2	0.2	0.2	0.4	0.4	..
Oil		–	0.0	–	–	–	–	..
Gas		–	–	–	–	–	–	..
Comb. Renewables & Wastes[2]		3.5	5.5	8.0	8.3	8.1	9.0	..
Nuclear		0.6	17.8	19.1	14.9	17.4	17.8	..
Hydro		5.1	6.2	6.2	6.8	5.7	5.8	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	0.0	0.4	0.4	0.0	0.2	..
TOTAL NET IMPORTS[4]		**29.6**	**16.7**	**15.7**	**16.7**	**21.0**	**19.7**	**..**
Coal[1]	Exports	0.0	0.0	0.1	0.0	0.1	0.1	..
	Imports	1.7	2.6	2.4	2.4	2.3	2.3	..
	Net Imports	1.7	2.6	2.3	2.3	2.3	2.2	..
Peat	Exports	–	–	–	–	–	–	..
	Imports	–	–	–	–	–	–	..
	Net Imports	–	–	–	–	–	–	..
Oil	Exports	1.4	8.7	9.9	11.1	9.6	9.4	..
	Imports	30.4	23.1	24.7	25.8	28.3	26.9	..
	Bunkers	1.1	0.7	1.5	1.4	1.2	1.4	..
	Net Imports	27.8	13.8	13.3	13.3	17.5	16.0	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	–	0.5	0.7	0.7	1.0	1.0	..
	Net Imports	–	0.5	0.7	0.7	1.0	1.0	..
Electricity	Exports	0.4	1.3	1.4	1.2	–	–	..
	Imports	0.5	1.1	0.7	1.6	0.3	0.5	..
	Net Imports	0.1	–0.2	–0.6	0.4	0.3	0.5	..
TOTAL STOCK CHANGES		**0.5**	**0.2**	**0.9**	**0.1**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**39.3**	**46.7**	**50.5**	**47.5**	**52.6**	**52.8**	**..**
Coal[1]		1.6	2.7	2.3	2.3	2.3	2.2	..
Peat		–	0.2	0.2	0.2	0.4	0.4	..
Oil		28.4	13.8	14.3	13.4	17.5	16.0	..
Gas		–	0.5	0.7	0.7	1.0	1.0	..
Comb. Renewables & Wastes[2]		3.5	5.5	8.0	8.3	8.1	9.0	..
Nuclear		0.6	17.8	19.1	14.9	17.4	17.8	..
Hydro		5.1	6.2	6.2	6.8	5.7	5.8	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	0.0	0.4	0.4	0.0	0.2	..
Electricity Trade[5]		0.1	–0.2	–0.6	0.4	0.3	0.5	..
Shares (%)								
Coal		*4.1*	*5.8*	*4.6*	*4.9*	*4.3*	*4.2*	..
Peat		–	*0.5*	*0.5*	*0.5*	*0.7*	*0.7*	..
Oil		*72.2*	*29.6*	*28.3*	*28.1*	*33.3*	*30.4*	..
Gas		–	*1.1*	*1.4*	*1.5*	*1.9*	*1.8*	..
Comb. Renewables & Wastes		*9.0*	*11.8*	*15.8*	*17.5*	*15.5*	*17.1*	..
Nuclear		*1.4*	*38.1*	*37.8*	*31.5*	*33.0*	*33.7*	..
Hydro		*13.1*	*13.4*	*12.2*	*14.3*	*10.8*	*10.9*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	*0.8*	*0.9*	*0.1*	*0.3*	..
Electricity Trade		*0.2*	*–0.3*	*–1.3*	*0.8*	*0.5*	*0.9*	..

0 is negligible, – is nil, .. is not available.
Please note: All forecast data are based on the 2000 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**35.3**	**32.1**	**35.4**	**35.7**	**37.9**	**38.2**	**..**
Coal[1]	0.9	1.0	0.6	0.8	1.7	1.6	..
Peat	–	0.0	0.0	0.0	–	–	..
Oil	24.8	14.0	14.5	14.4	14.9	14.0	..
Gas	0.1	0.4	0.5	0.5	0.5	0.5	..
Comb. Renewables & Wastes[2]	3.5	4.6	5.2	5.5	5.5	6.2	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	–	0.0	..
Electricity	6.0	10.4	10.9	11.0	11.5	11.8	..
Heat	–	1.7	3.8	3.6	3.8	4.1	..
Shares (%)							
Coal	*2.6*	*3.3*	*1.7*	*2.1*	*4.4*	*4.1*	..
Peat	–	–	–	–	–	–	..
Oil	*70.4*	*43.7*	*40.8*	*40.3*	*39.5*	*36.7*	..
Gas	*0.3*	*1.1*	*1.3*	*1.3*	*1.3*	*1.3*	..
Comb. Renewables & Wastes	*9.8*	*14.4*	*14.8*	*15.4*	*14.4*	*16.3*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.9*	*32.2*	*30.7*	*30.9*	*30.3*	*30.8*	..
Heat	–	*5.3*	*10.6*	*10.0*	*10.1*	*10.8*	..
TOTAL INDUSTRY[6]	**15.5**	**13.3**	**14.2**	**14.5**	**15.5**	**16.6**	**..**
Coal[1]	0.9	1.0	0.6	0.8	1.7	1.6	..
Peat	–	0.0	0.0	0.0	–	–	..
Oil	8.3	3.5	3.7	3.4	3.8	3.9	..
Gas	0.0	0.3	0.3	0.3	0.3	0.3	..
Comb. Renewables & Wastes[2]	2.9	3.7	4.4	4.9	4.5	5.3	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	3.4	4.6	4.8	4.9	4.9	5.0	..
Heat	–	0.2	0.4	0.4	0.4	0.4	..
Shares (%)							
Coal	*5.7*	*7.6*	*4.3*	*5.2*	*10.7*	*9.5*	..
Peat	–	–	–	–	–	–	..
Oil	*53.4*	*26.5*	*26.2*	*23.4*	*24.5*	*23.8*	..
Gas	*0.1*	*1.9*	*2.1*	*2.0*	*2.1*	*1.9*	..
Comb. Renewables & Wastes	*18.9*	*27.7*	*31.0*	*33.5*	*28.7*	*31.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*21.9*	*35.0*	*34.0*	*33.5*	*31.5*	*30.4*	..
Heat	–	*1.3*	*2.5*	*2.5*	*2.5*	*2.7*	..
TRANSPORT[7]	**5.5**	**7.4**	**8.2**	**8.3**	**8.6**	**8.0**	**..**
TOTAL OTHER SECTORS[8]	**14.3**	**11.5**	**13.1**	**12.9**	**13.7**	**13.6**	**..**
Coal[1]	0.0	0.0	–	–	0.0	–	..
Peat	–	–	–	–	–	–	..
Oil	11.2	3.3	2.9	3.0	2.8	2.3	..
Gas	0.1	0.1	0.2	0.2	0.2	0.2	..
Comb. Renewables & Wastes[2]	0.5	1.0	0.8	0.6	1.0	1.0	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	–	0.0	..
Electricity	2.4	5.5	5.8	5.9	6.3	6.5	..
Heat	–	1.5	3.4	3.2	3.4	3.7	..
Shares (%)							
Coal	*0.3*	*0.4*	–	–	–	–	..
Peat	–	–	–	–	–	–	..
Oil	*78.7*	*28.9*	*21.8*	*23.1*	*20.3*	*17.1*	..
Gas	*0.7*	*1.0*	*1.3*	*1.3*	*1.3*	*1.4*	..
Comb. Renewables & Wastes	*3.6*	*8.4*	*6.4*	*4.9*	*7.4*	*7.0*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.6*	*47.9*	*44.4*	*45.9*	*46.0*	*47.4*	..
Heat	–	*13.4*	*26.1*	*24.9*	*25.0*	*27.1*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**8.2**	**26.7**	**30.0**	**26.1**	**28.5**	**28.6**	**..**
OUTPUT (Mtoe)	**6.7**	**12.6**	**13.3**	**12.5**	**12.9**	**13.2**	**..**
(TWh gross)	78.1	146.0	155.1	145.9	150.0	153.0	..
Output Shares (%)							
Coal	*0.6*	*1.2*	*2.1*	*2.0*	*3.3*	*2.3*	..
Peat	–	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	..
Oil	*19.4*	*0.8*	*2.2*	*1.2*	*4.1*	*3.4*	..
Gas	–	*0.3*	*0.3*	*0.3*	*0.9*	*0.6*	..
Comb. Renewables & Wastes	*0.5*	*1.3*	*1.9*	*2.7*	*3.1*	*3.9*	..
Nuclear	*2.7*	*46.7*	*47.2*	*39.3*	*44.4*	*44.7*	..
Hydro	*76.7*	*49.7*	*46.2*	*54.1*	*43.9*	*43.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.0*	*0.2*	*0.3*	*0.3*	*1.3*	..
TOTAL LOSSES							
of which:	*3.4*	*15.2*	*15.6*	*12.8*	*14.7*	*14.5*	..
Electricity and Heat Generation[10]	1.5	12.2	13.4	10.5	11.0	10.7	..
Other Transformation	1.0	0.2	–0.2	–0.1	1.2	1.4	..
Own Use and Losses[11]	1.0	2.8	2.4	2.4	2.5	2.4	..
Statistical Differences	**0.6**	**–0.7**	**–0.5**	**–1.0**	**–**	**–**	**..**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	166.37	233.25	268.26	277.94	309.89	340.47	..
Population (millions)	8.14	8.57	8.86	8.87	8.97	9.00	..
TPES/GDP[12]	0.24	0.20	0.19	0.17	0.17	0.15	..
Energy Production/TPES	0.24	0.64	0.67	0.65	0.60	0.63	..
Per Capita TPES[13]	4.83	5.45	5.70	5.35	5.86	5.86	..
Oil Supply/GDP[12]	0.17	0.06	0.05	0.05	0.06	0.05	..
TFC/GDP[12]	0.21	0.14	0.13	0.13	0.12	0.11	..
Per Capita TFC[13]	4.34	3.75	4.00	4.02	4.22	4.25	..
Energy–related CO_2 Emissions (Mt CO_2)[14]	84.9	51.2	52.3	52.0	56.4	51.1	..
CO_2 Emissions from Bunkers (Mt CO_2)	3.9	3.0	6.3	5.8	5.4	6.1	..

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.5	0.8	0.9	–5.9	2.1	0.1	..
Coal	1.6	3.9	–1.8	1.3	–0.8	–0.5	..
Peat	–	–	0.7	–5.6	8.3	–	..
Oil	–1.3	–5.7	0.4	–6.4	5.6	–1.7	..
Gas	–	–	3.4	–2.1	7.3	–0.6	..
Comb. Renewables & Wastes	1.8	3.1	4.2	4.5	–0.4	2.1	..
Nuclear	46.7	11.3	0.8	–21.7	3.1	0.5	..
Hydro	0.3	1.6	–0.1	10.1	–3.6	0.4	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	27.7	22.2	–0.5	32.0	..
TFC	0.4	–1.1	1.1	0.8	1.2	0.2	..
Electricity Consumption	3.5	3.2	0.6	1.4	0.8	0.5	..
Energy Production	8.0	6.6	1.4	–9.3	0.6	1.0	..
Net Oil Imports	–0.2	–6.1	–0.4	–0.3	5.7	–1.7	..
GDP	1.8	2.1	1.6	3.6	2.2	1.9	..
Growth in the TPES/GDP Ratio	–0.3	–1.3	–0.7	–9.2	–0.1	–1.8	..
Growth in the TFC/GDP Ratio	–1.3	–3.1	–0.5	–2.7	–1.0	–1.7	..

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

SWITZERLAND

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**4.28**	**9.78**	**11.81**	**11.79**	**11.15**	**11.21**	**10.18**
Coal[1]		–	–	–	–	–	–	–
Oil		–	–	–	–	–	–	–
Gas		–	0.00	–	–	–	–	–
Comb. Renewables & Wastes[2]		0.24	0.98	1.50	1.60	1.96	2.03	1.78
Nuclear		1.64	6.18	6.75	6.91	6.31	6.29	5.52
Hydro		2.40	2.56	3.44	3.17	2.88	2.88	2.88
Geothermal		–	0.06	0.09	0.09	–	–	–
Solar/Wind/Other[3]		–	–	0.02	0.03	0.00	0.00	0.01
TOTAL NET IMPORTS[4]		**15.23**	**15.16**	**14.26**	**14.26**	**15.69**	**15.96**	**16.30**
Coal[1]	Exports	0.02	0.01	–	–	–	–	–
	Imports	0.24	0.35	0.06	0.19	0.10	0.10	0.10
	Net Imports	0.22	0.34	0.06	0.19	0.10	0.10	0.10
Oil	Exports	0.23	0.16	0.55	0.64	–	–	–
	Imports	15.38	13.54	13.19	12.90	13.15	13.14	13.04
	Bunkers	–	0.02	0.01	0.01	–	–	–
	Net Imports	15.16	13.36	12.63	12.25	13.15	13.14	13.04
Gas	Exports	–	–	–	–	–	–	–
	Imports	0.15	1.63	2.45	2.43	2.74	2.85	2.99
	Net Imports	0.15	1.63	2.45	2.43	2.74	2.85	2.99
Electricity	Exports	0.90	1.97	2.75	2.70	0.30	0.12	..
	Imports	0.60	1.79	1.87	2.09	..	..	0.17
	Net Imports	–0.30	–0.18	–0.88	–0.61	–0.30	–0.12	0.17
TOTAL STOCK CHANGES		**0.22**	**0.12**	**0.63**	**0.54**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**19.72**	**25.06**	**26.69**	**26.60**	**26.84**	**27.17**	**26.48**
Coal[1]		0.33	0.36	0.10	0.25	0.10	0.10	0.10
Oil		15.26	13.46	13.22	12.73	13.15	13.14	13.04
Gas		0.15	1.63	2.45	2.43	2.74	2.85	2.99
Comb. Renewables & Wastes[2]		0.24	0.99	1.50	1.60	1.96	2.03	1.78
Nuclear		1.64	6.18	6.75	6.91	6.31	6.29	5.52
Hydro		2.40	2.56	3.44	3.17	2.88	2.88	2.88
Geothermal		–	0.06	0.09	0.09	–	–	–
Solar/Wind/Other[3]		–	–	0.02	0.03	0.00	0.00	0.01
Electricity Trade[5]		–0.30	–0.18	–0.88	–0.61	–0.30	–0.12	0.17
Shares (%)								
Coal		*1.7*	*1.4*	*0.4*	*0.9*	*0.4*	*0.4*	*0.4*
Oil		*77.4*	*53.7*	*49.5*	*47.9*	*49.0*	*48.3*	*49.3*
Gas		*0.8*	*6.5*	*9.2*	*9.1*	*10.2*	*10.5*	*11.3*
Comb. Renewables & Wastes		*1.2*	*4.0*	*5.6*	*6.0*	*7.3*	*7.5*	*6.7*
Nuclear		*8.3*	*24.7*	*25.3*	*26.0*	*23.5*	*23.2*	*20.8*
Hydro		*12.2*	*10.2*	*12.9*	*11.9*	*10.7*	*10.6*	*10.9*
Geothermal		–	*0.2*	*0.3*	*0.3*	–	–	–
Solar/Wind/Other		–	–	*0.1*	*0.1*	–	–	–
Electricity Trade		*–1.5*	*–0.7*	*–3.3*	*–2.3*	*–1.1*	*–0.4*	*0.6*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**17.57**	**19.65**	**21.42**	**21.29**	**21.42**	**21.76**	**21.62**
Coal[1]	0.29	0.35	0.10	0.25	0.10	0.10	0.10
Oil	14.30	12.85	13.41	13.12	12.66	12.65	12.56
Gas	0.24	1.52	2.25	2.23	2.57	2.68	2.77
Comb. Renewables & Wastes[2]	0.24	0.60	0.73	0.75	1.24	1.31	1.11
Geothermal	–	0.06	0.09	0.09	–	–	–
Solar/Wind/Other	–	–	0.02	0.02	–	–	–
Electricity	2.50	4.04	4.48	4.50	4.58	4.76	4.83
Heat	–	0.25	0.34	0.32	0.27	0.27	0.26
Shares (%)							
Coal	*1.6*	*1.8*	*0.4*	*1.2*	*0.5*	*0.5*	*0.5*
Oil	*81.4*	*65.4*	*62.6*	*61.6*	*59.1*	*58.1*	*58.1*
Gas	*1.3*	*7.7*	*10.5*	*10.5*	*12.0*	*12.3*	*12.8*
Comb. Renewables & Wastes	*1.4*	*3.0*	*3.4*	*3.5*	*5.8*	*6.0*	*5.1*
Geothermal	–	*0.3*	*0.4*	*0.4*	–	–	–
Solar/Wind/Other	–	–	*0.1*	*0.1*	–	–	–
Electricity	*14.2*	*20.6*	*20.9*	*21.2*	*21.4*	*21.9*	*22.3*
Heat	–	*1.3*	*1.6*	*1.5*	*1.3*	*1.2*	*1.2*
TOTAL INDUSTRY[6]	**4.78**	**3.93**	**4.65**	**4.86**	**4.79**	**4.85**	**4.87**
Coal[1]	0.08	0.33	0.09	0.24	0.10	0.10	0.10
Oil	3.70	1.31	1.81	1.73	1.45	1.42	1.38
Gas	0.05	0.59	0.73	0.76	1.13	1.14	1.14
Comb. Renewables & Wastes[2]	–	0.16	0.41	0.43	0.46	0.49	0.50
Geothermal	–	–	0.01	0.01	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.95	1.48	1.46	1.56	1.57	1.63	1.69
Heat	–	0.05	0.14	0.13	0.09	0.08	0.07
Shares (%)							
Coal	*1.6*	*8.4*	*1.8*	*5.0*	*2.1*	*2.0*	*2.0*
Oil	*77.4*	*33.4*	*39.0*	*35.5*	*30.3*	*29.3*	*28.4*
Gas	*1.1*	*15.1*	*15.8*	*15.7*	*23.5*	*23.4*	*23.4*
Comb. Renewables & Wastes	–	*4.1*	*8.7*	*8.9*	*9.6*	*10.2*	*10.2*
Geothermal	–	–	*0.2*	*0.1*	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*19.9*	*37.7*	*31.5*	*32.0*	*32.7*	*33.5*	*34.6*
Heat	–	*1.2*	*3.0*	*2.8*	*1.8*	*1.6*	*1.4*
TRANSPORT[7]	**4.29**	**6.29**	**6.91**	**7.06**	**6.86**	**7.10**	**7.43**
TOTAL OTHER SECTORS[8]	**8.49**	**9.44**	**9.85**	**9.38**	**9.77**	**9.81**	**9.32**
Coal[1]	0.21	0.02	0.01	0.01	0.00	0.00	0.00
Oil	6.48	5.47	4.90	4.57	4.61	4.43	4.06
Gas	0.19	0.92	1.52	1.47	1.44	1.54	1.63
Comb. Renewables & Wastes[2]	0.24	0.44	0.32	0.32	0.78	0.82	0.61
Geothermal	–	0.06	0.09	0.08	–	–	–
Solar/Wind/Other	–	–	0.02	0.02	–	–	–
Electricity	1.37	2.34	2.80	2.72	2.75	2.83	2.83
Heat	–	0.20	0.20	0.18	0.19	0.19	0.19
Shares (%)							
Coal	*2.5*	*0.2*	*0.1*	*0.1*	–	–	–
Oil	*76.3*	*57.9*	*49.8*	*48.7*	*47.2*	*45.1*	*43.6*
Gas	*2.2*	*9.8*	*15.4*	*15.7*	*14.8*	*15.7*	*17.5*
Comb. Renewables & Wastes	*2.8*	*4.6*	*3.3*	*3.4*	*8.0*	*8.4*	*6.6*
Geothermal	–	*0.6*	*0.9*	*0.9*	–	–	–
Solar/Wind/Other	–	–	*0.2*	*0.2*	–	–	–
Electricity	*16.1*	*24.7*	*28.4*	*29.0*	*28.1*	*28.8*	*30.3*
Heat	–	*2.1*	*2.0*	*2.0*	*1.9*	*1.9*	*2.0*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.48**	**9.35**	**11.20**	**11.12**	**10.08**	**10.07**	**9.30**
OUTPUT (Mtoe)	**3.17**	**4.70**	**5.89**	**5.67**	**5.22**	**5.22**	**5.00**
(TWh gross)	36.82	54.62	68.53	65.96	60.65	60.73	58.18
Output Shares (%)							
Coal	*–*	*0.1*	*–*	*–*	*–*	*–*	*–*
Oil	*7.1*	*0.5*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*
Gas	*–*	*0.6*	*1.5*	*1.5*	*1.6*	*1.7*	*2.2*
Comb. Renewables & Wastes	*–*	*1.0*	*2.2*	*2.4*	*3.1*	*3.2*	*3.6*
Nuclear	*17.1*	*43.3*	*37.7*	*40.1*	*39.9*	*39.8*	*36.4*
Hydro	*75.8*	*54.6*	*58.4*	*55.8*	*55.2*	*55.2*	*57.6*
Geothermal	*–*	*–*	*–*	*–*	*–*	*–*	*–*
Solar/Wind/Other	*–*	*–*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*
TOTAL LOSSES	**2.17**	**5.05**	**5.75**	**5.92**	**5.42**	**5.41**	**4.86**
of which:							
Electricity and Heat Generation[10]	1.32	4.38	4.94	5.10	4.39	4.37	3.83
Other Transformation	0.14	0.01	–0.04	–0.03	0.10	0.10	0.10
Own Use and Losses[11]	0.72	0.66	0.86	0.85	0.93	0.94	0.93
Statistical Differences	**–0.02**	**0.36**	**–0.48**	**–0.62**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	246.18	308.43	326.15	335.86	372.63	415.47	486.94
Population (millions)	6.44	6.71	7.14	7.19	7.43	7.49	7.43
TPES/GDP[12]	0.08	0.08	0.08	0.08	0.07	0.07	0.05
Energy Production/TPES	0.22	0.39	0.44	0.44	0.42	0.41	0.38
Per Capita TPES[13]	3.06	3.73	3.74	3.70	3.61	3.63	3.56
Oil Supply/GDP[12]	0.06	0.04	0.04	0.04	0.04	0.03	0.03
TFC/GDP[12]	0.07	0.06	0.07	0.06	0.06	0.05	0.04
Per Capita TFC[13]	2.73	2.93	3.00	2.96	2.88	2.90	2.91
Energy–related CO_2 Emissions (Mt CO_2)[14]	43.6	40.6	42.2	41.7	41.0	41.2	41.2
CO_2 Emissions from Bunkers (Mt CO_2)	2.1	3.2	4.5	4.7	4.7	4.7	4.7

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	0.2	2.1	0.7	–0.3	0.2	0.2	–0.3
Coal	–6.3	4.5	–13.7	165.3	–16.5	–0.6	–0.1
Oil	–2.2	0.1	–0.2	–3.7	0.7	–0.0	–0.1
Gas	31.0	7.2	4.6	–0.5	2.4	0.8	0.5
Comb. Renewables & Wastes	11.2	7.3	4.7	6.4	4.2	0.8	–1.3
Nuclear	11.0	6.5	1.0	2.4	–1.8	–0.1	–1.3
Hydro	2.1	–0.5	3.3	–7.9	–1.9	–	–
Geothermal	–	–	4.5	–	–	–	–
Solar/Wind/Other	–	–	–	8.7	–39.7	8.4	5.2
TFC	–0.6	1.4	1.0	–0.6	0.1	0.3	–0.1
Electricity Consumption	2.6	3.0	1.2	0.6	0.3	0.8	0.2
Energy Production	6.5	4.2	2.1	–0.1	–1.1	0.1	–1.0
Net Oil Imports	–1.6	–0.3	–0.6	–3.0	1.4	–0.0	–0.1
GDP	–0.4	2.3	0.6	3.0	2.1	2.2	1.6
Growth in the TPES/GDP Ratio	0.6	–0.2	0.1	–3.2	–1.9	–1.9	–1.8
Growth in the TFC/GDP Ratio	–0.3	–0.9	0.3	–3.4	–1.9	–1.8	–1.6

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

TURKEY

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**15.48**	**25.50**	**27.07**	**26.19**	**31.71**	**40.86**	**61.22**
Coal[1]		5.21	12.41	13.29	13.29	18.80	26.15	32.36
Oil		3.59	3.61	2.91	2.73	1.81	1.13	0.49
Gas		–	0.18	0.60	0.53	0.19	0.17	0.14
Comb. Renewables & Wastes[2]		6.45	7.21	6.81	6.48	5.33	4.42	3.93
Nuclear		–	–	–	–	–	–	7.30
Hydro		0.22	1.99	2.98	2.66	3.09	5.34	10.00
Geothermal		–	0.09	0.24	0.25	2.12	2.62	4.73
Solar/Wind/Other[3]		–	0.02	0.24	0.27	0.38	1.05	2.27
TOTAL NET IMPORTS[4]		**8.74**	**27.98**	**43.04**	**50.60**	**83.65**	**113.11**	**221.18**
Coal[1]	Exports	–	–	–	–	–	–	–
	Imports	0.01	4.21	6.69	9.25	7.39	13.63	75.41
	Net Imports	0.01	4.21	6.69	9.25	7.39	13.63	75.41
Oil	Exports	0.86	1.90	2.47	1.31	..	..	..
	Imports	9.68	23.18	28.87	30.72	42.00	50.06	71.40
	Bunkers	0.09	0.12	0.28	0.40	..	..	..
	Net Imports	8.73	21.16	26.11	29.01	42.00	50.06	71.40
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	2.68	10.06	12.05	33.87	49.41	74.36
	Net Imports	–	2.68	10.06	12.05	33.87	49.41	74.36
Electricity	Exports	–	0.08	0.03	0.04	–	–	–
	Imports	–	0.02	0.20	0.33	0.39	–	–
	Net Imports	–	–0.06	0.18	0.29	0.39	–	–
TOTAL STOCK CHANGES		**0.11**	**–0.83**	**0.43**	**0.32**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**24.32**	**52.65**	**70.54**	**77.10**	**115.36**	**153.97**	**282.39**
Coal[1]		5.15	16.94	20.07	23.46	26.19	39.78	107.78
Oil		12.50	23.61	29.42	31.08	43.81	51.19	71.89
Gas		–	2.86	10.59	12.64	34.06	49.58	74.51
Comb. Renewables & Wastes[2]		6.45	7.21	6.81	6.48	5.33	4.42	3.93
Nuclear		–	–	–	–	–	–	7.30
Hydro		0.22	1.99	2.98	2.66	3.09	5.34	10.00
Geothermal		–	0.09	0.24	0.25	2.12	2.62	4.73
Solar/Wind/Other[3]		–	0.02	0.24	0.27	0.38	1.05	2.27
Electricity Trade[5]		–	–0.06	0.18	0.29	0.39	–	–
Shares (%)								
Coal		*21.2*	*32.2*	*28.5*	*30.4*	*22.7*	*25.8*	*38.2*
Oil		*51.4*	*44.8*	*41.7*	*40.3*	*38.0*	*33.2*	*25.5*
Gas		–	*5.4*	*15.0*	*16.4*	*29.5*	*32.2*	*26.4*
Comb. Renewables & Wastes		*26.5*	*13.7*	*9.7*	*8.4*	*4.6*	*2.9*	*1.4*
Nuclear		–	–	–	–	–	–	*2.6*
Hydro		*0.9*	*3.8*	*4.2*	*3.4*	*2.7*	*3.5*	*3.5*
Geothermal		–	*0.2*	*0.3*	*0.3*	*1.8*	*1.7*	*1.7*
Solar/Wind/Other		–	–	*0.3*	*0.3*	*0.3*	*0.7*	*0.8*
Electricity Trade		–	*–0.1*	*0.2*	*0.4*	*0.3*	–	–

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**19.99**	**40.20**	**52.12**	**56.70**	**84.27**	**113.59**	**200.74**
Coal[1]	2.94	7.57	7.36	10.22	8.96	15.64	55.88
Oil	9.70	20.80	25.92	26.92	36.33	44.19	63.06
Gas	0.04	0.72	4.04	4.49	17.43	25.25	29.71
Comb. Renewables & Wastes[2]	6.45	7.21	6.71	6.38	5.33	4.42	3.93
Geothermal	–	0.02	0.17	0.18	2.04	2.54	4.66
Solar/Wind/Other	–	0.02	0.24	0.26	0.38	0.60	1.12
Electricity	0.85	3.87	7.67	8.25	13.82	20.95	42.39
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*14.7*	*18.8*	*14.1*	*18.0*	*10.6*	*13.8*	*27.8*
Oil	*48.5*	*51.7*	*49.7*	*47.5*	*43.1*	*38.9*	*31.4*
Gas	*0.2*	*1.8*	*7.8*	*7.9*	*20.7*	*22.2*	*14.8*
Comb. Renewables & Wastes	*32.3*	*17.9*	*12.9*	*11.3*	*6.3*	*3.9*	*2.0*
Geothermal	–	–	*0.3*	*0.3*	*2.4*	*2.2*	*2.3*
Solar/Wind/Other	–	*0.1*	*0.5*	*0.5*	*0.4*	*0.5*	*0.6*
Electricity	*4.3*	*9.6*	*14.7*	*14.5*	*16.4*	*18.4*	*21.1*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**4.30**	**13.71**	**19.09**	**22.51**	**35.06**	**51.24**	**109.00**
Coal[1]	1.14	4.52	5.71	8.53	6.35	11.86	46.05
Oil	2.60	6.16	7.84	8.16	10.03	12.33	19.77
Gas	0.00	0.67	1.64	1.76	11.01	15.41	18.04
Comb. Renewables & Wastes[2]	–	–	–	–	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.01	0.08	0.10	0.19	0.27	0.51
Electricity	0.55	2.35	3.83	3.96	7.49	11.37	24.64
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*26.5*	*33.0*	*29.9*	*37.9*	*18.1*	*23.1*	*42.2*
Oil	*60.5*	*44.9*	*41.1*	*36.2*	*28.6*	*24.1*	*18.1*
Gas	*0.1*	*4.9*	*8.6*	*7.8*	*31.4*	*30.1*	*16.5*
Comb. Renewables & Wastes	–	–	–	–	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.1*	*0.4*	*0.4*	*0.5*	*0.5*	*0.5*
Electricity	*12.9*	*17.2*	*20.0*	*17.6*	*21.4*	*22.2*	*22.6*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**4.49**	**9.58**	**11.87**	**12.50**	**18.67**	**23.71**	**33.94**
TOTAL OTHER SECTORS[8]	**11.21**	**16.91**	**21.16**	**21.70**	**30.55**	**38.65**	**57.80**
Coal[1]	1.28	3.03	1.65	1.69	2.61	3.78	9.83
Oil	3.15	5.11	6.29	6.38	7.74	8.33	9.73
Gas	0.04	0.05	2.37	2.69	6.41	9.83	11.66
Comb. Renewables & Wastes[2]	6.45	7.21	6.71	6.38	5.33	4.42	3.93
Geothermal	–	0.02	0.17	0.18	2.04	2.54	4.66
Solar/Wind/Other	–	0.01	0.16	0.17	0.19	0.34	0.61
Electricity	0.29	1.49	3.81	4.22	6.23	9.41	17.40
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*11.4*	*17.9*	*7.8*	*7.8*	*8.5*	*9.8*	*17.0*
Oil	*28.1*	*30.2*	*29.7*	*29.4*	*25.3*	*21.6*	*16.8*
Gas	*0.3*	*0.3*	*11.2*	*12.4*	*21.0*	*25.4*	*20.2*
Comb. Renewables & Wastes	*57.5*	*42.6*	*31.7*	*29.4*	*17.4*	*11.4*	*6.8*
Geothermal	–	*0.1*	*0.8*	*0.8*	*6.7*	*6.6*	*8.1*
Solar/Wind/Other	–	*0.1*	*0.8*	*0.8*	*0.6*	*0.9*	*1.0*
Electricity	*2.6*	*8.8*	*18.0*	*19.4*	*20.4*	*24.3*	*30.1*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**2.77**	**11.08**	**22.24**	**24.52**	**39.77**	**56.01**	**116.54**
OUTPUT (Mtoe)	**1.07**	**4.95**	**10.01**	**10.74**	**16.42**	**24.65**	**48.72**
(TWh gross)	12.43	57.54	116.44	124.92	190.96	286.59	566.51
Output Shares (%)							
Coal	*26.1*	*35.1*	*31.8*	*30.6*	*33.6*	*33.3*	*37.2*
Oil	*51.4*	*6.9*	*6.9*	*8.4*	*4.0*	*0.0*	–
Gas	–	*17.7*	*31.2*	*36.1*	*43.5*	*43.1*	*35.0*
Comb. Renewables & Wastes	*1.6*	–	*0.2*	*0.2*	–	–	–
Nuclear	–	–	–	–	–	–	*4.9*
Hydro	*20.9*	*40.2*	*29.8*	*24.7*	*18.8*	*21.7*	*20.5*
Geothermal	–	*0.1*	*0.1*	*0.1*	*0.0*	*0.0*	*0.0*
Solar/Wind/Other	–	–	*0.0*	*0.0*	*0.0*	*1.8*	*2.4*
TOTAL LOSSES	**4.03**	**11.58**	**18.18**	**19.95**	**31.08**	**40.38**	**81.65**
of which:							
Electricity and Heat Generation[10]	1.70	6.13	12.22	13.78	23.35	31.36	67.82
Other Transformation	1.32	2.89	1.53	1.44	2.24	2.51	3.79
Own Use and Losses[11]	1.00	2.56	4.43	4.73	5.50	6.51	10.05
Statistical Differences	**0.30**	**0.88**	**0.24**	**0.46**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	68.39	144.57	191.39	205.07	283.62	410.97	793.46
Population (millions)	38.45	56.20	65.82	66.84	70.72	74.12	81.92
TPES/GDP[12]	0.36	0.36	0.37	0.38	0.41	0.37	0.36
Energy Production/TPES	0.64	0.48	0.38	0.34	0.27	0.27	0.22
Per Capita TPES[13]	0.63	0.94	1.07	1.15	1.63	2.08	3.45
Oil Supply/GDP[12]	0.18	0.16	0.15	0.15	0.15	0.12	0.09
TFC/GDP[12]	0.29	0.28	0.27	0.28	0.30	0.28	0.25
Per Capita TFC[13]	0.52	0.72	0.79	0.85	1.19	1.53	2.45
Energy–related CO_2 Emissions (Mt CO_2)[14]	52.8	128.8	181.3	204.1	296.9	407.4	785.6
CO_2 Emissions from Bunkers (Mt CO_2)	0.4	0.9	2.4	2.9	1.6	1.6	1.6

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	3.7	5.2	3.3	9.3	8.4	5.9	6.3
Coal	4.1	9.0	1.9	16.9	2.2	8.7	10.5
Oil	3.1	4.2	2.5	5.6	7.1	3.2	3.5
Gas	–	–	15.7	19.3	21.9	7.8	4.2
Comb. Renewables & Wastes	3.1	–0.7	–0.6	–4.9	–3.8	–3.7	–1.2
Nuclear	–	–	–	–	–	–	–
Hydro	25.7	7.6	4.6	–10.9	3.1	11.6	6.5
Geothermal	–	–	12.4	0.4	53.9	4.4	6.1
Solar/Wind/Other	–	–	31.0	11.3	7.5	22.6	8.0
TFC	4.1	4.2	2.9	8.8	8.2	6.2	5.9
Electricity Consumption	11.3	8.2	7.9	7.5	10.9	8.7	7.3
Energy Production	1.9	3.6	0.7	–3.3	3.9	5.2	4.1
Net Oil Imports	5.1	5.5	2.4	11.1	7.7	3.6	3.6
GDP	4.5	4.5	3.2	7.2	6.7	7.7	6.8
Growth in the TPES/GDP Ratio	–0.8	0.6	0.1	2.0	1.6	–1.6	–0.5
Growth in the TFC/GDP Ratio	–0.4	–0.3	–0.2	1.5	1.5	–1.4	–0.9

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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**108.5**	**208.0**	**281.5**	**272.7**	**..**	**..**	**..**
Coal[1]		75.9	53.6	22.1	18.6	9.0	2.6	–
Oil		0.5	95.2	143.0	131.7	..	..	..
Gas		24.4	40.9	89.1	97.6	..	..	..
Comb. Renewables & Wastes[2]		–	0.6	1.9	2.1	5.0	10.4	10.5
Nuclear		7.3	17.1	24.8	22.2	24.7	18.9	7.7
Hydro		0.3	0.4	0.5	0.4	0.4	0.4	0.4
Geothermal		–	0.0	0.0	0.0	–	–	–
Solar/Wind/Other[3]		–	0.0	0.1	0.1	–	–	–
TOTAL NET IMPORTS[4]		**110.4**	**2.1**	**–50.7**	**–42.8**	**..**	**..**	**..**
Coal[1]	Exports	2.0	1.8	0.7	0.7	0.2	–	–
	Imports	1.1	10.3	13.3	15.3	16.5	18.8	15.6
	Net Imports	–0.9	8.5	12.7	14.6	16.4	18.8	15.6
Oil	Exports	20.9	76.5	117.5	118.2	..	..	..
	Imports	136.9	65.4	60.8	71.0	..	..	..
	Bunkers	5.4	2.5	2.3	2.1	..	..	..
	Net Imports	110.6	–13.6	–59.1	–49.3	..	..	..
Gas	Exports	–	–	6.5	11.3	..	..	..
	Imports	0.7	6.2	1.0	2.0	..	..	..
	Net Imports	0.7	6.2	–5.5	–9.3	..	..	..
Electricity	Exports	0.0	0.0	0.0	0.0	–	–	–
	Imports	0.0	1.0	1.2	1.2	0.9	0.4	0.3
	Net Imports	0.0	1.0	1.2	1.2	0.9	0.4	0.3
TOTAL STOCK CHANGES		**1.8**	**2.3**	**0.5**	**2.8**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**220.7**	**212.4**	**231.2**	**232.6**	**238.3**	**244.1**	**251.5**
Coal[1]		76.4	63.3	34.3	36.0	25.3	21.3	15.6
Oil		111.6	82.6	84.3	83.2	86.9	92.6	103.0
Gas		25.1	47.2	84.1	87.5	95.1	100.1	114.1
Comb. Renewables & Wastes[2]		–	0.6	1.9	2.1	5.0	10.4	10.5
Nuclear		7.3	17.1	24.8	22.2	24.7	18.9	7.7
Hydro		0.3	0.4	0.5	0.4	0.4	0.4	0.4
Geothermal		–	0.0	0.0	0.0	–	–	–
Solar/Wind/Other[3]		–	0.0	0.1	0.1	–	–	–
Electricity Trade[5]		0.0	1.0	1.2	1.2	0.9	0.4	0.3
Shares (%)								
Coal		*34.6*	*29.8*	*14.8*	*15.5*	*10.6*	*8.7*	*6.2*
Oil		*50.5*	*38.9*	*36.4*	*35.7*	*36.4*	*37.9*	*40.9*
Gas		*11.4*	*22.2*	*36.4*	*37.6*	*39.9*	*41.0*	*45.3*
Comb. Renewables & Wastes		–	*0.3*	*0.8*	*0.9*	*2.1*	*4.3*	*4.2*
Nuclear		*3.3*	*8.1*	*10.7*	*9.5*	*10.4*	*7.8*	*3.1*
Hydro		*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		–	*0.5*	*0.5*	*0.5*	*0.4*	*0.2*	*0.1*

0 is negligible, – is nil, .. is not available.
Please note: Forecast data are based on the 2000 submission. Forecasts for production. imports and exports of coal are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**147.1**	**145.4**	**161.9**	**161.5**	**172.4**	**180.0**	**195.6**
Coal[1]	26.5	10.8	5.3	3.9	4.1	3.6	3.3
Oil	77.0	68.8	75.2	73.6	79.5	84.9	95.2
Gas	23.6	42.0	52.9	55.0	56.8	57.9	61.3
Comb. Renewables & Wastes[2]	–	0.2	0.8	0.7	0.8	0.7	0.8
Geothermal	–	0.0	0.0	0.0	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	–	–	–
Electricity	20.0	23.6	27.8	28.3	31.2	32.9	35.1
Heat	–	0.0	–	–	–	–	–
Shares (%)							
Coal	*18.0*	*7.4*	*3.3*	*2.4*	*2.3*	*2.0*	*1.7*
Oil	*52.3*	*47.3*	*46.5*	*45.6*	*46.1*	*47.2*	*48.7*
Gas	*16.1*	*28.9*	*32.6*	*34.0*	*33.0*	*32.2*	*31.3*
Comb. Renewables & Wastes	–	*0.1*	*0.5*	*0.4*	*0.5*	*0.4*	*0.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*13.6*	*16.2*	*17.1*	*17.5*	*18.1*	*18.3*	*17.9*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**65.0**	**42.8**	**46.2**	**45.2**	**47.5**	**48.1**	**50.0**
Coal[1]	13.3	6.4	3.1	2.2	3.1	2.9	2.9
Oil	33.7	15.7	17.2	16.3	16.7	17.0	17.1
Gas	10.1	12.0	15.9	16.5	16.8	17.0	17.8
Comb. Renewables & Wastes[2]	–	0.0	0.4	0.4	0.7	0.6	0.6
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	7.8	8.7	9.5	9.8	10.2	10.6	11.6
Heat	–	0.0	–	–	–	–	–
Shares (%)							
Coal	*20.5*	*14.9*	*6.8*	*4.9*	*6.4*	*6.0*	*5.7*
Oil	*51.8*	*36.8*	*37.3*	*36.2*	*35.2*	*35.3*	*34.2*
Gas	*15.6*	*28.0*	*34.4*	*36.6*	*35.4*	*35.3*	*35.6*
Comb. Renewables & Wastes	–	–	*0.9*	*0.8*	*1.5*	*1.2*	*1.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*12.1*	*20.2*	*20.7*	*21.6*	*21.5*	*22.0*	*23.2*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**31.0**	**46.5**	**53.0**	**52.7**	**57.7**	**62.8**	**73.0**
TOTAL OTHER SECTORS[8]	**51.2**	**56.2**	**62.7**	**63.7**	**67.2**	**69.1**	**72.7**
Coal[1]	13.1	4.4	2.1	1.7	1.0	0.7	0.4
Oil	12.6	7.0	5.7	5.4	5.8	5.8	5.9
Gas	13.5	30.0	37.0	38.4	40.0	40.9	43.5
Comb. Renewables & Wastes[2]	–	0.2	0.4	0.4	0.1	0.1	0.2
Geothermal	–	0.0	0.0	0.0	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	–	–	–
Electricity	12.0	14.5	17.5	17.8	20.3	21.6	22.7
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*25.5*	*7.8*	*3.4*	*2.7*	*1.5*	*1.0*	*0.6*
Oil	*24.7*	*12.5*	*9.1*	*8.4*	*8.6*	*8.4*	*8.1*
Gas	*26.4*	*53.5*	*59.0*	*60.4*	*59.5*	*59.2*	*59.9*
Comb. Renewables & Wastes	–	*0.4*	*0.6*	*0.6*	*0.1*	*0.2*	*0.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*23.4*	*25.8*	*27.9*	*27.9*	*30.2*	*31.3*	*31.2*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**72.5**	**74.4**	**76.7**	**77.6**	**78.0**	**79.4**	**74.9**
OUTPUT (Mtoe)	**24.2**	**27.3**	**31.4**	**32.0**	**33.9**	**36.2**	**38.2**
(TWh gross)	281.4	317.0	365.5	372.2	394.7	420.9	443.7
Output Shares (%)							
Coal	*62.1*	*65.3*	*30.5*	*33.4*	*20.7*	*15.8*	*9.4*
Oil	*25.6*	*10.8*	*1.6*	*1.5*	*0.5*	*0.4*	*0.3*
Gas	*1.0*	*1.1*	*39.1*	*39.4*	*49.0*	*56.0*	*73.6*
Comb. Renewables & Wastes	–	*0.4*	*1.1*	*1.2*	*4.5*	*9.3*	*8.9*
Nuclear	*10.0*	*20.7*	*26.0*	*22.9*	*24.0*	*17.3*	*6.7*
Hydro	*1.4*	*1.6*	*1.5*	*1.4*	*1.3*	*1.2*	*1.1*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.0*	*0.2*	*0.3*	–	–	–
TOTAL LOSSES	**72.7**	**67.5**	**68.8**	**69.0**	**66.0**	**64.1**	**55.9**
of which:							
Electricity and Heat Generation[10]	48.3	47.1	45.3	45.6	44.1	43.2	36.7
Other Transformation	7.1	4.1	4.9	4.6	2.7	2.6	2.5
Own Use and Losses[11]	17.3	16.3	18.7	18.8	19.2	18.3	16.7
Statistical Differences	**0.9**	**–0.5**	**0.5**	**2.1**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	748.36	1040.25	1267.26	1303.75	1467.89	1640.63	2049.48
Population (millions)	56.22	57.56	59.50	59.76	60.35	61.00	61.65
TPES/GDP[12]	0.29	0.20	0.18	0.18	0.16	0.15	0.12
Energy Production/TPES	0.49	0.98	1.22	1.17	–	–	–
Per Capita TPES[13]	3.93	3.69	3.89	3.89	3.95	4.00	4.08
Oil Supply/GDP[12]	0.15	0.08	0.07	0.06	0.06	0.06	0.05
TFC/GDP[12]	0.20	0.14	0.13	0.12	0.12	0.11	0.10
Per Capita TFC[13]	2.62	2.53	2.72	2.70	2.86	2.95	3.17
Energy–related CO_2 Emissions (Mt CO_2)[14]	640.0	559.9	526.0	531.5	530.3	542.5	581.8
CO_2 Emissions from Bunkers (Mt CO_2)	25.4	20.9	25.7	26.4	19.9	19.9	19.9

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	–0.1	–0.3	0.9	0.6	0.5	0.5	0.3
Coal	–0.5	–1.4	–6.6	4.8	–6.8	–3.4	–3.1
Oil	–2.6	–1.3	0.2	–1.3	0.9	1.3	1.1
Gas	8.3	1.4	6.6	4.0	1.7	1.0	1.3
Comb. Renewables & Wastes	–	–	13.3	9.9	18.6	15.8	0.0
Nuclear	5.4	5.0	4.2	–10.6	2.2	–5.2	–8.6
Hydro	1.6	1.8	0.4	–4.8	–0.4	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	25.2	10.8	–	–	–
TFC	0.1	–0.2	1.2	–0.2	1.3	0.9	0.8
Electricity Consumption	0.9	1.0	1.8	1.9	2.0	1.1	0.6
Energy Production	10.1	0.7	3.4	–3.1	..	..	..
Net Oil Imports	–27.1	–	17.7	–16.6	..	..	..
GDP	1.5	2.2	2.2	2.9	2.4	2.2	2.2
Growth in the TPES/GDP Ratio	–1.5	–2.5	–1.2	–2.2	–1.9	–1.7	–1.9
Growth in the TFC/GDP Ratio	–1.3	–2.3	–1.0	–3.0	–1.1	–1.3	–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	1999	2000	2005	2010	2020
TOTAL PRODUCTION		**1455**	**1650**	**1686**	**1676**	**1822**	**1924**	**2153**
Coal[1]		333	539	561	543	629	661	708
Oil		534	433	367	366	352	350	394
Gas		503	419	441	444	494	560	678
Comb. Renewables & Wastes[2]		37	62	76	78	94	103	118
Nuclear		23	159	201	208	210	204	194
Hydro		23	23	25	21	27	27	26
Geothermal		2	14	14	13	14	18	32
Solar/Wind/Other[3]		–	0	2	2	2	2	2
TOTAL NET IMPORTS[4]		**289**	**315**	**548**	**576**	**733**	**837**	**976**
Coal[1]	Exports	31	67	36	37	36	34	35
	Imports	1	2	7	10	11	12	13
	Net Imports	–30	–65	–29	–27	–24	–22	–22
Oil	Exports	11	39	46	50	44	49	54
	Imports	316	413	567	601	716	816	944
	Bunkers	9	29	26	33	26	26	26
	Net Imports	296	346	495	518	646	741	864
Gas	Exports	2	2	4	6	9	15	13
	Imports	24	35	83	88	116	130	143
	Net Imports	22	33	79	82	106	116	130
Electricity	Exports	0	2	1	1	1	1	1
	Imports	1	2	4	4	6	4	4
	Net Imports	1	0	2	3	4	3	3
TOTAL STOCK CHANGES		**–8**	**–38**	**13**	**48**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**1736**	**1927**	**2248**	**2300**	**2555**	**2761**	**3128**
Coal[1]		311	458	522	542	605	639	686
Oil		824	770	881	888	999	1091	1258
Gas		515	439	525	545	601	675	809
Comb. Renewables & Wastes[2]		37	62	75	78	94	103	118
Nuclear		23	159	201	208	210	204	194
Hydro		23	23	25	21	27	27	26
Geothermal		2	14	14	13	14	18	32
Solar/Wind/Other[3]		–	0	2	2	2	2	2
Electricity Trade[5]		1	0	2	3	4	3	3
Shares (%)								
Coal		*17.9*	*23.8*	*23.2*	*23.6*	*23.7*	*23.1*	*21.9*
Oil		*47.5*	*40.0*	*39.2*	*38.6*	*39.1*	*39.5*	*40.2*
Gas		*29.6*	*22.8*	*23.4*	*23.7*	*23.5*	*24.5*	*25.8*
Comb. Renewables & Wastes		*2.2*	*3.2*	*3.4*	*3.4*	*3.7*	*3.7*	*3.8*
Nuclear		*1.3*	*8.3*	*8.9*	*9.1*	*8.2*	*7.4*	*6.2*
Hydro		*1.3*	*1.2*	*1.1*	*0.9*	*1.0*	*1.0*	*0.8*
Geothermal		*0.1*	*0.7*	*0.6*	*0.6*	*0.6*	*0.7*	*1.0*
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Electricity Trade		*0.1*	–	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1999	2000	2005	2010	2020
TFC	**1246**	**1283**	**1469**	**1499**	**1695**	**1849**	**2120**
Coal[1]	44	31	31	31	30	31	32
Oil	701	698	802	811	931	1029	1191
Gas	341	303	312	322	366	385	422
Comb. Renewables & Wastes[2]	16	23	13	14	38	41	45
Geothermal	–	–	0	1	–	–	–
Solar/Wind/Other	–	–	2	1	–	–	–
Electricity	143	226	290	299	322	354	418
Heat	–	2	20	20	8	10	12
Shares (%)							
Coal	*3.5*	*2.4*	*2.1*	*2.1*	*1.8*	*1.7*	*1.5*
Oil	*56.3*	*54.4*	*54.5*	*54.1*	*54.9*	*55.6*	*56.2*
Gas	*27.4*	*23.6*	*21.2*	*21.5*	*21.6*	*20.8*	*19.9*
Comb. Renewables & Wastes	*1.3*	*1.8*	*0.9*	*0.9*	*2.3*	*2.2*	*2.1*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.1*	*0.1*	–	–	–
Electricity	*11.5*	*17.7*	*19.7*	*20.0*	*19.0*	*19.1*	*19.7*
Heat	–	*0.2*	*1.3*	*1.3*	*0.5*	*0.5*	*0.6*
TOTAL INDUSTRY[6]	**406**	**377**	**419**	**416**	**475**	**519**	**578**
Coal[1]	31	21	29	29	27	28	29
Oil	161	149	162	156	187	210	235
Gas	151	124	115	116	143	152	164
Comb. Renewables & Wastes[2]	7	9	–	–	20	22	25
Geothermal	–	–	0	0	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	56	75	96	97	92	101	117
Heat	–	–	18	18	6	7	9
Shares (%)							
Coal	*7.5*	*5.7*	*6.9*	*7.0*	*5.7*	*5.3*	*5.0*
Oil	*39.7*	*39.4*	*38.5*	*37.5*	*39.5*	*40.5*	*40.6*
Gas	*37.3*	*32.8*	*27.5*	*27.8*	*30.1*	*29.2*	*28.4*
Comb. Renewables & Wastes	*1.8*	*2.4*	–	–	*4.1*	*4.2*	*4.3*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*13.7*	*19.7*	*22.9*	*23.4*	*19.3*	*19.5*	*20.2*
Heat	–	–	*4.2*	*4.2*	*1.3*	*1.4*	*1.5*
TRANSPORT[7]	**420**	**502**	**599**	**610**	**714**	**794**	**940**
TOTAL OTHER SECTORS[8]	**420**	**403**	**451**	**473**	**506**	**536**	**602**
Coal[1]	14	10	3	2	3	3	3
Oil	137	63	58	62	56	55	53
Gas	173	164	181	191	203	212	231
Comb. Renewables & Wastes[2]	9	14	12	12	13	13	13
Geothermal	–	–	0	0	–	–	–
Solar/Wind/Other	–	–	2	1	–	–	–
Electricity	87	152	193	202	229	251	298
Heat	–	2	2	2	2	3	3
Shares (%)							
Coal	*3.2*	*2.4*	*0.6*	*0.5*	*0.6*	*0.6*	*0.5*
Oil	*32.6*	*15.6*	*12.9*	*13.1*	*11.1*	*10.3*	*8.8*
Gas	*41.2*	*40.6*	*40.2*	*40.4*	*40.2*	*39.5*	*38.3*
Comb. Renewables & Wastes	*2.1*	*3.4*	*2.6*	*2.6*	*2.5*	*2.4*	*2.2*
Geothermal	–	–	*0.1*	*0.1*	–	–	–
Solar/Wind/Other	–	–	*0.3*	*0.3*	–	–	–
Electricity	*20.8*	*37.6*	*42.9*	*42.6*	*45.2*	*46.8*	*49.5*
Heat	–	*0.5*	*0.4*	*0.4*	*0.5*	*0.5*	*0.5*

Unit:Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1999	2000	2005	2010	2020
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**507**	**768**	**965**	**994**	**1064**	**1148**	**1305**
OUTPUT (Mtoe)	**169**	**274**	**335**	**344**	**385**	**424**	**497**
(TWh gross)	1966	3182	3890	4004	4478	4932	5781
Output Shares (%)							
Coal	*46.2*	*53.4*	*51.9*	*52.7*	*51.0*	*49.1*	*45.8*
Oil	*17.1*	*4.1*	*3.5*	*3.1*	*1.4*	*1.0*	*1.1*
Gas	*18.6*	*12.0*	*15.0*	*15.7*	*20.0*	*24.8*	*31.9*
Comb. Renewables & Wastes	*0.0*	*2.1*	*1.7*	*1.7*	*1.9*	*2.0*	*1.9*
Nuclear	*4.5*	*19.2*	*19.8*	*20.0*	*18.0*	*15.8*	*12.9*
Hydro	*13.5*	*8.6*	*7.5*	*6.2*	*6.9*	*6.3*	*5.3*
Geothermal	*0.1*	*0.5*	*0.4*	*0.4*	*0.4*	*0.4*	*0.6*
Solar/Wind/Other	*–*	*0.1*	*0.1*	*0.2*	*0.4*	*0.4*	*0.5*
TOTAL LOSSES	**498**	**655**	**759**	**780**	**860**	**913**	**1008**
of which:							
Electricity and Heat Generation[10]	338	492	608	627	667	711	792
Other Transformation	–1	15	3	4	34	34	29
Own Use and Losses[11]	160	147	147	149	158	167	187
Statistical Differences	**–7**	**–10**	**20**	**20**	**–**	**–**	**–**

INDICATORS

	1973	1990	1999	2000	2005	2010	2020
GDP (billion 1995 US$)	4005.10	6520.50	8626.70	8986.90	10240.36	12101.31	16243.00
Population (millions)	211.94	249.98	273.00	275.42	288.09	300.24	325.33
TPES/GDP[12]	0.43	0.30	0.26	0.26	0.25	0.23	0.19
Energy Production/TPES	0.84	0.86	0.75	0.73	0.71	0.70	0.69
Per Capita TPES[13]	8.19	7.71	8.23	8.35	8.87	9.20	9.62
Oil Supply/GDP[12]	0.21	0.12	0.10	0.10	0.10	0.09	0.08
TFC/GDP[12]	0.31	0.20	0.17	0.17	0.17	0.15	0.13
Per Capita TFC[13]	5.88	5.13	5.38	5.44	5.88	6.16	6.52
Energy–related CO_2 Emissions (Mt CO_2)[14]	4703.9	4825.7	5488.0	5665.4	6287.5	6847.1	7805.6
CO_2 Emissions from Bunkers (Mt CO_2)	45.2	129.8	137.4	159.0	137.3	137.9	139.4

GROWTH RATES (% per year)

	73–79	79–90	90–99	99–00	00–05	05–10	10–20
TPES	1.3	0.2	1.7	2.3	2.1	1.6	1.3
Coal	2.8	2.0	1.5	3.8	2.2	1.1	0.7
Oil	1.2	–1.2	1.5	0.8	2.4	1.8	1.4
Gas	–1.3	–0.7	2.0	3.7	2.0	2.4	1.8
Comb. Renewables & Wastes	5.9	1.5	2.2	3.0	4.0	1.8	1.3
Nuclear	20.3	7.7	2.6	3.6	0.1	–0.6	–0.5
Hydro	1.1	–0.3	0.8	–15.3	4.4	–0.0	–0.0
Geothermal	9.0	13.2	–0.0	–4.5	1.7	5.2	5.6
Solar/Wind/Other	–	–	25.6	1.3	–4.9	3.4	2.3
TFC	0.8	–0.2	1.5	2.0	2.5	1.8	1.4
Electricity Consumption	3.1	2.5	2.8	3.3	1.5	1.9	1.7
Energy Production	0.8	0.7	0.2	–0.6	1.7	1.1	1.1
Net Oil Imports	5.1	–1.3	4.0	4.8	4.5	2.8	1.5
GDP	3.0	2.9	3.2	4.2	2.6	3.4	3.0
Growth in the TPES/GDP Ratio	–1.6	–2.6	–1.4	–1.8	–0.5	–1.8	–1.7
Growth in the TFC/GDP Ratio	–2.1	–2.9	–1.6	–2.1	–0.2	–1.6	–1.6

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	1996	1997	1998	1999	2000	2001
Canada	3.9	1.6	4.3	3.9	5.1	4.5	1.5
United States	3.0	3.6	4.5	4.3	4.1	4.2	1.2
North America	**3.1**	**3.5**	**4.5**	**4.3**	**4.2**	**4.2**	**1.2**
Australia	2.6	3.7	4.5	5.3	4.3	1.9	2.4
Japan	3.5	3.5	1.8	–1.1	0.7	2.4	–0.4
Korea	8.5	6.8	5.0	–6.7	10.9	8.8	3.0
New Zealand	0.0	3.0	1.9	0.4	4.6	2.5	1.9
Pacific	**3.6**	**3.7**	**2.2**	**–1.2**	**1.7**	**2.9**	**0.1**
Austria	3.0	2.0	1.6	3.5	2.8	3.0	1.0
Belgium	2.4	1.2	3.6	2.2	3.0	4.0	1.1
Czech Republic	2.5	4.3	–0.8	–1.2	–0.4	2.9	3.6
Denmark	1.5	2.5	3.0	2.8	2.1	3.2	1.0
Finland	2.4	4.0	6.3	5.3	4.0	5.7	0.6
France	2.8	1.1	1.9	3.4	2.9	3.1	2.0
Germany	2.4	0.8	1.4	2.0	1.8	3.0	0.6
Greece	3.3	2.4	3.6	3.4	3.4	4.3	4.0
Hungary	4.3	1.3	4.6	4.9	4.2	5.2	3.8
Ireland	4.9	7.8	10.8	8.6	10.8	11.5	6.6
Italy	3.5	1.1	2.0	1.8	1.6	2.9	1.7
Luxembourg	1.3	3.6	9.0	5.8	6.0	7.5	5.1
Netherlands	2.6	3.0	3.8	4.3	3.7	3.5	1.1
Norway	4.6	4.9	4.7	2.4	1.1	2.3	1.4
Portugal	2.9	3.8	3.9	4.5	3.4	3.4	1.9
Spain	2.3	2.4	4.0	4.3	4.1	4.1	2.8
Sweden	1.8	1.1	2.1	3.6	4.5	3.6	1.2
Switzerland	–0.4	0.3	1.7	2.4	1.6	3.0	1.3
Turkey	4.5	7.0	7.5	3.1	–4.7	7.2	–7.4
United Kingdom	1.5	2.6	3.4	3.0	2.1	2.9	2.4
IEA Europe	**2.4**	**1.7**	**2.6**	**2.9**	**2.4**	**3.4**	**1.4**
IEA Total	**2.9**	**2.8**	**3.1**	**2.3**	**2.9**	**3.5**	**1.0**

1. Data are in 1995 dollars at 1995 prices

Sources: *National Accounts, Volume 1*, OECD Paris, 2002, and *Main Economic Indicators*, OECD Paris, May 2002.

Table A2

TPES/GDP Ratios for IEA Countries[1]

	1973	1979	1999	2000	2001[2]	Average Annual Growth Rates (%) 1989-94	1995-2000
Canada	0.50	0.47	0.36	0.36	0.34	–0.2	–2.2
United States	0.43	0.39	0.26	0.26	0.25	–1.2	–2.1
North America	**0.44**	**0.40**	**0.27**	**0.26**	**0.26**	**–1.1**	**–2.1**
Australia	0.29	0.30	0.24	0.24	0.24	–0.6	–0.7
Japan	0.12	0.11	0.09	0.09	0.09	0.8	–0.4
Korea	0.23	0.26	0.32	0.31	0.31	3.6	0.4
New Zealand	0.19	0.21	0.27	0.27	0.27	0.9	0.57
Pacific	**0.14**	**0.13**	**0.12**	**0.12**	**0.12**	**1.6**	**0.35**
Austria	0.16	0.14	0.11	0.11	0.11	–1.3	–0.9
Belgium	0.27	0.24	0.19	0.19	0.18	–0.1	–0.3
Czech Republic	1.12	1.04	0.72	0.74	0.75	–1.6	–1.4
Denmark	0.15	0.15	0.10	0.09	0.10	0.4	–3.5
Finland	0.26	0.26	0.21	0.20	0.20	2.5	–2.4
France	0.18	0.16	0.15	0.15	0.15	–0.5	–1.1
Germany	0.21	0.20	0.13	0.13	0.13	–3.2	–1.8
Greece	0.15	0.16	0.20	0.20	0.20	0.3	0.3
Hungary	0.63	0.66	0.49	0.46	0.46	–0.8	–4.4
Ireland	0.27	0.25	0.15	0.14	0.13	–1.3	–4.3
Italy	0.20	0.18	0.14	0.14	0.14	–0.9	–0.5
Luxembourg	0.55	0.44	0.15	0.15	0.15	–2.8	–4.3
Netherlands	0.25	0.23	0.16	0.15	0.15	–0.8	–2.9
Norway	0.22	0.20	0.16	0.15	0.15	–1.8	–1.2
Portugal	0.13	0.15	0.19	0.19	0.19	0.6	0.4
Spain	0.15	0.17	0.18	0.18	0.18	0.4	0.1
Sweden	0.24	0.23	0.19	0.17	0.17	0.9	–3.8
Switzerland	0.08	0.08	0.08	0.08	0.08	1.3	–0.7
Turkey	0.36	0.34	0.37	0.38	0.38	–0.8	0.7
United Kingdom	0.29	0.27	0.18	0.18	0.17	0.1	–2.0
IEA Europe	**0.22**	**0.21**	**0.16**	**0.16**	**0.16**	**–1.1**	**–1.3**
IEA Total	**0.27**	**0.25**	**0.19**	**0.19**	**0.18**	**–0.7**	**–1.1**

1. Measured in toe per $1 000 of GDP at 1995 prices and exchange rates; changes in energy intensity reflect the combined effects of efficiency improvements, structural changes, fuel substitution and exchange rates.
2. Preliminary data.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, *National Accounts, Volume 1*, OECD Paris, 2001, and *Main Economic Indicators*, OECD Paris, May 2002.

Table A3

TPES per Inhabitant for IEA Countries

(toe per capita)

	1973	1979	1999	2000	2001[1]	Average Annual Growth Rates (%) 1989-94	1995-2000
Canada	7.16	7.88	7.97	8.16	7.89	–0.3	0.7
United States	8.19	8.36	8.23	8.35	8.18	–0.0	1.0
North America	**8.09**	**8.31**	**8.21**	**8.33**	**8.15**	**–0.1**	**1.0**
Australia	4.27	4.73	5.69	5.75	5.71	0.57	1.9
Japan	2.98	3.06	4.07	4.13	4.13	2.7	0.8
Korea	0.63	1.07	3.87	4.10	4.13	10.2	4.2
New Zealand	2.78	2.88	4.75	4.86	4.95	1.52	2.1
Pacific	**2.58**	**2.76**	**4.19**	**4.30**	**4.30**	**3.53**	**1.7**
Austria	2.86	3.17	3.53	3.52	3.61	0.3	1.5
Belgium	4.76	4.93	5.73	5.78	5.76	1.1	2.2
Czech Republic	4.58	4.73	3.72	3.93	4.11	–3.9	–0.4
Denmark	3.95	4.16	3.75	3.64	3.72	1.8	–1.3
Finland	4.57	5.12	6.46	6.40	6.55	0.5	2.3
France	3.31	3.40	4.24	4.25	4.31	0.3	1.0
Germany	4.28	4.73	4.15	4.13	4.25	–2.0	–0.1
Greece	1.38	1.68	2.53	2.64	2.68	0.5	3.6
Hungary	2.06	2.68	2.50	2.47	2.58	–3.7	–0.2
Ireland	2.34	2.63	3.72	3.86	3.96	2.6	4.1
Italy	2.35	2.50	2.93	2.97	2.98	–0.1	1.3
Luxembourg	12.83	10.69	8.01	8.35	8.82	0.8	0.4
Netherlands	4.65	4.91	4.72	4.76	4.86	0.9	0.1
Norway	3.82	4.61	5.97	5.70	5.58	0.9	1.2
Portugal	0.84	1.03	2.44	2.46	2.48	2.3	4.1
Spain	1.50	1.80	2.99	3.13	3.19	1.8	3.5
Sweden	4.83	5.17	5.70	5.35	5.48	0.4	–1.1
Switzerland	3.06	3.15	3.74	3.70	3.87	0.8	0.6
Turkey	0.63	0.70	1.07	1.15	1.06	0.8	3.0
United Kingdom	3.93	3.91	3.89	3.89	3.90	1.1	0.3
IEA Europe	**3.08**	**3.25**	**3.44**	**3.47**	**3.50**	**–0.2**	**0.8**
IEA Total	**4.43**	**4.64**	**5.08**	**5.15**	**5.12**	**0.51**	**1.1**

1. Preliminary data.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, *National Accounts. Volume 1*, OECD Paris, 2001, and *Main Economic Indicators*, OECD Paris, May 2002.

Table A4

TFC/GDP Ratios for IEA Countries[1]

	1973	1979	1998	1999	2000	Average Annual Growth Rates (%) 1989-94	1995-2000
Canada	0.42	0.38	0.28	0.28	0.27	–0.3	–2.0
United States	0.31	0.27	0.17	0.17	0.17	–1.3	–2.6
North America	**0.32**	**0.28**	**0.18**	**0.18**	**0.17**	**–1.3**	**–2.5**
Australia	0.20	0.20	0.16	0.16	0.16	–0.4	–1.6
Japan	0.09	0.08	0.06	0.06	0.06	0.2	–0.4
Korea	0.19	0.20	0.22	0.22	0.21	4.8	–1.0
New Zealand	0.14	0.16	0.20	0.20	0.20	1.3	0.60
Pacific	**0.10**	**0.09**	**0.08**	**0.08**	**0.08**	**1.5**	**–0.0**
Austria	0.12	0.12	0.10	0.09	0.09	–0.8	–0.3
Belgium	0.20	0.18	0.14	0.13	0.13	0.5	0.1
Czech Republic	0.82	0.83	0.48	0.47	0.46	–4.0	–3.3
Denmark	0.13	0.12	0.08	0.08	0.07	–0.6	–3.0
Finland	0.24	0.21	0.16	0.16	0.15	2.2	–3.0
France	0.14	0.13	0.10	0.10	0.10	–0.2	–1.0
Germany	0.16	0.15	0.10	0.09	0.09	–3.0	–1.3
Greece	0.11	0.11	0.15	0.14	0.14	0.1	0.5
Hungary	0.51	0.52	0.35	0.33	0.32	–2.2	–3.9
Ireland	0.20	0.19	0.12	0.11	0.10	–1.9	–3.9
Italy	0.15	0.13	0.11	0.11	0.11	–0.8	–0.6
Luxembourg	0.36	0.33	0.15	0.15	0.15	–1.9	–2.6
Netherlands	0.19	0.19	0.13	0.12	0.12	–0.7	–2.4
Norway	0.20	0.18	0.12	0.12	0.12	–2.6	–1.8
Portugal	0.11	0.12	0.15	0.15	0.15	1.1	1.3
Spain	0.11	0.13	0.12	0.12	0.13	0.9	0.8
Sweden	0.21	0.20	0.14	0.13	0.13	1.0	–2.6
Switzerland	0.07	0.07	0.07	0.07	0.06	0.2	–0.7
Turkey	0.29	0.29	0.27	0.27	0.28	–1.5	–0.4
United Kingdom	0.20	0.18	0.13	0.13	0.12	–0.2	–1.5
IEA Europe	**0.17**	**0.15**	**0.12**	**0.11**	**0.11**	**–1.1**	**–1.0**
IEA Total	**0.20**	**0.18**	**0.13**	**0.13**	**0.13**	**–0.8**	**–1.3**

1. Measured in toe per $1 000 of GDP at 1995 prices and exchange rates.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, *National Accounts, Volume 1*, OECD Paris, 2001, and *Main Economic Indicators*, OECD Paris, May 2002.

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	354.7	14.4	73.0	5.2	5.2	2.2
Korea	21.6	37.6	61.9	-	-	0.5	40.0	30.2	67.2	-	2.1	0.5
New Zealand	8.3	15.3	53.5	3.4	-	27.8	9.0	10.6	46.4	9.5	-	33.5
Pacific	**411.1**	**21.9**	**72.3**	**2.1**	**0.6**	**3.1**	**472.4**	**18.8**	**68.2**	**5.6**	**4.1**	**3.4**
Austria	21.7	17.9	56.7	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
Czech Republic	45.4	78.4	19.6	2.2	-	–0.2	48.7	71.9	23.5	4.6	-	0.0
Denmark	19.8	9.7	88.6	-	-	1.7	21.3	20.3	75.9	-	-	3.7
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	187.0	17.3	61.2	11.1	5.6	4.8
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	21.5	36.8	38.2	19.4	-	5.5	28.7	29.7	39.8	25.8	-	4.8
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	68.9	4.8	45.9	47.6	1.3	0.4
Norway	15.1	6.0	55.5	-	-	38.5	18.8	5.3	49.5	3.8	-	41.5
Portugal	7.2	7.0	75.4	-	-	17.5	10.0	4.4	78.3	-	-	17.3
Spain	52.4	17.2	73.3	1.8	3.3	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	42.9	4.2	61.3	-	12.8	21.7
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	220.7	34.6	50.5	11.4	3.3	0.2	220.0	33.7	43.2	18.4	4.5	0.2
IEA Europe	**1284.4**	**26.7**	**57.8**	**9.9**	**1.5**	**4.1**	**1399.1**	**25.2**	**52.4**	**14.0**	**3.6**	**4.8**
IEA Total	**3593.0**	**21.1**	**54.1**	**19.1**	**1.4**	**4.3**	**3943.5**	**21.0**	**51.5**	**18.8**	**3.8**	**4.8**

1. Includes hydro, geothermal, combustible renewables, wastes, solar, wind, tide, wave, ambient heat used in heat pumps, and electricity and heat trade.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Table A5 (continued)

Total Energy Demand in IEA Countries

(Mtoe and %)

	1999						2000[1]						1999-2000
	TPES	Shares of TPES					TPES	Shares of TPES					Change in TPES
	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[2] %	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[2] %	%
Canada	251.0	12.1	35.1	29.7	7.6	15.5	245.5	12.6	34.9	28.7	8.1	15.6	–2.2
United States	2299.7	23.6	38.6	23.7	9.1	5.1	2272.4	24.5	38.9	22.4	9.2	5.0	–1.2
North America	**2550.6**	**22.4**	**38.3**	**24.3**	**8.9**	**6.1**	**2517.9**	**23.3**	**38.5**	**23.0**	**9.1**	**6.1**	**–1.3**
Australia	110.2	43.1	33.2	17.5	-	6.3	110.7	44.3	31.3	18.1	-	6.4	0.5
Japan	524.7	17.9	50.5	12.3	16.0	3.3	526.0	18.5	49.3	12.8	16.1	3.3	0.3
Korea	193.6	21.7	53.6	8.8	14.7	1.3	196.9	22.7	51.6	9.5	14.8	1.4	1.7
New Zealand	18.6	5.4	33.9	27.1	-	33.5	19.0	6.6	32.8	28.3	-	32.4	1.9
Pacific	**847.1**	**21.7**	**48.6**	**12.5**	**13.3**	**3.9**	**852.6**	**22.5**	**47.1**	**13.1**	**13.4**	**3.9**	**0.6**
Austria	28.6	12.6	41.3	22.8	-	23.3	29.3	12.3	41.6	23.1	-	23.1	2.7
Belgium	59.2	14.1	40.1	22.6	21.2	2.0	58.7	13.2	41.0	22.4	20.6	2.8	–0.8
Czech Republic	40.4	53.3	19.5	18.6	8.8	–0.2	42.1	51.9	19.8	19.1	9.1	0.0	4.3
Denmark	19.5	20.6	44.9	22.9	-	11.6	19.9	21.1	45.1	23.2	-	10.6	2.2
Finland	33.1	15.3	29.5	10.3	17.7	27.2	34.0	17.4	28.7	10.9	17.5	25.5	2.5
France	257.1	5.8	33.9	13.7	42.1	4.4	260.9	4.9	34.4	14.0	42.2	4.6	1.5
Germany	339.6	23.7	38.7	21.1	13.0	3.4	346.8	23.2	38.8	21.8	12.9	3.3	2.1
Greece	27.8	32.5	56.1	6.1	-	5.3	28.4	33.4	55.1	5.9	-	5.6	2.1
Hungary	24.8	16.0	27.7	38.8	14.7	2.8	25.8	14.7	26.7	41.5	14.3	2.8	4.0
Ireland	14.6	18.2	56.5	23.5	-	1.8	15.2	19.2	55.5	23.6	-	1.6	3.6
Italy	171.6	7.3	51.4	33.8	-	7.5	172.3	7.7	50.8	33.8	-	7.7	0.4
Luxembourg	3.7	3.4	63.5	18.2	-	14.9	3.9	2.9	63.6	19.6	-	13.9	6.1
Netherlands	75.8	10.5	37.7	45.8	1.3	4.7	77.5	10.6	38.1	45.5	1.3	4.4	2.2
Norway	25.6	4.2	35.2	14.2	-	46.4	25.2	3.0	28.6	20.8	-	47.5	–1.6
Portugal	24.6	15.5	63.2	8.3	-	13.0	24.9	12.8	64.3	9.1	-	13.8	1.1
Spain	124.9	16.7	51.9	12.2	13.0	6.2	128.2	15.0	52.3	12.8	13.0	6.9	2.6
Sweden	47.5	5.4	28.1	1.5	31.5	33.5	48.8	5.7	27.0	1.6	37.0	28.7	2.7
Switzerland	26.6	0.9	47.9	9.1	26.0	16.1	28.0	0.8	49.7	9.0	24.9	15.5	5.3
Turkey	77.1	30.4	40.3	16.4	-	12.9	71.8	28.3	40.3	18.6	-	12.8	–6.9
United Kingdom	232.6	15.5	35.7	37.6	9.5	1.7	233.6	16.9	34.3	37.3	10.1	1.5	0.4
IEA Europe	**1654.8**	**15.9**	**39.9**	**22.6**	**14.5**	**7.1**	**1675.2**	**15.5**	**39.7**	**23.1**	**14.7**	**7.0**	**1.2**
IEA Total	**5052.6**	**20.2**	**40.5**	**21.8**	**11.5**	**6.1**	**5045.8**	**20.6**	**40.3**	**21.4**	**11.7**	**6.0**	**–0.1**

1. Preliminary data.
2. Includes hydro, geothermal, combustible renewables, wastes, solar, wind, tide, wave, ambient heat used in heat pumps, and electricity and heat trade.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Table A5 (continued)

Total Energy Demand in IEA Countries

(Mtoe and %)

	2005						2010						2005-10
	TPES	Shares of TPES					TPES	Shares of TPES					Change in TPES
	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[1] %	Mtoe	Solid Fuels %	Oil %	Natural Gas %	Nuclear %	Other[1] %	%
Canada	272.1	10.1	33.3	31.3	8.6	16.8	284.4	9.0	33.9	32.5	7.1	17.5	4.5
United States	2554.6	23.7	39.1	23.5	8.2	5.5	2761.5	23.1	39.5	24.5	7.4	5.5	8.1
North America	**2826.8**	**22.4**	**38.5**	**24.3**	**8.2**	**6.6**	**3045.8**	**21.8**	**39.0**	**25.2**	**7.4**	**6.7**	**7.7**
Australia	133.7	38.1	36.5	19.4	-	6.0	149.4	36.7	36.6	20.3	-	6.5	11.7
Japan	..	..	..	..	..	..	537.6	14.7	43.9	12.4	23.3	5.7	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	17.8	8.5	40.1	17.5	-	33.9	19.2	8.4	42.0	15.5	-	34.1	7.7
Pacific	..	..	..	..	..	..	..	..	..	..	..	..	..
Austria	30.76	6.8	36.2	32.3	-	24.6	32.8	5.6	34.2	34.9	-	25.3	6.7
Belgium	54.36	14.2	40.1	22.8	22.6	0.3	57.3	13.4	39.3	24.7	21.4	1.1	5.4
Czech Republic	40.35	35.4	21.1	25.0	16.6	1.9	42.1	33.5	21.4	26.4	15.9	2.7	4.2
Denmark	21.283	24.6	43.4	25.2	-	6.7	21.6	24.5	43.7	24.3	-	7.5	1.3
Finland	33.319	13.9	24.4	18.1	17.0	26.5	33.2	6.5	23.7	23.8	17.1	29.0	–0.2
France	..	..	..	..	..	..	307.8	3.5	36.5	19.4	36.2	4.4	..
Germany	350.84	21.7	40.1	22.2	12.6	3.4	350.4	21.1	39.9	24.0	11.2	3.7	–0.1
Greece	36.057	26.4	56.4	12.7	-	4.6	40.5	23.6	54.1	17.4	-	4.9	12.4
Hungary	25.819	14.1	29.2	38.8	14.6	3.4	27.1	12.2	29.0	40.8	13.9	4.1	5.1
Ireland	15.464	17.5	53.3	26.5	-	2.7	16.2	15.1	51.0	30.0	-	3.8	5.0
Italy	178.69	8.1	45.1	39.2	-	7.7	182.9	10.9	33.9	43.8	-	11.4	2.3
Luxembourg	3.792	2.6	51.4	37.3	-	8.6	3.7	2.7	48.4	39.5	-	9.5	–1.9
Netherlands	77.574	10.6	35.9	48.5	-	5.0	80.3	10.1	36.2	48.2	-	5.6	3.5
Norway	..	..	..	..	..	..	..	..	..	..	..	..	..
Portugal	24.7	13.7	57.2	15.2	-	13.8	26.2	13.2	51.4	19.9	-	15.5	5.8
Spain	144.4	12.5	51.5	17.9	10.6	7.5	167.6	8.7	50.1	22.0	9.1	10.1	16.1
Sweden	52.6	4.9	33.3	1.9	33.0	26.9	52.8	4.8	30.4	1.8	33.7	29.2	0.3
Switzerland	26.8	0.4	49.0	10.2	23.5	16.9	27.2	0.4	48.3	10.5	23.2	17.6	1.3
Turkey	115.4	22.7	38.0	29.5	-	9.8	154.0	25.8	33.2	32.2	-	8.7	33.5
United Kingdom	238.3	10.6	36.4	39.9	10.4	2.7	244.1	8.7	37.9	41.0	7.8	4.6	2.4
IEA Europe	..	..	..	..	..	..	..	..	..	..	..	..	..
IEA Total	..	..	..	..	..	..	..	..	..	..	..	..	..

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. Please see Energy Balances and Key Statistical Data for details.
Source: Country submissions.

Table A6

Development of IEA Energy Self–Sufficiency by Product
(Mtoe and %)

	1973			1979			1999			2000			2001[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	549.8	600.3	109.2	572.0	580.0	101.4	586.9	608.5	103.7
Oil	905.0	630.2	69.6	975.6	581.7	59.6	967.1	489.9	50.7	975.9	494.6	50.7	969.1	494.5	51.0
Natural Gas	551.8	564.0	102.2	520.6	521.8	100.2	596.3	585.2	98.1	619.5	592.4	95.6	579.5	603.1	104.1
Total	**1897.4**	**1653.5**	**87.1**	**2072.0**	**1736.1**	**83.8**	**2490.8**	**2053.1**	**82.4**	**2550.6**	**2050.6**	**80.4**	**2517.9**	**2088.6**	**82.9**
Pacific															
Coal	89.8	66.1	73.6	89.0	70.3	79.0	173.3	159.6	92.1	184.1	169.2	91.9	192.2	180.1	93.7
Oil	297.2	20.8	7.0	322.0	23.8	7.4	407.8	28.4	7.0	411.8	37.2	9.0	401.9	38.7	9.6
Natural Gas	8.7	6.0	68.1	26.4	9.9	37.6	100.3	33.9	33.8	106.1	35.7	33.6	111.4	36.4	32.7
Total	**411.1**	**108.3**	**26.3**	**472.4**	**139.0**	**29.4**	**822.6**	**363.0**	**44.1**	**847.1**	**387.2**	**45.7**	**852.6**	**402.3**	**47.2**
IEA Europe															
Coal	342.7	303.2	88.5	352.8	296.6	84.1	249.5	147.8	59.2	262.5	141.0	53.7	260.2	140.2	53.9
Oil	742.5	22.9	3.1	733.1	118.7	16.2	669.4	330.7	49.4	660.4	334.4	50.6	664.5	324.9	48.9
Natural Gas	127.0	119.9	94.4	196.0	167.2	85.3	364.9	233.2	63.9	374.6	239.5	63.9	386.4	243.2	62.9
Total	**1284.4**	**517.6**	**40.3**	**1399.1**	**699.0**	**50.0**	**1636.1**	**1062.6**	**64.9**	**1654.8**	**1070.5**	**64.7**	**1675.2**	**1069.9**	**63.9**
IEA Total															
Coal	758.9	714.4	94.1	828.6	810.6	97.8	972.5	907.6	93.3	1018.6	890.1	87.4	1039.2	928.8	89.4
Oil	1944.7	673.8	34.7	2030.7	724.2	35.7	2044.3	848.9	41.5	2048.1	866.2	42.3	2035.5	858.0	42.2
Natural Gas	687.5	689.9	100.3	743.0	698.9	94.1	1061.5	852.3	80.3	1100.2	867.6	78.9	1077.4	882.7	81.9
Tota	**3593.0**	**2279.4**	**63.4**	**3943.5**	**2574.1**	**65.3**	**4949.5**	**3478.7**	**70.3**	**5052.6**	**3508.3**	**69.4**	**5045.8**	**3560.8**	**70.6**

1. Preliminary data.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Table A7

Indigenous Production/Primary Energy Supply in IEA Countries, 2000

	Total Energy[1]	Coal[1]	Oil[1]	Gas[1]	Electricity[2]
Canada	1.494	1.221	1.459	1.987	1.063
United States	0.729	1.002	0.412	0.815	0.992
North America	**0.804**	**1.014**	**0.507**	**0.956**	**1.001**
Australia	2.111	3.442	0.928	1.477	1.000
Japan	0.201	0.018	0.003	0.033	1.000
Korea	0.174	0.049	0.006	-	1.000
New Zealand	0.825	2.146	0.304	1.000	1.000
Pacific	**0.457**	**0.919**	**0.090**	**0.336**	**1.000**
Austria	0.339	0.082	0.087	0.235	1.023
Belgium	0.227	0.025	-	0.000	0.950
Czech Republic	0.740	1.161	0.048	0.023	1.159
Denmark	1.432	-	2.090	1.666	0.982
Finland	0.457	0.239	0.006	-	0.855
France	0.511	0.166	0.021	0.043	1.149
Germany	0.395	0.734	0.030	0.220	0.995
Greece	0.359	0.910	0.016	0.025	1.000
Hungary	0.447	0.730	0.245	0.257	0.910
Ireland	0.150	0.369	-	0.279	0.996
Italy	0.157	0.000	0.053	0.235	0.859
Luxembourg	0.015	-	-	-	0.070
Netherlands	0.755	-	0.085	1.495	0.826
Norway	8.783	0.394	18.312	12.615	1.155
Portugal	0.127	-	-	-	0.979
Spain	0.255	0.381	0.004	0.010	0.980
Sweden	0.646	0.091	-	-	0.968
Switzerland	0.443	-	-	-	1.120
Turkey	0.340	0.567	0.088	0.042	0.974
United Kingdom	1.172	0.517	1.583	1.116	0.963
IEA Europe	**0.647**	**0.537**	**0.506**	**0.639**	**0.996**
IEA Total	**0.694**	**0.874**	**0.423**	**0.789**	**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, 2002.

Table A8

Recent Energy and Oil Supply Trends for IEA Countries

(Mtoe and %)

	TPES					Oil Supply					Net Oil Imports[1]				
	1999	2000	% Chg.	2001[2]	% Chg.	1999	2000	% Chg.	2001[2]	% Chg.	1999	2000	% Chg.	2001[2]	% Chg.
Canada	243,0	251.0	3.3	245.5	–2.2	86.5	88.0	1.8	85.7	–2.6	–36.2	–39.1	8.0	–39.4	0.7
United States	2247.8	2299.7	2.3	2272.4	–1.2	880.6	887.8	0.8	883.4	–0.5	520.9	551.1	5.8	562.4	2.1
North America	**2490.8**	**2550.6**	**2.4**	**2517.9**	**–1.3**	**967.1**	**975.9**	**0.9**	**969.1**	**–0.7**	**484.8**	**512.0**	**5.6**	**523.0**	**2.2**
Australia	107.7	110.2	2.3	110.7	0.5	35.6	36.5	2.6	34.6	–5.3	10.9	3.5	–67.9	–0.2	–105.0
Japan	515.6	524.7	1.8	526.0	0.3	266.4	265.2	–0.5	259.5	–2.1	268.1	270.3	0.8	263.5	–2.5
Korea	181.2	193.6	6.8	196.9	1.7	99.7	103.8	4.1	101.6	–2.1	105.6	109.9	4.1	106.9	–2.8
New Zealand	18.1	18.6	2.9	19.0	1.9	6.0	6.3	4.7	6.2	–1.7	4.5	4.5	–0.1	4.5	–0.3
Pacific	**822.6**	**847.1**	**3.0**	**852.6**	**0.6**	**407.8**	**411.8**	**1.0**	**401.9**	**–2.4**	**389.1**	**388.3**	**–0.2**	**374.6**	**–3.5**
Austria	28.6	28.6	0.0	29.3	2.7	11.9	11.8	–1.0	12.2	3.3	11.0	10.6	–3.3	10.9	3.2
Belgium	58.6	59.2	1.1	58.7	–0.8	24.2	23.8	–1.7	24.1	1.3	27.6	29.2	5.9	29.8	2.1
Czech Republic	38.2	40.4	5.6	42.1	4.3	8.3	7.9	–4.5	8.4	5.8	7.9	7.5	–4.0	8.2	8.3
Denmark	20.0	19.5	–2.6	19.9	2.2	9.0	8.7	–3.4	9.0	2.7	–5.1	–8.5	67.8	–7.2	–15.1
Finland	33.4	33.1	–0.6	34.0	2.5	10.4	9.8	–6.3	9.7	–0.3	10.5	10.8	3.0	10.2	–5.3
France	255.2	257.1	0.8	260.9	1.5	90.1	87.2	–3.2	89.7	2.8	89.9	90.0	0.1	89.6	–0.4
Germany	341.0	339.6	–0.4	346.8	2.1	135.1	131.6	–2.6	134.7	2.4	129.4	127.4	–1.6	132.9	4.4
Greece	26.6	27.8	4.5	28.4	2.1	15.3	15.6	1.8	15.7	0.2	17.6	19.3	9.6	19.1	–0.8
Hungary	25.2	24.8	–1.6	25.8	4.0	7.0	6.9	–1.9	6.9	0.1	5.3	5.3	0.3	4.8	–9.2
Ireland	13.9	14.6	4.9	15.2	3.6	8.2	8.3	1.0	8.4	1.9	8.4	8.3	–2.0	8.7	5.4
Italy	169.0	171.6	1.5	172.3	0.4	89.4	88.2	–1.4	87.5	–0.8	86.8	87.9	1.2	85.3	–2.9
Luxembourg	3.5	3.7	5.5	3.9	6.1	2.2	2.3	6.3	2.5	6.3	2.2	2.4	11.0	2.5	2.8
Netherlands	74.6	75.8	1.7	77.5	2.2	28.1	28.6	1.5	29.5	3.4	36.8	41.9	13.8	41.9	0.1
Norway	26.6	25.6	–3.8	25.2	–1.6	9.0	9.0	0.0	7.2	–20.0	–143.4	–155.0	8.1	–160.1	3.3
Portugal	24.3	24.6	1.1	24.9	1.1	16.0	15.6	–2.9	16.0	2.9	16.9	16.1	–5.0	16.5	2.4
Spain	118.5	124.9	5.4	128.2	2.6	63.8	64.9	1.7	67.1	3.5	69.8	71.6	2.6	73.3	2.4
Sweden	50.5	47.5	–5.9	48.8	2.7	14.3	13.4	–6.4	13.1	–1.5	14.8	14.6	–1.3	14.6	–0.1
Switzerland	26.7	26.6	–0.3	28.0	5.3	13.2	12.7	–3.7	13.9	9.5	12.6	12.3	–3.0	13.8	12.4
Turkey	70.5	77.1	9.3	71.8	–6.9	29.4	31.1	5.6	28.9	–7.0	26.4	29.4	11.4	26.8	–9.0
United Kingdom	231.2	232.6	0.6	233.6	0.4	84.3	83.2	–1.3	80.0	–3.8	–56.8	–47.2	–16.8	–39.9	–15.5
IEA Europe	**1636.1**	**1654.8**	**1.1**	**1675.2**	**1.2**	**669.4**	**660.4**	**–1.3**	**664.5**	**0.6**	**368.5**	**373.7**	**1.4**	**381.7**	**2.1**
IEA Total	**4949.5**	**5052.6**	**2.1**	**5045.8**	**–0.1**	**2044.3**	**2048.1**	**0.2**	**2035.5**	**–0.6**	**1242.4**	**1273.9**	**2.5**	**1279.4**	**0.4**

1. Imports minus exports.
2. Preliminary data.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Table A9

Share of Oil Use by Sector in IEA Countries
(%)

	TFC				Industry[1]				Residential/Commercial[2]				Transport			
	1973	**1979**	**1999**	**2000**	**1973**	**1979**	**1999**	**2000**	**1973**	**1979**	**1999**	**2000**	**1973**	**1979**	**1999**	**2000**
Canada	58.3	53.3	43.4	42.7	40.4	37.3	29.5	28.4	47.4	35.4	18.5	19.3	98.9	95.2	89.4	90.4
United States	56.3	57.7	54.5	54.1	39.7	48.3	38.5	37.5	32.6	25.0	12.9	13.1	95.9	96.9	97.1	97.1
North America	**56.5**	**57.2**	**53.3**	**52.8**	**39.8**	**47.0**	**37.2**	**36.1**	**34.0**	**26.1**	**13.5**	**13.8**	**96.1**	**96.7**	**96.5**	**96.6**
Australia	61.7	59.7	51.5	51.7	43.8	40.6	26.4	26.7	39.7	26.7	13.0	12.7	99.4	99.6	98.0	98.0
Japan	73.2	70.3	63.0	61.9	67.7	62.2	55.0	52.9	68.5	63.6	42.4	42.2	96.9	97.6	98.0	98.0
Korea	56.4	62.0	69.3	66.6	84.4	77.7	65.7	63.4	13.7	25.1	52.8	46.3	99.1	99.4	99.5	99.4
New Zealand	60.6	55.1	42.8	42.3	43.9	35.0	9.3	9.5	32.8	22.8	13.7	12.5	99.9	99.9	99.2	99.2
Pacific	**70.4**	**67.8**	**62.4**	**61.2**	**65.6**	**60.5**	**53.2**	**51.4**	**58.1**	**53.2**	**41.6**	**39.8**	**97.6**	**98.2**	**98.3**	**98.3**
Austria	60.4	54.8	45.4	44.6	52.3	41.0	26.8	25.7	47.8	43.6	26.6	24.5	93.4	95.0	93.0	92.5
Belgium	60.7	56.9	53.3	52.0	46.8	38.6	36.5	36.9	64.2	58.3	42.1	39.0	98.4	98.6	98.8	98.7
Czech Republic	24.4	24.8	31.1	29.9	27.3	26.0	27.1	24.0	5.4	8.8	1.6	2.1	88.0	88.6	95.2	94.6
Denmark	87.7	80.2	49.8	49.4	83.3	70.5	32.8	32.4	84.9	76.2	23.8	22.2	99.7	99.7	99.4	99.4
Finland	59.2	54.8	34.7	33.7	66.2	54.3	16.8	15.0	42.3	41.1	25.8	25.6	99.3	99.5	98.6	98.6
France	72.0	66.8	52.7	52.2	63.4	59.2	38.3	38.1	68.0	56.1	28.8	26.4	97.7	98.1	97.7	97.6
Germany	56.0	53.2	51.4	50.2	44.3	39.5	36.4	34.5	53.6	47.8	30.9	30.0	93.5	97.1	98.0	98.0
Greece	77.6	77.4	70.3	69.0	68.7	69.4	49.8	49.4	68.6	61.6	51.0	51.1	99.2	99.7	99.8	99.7
Hungary	38.8	41.7	31.5	31.9	29.6	32.7	29.4	31.3	34.9	35.4	8.4	8.4	81.2	90.6	97.3	97.3
Ireland	71.2	64.3	64.3	63.7	86.6	73.8	40.2	39.5	37.7	30.5	47.2	45.8	100.0	100.0	99.9	99.9
Italy	73.0	65.1	50.6	49.6	62.3	52.1	32.5	30.4	73.5	58.5	23.8	22.8	97.1	97.3	97.6	97.5
Luxembourg	52.1	43.8	64.0	64.6	38.6	19.9	10.6	9.0	78.4	67.8	47.5	46.1	99.0	99.2	99.5	99.6
Netherlands	50.5	42.6	39.9	40.5	48.8	46.7	35.4	39.1	34.2	16.8	7.1	5.4	99.0	99.0	99.0	99.0
Norway	55.9	52.6	42.0	39.3	43.2	43.3	29.2	27.2	50.6	37.3	18.5	16.2	98.3	98.3	96.9	96.5
Portugal	75.1	73.7	68.6	67.1	66.9	66.9	64.3	60.2	59.7	52.9	34.9	34.4	98.0	99.0	99.5	99.5
Spain	75.6	78.6	64.2	62.6	64.7	70.0	45.4	43.0	68.2	64.4	36.0	36.7	98.8	99.1	99.0	98.9
Sweden	70.4	62.8	40.8	40.3	53.4	48.1	26.2	23.4	78.7	62.6	21.8	23.1	96.8	96.9	96.8	96.8
Switzerland	81.4	75.3	62.6	61.6	77.4	64.0	39.0	35.5	76.3	70.7	49.8	48.7	95.9	95.8	96.8	96.8
Turkey	48.5	49.5	49.7	47.5	60.5	56.6	41.1	36.2	28.1	23.8	29.7	29.4	88.1	96.3	99.4	99.2
United Kingdom	52.3	48.5	46.5	45.6	51.8	45.6	37.3	36.2	24.7	21.6	9.1	8.4	99.1	99.1	98.6	98.6
IEA Europe	**60.7**	**56.7**	**50.4**	**49.5**	**52.6**	**47.6**	**36.2**	**34.9**	**52.3**	**44.2**	**25.2**	**24.1**	**96.5**	**97.8**	**98.1**	**98.0**
IEA Total	**59.6**	**58.3**	**53.8**	**53.0**	**49.1**	**49.3**	**40.2**	**38.9**	**43.3**	**36.1**	**22.2**	**21.5**	**96.4**	**97.2**	**97.2**	**97.2**

1. Includes non-energy use.
2. Includes public and agricultural use.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris. 2002.

Table A10

Historical and Projected Oil Production in IEA Countries

(Mtoe)

	1973	1979	2000	2001[1]	2005	2010	2020
Canada	96.3	86.6	128.5	128.7	163.1	170.9	193.5
United States	533.8	495.1	366.1	365.7	352.2	349.7	394.2
North America	**630.2**	**581.7**	**494.6**	**494.5**	**515.4**	**520.6**	**587.8**
Australia	19.8	22.7	33.9	35.6	30.3	31.9	34.0
Japan	0.8	0.6	0.7	0.7	..	0.7	..
Korea	–	–	0.7	0.6	..	..	..
New Zealand	0.2	0.4	1.9	1.8	2.1	2.1	2.2
Pacific	**20.8**	**23.8**	**37.2**	**38.7**	**..**	**34.7**	**..**
Austria	2.7	1.8	1.0	1.0	0.7	0.6	..
Belgium	–	–	–	–	–	–	..
Czech Republic	0.0	0.3	0.4	0.4	0.4	0.4	0.4
Denmark	0.1	0.4	18.3	17.6	16.2	8.0	..
Finland	–	–	0.1	0.1	–	–	–
France	2.1	2.0	1.8	1.7	..	–	–
Germany	6.8	4.9	3.9	4.0	2.0	1.6	..
Greece	–	–	0.3	0.2	0.3	0.3	..
Hungary	2.0	2.4	1.7	1.7	1.2	0.9	0.7
Ireland	–	–	–	–	–	–	..
Italy	1.1	1.8	4.7	4.0	7.0	10.0	10.0
Luxembourg	–	–	–	–	–	–	..
Netherlands	1.6	1.6	2.4	2.3	1.1	0.8	0.8
Norway	1.6	19.3	165.2	165.8	..	..	..
Portugal	–	–	–	–	–	–	..
Spain	0.7	1.4	0.2	0.3	..	..	..
Sweden	–	0.0	–	–	–	–	..
Switzerland	–	–	–	–	–	–	–
Turkey	3.6	2.9	2.7	2.5	1.8	1.1	0.5
United Kingdom	0.5	79.9	131.7	123.2	..	..	..
IEA Europe	**22.9**	**118.7**	**334.4**	**324.9**	**..**	**..**	**..**
IEA Total	**673.8**	**724.2**	**866.2**	**858.0**	**..**	**..**	**..**

1. Preliminary data.

Note: The IEA Secretariat has estimated forecast data for certain countries. Please see Energy Balances and Key Statistical Data for details.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, for 1973, 1979 and 2000; and country submissions for 2005, 2010 and 2020.

Table A11

Historical and Projected Net Oil Imports of IEA Countries[1]

(Mtoe)

	1979	1999	2000	2001[2]	2005	2010	2020
Canada	7.8	–36.2	–39.1	–39.4	–71.9	–73.9	–83.9
United States	423.7	520.9	551.1	562.4	672.0	767.0	890.5
North America	**431.5**	**484.8**	**512.0**	**523.0**	**600.2**	**693.1**	**806.6**
Australia	10.8	10.9	3.5	–0.2	19.5	23.8	36.4
Japan	277.0	268.1	270.3	263.5	..	240.5	..
Korea	27.0	105.6	109.9	106.9	..	..	..
New Zealand	4.2	4.5	4.5	4.5	5.3	6.3	7.8
Pacific	**318.9**	**389.1**	**388.3**	**374.6**	**..**	**..**	**..**
Austria	11.4	11.0	10.6	10.9	10.5	10.7	..
Belgium	29.4	27.6	29.2	29.8	25.8	26.5	..
Czech Republic	11.2	7.9	7.5	8.2	8.1	8.6	9.0
Denmark	15.8	–5.1	–8.5	–7.2	–5.6	2.8	..
Finland	15.3	10.5	10.8	10.2	8.1	7.9	7.6
France	120.7	89.9	90.0	89.6	..	115.0	129.5
Germany	162.7	129.4	127.4	132.9	140.6	140.2	..
Greece	13.3	17.6	19.3	19.1	23.6	25.2	..
Hungary	9.8	5.3	5.3	4.8	6.3	7.0	8.3
Ireland	6.4	8.4	8.3	8.7	8.3	8.3	..
Italy	102.6	86.8	87.9	85.3	76.0	54.5	52.0
Luxembourg	1.4	2.2	2.4	2.5	2.0	1.8	..
Netherlands	41.4	36.8	41.9	41.9	40.4	49.4	49.7
Norway	–9.7	–143.4	–155.0	–160.1	..	..	..
Portugal	9.2	16.9	16.1	16.5	15.2	14.8	..
Spain	49.6	69.8	71.6	73.3	..	..	..
Sweden	28.4	14.8	14.6	14.6	18.7	17.5	..
Switzerland	13.8	12.6	12.3	13.8	13.1	13.1	13.0
Turkey	11.8	26.4	29.4	26.8	42.0	50.1	71.4
United Kingdom	19.2	–56.8	–47.2	–39.9	..	..	..
IEA Europe	**663.8**	**368.5**	**373.7**	**381.7**	**..**	**..**	**..**
IEA Total	**1414.2**	**1242.4**	**1273.9**	**1279.4**	**..**	**..**	**..**

1. Includes requirements for marine bunkers.
2. Preliminary data.

Note: The IEA Secretariat has estimated data for certain countries. Please see Energy Balances and Key Statistical Data for details.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, for 1979, 1999 and 2000, and country submissions for 2005, 2010 and 2020.

Table A12

Total IEA Electricity Generation by Fuel

(TWh and %)

	1973		1979		2000		2001[1]		2005[2]		2010[3]	
	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %
Coal	1606.5	37.2	2019.6	37.8	3576.2	38.7	3545.9	38.3	3293.2	41.5	3657.7	34.7
Oil	1105.7	25.6	1052.3	19.7	502.4	5.4	490.1	5.3	223.0	2.8	287.5	2.7
Natural Gas	512.9	11.9	598.5	11.2	1472.1	15.9	1549.8	16.8	1701.8	21.4	2651.6	25.2
Comb. Renewables & Wastes	6.9	0.2	11.7	0.2	144.5	1.6	149.7	1.6	184.9	2.3	273.6	2.6
Nuclear	188.3	4.4	573.4	10.7	2221.6	24.0	2264.8	24.5	1416.5	17.8	2249.5	21.3
Hydro	891.2	20.6	1073.7	20.1	1269.1	13.7	1182.6	12.8	1032.7	13.0	1272.8	12.1
Geothermal	6.4	0.1	8.6	0.2	25.7	0.3	25.6	0.3	25.9	0.3	44.0	0.4
Solar/Wind	0.6	0.0	0.5	0.0	32.0	0.3	38.6	0.4	64.3	0.8	105.0	1.0
Total	**4318.4**	**100.0**	**5338.4**	**100.0**	**9243.6**	**100.0**	**9247.0**	**100.0**	**7942.2**	**100.0**	**10541.7**	**100.0**

1. Preliminary data.
2. Excluding Japan, Korea and Norway.
3. Excluding France, Korea and Norway.

Note: The IEA Secretariat has estimated forecast data for certain countries. Please see Energy Balances and Key Statistical Data for details.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002 for 1973, 1979 and 2000; and country submissions for 2005 and 2010.

Table A13

Electricity Generation in IEA Countries, 2000

	Energy Inputs[1] (Mtoe)	Output in TWh	Shares of Fuel in Electricity Generation (%)					
			Coal	Oil	Gas	Nuclear	Hydro	Other[2]
Canada	86.1	605.1	19.5	2.5	5.5	12.0	59.2	1.3
United States	993.6	4003.5	52.7	3.1	15.7	20.0	6.2	2.2
North America	**1079.6**	**4608.6**	**48.3**	**3.0**	**14.4**	**18.9**	**13.2**	**2.1**
Australia	47.1	208.1	77.2	1.3	12.6	–	8.1	0.9
Japan	219.4	1081.9	23.5	14.7	22.1	29.8	8.1	1.8
Korea	68.6	292.5	43.2	8.4	9.6	37.3	1.4	0.2
New Zealand	7.1	39.0	2.6	–	23.8	–	63.1	10.5
Pacific	**342.2**	**1621.5**	**33.4**	**11.5**	**18.7**	**26.6**	**8.2**	**1.6**
Austria	8.1	60.3	11.1	3.3	13.0	–	69.6	3.0
Belgium	20.1	82.7	19.4	1.0	19.3	58.3	0.6	1.5
Czech Republic	20.4	72.9	73.1	0.5	4.3	18.6	2.4	1.0
Denmark	8.5	36.2	46.0	12.2	24.3	–	0.1	17.4
Finland	14.8	70.0	18.9	0.9	14.4	32.1	20.9	12.8
France	126.2	535.8	5.8	1.4	2.1	77.5	12.5	0.7
Germany	132.4	567.1	52.7	0.8	9.3	29.9	3.8	3.4
Greece	11.9	53.4	64.2	16.6	11.1	–	6.9	1.2
Hungary	10.0	35.0	27.7	12.6	18.9	40.0	0.5	0
Ireland	5.0	23.7	36.3	19.6	39.1	–	3.6	1.4
Italy	52.1	269.9	11.3	31.8	37.5	–	16.4	3.0
Luxembourg	0.1	0.4	..	..	53.1	–	27.7	19.2
Netherlands	19.0	89.6	28.4	3.5	57.7	4.4	0.2	5.9
Norway	12.4	142.4	0.1	0.0	0.1	–	99.5	0.3
Portugal	7.6	43.4	33.9	19.4	16.5	–	26.1	4.2
Spain	45.6	221.7	36.5	10.2	9.1	28.1	12.8	3.4
Sweden	26.1	145.9	2.1	1.2	0.3	39.3	54.1	3.0
Switzerland	11.1	66.0	–	0.1	1.5	40.1	55.8	2.5
Turkey	24.5	124.9	30.6	8.4	36.1	–	24.7	0.3
United Kingdom	77.6	372.2	33.4	1.5	39.4	22.9	1.4	1.4
IEA Europe	**633.7**	**3013.5**	**26.7**	**5.9**	**16.8**	**30.5**	**17.6**	**2.6**
IEA Total	**2055.5**	**9243.6**	**38.7**	**5.4**	**15.9**	**24.0**	**13.7**	**2.2**

1. Includes CHP units.
2. Includes combustible renewables, wastes, geothermal, solar, wind, tide and wave.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Table A14

Electricity Intensity of IEA Countries[1]

	1973	1979	1998	1999	2000	Average Annual Growth Rates (%) 1989-94	1995-2000
Canada	0.80	0.82	0.83	0.81	0.81	–0.3	–2.1
United States	0.49	0.50	0.46	0.45	0.45	–0.0	–1.7
North America	**0.52**	**0.52**	**0.49**	**0.48**	**0.47**	**–0.1**	**–1.8**
Australia	0.33	0.40	0.46	0.46	0.46	0.23	–0.2
Japan	0.18	0.18	0.19	0.19	0.19	1.61	0.54
Korea	0.16	0.23	0.46	0.46	0.47	6.05	2.88
New Zealand	0.43	0.51	0.59	0.56	0.57	–0.2	–0.5
Pacific	**0.19**	**0.20**	**0.23**	**0.23**	**0.24**	**2.11**	**1.23**
Austria	0.21	0.22	0.22	0.22	0.22	–0.9	–0.3
Belgium	0.23	0.25	0.28	0.28	0.27	1.70	–0.5
Czech Republic	0.96	1.05	1.17	1.15	1.15	0.90	–0.3
Denmark	0.15	0.18	0.19	0.18	0.18	0.16	–2.1
Finland	0.37	0.43	0.53	0.51	0.49	4.33	–2.1
France	0.19	0.22	0.27	0.27	0.27	1.35	–0.4
Germany	0.25	0.26	0.22	0.21	0.21	–3.0	–0.6
Greece	0.18	0.22	0.37	0.37	0.38	2.48	1.41
Hungary	0.66	0.70	0.76	0.75	0.71	0.51	–2.8
Ireland	0.27	0.30	0.24	0.23	0.22	0.05	–3.4
Italy	0.22	0.23	0.26	0.26	0.26	0.94	0.82
Luxembourg	0.42	0.43	0.27	0.26	0.25	–2.4	–3.8
Netherlands	0.20	0.22	0.22	0.22	0.22	0.60	–0.4
Norway	0.97	0.92	0.73	0.72	0.72	–1.8	–1.7
Portugal	0.17	0.23	0.32	0.34	0.34	2.15	1.52
Spain	0.21	0.26	0.30	0.31	0.32	0.72	1.98
Sweden	0.47	0.52	0.56	0.54	0.53	–0.7	–2.1
Switzerland	0.14	0.16	0.17	0.18	0.18	0.39	–0.4
Turkey	0.18	0.26	0.57	0.62	0.63	4.38	4.36
United Kingdom	0.38	0.37	0.30	0.30	0.30	–0.4	–0.9
IEA Europe	**0.26**	**0.28**	**0.29**	**0.29**	**0.28**	**–0.2**	**–0.1**
IEA Total	**0.33**	**0.34**	**0.34**	**0.34**	**0.34**	**0.20**	**–0.5**

1. Calculated as production plus net imports divided by GDP and measured in kWh per dollar of GDP at 1995 prices and exchange rates; includes CHP units.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris 2002, *National Accounts, Volume 1*, OECD Paris, 2001, and *Main Economic Indicators*, OECD Paris, May 2002.

Table A15

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	17.78	8.17	6.00	10.62	67.41	1.33	111.31	17.90	6.20	23.43	12.07	69.58	2.66	131.84
United States[1]	313.62	41.65	249.74	98.83	98.13	16.68	818.64	312.62	39.17	296.42	97.70	100.39	22.80	869.10
North America	**331.40**	**49.82**	**255.75**	**109.45**	**165.53**	**18.00**	**929.94**	**330.52**	**45.38**	**319.85**	**109.77**	**169.97**	**25.47**	**1000.94**
Australia	27.73	2.27	6.10	0	7.67	0.45	44.22	29.54	2.27	8.98	0	7.69	1.24	49.71
Japan[2, 3]	38.15	67.34	59.22	45.25	46.32	2.55	258.84	45.59e	65.64e	62.66e	46.07e	48.34e	2.71e	271.01e
Korea	14.44e	9.92e	11.94e	13.72e	3.15e	0.52e	53.69e	19.04e	9.92e	13.37e	17.72e	5.53e	0.52e	66.1e
New Zealand	0.45	0	2.16	0	5.19	0.71	8.51	0.45	0	3.23	0	5.43	0.78	9.88
Pacific	**80.77e**	**79.53e**	**79.42e**	**58.96e**	**62.34e**	**4.24e**	**365.26e**	**94.62e**	**77.82e**	**88.24e**	**63.79e**	**66.99e**	**5.25e**	**396.7e**
Austria	1.90	0.32	3.59	0	11.65	0.38	17.84	1.54e	0.32e	3.89e	0	11.75e	0.87e	18.37e
Belgium	2.08	1.35	4.94	5.71	1.41	0.19	15.68	1.21e	0.69e	4.48e	5.71e	1.40e	0.16e	13.65e
Czech Republic	10.43e	0.07e	0.81e	1.76e	2.10e	0.15e	15.32e	8.72e	0.22e	0.96e	3.72e	2.01e	0.17e	15.81e
Denmark	5.38	1.82	2.67	0	0.01	2.78	12.65	3.47	1.51	2.33	0	0.01	4.21	11.53
Finland	5.11	1.40	2.69	2.64	2.88	1.44	16.17	5.11	1.40	2.69	2.64	3.09	2.08	17.02
France	12.50e	12.23	1.60	63.18	25.36	0.76	115.63	11.92e	11.65	2.09	63.18	25.09	1.03	114.96
Germany	48.78	8.13	21.94	22.40	8.98	8.12	118.35	58.05	7.76	23.22	22.40	10.44	4.86	126.72
Greece	4.53	1.97	1.13	0	3.07	0.26	10.96	4.75	2.35	2.80	0	3.22	0.82	13.94
Hungary	1.84	0.58	3.96	1.85	0.05	0.02	8.31	1.08	0.73	3.97	1.89	0.05	0.05	7.77
Ireland[2]	1.26	0.84	1.95	0	0.53	0.13	4.71	1.76	0.84	2.97	0	0.54	0.65	6.76
Italy	6.68	21.11	25.55	0	20.35	1.80	75.50	10.30	16.30	33.80	0	23.10	3.50	87.00
Luxembourg	0	0	0.07	0	1.14	0.02	1.23	0	0	0.40	0	1.14	0.03	1.57
Netherlands	3.28	0.81	15.43	0.45	0.04	1.05	21.06	3.28	1.25	15.98	0	0.09	2.93	23.53
Norway	0.08	0.01	0.04	0	28.35	0.16	28.63	0.08e	0.01e	0.04e	0	28.43e	0.16e	28.72e
Portugal	1.78	2.85	1.35	0	4.53	0.40	10.90	1.78	2.64	2.38	0	4.94	0.86	12.60
Spain	11.45	8.73	4.82	7.50	17.99	2.39	52.88	11.45e	8.83e	9.61e	7.50e	17.99e	7.37e	62.74e
Sweden	1.00	4.03	0.35	9.46	16.37	1.56	32.78	0.97	3.05	0.27	9.46	16.30	1.56	31.61
Switzerland	0	0.23	0.20	3.16	13.23	0.46	17.28	0	0.55e	0.20e	3.16e	13.30	0.51e	17.72e
Turkey	6.99	2.00	7.04	0	11.18	0.06	27.26	10.14	2.36	13.66	0	13.90	0.06	40.12
United Kingdom	33.43	5.72	21.85	12.49	4.27	1.34	79.09	59.41e	3.00	51.5e	25.00e	8.27e	4.04e	151.21e
IEA Europe	**158.51e**	**74.19e**	**121.98e**	**130.60e**	**173.47e**	**23.48e**	**682.22e**	**195.02e**	**65.46e**	**177.25e**	**144.67e**	**185.04e**	**35.9e**	**803.34e**
IEA Total	**570.68e**	**203.53e**	**457.15e**	**299.01e**	**401.33e**	**45.71e**	**1977.42e**	**620.15e**	**188.66e**	**585.33e**	**318.23e**	**421.99e**	**66.61e**	**2200.98e**

Note: e = IEA estimates.

1. Capacity is net summer capacity. 2. Only gross capacity data are available. 3. Does not include autoproducer capacity.

Source: Country submissions.

Table A15 (continued)

Electricity Generation in IEA Countries

(GW net)

	2010							2020						
	Total Capacity							Total Capacity						
	Coal	Oil	Natural Gas	Nuclear	Hydro	Other	Total	Coal	Oil	Natural Gas	Nuclear	Hydro	Other	Total
Canada	14.64	6.45	34.00	10.50	73.13	2.75	141.47	10.04e	6.45e	64.00e	9.28e	76.03e	3.03e	168.83e
United States[1]	314.30	37.98	397.60	94.34	100.51	25.71	970.43	337.59	35.56	542.93	88.03	100.51	31.60	1136.22
North America	**328.94**	**44.43**	**431.60**	**104.84**	**173.64**	**28.46**	**1111.90**	**347.63e**	**42.01e**	**606.94e**	**97.31e**	**176.54e**	**34.63e**	**1305.05e**
Australia	32.36	2.27	9.58	0	7.70	2.31	54.23	37.11	2.96	15.78	0	8.20	2.79	66.84
Japan[2, 3]	36.00	35.90	64.50	70.00	48.34	3.85	258.60	32.69e	19.98e	64.50e	72.84e	50.56e	7.56e	248.13e
Korea	22.00e	11.07e	17.14e	27.32e	5.53e	0.60e	83.65e	25.36e	11.25e	23.03e	30.17e	7.08e	1.04e	97.93e
New Zealand	0.45	0	3.63	0	6.12	0.90	11.10	0.45	0	3.63	0	6.87	0.93	11.88
Pacific	**90.81e**	**49.24e**	**94.85e**	**97.32e**	**67.70e**	**7.66e**	**407.58e**	**95.61e**	**34.19e**	**106.94e**	**103.00e**	**72.71e**	**12.32e**	**424.78e**
Austria	1.54e	0.24e	4.67e	0	11.75e	1.14e	19.34e	1.45e	0.24e	4.67e	0	13.95e	1.91e	22.22e
Belgium	1.21e	0.25e	4.48e	5.71e	1.40e	1.12e	14.17e	1.01e	0.28e	6.73e	5.71e	1.40e	1.42e	16.54e
Czech Republic	7.55e	0.22e	0.96e	3.72e	2.01e	0.17e	14.64e	5.86e	0.36e	1.77e	3.72e	2.01e	0.36e	14.08e
Denmark	3.04	1.45	2.20	0	0.01	4.69	11.40	3.04e	1.45e	2.20e	0	0.01e	5.70e	12.41e
Finland	4.24	1.40	4.28	3.89	3.09	2.45	19.35	2.32	1.40	4.94	3.89	3.09	3.50	19.14
France	7.22e	10.27e	14.24e	63.18e	25.09e	1.25e	121.25e	7.22e	10.27e	28.50e	58.90e	25.09e	1.58e	131.56e
Germany	58.65	6.86	24.14	20.18	10.64	5.94	126.41	58.65e	6.86e	29.36e	6.04e	11.08e	13.38e	125.37e
Greece	4.75	3.10	4.22	0	3.41	1.13	16.62	4.75e	3.10e	6.63e	0	3.41e	2.50e	20.40e
Hungary	1.08e	0.81e	4.24e	1.89	0.05	0.06	8.13	1.08e	1.11e	4.96e	1.89e	0.05	0.06	9.15
Ireland[2]	1.76	0.84	3.78	0	0.54	1.16	8.08	1.76	0.84	4.61	0	0.55	1.67	9.42
Italy	18.90	6.20	42.70	0	25.50	6.70	100.00	21.00	5.20	52.40	0	25.50	13.90	118.00
Luxembourg	0	0	0.45e	0	1.14e	0.04e	1.64e	0	0	0.45e	0	1.14e	0.09e	1.68e
Netherlands	3.28	1.25	15.96	0	0.14	5.40	26.03	3.99	1.23	18.22	0	0.14	5.40	28.98
Norway	0.08e	0.01e	0.34e	0	28.53e	0.17e	29.13e	0.08e	0.01e	0.64e	0	28.63e	0.36e	29.72e
Portugal	1.78	2.42	3.09	0	5.31	3.52	16.12	1.20	1.03	8.79	0	5.78	4.42	21.23
Spain	11.41	8.83	18.19	7.50	18.80	12.03	76.75	9.94e	6.59e	18.04e	7.50e	18.80e	16.55e	77.43e
Sweden	0.97	3.05	0.27	8.86	16.20	2.16	31.51	0.94e	2.41e	0.59e	8.86e	16.20e	2.83e	31.83e
Switzerland	0	0.55e	0.20e	31.60e	13.30e	0.54e	17.75e	0	0.55e	0.20e	2.80e	13.30e	0.54e	17.39e
Turkey	15.18	1.85	20.66	0	18.82	2.14	58.65	33.02	1.85	39.26	4.00	33.07	5.04	116.24
United Kingdom	52.58e	1.00e	61.50e	23.00e	8.27e	8.86e	155.21e	44.81e	0	78.50e	17.00e	8.27e	9.63e	158.21e
IEA Europe	**195.23e**	**50.6e**	**230.57e**	**141.10e**	**194.00e**	**60.67e**	**872.16e**	**202.13e**	**44.78e**	**311.46e**	**120.31e**	**211.46e**	**90.85e**	**980.98e**
IEA Total	**614.98e**	**144.27e**	**757.02e**	**343.25e**	**435.33e**	**96.79e**	**2391.64e**	**645.37e**	**120.98e**	**1025.34e**	**320.62e**	**460.70e**	**137.80e**	**2710.80e**

Note: e = IEA estimates.
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, 2000–2001

	Total Energy		Oil Products		Electricity		Gas		Coal	
	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial
Canada	17.4	14.8	–6.1	–2.8	..	..	..	..	..	..
United States	6.0	–0.4	–12.5	–6.0	5.5	0.2	11.6	20.4	1.1	..
Australia	–3.0	–5.2	..	–5.5	..	..	..	..	..	..
Japan	2.3	2.1	5.6	2.8	..	..	..	..	1.0	..
Korea	1.8	–1.8	3.6	–1.2	3.4	–6.2	..	..	–1.5	..
New Zealand	–4.0	–4.0	–0.8	–4.6	–3.2	–2.7	–4.8	–3.2	..	..
Austria	–1.6	–4.3	–2.1	–8.3	..	..	..	6.1	..	3.2
Belgium	3.4	–5.7	–6.5	–7.7	..	..	..	..	18.9	–1.0
Czech Republic	0.3	–0.8	–8.4	–9.1	–5.0	3.2	1.2	2.2	2.9	–1.3
Denmark	–1.9	–1.6	–6.3	–1.2	3.5	–0.7	..	–3.0	..	4.6
Finland	1.8	–5.1	–7.1	–6.9	2.8	–0.8	0.4	39.1	10.4	..
France	3.4	–2.4	–10.9	–9.6	..	..	13.2	17.2	7.6	..
Germany	–2.6	–4.9	–5.6	–6.1	..	..	..	..	..	..
Greece	–5.6	–4.4	–6.8	–4.5	..	..	..	..	..	..
Hungary	13.7	–2.0	–5.0	–11.2	1.9	–2.4	23.5	2.0	..	3.1
Ireland	–1.3	–4.7	–6.8	–5.6	..	..	18.8	0.2	..	..
Italy	2.3	–3.7	–8.8	–5.7	..	..	..	..	11.2	..
Luxembourg	–9.4	–8.1	–9.4	–8.4	..	–1.3	..	..	..	..
Netherlands	5.8	16.1	–5.6	–5.1	4.4	21.3	7.1	26.8	..	..
Norway	24.0	8.0	–1.2	–11.0	..	23.3	..	..	..	..
Portugal	1.9	–0.1	–0.6	0.9	0.9	–2.9	..	..	25.9	..
Spain	–1.6	–5.0	–9.0	–6.5	..	..	1.5	2.7	..	..
Sweden	–1.0	–1.3	0.1	–0.6	..	..	..	..	..	..
Switzerland	–0.3	–4.9	–8.2	–7.2	–0.4	–3.1	31.6	18.0	13.7	..
Turkey	15.8	15.9	6.8	10.1	20.5	26.0	39.1	22.2	12.0	6.1
United Kingdom	12.6	–3.3	0.2	–6.9	–8.9	–2.8	33.8	0.9	–1.3	3.1

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Table A17

Tax as a Percentage of Oil Product Prices in IEA Countries, 1998–2001

	Heavy Fuel Oil Industry				Heating Oil Residential				Diesel Transport				Premium Unleaded Gasoline (95 RON)[1] Transport			
	1998	1999	2000	2001	1998	1999	2000	2001	1998	1999	2000	2001	1998	1999	2000	2001
Canada	..	..	..	..	10.2	10.2	10.2	10.2	39.4	39.3	32.7	32.4	53.0	48.9	41.2	42.3
United States	..	..	..	..	..	..	..	..	42.0	39.1	29.7	31.8	30.6	28.2	22.6	23.1
Australia	..	..	..	..	..	..	..	..	..	..	..	..	62.9	60.9	51.2	52.8
Japan	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	57.1	57.8	55.0	53.5	59.9	59.5	55.3	54.7
Korea	..	..	9.1	9.6	..	..	24.4	26.9	..	..	38.4	41.5	..	..	..	..
New Zealand	..	..	..	..	..	..	..	..	0.9	0.9	0.6	0.6	49.4	49.9	42.5	43.0
Austria	48.0	..	..	..	44.7	42.2	33.6	35.0	55.0	54.5	44.7	46.5	67.7	67.6	60.6	62.6
Belgium	17.5	14.4	9.5	10.7	25.0	24.1	21.2	21.5	58.2	55.4	44.4	46.1	75.8	73.5	65.9	67.7
Czech Republic	..	..	..	..	32.0	30.5	27.3	29.4	49.6	49.7	40.2	41.3	63.0	62.8	55.8	57.7
Denmark	..	..	..	..	64.2	62.1	55.8	56.3	39.5	54.1	45.3	48.7	72.4	72.3	66.3	68.4
Finland	..	..	..	..	42.0	41.3	33.6	34.9	58.1	54.4	43.6	45.3	78.0	74.3	67.3	68.4
France	26.0	21.4	9.6	10.8	43.4	41.6	30.6	26.5	69.4	66.8	54.5	56.1	81.2	78.8	69.8	71.6
Germany	..	..	..	..	33.4	35.6	28.8	30.2	63.0	62.0	54.7	57.7	75.2	73.8	69.3	71.7
Greece	..	..	..	..	59.8	52.4	41.2	46.5	59.2	57.3	43.3	45.4	66.6	63.0	52.8	54.5
Hungary	..	..	..	..	..	..	..	..	68.7	65.1	57.3	58.4	69.7	66.8	60.0	61.3
Ireland	13.1	9.4	5.5	6.1	27.9	25.7	21.4	21.7	56.7	56.3	46.4	36.5	68.0	67.7	58.9	55.8
Italy	34.6	36.4	26.6	28.9	72.0	71.2	60.6	61.4	65.2	63.5	51.5	52.9	74.7	73.0	64.8	66.1
Luxembourg	..	..	..	..	13.5	13.1	12.2	12.4	57.0	53.6	42.2	44.3	65.5	63.9	55.7	57.5
Netherlands	..	..	..	..	45.3	46.0	40.7	46.3	61.1	58.3	49.0	49.6	74.9	73.3	66.4	68.8
Norway	..	..	..	..	31.5	30.0	27.8	35.4	61.0	59.2	55.4	54.2	76.0	74.7	68.7	69.2
Portugal	21.2	18.9	11.4	11.5	..	..	..	..	61.0	59.7	48.3	47.5	72.9	67.7	49.4	46.2
Spain	11.6	9.9	6.6	7.5	44.1	41.1	32.3	34.0	58.0	55.4	45.0	45.2	68.7	66.9	59.2	59.9
Sweden	..	..	..	..	64.7	62.3	53.2	56.9	53.0	49.8	43.3	44.0	75.5	73.1	67.0	67.6
Switzerland	..	..	..	..	11.1	11.4	9.6	9.5	78.4	75.6	63.2	65.9	70.1	69.0	60.3	62.1
Turkey	36.2	28.2	21.7	27.7	63.7	65.4	62.0	56.7	64.0	64.3	58.6	53.9	70.5	71.2	61.8	62.8
United Kingdom	26.9	27.9	21.7	22.4	26.9	26.3	19.2	21.1	78.6	77.5	69.9	69.9	81.5	81.5	75.5	76.1

1. Regular unleaded gasoline for Australia, Canada and Japan 1998 to 2001.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Table A18

Energy Balances and Key Statistical Data for IEA and Regions

		IEA Total 1973	IEA Total 1979	IEA Total 1999	IEA Total 2000	IEA North America 1973	IEA North America 1979	IEA North America 1999	IEA North America 2000	IEA Pacific 1973	IEA Pacific 1979	IEA Pacific 1999	IEA Pacific 2000	IEA Europe 1973	IEA Europe 1979	IEA Europe 1999	IEA Europe 2000
SUPPLY																	**Unit: Mtoe**
TOTAL PRODUCTION		**2279.4**	**2574.1**	**3478.7**	**3508.3**	**1653.5**	**1736.1**	**2053.1**	**2050.6**	**108.3**	**139.0**	**363.0**	**387.2**	**517.6**	**699.0**	**1062.6**	1070.5
Coal[1]		714.4	810.6	907.6	890.1	345.1	443.6	600.3	580.0	66.1	70.3	159.6	169.2	303.2	296.6	147.8	141.0
Oil		673.8	724.2	848.9	866.2	630.2	581.7	489.9	494.6	20.8	23.8	28.4	37.2	22.9	118.7	330.7	334.4
Gas		689.9	698.9	852.3	867.6	564.0	521.8	585.2	592.4	6.0	9.9	33.9	35.7	119.9	167.2	233.2	239.5
Comb. Renewables & Wastes[2]		70.3	91.0	162.3	167.3	45.3	59.9	86.7	88.9	3.5	4.0	13.4	14.3	21.5	27.1	62.2	64.1
Nuclear		49.2	150.0	569.6	579.0	27.3	80.3	220.3	227.4	2.5	19.2	109.4	112.3	19.3	50.6	239.9	239.2
Hydro		76.6	92.3	109.3	109.1	39.6	45.3	54.9	52.2	8.1	10.1	11.2	11.4	29.0	37.0	43.2	45.6
Geothermal		5.2	7.0	23.2	22.6	2.1	3.5	13.8	13.1	1.3	1.7	6.1	6.0	1.8	1.8	3.3	3.5
Solar/Wind/Other[3]		0.0	0.1	5.5	6.3	–	–	2.0	2.0	–	0.0	1.1	1.1	0.0	0.0	2.4	3.2
TOTAL NET IMPORTS[4]		**1333.0**	**1424.9**	**1437.0**	**1494.3**	**253.8**	**374.4**	**419.8**	**443.5**	**307.7**	**338.7**	**452.3**	**463.8**	**771.5**	**711.8**	**564.8**	**587.0**
Coal[1]	Exports	84.1	113.4	186.2	192.6	38.7	51.5	59.3	58.9	18.2	26.7	112.4	117.5	27.2	35.2	14.5	16.1
	Imports	114.4	144.7	256.7	288.1	11.2	15.5	19.4	23.6	41.8	44.4	121.8	134.7	61.4	84.9	115.5	129.8
	Net Imports	30.3	31.3	70.4	95.5	–27.5	–36.1	–39.9	–35.3	23.6	17.7	9.4	17.2	34.2	49.7	100.9	113.6
Oil	Exports	233.2	252.5	658.2	702.6	74.1	40.4	132.1	143.5	7.3	4.2	63.8	69.3	151.7	207.9	462.2	489.8
	Imports	1596.8	1666.6	1900.5	1976.6	365.3	471.9	616.9	655.4	308.1	323.1	452.9	457.6	923.4	871.7	830.7	863.5
	Bunkers	71.0	74.0	81.0	89.6	9.2	26.0	27.1	33.6	19.4	14.5	12.8	12.1	42.3	33.6	41.1	43.8
	Net Imports	1292.6	1340.1	1161.4	1184.4	281.9	405.5	457.7	478.4	281.3	304.4	376.3	376.1	729.3	630.2	327.4	329.9
Gas	Exports	50.3	82.5	171.3	188.9	24.9	24.0	81.7	88.2	–	–	8.9	9.2	25.5	58.5	80.7	91.5
	Imports	60.0	135.3	375.0	402.1	24.2	29.0	83.7	89.1	2.8	16.7	75.4	79.7	33.0	89.6	215.9	233.3
	Net Imports	9.7	52.8	203.8	213.2	–0.7	5.0	2.0	0.9	2.8	16.7	66.6	70.5	7.5	31.2	135.1	141.8
Electricity	Exports	6.7	10.3	24.6	27.5	1.6	2.9	5.1	5.5	–	–	–	–	5.0	7.4	19.5	22.0
	Imports	7.1	10.9	25.6	28.2	1.6	2.9	5.1	5.1	–	–	–	–	5.4	8.1	20.5	23.1
	Net Imports	0.4	0.6	1.0	0.7	0.0	–0.0	0.0	–0.4	–	–	–	–	0.4	0.7	1.0	1.1
TOTAL STOCK CHANGES		**–19.4**	**–55.5**	**33.8**	**49.9**	**–9.8**	**–38.5**	**18.0**	**56.5**	**–4.8**	**–5.3**	**7.2**	**–3.9**	**–4.8**	**–11.7**	**8.6**	**–2.7**
TOTAL SUPPLY (TPES)		3593.0	3943.5	4949.5	5052.6	1897.4	2072.0	2490.8	2550.6	411.1	472.4	822.6	847.1	1284.4	1399.1	1636.1	1654.8
Coal[1]		758.9	828.6	972.5	1018.6	326.3	386.8	549.8	572.0	89.8	89.0	173.3	184.1	342.7	352.8	249.5	262.5
Oil		1944.7	2030.7	2044.3	2048.1	905.0	975.6	967.1	975.9	297.2	322.0	407.8	411.8	742.5	733.1	669.4	660.4
Gas		687.5	743.0	1061.5	1100.2	551.8	520.6	596.3	619.5	8.7	26.4	100.3	106.1	127.0	196.0	364.9	374.6
Comb. Renewables & Wastes[2]		70.4	91.1	162.7	167.9	45.3	59.9	86.7	88.9	3.5	4.0	13.4	14.3	21.6	27.2	62.6	64.7
Nuclear		49.2	150.0	569.6	579.0	27.3	80.3	220.3	227.4	2.5	19.2	109.4	112.3	19.3	50.6	239.9	239.2
Hydro		76.6	92.3	109.3	109.1	39.6	45.3	54.9	52.2	8.1	10.1	11.2	11.4	29.0	37.0	43.2	45.6
Geothermal		5.2	7.0	23.2	22.6	2.1	3.5	13.8	13.1	1.3	1.7	6.1	6.0	1.8	1.8	3.3	3.5
Solar/Wind/Other[3]		0.0	0.1	5.5	6.3	–	–	2.0	2.0	–	0.0	1.1	1.1	0.0	0.0	2.4	3.2
Electricity Trade[5]		0.4	0.7	1.0	0.7	0.0	–0.0	0.0	–0.4	–	–	–	–	0.4	0.7	1.0	1.1

Table A18 (continued)

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				IEA North America				IEA Pacific				IEA Europe			
	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000
SUPPLY																**Unit: Mtoe**
Fuel Shares (%)																
Coal	*21.1*	*21.0*	*19.6*	*20.2*	*17.2*	*18.7*	*22.1*	*22.4*	*21.9*	*18.8*	*21.1*	*21.7*	*26.7*	*25.2*	*15.2*	*15.9*
Oil	*54.1*	*51.5*	*41.3*	*40.5*	*47.7*	*47.1*	*38.8*	*38.3*	*72.3*	*68.2*	*49.6*	*48.6*	*57.8*	*52.4*	*40.9*	*39.9*
Gas	*19.1*	*18.8*	*21.4*	*21.8*	*29.1*	*25.1*	*23.9*	*24.3*	*2.1*	*5.6*	*12.2*	*12.5*	*9.9*	*14.0*	*22.3*	*22.6*
Comb. Renewables & Wastes	*2.0*	*2.3*	*3.3*	*3.3*	*2.4*	*2.9*	*3.5*	*3.5*	*0.9*	*0.9*	*1.6*	*1.7*	*1.7*	*1.9*	*3.8*	*3.9*
Nuclear	*1.4*	*3.8*	*11.5*	*11.5*	*1.4*	*3.9*	*8.8*	*8.9*	*0.6*	*4.1*	*13.3*	*13.3*	*1.5*	*3.6*	*14.7*	*14.5*
Hydro	*2.1*	*2.3*	*2.2*	*2.2*	*2.1*	*2.2*	*2.2*	*2.0*	*2.0*	*2.1*	*1.4*	*1.3*	*2.3*	*2.6*	*2.6*	*2.8*
Geothermal	*0.1*	*0.2*	*0.5*	*0.4*	*0.1*	*0.2*	*0.6*	*0.5*	*0.3*	*0.4*	*0.7*	*0.7*	*0.1*	*0.1*	*0.2*	*0.2*
Solar/Wind/Other	–	–	*0.1*	*0.1*	–	–	*0.1*	*0.1*	–	–	*0.1*	*0.1*	–	–	*0.1*	*0.2*
Electricity Trade	–	–	–	–	–	–	–	–	–	–	–	–	–	–	*0.1*	*0.1*
DEMAND																**Unit: Mtoe**
FINAL CONSUMPTION BY SECTOR																
TFC	**2644.0**	**2840.5**	**3380.5**	**3446.3**	**1379.1**	**1460.6**	**1656.2**	**1691.6**	**297.8**	**332.2**	**548.2**	**561.4**	**967.0**	**1047.8**	**1176.1**	**1193.2**
Coal[1]	224.3	201.5	111.8	116.9	49.4	45.8	34.8	34.9	32.5	33.1	31.1	33.5	142.5	122.6	45.9	48.5
Oil	1575.1	1654.6	1817.3	1826.4	778.7	835.7	882.5	892.7	209.6	225.1	342.3	343.5	586.8	593.9	592.5	590.2
Gas	475.4	519.3	657.5	685.0	365.0	347.5	362.7	376.2	9.5	14.3	44.5	48.4	100.9	157.5	250.3	260.4
Comb. Renewables & Wastes[2]	47.3	61.6	77.7	79.7	23.6	33.8	23.9	24.7	3.5	3.8	7.7	8.0	20.2	23.9	46.0	47.0
Geothermal	–	–	1.4	1.4	–	–	0.5	0.5	–	–	0.6	0.6	–	–	0.3	0.3
Solar/Wind/Other	–	0.0	3.0	3.0	–	–	1.5	1.4	–	0.0	1.0	0.9	–	0.0	0.6	0.6
Electricity	314.2	389.3	662.3	685.7	162.3	196.8	329.9	340.6	42.7	55.7	118.7	123.7	109.2	136.9	213.7	221.4
Heat	7.6	14.2	49.5	48.2	0.1	1.0	20.4	20.5	0.0	0.1	2.3	2.8	7.5	13.0	26.8	24.9
Fuel Shares (%)																
Coal	*8.5*	*7.1*	*3.3*	*3.4*	*3.6*	*3.1*	*2.1*	*2.1*	*10.9*	*10.0*	*5.7*	*6.0*	*14.7*	*11.7*	*3.9*	*4.1*
Oil	*59.6*	*58.3*	*53.8*	*53.0*	*56.5*	*57.2*	*53.3*	*52.8*	*70.4*	*67.8*	*62.4*	*61.2*	*60.7*	*56.7*	*50.4*	*49.5*
Gas	*18.0*	*18.3*	*19.4*	*19.9*	*26.5*	*23.8*	*21.9*	*22.2*	*3.2*	*4.3*	*8.1*	*8.6*	*10.4*	*15.0*	*21.3*	*21.8*
Comb. Renewables & Wastes	*1.8*	*2.2*	*2.3*	*2.3*	*1.7*	*2.3*	*1.4*	*1.5*	*1.2*	*1.2*	*1.4*	*1.4*	*2.1*	*2.3*	*3.9*	*3.9*
Geothermal	–	–	–	–	–	–	–	–	–	–	*0.1*	*0.1*	–	–	–	–
Solar/Wind/Other	–	–	*0.1*	*0.1*	–	–	*0.1*	*0.1*	–	–	*0.2*	*0.2*	–	–	–	*0.1*
Electricity	*11.9*	*13.7*	*19.6*	*19.9*	*11.8*	*13.5*	*19.9*	*20.1*	*14.3*	*16.8*	*21.7*	*22.0*	*11.3*	*13.1*	*18.2*	*18.6*
Heat	*0.3*	*0.5*	*1.5*	*1.4*	–	*0.1*	*1.2*	*1.2*	–	–	*0.4*	*0.5*	*0.8*	*1.2*	*2.3*	*2.1*

Table A18 (continued)

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				North America				Pacific				IEA Europe			
	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000
DEMAND																**Unit: Mtoe**
TOTAL INDUSTRY[6]	**1045.9**	**1084.7**	**1118.7**	**1141.5**	**458.4**	**488.8**	**493.4**	**492.7**	**167.4**	**168.0**	**235.2**	**241.3**	**420.1**	**427.9**	**390.1**	**407.5**
Coal[1]	139.2	126.1	99.0	104.9	35.2	31.3	32.0	32.6	23.9	24.0	29.4	31.8	80.1	70.7	37.5	40.6
Oil	513.1	535.1	449.5	444.0	182.4	229.7	183.3	177.9	109.8	101.6	125.0	124.0	221.0	203.7	141.1	142.1
Gas	220.8	218.3	259.7	271.7	163.2	135.9	138.0	140.2	3.9	6.0	19.9	22.2	53.8	76.3	101.8	109.3
Comb. Renewables & Wastes[2]	18.0	20.8	28.8	29.9	12.9	13.7	8.7	8.7	1.5	2.1	5.5	5.9	3.6	4.9	14.6	15.3
Geothermal	–	–	0.5	0.5	–	–	0.1	0.1	–	–	0.4	0.4	–	–	0.0	0.0
Solar/Wind/Other	–	–	0.1	0.1	–	–	–	–	–	–	–	–	–	–	0.1	0.1
Electricity	152.2	180.2	257.6	266.7	64.6	77.2	112.9	114.8	28.3	34.2	54.9	57.1	59.3	68.9	89.8	94.8
Heat	2.5	4.4	23.6	23.7	0.1	1.0	18.4	18.4	–	–	–	–	2.5	3.4	5.2	5.4
Fuel Shares (%)																
Coal	*13.3*	*11.6*	*8.8*	*9.2*	*7.7*	*6.4*	*6.5*	*6.6*	*14.3*	*14.3*	*12.5*	*13.2*	*19.1*	*16.5*	*9.6*	*10.0*
Oil	*49.1*	*49.3*	*40.2*	*38.9*	*39.8*	*47.0*	*37.2*	*36.1*	*65.6*	*60.5*	*53.2*	*51.4*	*52.6*	*47.6*	*36.2*	*34.9*
Gas	*21.1*	*20.1*	*23.2*	*23.8*	*35.6*	*27.8*	*28.0*	*28.5*	*2.3*	*3.6*	*8.5*	*9.2*	*12.8*	*17.8*	*26.1*	*26.8*
Comb. Renewables & Wastes	*1.7*	*1.9*	*2.6*	*2.6*	*2.8*	*2.8*	*1.8*	*1.8*	*0.9*	*1.3*	*2.4*	*2.4*	*0.9*	*1.2*	*3.7*	*3.8*
Geothermal	–	–	–	–	–	–	–	–	–	–	*0.2*	*0.2*	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Electricity	*14.6*	*16.6*	*23.0*	*23.4*	*14.1*	*15.8*	*22.9*	*23.3*	*16.9*	*20.3*	*23.3*	*23.7*	*14.1*	*16.1*	*23.0*	*23.3*
Heat	*0.2*	*0.4*	*2.1*	*2.1*	–	*0.2*	*3.7*	*3.7*	–	–	–	–	*0.6*	*0.8*	*1.3*	*1.3*
TRANSPORT[7]	**697.5**	**796.0**	**1154.1**	**1170.9**	**455.8**	**498.7**	**653.2**	**663.8**	**60.9**	**80.3**	**153.5**	**157.2**	**180.9**	**217.0**	**347.3**	**349.8**
TOTAL OTHER SECTORS[8]	**900.5**	**959.8**	**1107.6**	**1133.9**	**464.9**	**473.1**	**509.5**	**535.1**	**69.6**	**83.9**	**159.5**	**162.9**	**366.0**	**402.9**	**438.6**	**435.9**
Coal[1]	81.5	74.5	12.8	11.9	14.0	14.5	2.8	2.3	8.3	9.1	1.6	1.6	59.2	50.9	8.4	7.9
Oil	390.0	346.2	245.9	243.8	158.1	123.6	68.9	73.7	40.5	44.6	66.4	64.9	191.4	178.0	110.6	105.1
Gas	237.6	284.9	376.4	392.4	185.0	195.7	204.2	216.0	5.7	8.3	24.3	26.0	46.9	80.9	147.9	150.5
Comb. Renewables & Wastes[2]	29.3	40.8	46.9	47.6	10.8	20.1	13.6	14.1	2.0	1.7	2.2	2.2	16.6	19.0	31.2	31.3
Geothermal	–	–	0.9	0.9	–	–	0.4	0.4	–	–	0.2	0.2	–	–	0.3	0.3
Solar/Wind/Other	–	0.0	3.0	2.9	–	–	1.5	1.4	–	0.0	1.0	0.9	–	0.0	0.5	0.5
Electricity	157.1	203.7	396.0	410.0	97.0	119.2	216.2	225.0	13.2	20.1	61.6	64.3	46.8	64.5	118.2	120.7
Heat	5.0	9.8	25.9	24.4	–	0.0	2.0	2.1	0.0	0.1	2.3	2.8	5.0	9.7	21.6	19.6

Table A18 (continued)

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				IEA North America				IEA Pacific				IEA Europe			
	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000
DEMAND																Unit: Mtoe
Fuel Shares (%)																
Coal	9.1	7.8	1.2	1.0	3.0	3.1	0.5	0.4	11.9	10.8	1.0	1.0	16.2	12.6	1.9	1.8
Oil	43.3	36.1	22.2	21.5	34.0	26.1	13.5	13.8	58.1	53.2	41.6	39.8	52.3	44.2	25.2	24.1
Gas	26.4	29.7	34.0	34.6	39.8	41.4	40.1	40.4	8.1	9.9	15.2	15.9	12.8	20.1	33.7	34.5
Comb. Renewables & Wastes	3.3	4.3	4.2	4.2	2.3	4.3	2.7	2.6	2.9	2.0	1.4	1.3	4.5	4.7	7.1	7.2
Geothermal	–	–	0.1	0.1	–	–	0.1	0.1	–	–	0.1	0.1	–	–	0.1	0.1
Solar/Wind/Other	–	–	0.3	0.3	–	–	0.3	0.3	–	–	0.6	0.6	–	–	0.1	0.1
Electricity	17.4	21.2	35.7	36.2	20.9	25.2	42.4	42.1	18.9	24.0	38.6	39.5	12.8	16.0	26.9	27.7
Heat	0.6	1.0	2.3	2.2	–	–	0.4	0.4	–	0.1	1.5	1.7	1.4	2.4	4.9	4.5
ENERGY TRANSFORMATION AND LOSSES																
ELECTRICITY GENERATION[9]																
INPUT (Mtoe)	**983.3**	**1207.4**	**2000.6**	**2055.5**	**543.3**	**649.8**	**1047.6**	**1079.6**	**113.1**	**152.5**	**330.6**	**342.2**	**326.9**	**405.1**	**622.4**	**633.7**
OUTPUT (Mtoe)	**371.4**	**459.1**	**769.2**	**795.0**	**192.3**	**233.8**	**384.3**	**396.3**	**48.4**	**63.1**	**134.0**	**139.4**	**130.7**	**162.2**	**250.9**	**259.2**
(TWh gross)	4318.4	5338.4	8943.8	9243.6	2235.6	2718.8	4468.4	4608.6	563.2	733.7	1558.2	1621.5	1519.7	1885.9	2917.2	3013.5
Output Shares (%)																
Coal	37.2	37.8	37.8	38.7	42.1	43.3	47.6	48.3	15.7	15.7	31.7	33.4	37.9	38.5	26.0	26.7
Oil	25.6	19.7	6.0	5.4	15.4	12.5	3.4	3.0	63.2	46.9	12.4	11.5	26.6	19.5	6.7	5.9
Gas	11.9	11.2	15.4	15.9	17.0	13.4	13.6	14.4	2.4	11.0	19.0	18.7	7.8	8.2	16.3	16.8
Comb. Renewables & Wastes	0.2	0.2	1.5	1.6	0.0	0.1	1.7	1.7	0.1	0.1	1.2	1.2	0.4	0.5	1.5	1.6
Nuclear	4.4	10.7	24.4	24.0	4.7	11.2	18.9	18.9	1.7	10.0	26.9	26.6	4.9	10.3	31.6	30.5
Hydro	20.6	20.1	14.2	13.7	20.6	19.4	14.3	13.2	16.7	16.0	8.4	8.2	22.2	22.8	17.2	17.6
Geothermal	0.1	0.2	0.3	0.3	0.1	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.2	0.1	0.2	0.2
Solar/Wind/Other	0.0	0.0	0.2	0.3	–	–	0.1	0.1	–	0.0	0.1	0.1	0.0	0.0	0.5	0.8
TOTAL LOSSES (Mtoe)	**964.6**	**1102.6**	**1556.1**	**1593.7**	**529.2**	**605.8**	**815.1**	**838.2**	**118.8**	**142.2**	**275.9**	**284.6**	**316.6**	**354.6**	**465.1**	**470.9**
of which:																
Electricity and Heat Generation[10]	603.2	732.7	1176.6	1207.1	351.0	415.0	640.7	660.5	64.6	89.2	193.8	199.4	187.6	228.5	342.1	347.1
Other Transformation	80.9	96.2	55.3	59.4	1.3	33.4	0.1	0.4	32.1	25.0	36.3	38.2	47.5	37.9	19.0	20.7
Own Use and Losses[11]	280.5	273.7	324.2	327.3	176.9	157.4	174.4	177.2	22.2	28.1	45.8	47.0	81.5	88.2	104.0	103.1
Statistical Differences	**–15.6**	**0.4**	**12.9**	**12.5**	**–10.9**	**5.6**	**19.5**	**20.8**	**–5.5**	**–1.9**	**–1.5**	**1.1**	**0.8**	**–3.3**	**–5.1**	**–9.4**

Table A18 (continued)

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				IEA North America				IEA Pacific				IEA Europe			
	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000	1973	1979	1999	2000
INDICATORS																
GDP (billion 1995 US$)	13136	15593	26190	27116	4326	5186	9302	9692	2951	3638	6627	6818	5860	6769	10261	10606
Population (millions)	811	851	975	981	234	249	303	306	159	171	196	197	417	430	475	477
TPES/GDP[12]	0.27	0.25	0.19	0.19	0.44	0.40	0.27	0.26	0.14	0.13	0.12	0.12	0.22	0.21	0.16	0.16
Energy Production/TPES	0.63	0.65	0.70	0.69	0.87	0.84	0.82	0.80	0.26	0.29	0.44	0.46	0.40	0.50	0.65	0.65
Per Capita TPES[13]	4.43	4.64	5.08	5.15	8.09	8.31	8.21	8.33	2.58	2.76	4.19	4.30	3.08	3.25	3.44	3.47
Oil Supply/GDP[12]	0.15	0.13	0.08	0.08	0.21	0.19	0.10	0.10	0.10	0.09	0.06	0.06	0.13	0.11	0.07	0.06
TFC/GDP[12]	0.20	0.18	0.13	0.13	0.32	0.28	0.18	0.17	0.10	0.09	0.08	0.08	0.17	0.15	0.11	0.11
Per Capita TFC[13]	3.26	3.34	3.47	3.51	5.88	5.86	5.46	5.52	1.87	1.94	2.79	2.85	2.32	2.44	2.48	2.50
Energy–Related CO_2 Emissions (Mt CO_2)[14]	9842.05	10370.45	11444.38	11756.64	5083.85	5298.77	5993.51	6192.21	1131.93	1249.33	1888.83	1949.34	3626.27	3822.35	3562.04	3615.09
CO_2 Emissions from Bunkers (Mt CO_2)	294.62	312.97	453.55	486.01	46.73	105.19	143.81	165.47	69.58	53.32	70.18	68.57	178.31	154.46	239.56	251.97
GROWTH RATES (% per year)																
	73–79	79–00	90–00	99–00	73–79	79–00	90–00	99–00	73–79	79–00	90–00	99–00	73–79	79–00	90–00	99–00
TPES	1.6	1.2	1.7	2.1	1.5	1.0	1.8	2.4	2.3	2.8	3.0	3.0	1.4	0.8	1.0	1.1
Coal	1.5	1.0	0.5	4.7	2.9	1.9	1.7	4.1	–0.2	3.5	3.1	6.2	0.5	–1.4	–2.9	5.2
Oil	0.7	0.0	1.3	0.2	1.3	0.0	1.4	0.9	1.3	1.2	2.0	1.0	–0.2	–0.5	0.8	–1.3
Gas	1.3	1.9	3.2	3.6	–1.0	0.8	2.3	3.9	20.3	6.8	5.1	5.8	7.5	3.1	4.4	2.6
Comb. Renewables & Wastes	4.4	3.0	2.8	3.2	4.8	1.9	2.4	2.6	2.3	6.2	2.3	6.7	3.9	4.2	3.5	3.4
Nuclear	20.4	6.6	2.6	1.7	19.7	5.1	2.4	3.2	40.1	8.8	5.4	2.7	17.4	7.7	1.8	–0.3
Hydro	3.2	0.8	1.1	–0.2	2.3	0.7	0.6	–5.0	3.8	0.6	–0.0	1.4	4.1	1.0	2.0	5.6
Geothermal	5.2	5.7	1.3	–2.5	9.0	6.5	–0.5	–4.5	4.7	6.1	4.6	–2.4	0.1	3.2	4.1	5.6
Solar/Wind/Other	7.2	23.3	25.4	16.1	–	–	22.9	1.3	–	19.0	25.5	–	–1.4	21.9	27.4	39.6
TFC	**1.2**	**0.9**	**1.6**	**1.9**	**1.0**	**0.7**	**1.6**	**2.1**	**1.8**	**2.5**	**2.8**	**2.4**	**1.3**	**0.6**	**1.1**	**1.5**
Electricity Consumption	3.6	2.7	2.6	3.5	3.3	2.6	2.6	3.3	4.5	3.9	3.6	4.1	3.8	2.3	2.1	3.6
Energy Production	2.0	1.5	1.2	0.9	0.8	0.8	0.6	–0.1	4.3	5.0	3.8	6.7	5.1	2.1	1.5	0.7
Net Oil Imports	0.6	–0.6	1.3	2.0	6.2	0.8	3.8	4.5	1.3	1.0	2.0	–0.1	–2.4	–3.0	–2.0	0.8
GDP	2.9	2.7	2.4	3.5	3.1	3.0	3.2	4.2	3.6	3.0	1.9	2.9	2.4	2.2	2.0	3.4
Growth in the TPES/GDP Ratio	–1.3	–1.4	–0.7	–1.4	–1.5	–2.0	–1.4	–1.7	–1.2	–0.2	1.0	0.1	–1.0	–1.3	–1.0	–2.2
Growth in the TFC/GDP Ratio	–1.6	–1.7	–0.8	–1.5	–2.0	–2.3	–1.6	–2.0	–1.7	–0.5	0.9	–0.5	–1.1	–1.5	–0.8	–1.8

Table A18 (Footnotes)

1. Includes lignite and peat.
2. Comprises solid biomass, liquid biomass, biogas, 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 1995 prices and exchange rates.
13. Toe per person.
14. "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2000 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)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	378.5	362.4	367.6	315.7	322.0	322.0	300.6	265.9	249.6	248.6	244.2	241.8
United States	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	2 293.8	2 266.7	2 759.7
Australia	..	..	..	110.4	..	116.3	..	157.6	..	..	..	..
Japan	367.7	383.0	392.9	404.7	433.9	445.7	459.1	437.7	441.8	433.2	436.3	433.5
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	2.0	2.0	..	4.7	3.8	4.4	5.3	5.1	6.4	6.1	6.4	8.9
Austria	10.0	17.8	15.3	20.8	23.6	24.1	24.3	25.7	27.4	26.5	..	..
Belgium[1]	..	8.9	9.6	16.6	17.4	43.8	56.4	54.5	70.4	49.7	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	215.0	262.0	310.0	302.0	259.0	245.1	217.6	258.3	316.2	312.6	327.1	347.3
Finland	32.5	36.1	38.3	39.8	48.2	58.2	56.1	79.4	81.9	56.6	65.5	55.9
France	460.2	466.3	444.3	448.9	424.3	501.9	483.2	488.2	527.1	617.1	..	..
Germany[2]	437.7	441.2	363.1	366.0	300.0	262.2	285.0	259.2	280.1	187.7	268.6	282.1
Greece	4.4	4.6	3.5	3.3	3.3	6.1	7.5	14.3	..	..	5.7	7.0
Hungary	..	..	..	..	..	44.6	10.5	..	122.0	75.1	..	..
Ireland	0.9	..	..	..	..	..	..	..	..	..	..	..
Italy	412.4	407.3	..	229.7	225.4	243.8	237.8	221.9	222.1	..	262.7	283.0
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	138.0	138.0	136.0	153.6	165.9	121.2	127.1	144.9	137.3	139.8	142.5	..
Norway	323.7	368.5	391.9	366.5	355.7	304.4	288.3	281.8	277.4	371.6	370.0	384.5
Portugal	7.1	5.1	4.7	3.2	2.7	1.4	1.7	1.2	1.6	2.0	1.5	1.2
Spain	32.5	78.0	66.0	58.0	64.1	60.0	59.3	60.3	47.4	50.0	49.3	50.0
Sweden	591.0	567.0	714.1	553.1	598.0	452.9	413.1	467.0	440.0	590.0	630.0	..
Switzerland	187.2	199.0	220.6	223.3	220.8	215.1	206.7	196.9	182.6	179.9	187.0	200.0
Turkey[4]	5.2	9.7	23.6	41.2	42.1	189.1	274.8	1 608.9	1 387.8	1 406.3	2 730.6	8 326.8
United Kingdom	166.7	142.9	133.5	98.8	50.9	52.9	36.4	49.3	43.8	42.8	48.0	52.5
European Commission[5]	..	..	..	..	..	..	..	..	..	..	..	..

1. Figure for 1991 refers to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
2. Data do not include the new Länder of Germany prior to 1992.
3. Luxembourg has no energy R&D programme.
4. The strong increase in the budget is due to high inflation rate in Turkey and to new RD&D activities.
5. No information on R&D budgets has been provided by the European Commission.

Source: Country submissions.

Table B2

IEA Government R&D Budgets in 2001 National Currencies

(millions except for Italian, Japanese and Turkish currencies, which are in billions)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	452.9	422.2	422.7	357.7	361.0	353.0	324.0	284.0	268.0	262.8	249.9	241.8
United States	3 158.0	3 169.1	2 695.3	2 632.1	2 782.4	2 686.6	2 352.0	2 108.3	2 146.2	2 394.5	2 317.6	2 759.7
Australia	..	..	..	126.0	..	129.7	..	169.3	..	..	..	..
Japan	371.0	376.3	379.3	388.5	415.8	429.9	449.3	427.1	429.9	425.2	435.0	433.5
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	2.4	2.4	..	5.3	4.2	4.8	5.7	5.5	6.7	6.4	6.6	8.9
Austria	12.5	21.4	17.6	23.4	25.7	25.7	25.5	26.6	28.2	27.0	..	..
Belgium[1]	..	10.8	11.3	18.8	19.3	47.8	60.9	58.1	73.7	51.6	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	275.1	326.2	375.1	360.5	303.8	282.6	244.8	286.1	343.0	330.1	335.8	347.3
Finland	39.7	43.2	45.4	46.1	54.8	63.6	61.4	85.2	85.2	58.5	66.9	55.9
France	545.8	536.8	501.8	495.0	459.7	534.5	507.0	506.3	542.3	632.6	..	..
Germany[2]	543.3	527.2	413.1	401.6	321.1	275.0	296.0	266.9	285.3	189.5	271.2	282.1
Greece	11.0	9.7	6.5	5.3	4.8	8.0	9.2	16.3	..	..	5.8	7.0
Hungary	..	..	..	..	..	90.4	17.6	..	152.8	86.4	..	..
Ireland	1.3	..	..	..	..	..	..	..	..	..	..	..
Italy	612.6	562.2	..	291.8	276.8	285.0	264.1	240.6	234.5	..	268.4	283.0
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	176.3	171.7	165.4	183.4	193.4	138.7	143.8	160.8	149.4	149.6	148.1	..
Norway	490.6	545.3	582.6	535.2	520.0	432.1	391.9	372.0	369.1	464.1	398.0	384.5
Portugal	12.5	8.0	6.7	4.3	3.4	1.6	2.0	1.3	1.7	2.1	1.5	1.2
Spain	49.9	111.7	88.6	74.6	79.2	70.8	67.6	67.2	51.6	52.9	50.7	50.0
Sweden	751.5	670.1	833.0	628.1	663.6	485.5	436.7	487.5	453.5	605.2	642.0	..
Switzerland	223.0	223.6	241.3	237.9	231.3	223.0	213.3	203.7	188.4	184.7	189.9	200.0
Turkey	1 415.8	1 672.3	2 487.2	2 586.7	1 281.3	3 075.4	2 513.2	8 104.4	3 979.3	2 585.0	3 343.3	8 326.8
United Kingdom	231.8	186.1	167.3	120.5	61.2	62.0	41.2	54.4	46.9	44.7	49.1	52.5
European Commission[4]	..	..	..	..	..	..	..	..	..	..	..	..

1. Figure for 1991 refers to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
2. Data do not include the new Länder of Germany prior to 1992.
3. Luxembourg has no energy R&D programme.
4. No information on R&D budgets has been provided by the European Commission.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B3

IEA Government R&D Budgets

(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2001 exch. rates Unit per $
Canada	292.6	272.8	273.1	231.1	233.2	228.1	209.3	183.4	173.2	169.8	161.4	156.2	1.548
United States	3 158.0	3 169.1	2 695.3	2 632.1	2 782.4	2 686.6	2 352.0	2 108.3	2 146.2	2 394.5	2 317.6	2 759.7	1.0
Australia	..	..	..	65.1	..	67.0	..	87.5	..	..	..	..	1.935
Japan	3 053.7	3 097.0	3 121.9	3 197.8	3 422.2	3 538.3	3 697.9	3 515.2	3 538.3	3 499.3	3 580.5	3 568.0	121.50
Korea	..	..	..	..	..	..	..	..	..	..	..	..	1 290.0
New Zealand	1.0	1.0	..	2.2	1.8	2.0	2.4	2.3	2.8	2.7	2.8	3.7	2.382
Austria	11.2	19.2	15.8	20.9	23.0	23.0	22.9	23.8	25.2	24.2	..	..	1.117
Belgium[1]	..	9.7	10.1	16.8	17.3	42.8	54.5	52.0	66.0	46.2	..	..	1.117
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..	38.02
Denmark	33.1	39.2	45.1	43.3	36.5	34.0	29.4	34.4	41.2	39.7	40.4	41.7	8.321
Finland	35.5	38.7	40.7	41.3	49.1	56.9	55.0	76.3	76.3	52.4	59.9	50.0	1.117
France	488.6	480.6	449.2	443.1	411.5	478.6	453.9	453.2	485.5	566.3	..	..	1.117
Germany[2]	486.4	472.0	369.8	359.6	287.5	246.2	265.0	238.9	255.4	169.6	242.8	252.6	1.117
Greece	9.8	8.7	5.8	4.7	4.3	7.2	8.2	14.6	..	..	5.2	6.2	1.117
Hungary	..	..	..	..	..	0.3	0.1	..	0.5	0.3	..	..	286.5
Ireland	1.1	..	..	..	..	..	..	..	..	..	..	..	1.117
Italy	548.4	503.3	..	261.3	247.8	255.2	236.4	215.4	209.9	..	240.3	253.4	1.117
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–	1.117
Netherlands	157.9	153.8	148.1	164.2	173.1	124.2	128.7	143.9	133.8	133.9	132.6	..	1.117
Norway	54.5	60.6	64.8	59.5	57.8	48.0	43.6	41.4	41.0	51.6	44.3	42.8	8.993
Portugal	11.2	7.2	6.0	3.9	3.1	1.5	1.8	1.2	1.6	1.9	1.4	1.0	1.117
Spain	44.7	100.0	79.3	66.8	70.9	63.4	60.5	60.2	46.2	47.4	45.4	44.7	1.117
Sweden	72.7	64.8	80.6	60.8	64.2	47.0	42.2	47.2	43.9	58.5	62.1	..	10.34
Switzerland	132.2	132.5	143.0	141.0	137.1	132.2	126.5	120.8	111.7	109.5	112.5	118.6	1.687
Turkey	1.2	1.4	2.0	2.1	1.0	2.5	2.0	6.6	3.2	2.1	2.7	6.8	1228 300
United Kingdom	334.0	268.1	241.0	173.6	88.2	89.4	59.4	78.3	67.6	64.4	70.8	75.6	0.694
Total Reported[4]	**8 927.9**	**8 899.5**	**7 791.6**	**7 991.1**	**8 112.0**	**8 174.2**	**7 851.7**	**7 504.9**	**7 469.6**	**..**	**..**	**..**	
European Commission[5]	..	..	..	..	..	..	..	..	..	..	..	..	1.117

1. Figure for 1991 refers to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
2. Data do not include the new Länder of Germany prior to 1992.
3. Luxembourg has no energy R&D programme.
4. Yearly totals are not comparable because of missing data.
5. No information on R&D budgets has been provided by the European Commission.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B4

IEA Government Budgets on Energy R&D

(per thousand units of GDP)

	R&D/GDP including nuclear research								
	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Canada	0.44	0.42	0.40	0.36	0.30	0.28	0.26	0.24	0.22
United States	0.34	0.35	0.33	0.28	0.24	0.23	0.25	0.23	0.26
Australia	0.25	..	0.24	..	0.29	..	..	..	..
Japan	0.85	0.91	0.92	0.92	0.86	0.89	0.88	0.88	0.86
Korea	..	..	..	..	..	..	..	..	..
New Zealand	0.06	0.04	0.05	0.06	0.05	0.06	0.06	0.06	0.08
Austria	0.13	0.14	0.14	0.14	0.14	0.14	0.14	..	..
Belgium[1]	0.09	0.09	0.22	0.27	0.25	0.31	0.21	..	..
Czech Republic	..	..	..	..	..	..	..	..	..
Denmark	0.34	0.27	0.24	0.21	0.23	0.27	0.26	0.25	0.26
Finland	0.48	0.55	0.61	0.57	0.74	0.70	0.46	0.50	0.40
France	0.41	0.37	0.42	0.40	0.39	0.41	0.46	..	..
Germany	0.22	0.17	0.15	0.16	0.14	0.14	0.09	0.13	0.13
Greece	0.05	0.05	0.08	0.09	0.15	..	..	0.05	0.05
Hungary	..	..	0.01	0.00	..	0.01	0.01	..	..
Ireland	..	..	..	..	..	..	..	..	..
Italy	0.28	0.26	0.26	0.24	0.22	0.21	..	0.23	0.23
Luxembourg[2]	–	–	–	–	–	–	–	–	–
Netherlands	0.56	0.57	0.40	0.40	0.43	0.39	0.37	0.35	..
Norway	0.44	0.41	0.33	0.28	0.26	0.25	0.31	0.26	0.24
Portugal	0.05	0.04	0.02	0.02	0.01	0.02	0.02	0.01	0.01
Spain	0.15	0.16	0.14	0.13	0.12	0.09	0.09	0.08	0.08
Sweden	0.37	0.37	0.26	0.24	0.26	0.23	0.30	0.31	..
Switzerland	0.64	0.62	0.59	0.56	0.53	0.48	0.46	0.46	0.47
Turkey	0.02	0.01	0.02	0.02	0.06	0.03	0.02	0.02	0.05
United Kingdom	0.15	0.08	0.07	0.05	0.06	0.05	0.05	0.05	0.05

	R&D/GDP excluding nuclear research								
	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Canada	0.21	0.20	0.19	0.20	0.17	0.16	0.18	0.17	0.16
United States	0.27	0.29	0.26	0.24	0.20	0.20	0.22	0.20	0.23
Australia	0.25	..	0.22	..	0.29	..	..	..	..
Japan	0.17	0.23	0.23	0.22	0.21	0.26	0.25	0.26	0.25
Korea	..	..	..	..	..	..	..	..	..
New Zealand	0.06	0.04	0.05	0.06	0.05	0.06	0.06	0.06	0.08
Austria	0.12	0.13	0.13	0.13	0.13	0.13	0.12	..	..
Belgium[1]	0.09	0.09	0.10	0.10	0.08	0.09	0.04	..	..
Czech Republic	..	..	..	..	..	..	..	..	..
Denmark	0.32	0.26	0.24	0.20	0.23	0.24	0.23	0.23	0.24
Finland	0.39	0.48	0.55	0.49	0.67	0.64	0.40	0.45	0.35
France	0.04	0.04	0.04	0.04	0.03	0.03	0.04	..	..
Germany	0.10	0.07	0.06	0.07	0.06	0.06	0.05	0.06	0.07
Greece	0.05	0.05	0.07	0.08	0.14	..	..	0.04	0.05
Hungary	..	..	0.01	0.00	..	0.01	0.00	..	..
Ireland	..	..	..	..	..	..	..	..	..
Italy	0.15	0.15	0.16	0.14	0.12	0.12	..	0.14	0.15
Luxembourg[2]	–	–	–	–	–	–	–	–	–
Netherlands	0.44	0.42	0.35	0.36	0.38	0.36	0.34	0.32	..
Norway	0.38	0.35	0.27	0.23	0.21	0.20	0.26	0.22	0.21
Portugal	0.03	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01
Spain	0.09	0.09	0.07	0.07	0.06	0.05	0.05	0.04	0.04
Sweden	0.29	0.30	0.23	0.21	0.23	0.21	0.28	0.31	..
Switzerland	0.44	0.44	0.43	0.40	0.37	0.34	0.34	0.35	0.37
Turkey	0.01	0.00	0.02	0.01	0.05	0.02	0.02	0.02	0.05
United Kingdom	0.07	0.04	0.04	0.03	0.04	0.03	0.03	0.03	0.04

1. Nuclear data are not available before 1994 and therefore are not included in the budget.
2. Luxembourg has no energy R&D programme.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B5

IEA Government R&D Budgets for Conservation

(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	30.5	27.6	23.4	25.5	38.0	37.1	38.0	36.8	37.6	39.9	40.0	40.2
United States	229.1	264.4	339.5	357.5	487.6	564.5	452.0	415.9	446.6	501.4	550.9	581.6
Australia	..	..	..	3.9	..	8.0	..	5.6	..	..	..	..
Japan[1]	3.4	17.4	17.2	26.6	223.3	238.5	274.1	266.8	429.1	519.7	563.4	593.0
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	0.5	0.5	..	0.4	0.3	0.5	0.4	0.4	0.2	0.4	0.4	0.3
Austria	5.0	6.0	5.0	7.5	9.2	8.4	8.4	7.9	6.3	7.0	..	..
Belgium[2]	..	6.6	2.9	6.1	8.3	7.5	9.7	8.5	12.5	3.8	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	9.7	7.6	8.6	6.2	5.1	4.3	4.5	6.9	7.9	8.7	11.8	8.8
Finland	8.4	12.4	12.8	13.3	14.6	19.9	19.6	32.6	39.6	23.3	24.9	18.5
France	21.8	16.5	15.9	10.3	7.0	6.8	6.1	3.9	5.6	10.6	..	..
Germany[3]	15.2	15.3	10.8	10.2	11.7	13.4	19.4	12.6	11.4	10.4	8.1	13.5
Greece	2.8	1.1	0.2	0.2	1.2	1.4	1.8	4.4	..	..	0.4	0.5
Hungary	..	..	..	..	..	–	–	..	–	..	..	..
Ireland	0.2	..	..	..	..	..	..	..	..	..	..	..
Italy	41.7	48.6	..	47.4	44.8	47.2	47.9	44.3	44.2	..	21.1	22.4
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	51.1	49.8	39.1	56.2	43.2	45.8	52.6	54.9	54.7	55.3	49.9	..
Norway	10.8	12.8	15.2	14.6	8.4	2.0	1.8	1.7	1.6	1.5	1.6	1.3
Portugal	2.3	1.0	0.5	0.9	0.4	0.7	0.6	0.5	0.1	0.2	0.2	..
Spain	3.2	37.5	11.0	4.2	6.9	5.3	3.3	3.2	6.1	2.8	3.7	3.3
Sweden	23.6	22.0	24.8	19.9	18.8	17.1	19.8	14.8	12.3	18.5	..	..
Switzerland	17.2	19.3	21.7	23.0	26.1	24.9	23.2	18.4	17.5	19.4	19.9	20.2
Turkey	0.2	–	–	0.7	–	0.1	0.1	–	0.1	0.1	0.3	3.4
United Kingdom	33.4	25.4	31.4	35.6	4.0	2.5	2.1	1.6	0.8	1.1	2.1	2.9
Total Reported[5]	**510.1**	**591.9**	**580.0**	**670.1**	**958.8**	**1 055.9**	**985.6**	**941.8**	**1 134.1**	**..**	**..**	**..**

1. The items included in Conservation were expanded in 1994. Earlier budgetary data are not comparable.
2. Figure for 1991 refers to Wallonia only.
3. Data do not include the new Länder of Germany prior to 1992.
4. Luxembourg has no energy R&D programme.
5. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B6

IEA Government R&D Budgets for Oil & Gas

(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	89,4	82.2	68.7	49.2	39.5	36.6	43.1	36.2	37.1	37.4	34.1	32.9
United States	75.2	97.1	103.1	184.3	111.8	123.5	84.8	73.2	77.5	76.3	88.5	110.8
Australia	..	..	..	28.0	..	23.3	..	48.6	..	..	..	..
Japan	86.0	98.8	103.9	109.4	115.8	132.2	131.6	127.6	95.7	32.3	25.6	32.5
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	–	..	1.1	0.4	0.4	0.4	0.4	0.5	0.5	0.5	1.3
Austria	0.1	0.5	0.7	0.3	0.2	0.3	0.5	0.2	0.2	0.1	..	..
Belgium	..	–	–	–	–	–	0.1	0.1	–	0.2	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	–	–	2.3	2.7	3.0	3.1	2.5	2.3	1.8	2.2	1.7	1.6
Finland	–	–	–	–	–	–	–	1.9	2.2	2.1	1.2	2.3
France	35.6	32.4	31.0	28.7	28.7	27.5	27.1	26.7	26.5	26.4	..	..
Germany[1]	13.0	6.5	5.9	3.5	2.4	0.7	–	–	–	–	–	–
Greece	–	–	0.1	0.1	0.5	0.9	1.0	1.5	..	..	–	–
Hungary	..	..	..	..	..	–	–	..	–	..	..	..
Ireland	0.2	..	..	..	..	..	..	..	..	..	..	..
Italy	–	–	..	–	–	–	–	–	–	..	–	–
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	0.6	0.6	6.2	8.8	11.2	8.0	8.0	8.9	7.4	7.0	6.6	..
Norway	21.0	17.6	18.5	16.3	25.7	23.9	21.0	19.9	19.1	31.0	23.9	21.0
Portugal	–	–	–	–	0.2	0.1	0.1	0.1	0.1	0.1	0.1	..
Spain	–	–	–	–	–	–	–	–	–	0.1	1.3	0.6
Sweden	3.2	1.6	1.0	–	–	–	–	–	–	–	..	..
Switzerland	7.8	10.1	11.1	11.1	10.5	10.0	7.8	8.5	7.4	7.0	7.2	7.7
Turkey	0.1	–	0.2	0.1	0.1	1.7	1.2	2.5	0.5	0.1	0.1	0.1
United Kingdom	10.5	1.5	6.5	6.0	4.7	10.1	4.7	7.0	5.6	3.7	4.1	4.1
Total Reported[3]	**342.7**	**348.8**	**359.0**	**449.6**	**354.7**	**402.2**	**333.9**	**365.7**	**281.5**	**226.6**	**..**	**..**

1. Data do not include the new Länder of Germany prior to 1992.
2. Luxembourg has no energy R&D programme.
3. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B7

IEA Government R&D Budgets for Coal

(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	24.5	23.9	18.1	10.9	7.9	9.9	7.1	2.4	4.0	5.1	4.0	3.9
United States	1 014.8	836.7	367.2	275.2	441.4	213.2	291.4	103.5	110.7	132.1	123.6	238.4
Australia	..	..	..	11.8	..	11.4	..	14.5	..	..	..	..
Japan	259.4	211.7	217.3	247.5	245.2	226.8	203.7	180.6	163.4	125.2	79.1	41.3
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	0.2	0.2	..	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2
Austria	0.1	0.4	0.5	1.0	0.6	0.5	1.1	1.3	0.3	0.5	..	..
Belgium[1]	..	0.9	1.2	1.0	1.5	1.2	1.4	1.9	0.4	0.5	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	3.8	5.5	5.8	4.7	4.2	2.5	0.7	–	–	–	–	–
Finland	4.7	4.2	4.1	2.7	3.3	2.8	3.1	3.1	2.6	2.0	2.4	0.1
France	4.9	4.7	4.6	4.8	4.7	4.8	4.4	4.4	0.1	–	..	..
Germany[2]	67.4	50.5	36.6	21.7	15.8	11.4	3.1	1.2	1.1	9.0	8.3	7.1
Greece	1.8	1.3	0.5	0.3	0.3	0.6	0.6	1.8	..	..	..	..
Hungary	..	..	..	..	..	–	–	..	–	..	..	..
Ireland	0.1	..	..	..	..	..	..	..	..	..	..	..
Italy	–	–	..	–	–	–	–	–	–	..	–	–
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	11.7	11.4	6.5	6.7	11.5	3.1	3.0	2.5	1.8	0.7	0.8	..
Norway	0.1	0.1	0.1	0.1	–	–	–	–	–	–	–	–
Portugal	1.0	0.7	1.4	0.5	–	–	–	–	0.1	0.2	0.2	..
Spain	2.5	3.1	2.1	1.4	3.8	4.2	3.7	3.5	2.3	4.5	1.5	1.5
Sweden	2.5	1.2	1.2	0.7	0.6	0.4	0.2	0.1	–	–	..	..
Switzerland	1.3	1.1	0.2	0.1	0.3	0.4	–	–	–	–	–	–
Turkey	0.5	1.2	0.4	0.2	0.1	0.1	0.1	1.9	1.0	0.8	0.8	1.1
United Kingdom	23.5	7.9	7.2	12.9	5.6	8.3	7.9	3.9	2.1	0.9	2.4	2.9
Total Reported[4]	**1 424.8**	**1 166.7**	**675.0**	**604.5**	**747.1**	**501.8**	**531.8**	**326.9**	**290.3**	**282.0**	**223.5**	**..**

1. Figure for 1991 refers to Wallonia only.
2. Data do not include the new Länder of Germany prior to 1992.
3. Luxembourg has no energy R&D programme.
4. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B8

IEA Government R&D Budgets for Conventional Nuclear
(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	115.3	107.6	117.5	114.4	114.6	112.1	85.1	82.5	69.1	52.6	45.5	44.6
United States	678.3	684.1	260.4	136.0	108.5	94.0	42.8	60.6	21.2	23.5	35.6	48.7
Australia	..	..	..	0.7	..	4.5	..	0.7	..	..	..	..
Japan	1 638.6	1 711.4	1 751.6	1 808.3	1 858.2	2 038.5	2 167.7	2 079.8	2 035.6	2 055.6	1 950.4	2 022.3
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	–	..	–	–	–	–	–	–	–	–	–
Austria	0.4	0.3	0.4	0.5	0.5	0.5	0.7	0.5	–	0.3	..	..
Belgium	..	..	..	..	..	20.8	30.5	31.2	42.2	32.6	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	2.5	0.6	0.7	0.7	0.7	0.5	0.5	0.5	2.6	2.5	2.4	1.7
Finland	7.2	7.8	7.7	7.3	6.2	5.3	6.8	6.2	6.5	6.7	5.6	5.6
France	355.1	349.8	329.1	323.4	303.7	389.5	367.2	373.8	403.2	472.7	..	..
Germany[1]	140.8	161.5	85.9	76.3	62.8	61.6	48.3	34.2	32.6	18.2	20.9	14.7
Greece	0.1	0.1	–	–	0.1	0.2	0.2	0.2	..	..	..	..
Hungary	..	..	..	..	..	–	–	..	0.2	0.3	..	..
Ireland	–	..	..	..	..	..	..	..	..	..	..	..
Italy	79.0	51.7	..	45.7	45.9	36.6	33.0	32.6	29.3	..	42.4	41.5
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	20.6	20.1	27.7	22.7	11.3	10.7	9.5	9.2	3.7	6.0	5.8	..
Norway	3.1	8.4	8.6	8.7	8.2	8.3	7.9	7.6	8.6	8.1	7.3	6.7
Portugal	1.8	1.2	1.0	0.3	2.0	0.1	0.1	0.1	–	–	–	–
Spain	14.4	16.1	19.5	17.0	16.1	15.1	15.1	14.9	7.0	4.5	12.3	13.3
Sweden	1.0	1.2	1.3	1.3	1.2	1.1	1.0	0.9	0.9	0.9	..	..
Switzerland	26.1	24.2	21.8	21.5	21.5	20.8	18.0	18.5	17.2	12.6	12.0	11.9
Turkey	0.2	–	0.6	0.8	0.6	0.4	0.5	0.7	0.5	0.1	0.1	0.1
United Kingdom	41.3	39.5	34.8	19.3	13.9	12.3	6.5	1.6	3.1	–	–	–
Total Reported[3]	**3 125.7**	**3 185.7**	**2 668.6**	**2 604.8**	**2 576.0**	**2 832.9**	**2 841.4**	**2 756.1**	**2 683.3**	**..**	**..**	**..**

1. Data do not include the new Länder of Germany prior to 1992.
2. Luxembourg has no energy R&D programme.
3. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B9

IEA Government R&D Budgets for Nuclear Breeders
(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	–	–	–	–	–	–	–	–	0,2	0,4	0,4	0,4
United States	–	–	–	–	–	–	–	–	–	–	..	..
Australia	..	..	..	–	..	–	..	–	..	..	..	..
Japan	574.0	522.6	467.1	464.3	418.2	326.9	304.6	261.9	225.3	207.2	352.1	287.3
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	–	..	–	–	–	–	–	–	–	–	–
Austria	–	–	–	–	–	–	–	–	–	–	..	..
Belgium	..	..	..	..	..	–	–	–	–	–	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	–	–	–	–	–	–	–	–	..	–	–	–
Finland	–	–	–	0.1	–	0.8	–	–	–	–	–	–
France	24.6	34.6	24.7	39.3	31.5	13.4	12.9	10.3	19.0	17.5	..	..
Germany[1]	37.6	20.7	3.5	–	–	–	–	–	–	–	–	–
Greece	–	–	–	–	–	–	–	–	..	..	..	..
Hungary	..	..	..	..	..	–	–	..	–	–	..	..
Ireland	–	..	..	..	..	..	..	..	..	..	..	..
Italy	–	–	..	–	–	–	–	–	–	..	–	–
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	1.6	1.5	0.4	0.4	19.9	–	–	–	–	–	–	..
Norway	–	–	–	–	–	–	–	–	–	–	–	–
Portugal	–	–	–	–	–	–	–	–	–	–	–	–
Spain	–	–	–	–	–	–	–	–	–	–	0.7	–
Sweden	2.9	3.7	3.9	3.8	3.6	3.3	2.9	2.6	2.6	2.6	..	..
Switzerland	1.2	0.9	1.2	1.1	0.4	0.8	0.9	0.3	0.1	0.1	..	..
Turkey	–	–	–	–	–	–	–	–	–	–	–	–
United Kingdom	142.4	113.2	93.2	43.9	1.7	0.2	–	–	–	–	–	–
Total Reported[3]	**784.2**	**697.3**	**594.1**	**552.9**	**475.4**	**345.4**	**321.3**	**275.2**	**247.1**	**227.8**	**..**	**..**

1. Data do not include the new Länder of Germany prior to 1992.
2. Luxembourg has no energy R&D programme.
3. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook,* OECD Paris, 2001, and country submissions.

Table B10

IEA Government R&D Budgets for Nuclear Fusion

(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	10.0	9.3	9.4	6.1	6.1	6.0	6.6	–	2.4	0.1	0.1	0.1
United States	394.3	342.7	395.9	389.6	374.5	410.9	261.4	235.4	230.4	230.3	243.6	242.0
Australia	..	..	..	–	..	–	..	–	..	..	..	..
Japan	262.8	241.0	258.1	278.2	281.1	289.5	323.5	301.8	243.5	238.6	229.4	195.8
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	–	..	–	–	–	–	–	–	–	–	–
Austria	0.5	1.9	1.4	1.6	1.0	1.1	0.6	1.0	2.2	2.3	..	..
Belgium	..	..	..	..	..	3.1	4.2	4.5	4.6	5.1	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	2.8	1.8	1.9	1.1	–	–	–	–	1.6	1.6	1.7	0.9
Finland	–	–	–	–	–	–	0.8	1.4	0.9	0.5	1.3	1.2
France	39.2	35.8	37.3	31.7	31.3	32.1	31.9	31.4	27.7	27.6	..	..
Germany[1]	112.7	111.7	114.1	115.9	100.1	85.7	91.6	100.0	111.4	55.9	110.5	98.6
Greece	0.1	0.1	–	–	–	–	–	–	..	..	..	..
Hungary	..	..	..	..	..	–	–	..	–	–	..	..
Ireland	–	..	..	..	..	..	..	..	..	..	..	..
Italy	105.3	86.2	..	74.7	60.4	61.0	66.5	65.2	62.5	..	55.4	54.3
Luxembourg[2]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	9.6	9.3	22.7	12.8	14.4	6.3	5.3	7.2	6.7	7.3	8.1	..
Norway	–	–	–	–	–	–	–	–	–	–	–	–
Portugal	2.8	1.5	0.9	0.8	–	–	–	–	–	–	–	–
Spain	7.1	10.1	8.7	9.1	14.7	14.0	14.0	13.9	12.9	14.5	9.1	8.2
Sweden	8.5	7.7	7.5	7.9	8.2	1.5	1.4	1.1	1.1	1.0	..	..
Switzerland	24.7	21.6	20.7	20.3	17.4	15.5	18.1	18.8	15.1	15.4	15.0	14.8
Turkey	–	–	–	–	–	–	–	–	–	–	–	–
United Kingdom	43.8	37.6	29.4	28.1	27.7	26.8	19.6	27.0	20.0	21.7	25.2	20.6
Total Reported[3]	**1 024.1**	**918.5**	**908.1**	**978.1**	**937.0**	**953.2**	**845.6**	**808.6**	**743.1**	**..**	**..**	**..**

1. Data do not include the new Länder of Germany prior to 1992.
2. Luxembourg has no energy R&D programme.
3. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook,* OECD Paris, 2001, and country submissions.

Table B11

IEA Government R&D Budgets for Renewables
(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	9.7	9.3	10.6	9.5	11.0	10.8	10.7	8.3	8.6	10.4	11.8	8.9
United States	137.5	182.9	256.3	245.3	251.9	304.5	224.6	211.3	259.4	270.1	215.4	247.8
Australia	..	..	..	6.4	..	3.1	..	4.5	..	..	..	..
Japan	115.8	112.5	107.6	111.9	103.4	104.2	106.8	106.0	116.9	123.8	148.2	133.4
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	0.3	0.3	..	0.6	0.7	0.8	1.0	1.0	1.2	0.8	0.9	1.5
Austria	1.8	4.2	3.6	4.9	6.3	7.5	5.8	6.9	9.0	8.5	..	..
Belgium[1]	..	0.3	1.8	2.1	2.2	3.5	2.6	2.9	1.2	0.9	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	8.2	16.5	17.4	18.6	16.2	15.1	12.2	15.8	17.2	14.8	14.9	19.4
Finland	2.1	1.7	1.8	5.3	5.0	5.1	6.5	10.4	7.6	5.1	7.9	11.1
France	7.5	6.9	6.7	4.9	4.6	4.5	4.2	2.6	3.5	11.5	..	..
Germany[2]	90.1	98.7	104.1	113.6	75.0	66.2	82.2	64.2	72.0	63.2	66.1	66.6
Greece	3.8	3.8	4.1	2.9	1.6	2.8	2.6	5.5	..	..	1.6	2.4
Hungary	..	..	..	..	..	0.3	0.1	..	–	..	..	..
Ireland	0.4	..	..	..	..	..	..	..	..	..	..	..
Italy	42.4	32.4	..	24.0	27.1	37.0	34.6	31.8	29.7	..	20.4	33.8
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	31.9	31.0	18.4	18.4	22.9	20.6	24.8	32.9	36.1	37.5	42.8	..
Norway	5.8	10.4	11.5	9.1	7.5	4.9	4.6	4.5	5.3	5.2	5.2	3.8
Portugal	1.6	1.5	2.1	1.4	0.5	0.5	1.0	0.5	1.1	1.2	0.7	0.8
Spain	17.5	14.5	19.8	17.9	13.1	12.7	12.7	12.7	15.9	13.5	14.8	15.5
Sweden	14.0	9.4	22.7	11.3	13.8	10.6	6.7	7.0	11.2	11.0	..	..
Switzerland	26.8	28.6	34.0	35.5	33.5	32.7	31.1	32.9	31.9	32.8	35.5	39.1
Turkey	0.1	–	0.8	0.2	0.2	–	0.1	1.2	1.0	0.7	0.7	1.1
United Kingdom	29.5	32.1	29.1	26.7	15.8	15.4	10.1	6.8	5.0	6.9	6.5	10.1
Total Reported[4]	**546.8**	**597.2**	**652.5**	**670.5**	**612.2**	**662.7**	**584.7**	**569.8**	**633.7**	**..**	**..**	**..**

1. Figure for 1991 refers to Wallonia only.
2. Data do not include the new Länder of Germany prior to 1992.
3. Luxembourg has no energy R&D programme.
4. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B12

Total Reported Government R&D Budgets for Renewable Energy Sources

(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Solar Heating	49.1	50.5	252.6	48.6	52.2	44.3	29.7	31.3	28.9	26.4	28.0	..
Solar Photo Electric	188.6	204.9	140.6	367.4	215.1	232.5	208.9	207.8	232.6	237.3	258.0	..
Solar Thermal Electric	42.4	41.7	16.9	20.5	55.5	49.7	42.4	41.2	29.5	30.0	18.3	..
Wind	86.7	83.9	62.8	72.3	83.2	107.4	100.4	87.0	90.8	87.5	71.4	..
Ocean	12.5	11.4	2.9	4.1	3.9	2.2	2.0	2.2	11.2	6.6	7.0	..
Biomass	78.0	102.4	76.8	72.2	128.7	133.3	119.8	121.3	166.9	155.1	120.2	..
Geothermal	89.4	97.6	85.3	76.6	63.0	79.7	70.1	69.1	65.5	62.3	51.9	..
Large Hydro (>10 MW)	..	4.0	7.9	7.6	9.0	12.0	8.7	6.5	5.4	6.5	0.6	..
Small Hydro (<10 MW)	0.3	0.5	6.8	1.3	1.6	1.6	2.7	3.2	3.0	6.0	3.7	..
TOTAL	**546.8**	**597.2**	**652.5**	**670.5**	**612.2**	**662.7**	**584.7**	**569.8**	**633.7**	**617.8**	**593.4**	**..**

Note: Yearly totals are not comparable because of missing data (see Table B11).

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B13

IEA Government R&D Budgets for Electricity
(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	3.6	3.1	8.3	9.1	8.5	8.2	7.0	3.9	4.2	4.4	5.9	6.3
United States	68.2	66.7	47.7	49.2	132.2	146.8	132.3	134.7	133.9	132.8	126.6	128.8
Australia	..	..	..	4.9	..	3.9	..	3.6	..	..	..	..
Japan	92.7	93.6	95.3	58.7	67.1	67.3	70.6	72.6	124.6	129.1	159.6	181.5
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	–	..	–	–	0.1	0.2	0.2	0.2	0.5	0.5	0.4
Austria	2.6	4.8	3.0	3.2	4.0	3.4	3.9	3.4	3.8	2.8	..	..
Belgium[1]	..	0.1	2.3	6.5	3.6	5.0	4.9	1.6	4.2	2.5	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	4.6	3.7	4.4	5.0	3.7	3.5	3.8	3.8	3.9	3.5	3.2	4.6
Finland	10.4	10.2	12.0	10.3	14.3	14.6	10.9	14.1	12.9	10.5	11.6	7.5
France	–	–	–	–	–	–	–	–	–	–	..	..
Germany[2]	8.0	5.5	4.2	2.3	2.7	1.8	10.6	18.5	19.5	7.0	19.0	40.5
Greece	0.4	0.8	0.1	–	0.1	0.1	0.1	0.2	..	..	1.9	2.1
Hungary	..	..	..	..	..	–	–	..	0.1	–	..	..
Ireland	–	..	..	..	..	..	..	..	..	..	..	..
Italy	27.3	47.5	..	10.0	17.4	13.9	14.2	13.1	13.7	..	71.5	70.0
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	1.6	1.6	18.1	29.7	32.1	13.7	15.5	15.9	10.8	9.0	9.3	..
Norway	5.3	0.7	3.1	3.0	3.0	3.8	2.8	2.5	2.2	1.9	5.4	9.0
Portugal	0.1	–	–	–	–	–	–	–	–	–	–	..
Spain	–	–	–	–	–	0.3	0.3	0.3	0.3	1.1	1.4	1.5
Sweden	1.5	2.2	1.7	3.1	7.6	3.6	0.9	8.8	6.2	12.9	..	..
Switzerland	19.3	18.7	22.6	18.9	16.5	16.6	17.6	13.9	15.2	14.8	15.0	16.0
Turkey	–	–	–	–	–	–	–	0.1	0.1	0.3	0.7	0.8
United Kingdom	1.6	2.1	2.9	–	6.5	5.2	1.8	1.7	1.9	2.1	2.5	2.7
Total Reported[4]	**247.0**	**261.4**	**225.4**	**213.9**	**319.3**	**311.6**	**297.6**	**312.8**	**357.8**	**..**	**..**	**..**

1. Figure for 1991 refers to Wallonia only.
2. Data do not include the new Länder of Germany prior to 1992.
3. Luxembourg has no energy R&D programme.
4. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B13A

IEA Government R&D Budgets for Energy Systems Analysis & Others

(US$ million at 2001 prices and exchange rates)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	9.7	9.8	17.0	6.3	7.6	7.5	11.6	13.4	10.1	19.4	19.6	18.9
United States	560.6	694.5	925.0	995.1	874.5	829.2	862.8	873.9	866.6	1 028.0	933.4	1 161.7
Australia	..	..	..	9.3	..	12.8	..	10.0	..	..	..	..
Japan	21.0	88.0	103.9	92.8	110.0	114.6	115.2	118.1	104.2	67.8	72.7	81.0
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	–	..	–	0.2	0.1	–	–	0.5	0.2	0.3	0.1
Austria	0.6	1.0	1.3	1.9	1.1	1.5	1.9	2.5	3.3	2.7	..	..
Belgium[1]	..	1.8	2.0	1.1	1.7	1.7	1.1	1.3	0.9	0.5	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	1.5	3.4	3.9	4.2	3.7	4.9	5.1	5.1	6.2	6.2	4.6	4.8
Finland	2.7	2.4	2.3	2.4	5.6	8.5	7.3	6.6	4.0	2.2	5.0	3.7
France	–	–	–	–	–	–	–	–	–	–	..	..
Germany[2]	1.8	1.6	4.7	16.1	16.9	5.4	9.8	8.2	7.3	6.0	9.8	11.5
Greece	0.9	1.5	0.8	1.2	0.5	1.1	1.9	0.9	..	..	–	–
Hungary	..	..	..	..	..	–	–	..	0.2	–	..	..
Ireland	0.2	..	..	..	..	..	..	..	..	..	..	..
Italy	252.8	236.9	..	59.5	52.1	59.5	40.3	28.4	30.6	..	29.4	31.3
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	29.2	28.4	8.8	8.4	6.7	16.0	9.9	12.5	12.6	11.2	9.2	..
Norway	8.3	10.5	7.9	7.7	5.0	5.2	5.6	5.1	4.2	4.0	0.9	1.0
Portugal	1.8	1.3	0.1	–	–	–	–	–	0.2	0.2	0.2	0.2
Spain	–	18.6	18.2	17.1	16.4	11.8	11.5	11.8	1.8	6.4	0.5	0.8
Sweden	15.5	15.8	16.5	12.8	10.3	9.3	9.3	12.0	9.5	11.6	..	..
Switzerland	7.7	7.9	9.7	9.5	10.8	10.6	9.6	9.5	7.3	7.5	7.8	8.9
Turkey	–	–	0.1	0.1	–	0.2	0.1	0.1	0.1	0.1	–	0.1
United Kingdom	8.0	8.7	6.5	1.1	8.4	8.6	6.7	28.7	29.1	27.9	27.9	32.2
Total Reported[4]	**922.4**	**1 132.2**	**1 128.8**	**1 246.7**	**1 131.4**	**1 108.6**	**1 109.7**	**1 148.0**	**1 098.6**	**..**	**..**	**..**

1. Figure for 1991 refers to Wallonia only.
2. Data do not include the new Länder of Germany prior to 1992.
3. Luxembourg has no energy R&D programme.
4. Yearly totals are not comparable because of missing data.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Table B14

IEA Government Energy R&D Expenditure by Country, 2000 and 2001

(US$ million at 2001 prices and exchange rates)

	Australia[1]				Austria[2]			
	2000		2001		2000		2001	
	$	%	$	%	$	%	$	%
1.1 Industry	..	..	..	..	..	..	..	..
1.2 Residential, Commercial	..	..	..	..	..	..	..	..
1.3 Transportation	..	..	..	..	..	..	..	..
1.4 Other Conservation	..	..	..	..	..	..	..	..
TOTAL CONSERVATION	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
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	..	..	..	..	..	..	..	..
4.3 Solar Thermal–Electric	..	..	..	..	..	..	..	..
Total Solar	..	..	..	..	..	..	..	..
5. Wind	..	..	..	..	..	..	..	..
6. Ocean	..	..	..	..	..	..	..	..
7. Biomass	..	..	..	..	..	..	..	..
8. Geothermal	..	..	..	..	..	..	..	..
9.1 Large Hydro (>10 MW)	..	..	..	..	..	..	..	..
9.2 Small Hydro (<10 MW)	..	..	..	..	..	..	..	..
Total Hydro	..	..	..	..	..	..	..	..
TOTAL RENEWABLE ENERGY	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
10.1 Nuclear LWR	..	..	..	..	..	..	..	..
10.2 Other Converter Reactors	..	..	..	..	..	..	..	..
10.3 Nuclear Fuel Cycle	..	..	..	..	..	..	..	..
10.4 Nuclear Supporting Tech.	..	..	..	..	..	..	..	..
10.5 Nuclear Breeder	..	..	..	..	..	..	..	..
Total Nuclear Fission	..	..	..	..	..	..	..	..
11. Nuclear Fusion	..	..	..	..	..	..	..	..
TOTAL NUCLEAR	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
12.1 Electric Power Conversion	..	..	..	..	..	..	..	..
12.2 Electricity Transm. & Distr.	..	..	..	..	..	..	..	..
12.3 Energy Storage	..	..	..	..	..	..	..	..
TOTAL POWER & STORAGE	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
13.1 Energy Systems Analysis	..	..	..	..	..	..	..	..
13.2 Other Tech. or Research	..	..	..	..	..	..	..	..
TOTAL OTHER TECH./RESEARCH	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**
TOTAL ENERGY R&D	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**

1. Australia has not provided data for 2000 and 2001.
2. Austria has not provided data for 2000 and 2001.
3. Belgium has not provided data for 2000 and 2001.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Belgium[3]				Canada				Denmark			
2000		2001		2000		2001		2000		2001	
$	%	$	%	$	%	$	%	$	%	$	%
..	..	..	..	15.02	9.31	15.26	9.77	7.03	17.43	6.99	16.76
..	..	..	..	9.09	5.63	10.09	6.46	3.65	9.05	1.05	2.51
..	..	..	..	12.62	7.82	12.19	7.80	1.15	2.84	0.72	1.73
..	..	..	..	3.28	2.03	2.67	1.71	–	–	–	–
..	**..**	**..**	**..**	**40.02**	**24.79**	**40.21**	**25.74**	**11.83**	**29.32**	**8.76**	**20.99**
..	..	..	..	8.11	5.03	8.48	5.43	1.46	3.61	1.61	3.86
..	..	..	..	5.34	3.31	4.84	3.10	0.22	0.55	–	–
..	..	..	..	9.60	5.95	8.84	5.66	–	–	–	–
..	..	..	..	11.09	6.87	10.75	6.88	–	–	–	–
..	..	..	..	34.15	21.16	32.91	21.07	1.68	4.16	1.61	3.86
..	..	..	..	0.61	0.38	0.60	0.38	0.02	0.06	–	–
..	..	..	..	0.64	0.39	0.62	0.40	–	–	–	–
..	..	..	..	1.48	0.92	1.45	0.93	–	–	–	–
..	..	..	..	1.29	0.80	1.26	0.81	–	–	–	–
..	..	..	..	4.02	2.49	3.93	2.52	0.02	0.06	–	–
..	**..**	**..**	**..**	**38.17**	**23.65**	**36.84**	**23.58**	**1.70**	**4.22**	**1.61**	**3.86**
..	..	..	..	1.30	0.81	1.10	0.70	1.69	4.19	0.96	2.30
..	..	..	..	1.17	0.73	1.12	0.72	1.60	3.97	3.24	7.77
..	..	..	..	0.11	0.07	0.08	0.05	–	–	–	–
..	..	..	..	2.58	1.60	2.30	1.47	3.29	8.16	4.21	10.08
..	..	..	..	2.65	1.64	1.58	1.01	5.89	14.58	6.69	16.04
..	..	..	..	0.07	0.05	0.07	0.05	1.85	4.59	4.87	11.66
..	..	..	..	4.38	2.71	3.16	2.02	3.87	9.60	2.40	5.76
..	..	..	..	0.07	0.05	0.07	0.05	–	–	1.20	2.88
..	..	..	..	0.57	0.35	0.56	0.36	–	–	–	–
..	..	..	..	1.44	0.89	1.13	0.73	–	–	–	–
..	..	..	..	2.01	1.25	1.69	1.08	–	–	–	–
..	**..**	**..**	**..**	**11.77**	**7.29**	**8.88**	**5.68**	**14.91**	**36.93**	**19.37**	**46.42**
..	..	..	..	0.36	0.22	0.38	0.24	–	–	–	–
..	..	..	..	44.38	27.49	43.40	27.79	–	–	–	–
..	..	..	..	0.36	0.23	0.39	0.25	–	–	–	–
..	..	..	..	0.39	0.24	0.41	0.26	2.43	6.02	1.67	4.00
..	..	..	..	0.36	0.22	0.38	0.24	–	–	–	–
..	..	..	..	45.84	28.40	44.96	28.78	2.43	6.02	1.67	4.00
..	..	..	..	0.12	0.07	0.12	0.08	1.65	4.10	0.88	2.10
..	**..**	**..**	**..**	**45.96**	**28.48**	**45.08**	**28.86**	**4.08**	**10.12**	**2.55**	**6.10**
..	..	..	..	1.18	0.73	1.14	0.73	2.48	6.14	3.32	7.95
..	..	..	..	1.01	0.62	1.04	0.66	–	–	–	–
..	..	..	..	3.74	2.32	4.07	2.61	0.72	1.77	1.30	3.11
..	**..**	**..**	**..**	**5.92**	**3.67**	**6.25**	**4.00**	**3.20**	**7.92**	**4.61**	**11.06**
..	..	..	..	0.82	0.51	0.80	0.51	2.50	6.21	2.25	5.38
..	..	..	..	18.75	11.62	18.15	11.62	2.13	5.29	2.58	6.19
..	**..**	**..**	**..**	**19.57**	**12.13**	**18.95**	**12.13**	**4.64**	**11.49**	**4.83**	**11.58**
..	**..**	**..**	**..**	**161.42**	**100.00**	**156.20**	**100.00**	**40.36**	**100.00**	**41.74**	**100.00**

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 2000 and 2001

(US$ million at 2001 prices and exchange rates)

	Finland[1]				France[2]			
	2000		2001		2000		2001	
	$	%	$	%	$	%	$	%
1.1 Industry	10.08	16.83	9.59	19.16	..	..	..	..
1.2 Residential, Commercial	5.35	8.94	5.81	11.61	..	..	..	..
1.3 Transportation	6.49	10.84	2.92	5.83	..	..	..	..
1.4 Other Conservation	3.01	5.03	0.20	0.41	..	..	..	..
TOTAL CONSERVATION	**24.94**	**41.64**	**18.52**	**37.01**	**..**	**..**	**..**	**..**
2.1 Enhanced Oil & Gas	–	–	–	–	..	..	..	..
2.2 Refining. Transp. & Stor.	1.18	1.97	2.33	4.65	..	..	..	..
2.3 Oil Shale & Tar Sands	–	–	–	–	..	..	..	..
2.4 Other Oil & Gas	–	–	–	–	..	..	..	..
Total Oil & Gas	1.18	1.97	2.33	4.65	..	..	..	..
3.1 Coal Prod., Prep. & Trans.	0.01	0.01	–	–	..	..	..	..
3.2 Coal Combustion	0.56	0.94	0.10	0.21	..	..	..	..
3.3 Coal Conversion	–	–	–	–	..	..	..	..
3.4 Other Coal	1.82	3.05	–	–	..	..	..	..
Total Coal	2.40	4.00	0.10	0.21	..	..	..	..
TOTAL FOSSIL FUELS	**3.58**	**5.97**	**2.43**	**4.86**	**..**	**..**	**..**	**..**
4.1 Solar Heating & Cooling	0.01	0.02	0.03	0.05	..	..	..	..
4.2 Solar Photo–Electric	–	–	–	–	..	..	..	..
4.3 Solar Thermal–Electric	0.16	0.27	0.15	0.29	..	..	..	..
Total Solar	0.17	0.29	0.17	0.35	..	..	..	..
5. Wind	0.33	0.55	2.16	4.31	..	..	..	..
6. Ocean	–	–	–	–	..	..	..	..
7. Biomass	7.14	11.92	8.20	16.39	..	..	..	..
8. Geothermal	–	–	–	–	..	..	..	..
9.1 Large Hydro (>10 MW)	–	–	0.59	1.18	..	..	..	..
9.2 Small Hydro (<10 MW)	0.31	0.52	–	–	..	..	..	..
Total Hydro	0.31	0.52	0.59	1.18	..	..	..	..
TOTAL RENEWABLE ENERGY	**7.95**	**13.27**	**11.12**	**22.23**	**..**	**..**	**..**	**..**
10.1 Nuclear LWR	3.76	6.28	3.77	7.53	..	..	..	..
10.2 Other Converter Reactors	–	–	–	–	..	..	..	..
10.3 Nuclear Fuel Cycle	1.16	1.93	1.22	2.44	..	..	..	..
10.4 Nuclear Supporting Tech.	0.64	1.07	0.57	1.13	..	..	..	..
10.5 Nuclear Breeder	–	–	–	–	..	..	..	..
Total Nuclear Fission	5.56	9.29	5.55	11.10	..	..	..	..
11. Nuclear Fusion	1.29	2.15	1.18	2.36	..	..	..	..
TOTAL NUCLEAR	**6.85**	**11.44**	**6.73**	**13.45**	**..**	**..**	**..**	**..**
12.1 Electric Power Conversion	8.44	14.09	2.75	5.49	..	..	..	..
12.2 Electricity Transm. & Distr.	3.15	5.25	4.38	8.75	..	..	..	..
12.3 Energy Storage	–	–	0.40	0.79	..	..	..	..
TOTAL POWER & STORAGE	**11.59**	**19.35**	**7.52**	**15.04**	**..**	**..**	**..**	**..**
13.1 Energy Systems Analysis	4.72	7.87	0.40	0.79	..	..	..	..
13.2 Other Tech. or Research	0.27	0.45	3.31	6.62	..	..	..	..
TOTAL OTHER TECH./RESEARCH	**4.99**	**8.33**	**3.71**	**7.41**	**..**	**..**	**..**	**..**
TOTAL ENERGY R&D	**59.89**	**100.00**	**50.04**	**100.00**	**..**	**..**	**..**	**..**

1. Other coal refers to peat.
2. France has not provided data for 2000 and 2001.
3. Greece has provided only aggregated data for 2000 and 2001.
4. Hungary has not provided data for 2000 and 2001.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Germany				Greece[3]				Hungary[4]			
2000 $	%	2001 $	%	2000 $	%	2001 $	%	2000 $	%	2001 $	%
2.96	1.22	4.58	1.81	..	..	..	..	..	..	..	..
3.51	1.45	6.36	2.52	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
1.66	0.69	2.52	1.00	..	..	..	..	..	..	..	..
8.13	**3.35**	**13.46**	**5.33**	**0.45**	**8.57**	**0.47**	**7.59**	**..**	**..**	**..**	**..**
–	–	–	–	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
–	–	–	–	–	–	–	–	..	..	..	..
0.14	0.06	–	–	..	..	..	..	..	..	..	..
7.63	3.14	6.64	2.63	..	..	..	..	..	..	..	..
0.51	0.21	0.46	0.18	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
8.27	3.41	7.09	2.81	..	..	..	..	..	..	..	..
8.27	**3.41**	**7.09**	**2.81**	**0.39**	**7.54**	**0.42**	**6.67**	**..**	**..**	**..**	**..**
9.75	4.02	11.81	4.68	..	..	..	..	..	..	..	..
33.41	13.76	25.22	9.99	..	..	..	..	..	..	..	..
1.25	0.51	1.46	0.58	..	..	..	..	..	..	..	..
44.41	18.29	38.50	15.24	..	..	..	..	..	..	..	..
13.59	5.60	15.79	6.25	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
6.01	2.47	5.95	2.36	..	..	..	..	..	..	..	..
2.08	0.86	6.41	2.54	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
66.09	**27.22**	**66.65**	**26.39**	**1.60**	**30.65**	**2.40**	**38.56**	**..**	**..**	**..**	**..**
13.82	5.69	9.43	3.73	..	..	..	..	..	..	..	..
1.16	0.48	0.05	0.02	..	..	..	..	..	..	..	..
5.92	2.44	5.26	2.08	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
–	–	–	–	..	..	..	..	..	..	..	..
20.89	8.60	14.74	5.84	..	..	..	..	..	..	..	..
110.54	45.54	98.64	39.05	..	..	..	..	..	..	..	..
131.43	**54.14**	**113.38**	**44.89**	**0.84**	**16.07**	**0.89**	**14.22**	**..**	**..**	**..**	**..**
15.39	6.34	34.65	13.72	..	..	..	..	..	..	..	..
1.89	0.78	2.84	1.12	..	..	..	..	..	..	..	..
1.71	0.70	3.02	1.20	..	..	..	..	..	..	..	..
18.99	**7.82**	**40.51**	**16.04**	**1.94**	**37.17**	**2.05**	**32.95**	**..**	**..**	**..**	**..**
1.16	0.48	0.92	0.36	..	..	..	..	..	..	..	..
8.69	3.58	10.57	4.19	..	..	..	..	..	..	..	..
9.84	**4.05**	**11.49**	**4.55**	**–**	**–**	**–**	**–**	**..**	**..**	**..**	**..**
242.76	**100.00**	**252.58**	**100.00**	**5.23**	**100.00**	**6.23**	**100.00**	**..**	**..**	**..**	**..**

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 2000 and 2001

(US$ million at 2001 prices and exchange rates)

	Ireland[1]				Italy			
	2000		2001		2000		2001	
	$	%	$	%	$	%	$	%
1.1 Industry	..	..	..	..	6.59	2.74	8.95	3.53
1.2 Residential, Commercial	..	..	..	..	14.55	6.05	13.43	5.30
1.3 Transportation	..	..	..	..	-	-	-	-
1.4 Other Conservation	..	..	..	..	-	-	-	-
TOTAL CONSERVATION	**..**	**..**	**..**	**..**	**21.13**	**8.79**	**22.38**	**8.83**
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	..	..	..	..	4.76	1.98	4.12	1.63
4.2 Solar Photo-Electric	..	..	..	..	12.26	5.10	12.53	4.95
4.3 Solar Thermal-Electric	..	..	..	..	0.91	0.38	14.77	5.83
Total Solar	..	..	..	..	17.93	7.46	31.42	12.40
5. Wind	..	..	..	..	0.46	0.19	0.45	0.18
6. Ocean	..	..	..	..	-	-	-	-
7. Biomass	..	..	..	..	2.01	0.84	1.97	0.78
8. Geothermal	..	..	..	..	-	-	-	-
9.1 Large Hydro (>10 MW)	..	..	..	..	-	-	-	-
9.2 Small Hydro (<10 MW)	..	..	..	..	-	-	-	-
Total Hydro	..	..	..	..	-	-	-	-
TOTAL RENEWABLE ENERGY	**..**	**..**	**..**	**..**	**20.40**	**8.49**	**33.84**	**13.36**
10.1 Nuclear LWR	..	..	..	..	-	-	-	-
10.2 Other Converter Reactors	..	..	..	..	-	-	-	-
10.3 Nuclear Fuel Cycle	..	..	..	..	42.45	17.66	41.54	16.40
10.4 Nuclear Supporting Tech.	..	..	..	..	-	-	-	-
10.5 Nuclear Breeder	..	..	..	..	-	-	-	-
Total Nuclear Fission	..	..	..	..	42.45	17.66	41.54	16.40
11. Nuclear Fusion	..	..	..	..	55.44	23.07	54.25	21.41
TOTAL NUCLEAR	**..**	**..**	**..**	**..**	**97.89**	**40.73**	**95.79**	**37.81**
12.1 Electric Power Conversion	..	..	..	..	27.44	11.42	26.86	10.60
12.2 Electricity Transm. & Distr.	..	..	..	..	32.93	13.70	32.23	12.72
12.3 Energy Storage	..	..	..	..	11.16	4.64	10.92	4.31
TOTAL POWER & STORAGE	**..**	**..**	**..**	**..**	**71.54**	**29.77**	**70.01**	**27.63**
13.1 Energy Systems Analysis	..	..	..	..	-	-	-	-
13.2 Other Tech. or Research	..	..	..	..	29.37	12.22	31.33	12.37
TOTAL OTHER TECH./RESEARCH	**..**	**..**	**..**	**..**	**29.37**	**12.22**	**31.33**	**12.37**
TOTAL ENERGY R&D	**..**	**..**	**..**	**..**	**240.32**	**100.00**	**253.36**	**100.00**

1. Ireland has not provided data for 2000 and 2001.
2. Korea has not provided data for 2000 and 2001.
3. Luxembourg has no energy R&D programme.

Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Japan				Korea[2]				Luxembourg[3]			
2000		2001		2000		2001		2000		2001	
$	%	$	%	$	%	$	%	$	%	$	%
490.05	13.69	509.17	14.27	..	..	..	..	-	-	-	-
26.51	0.74	30.62	0.86	..	..	..	..	-	-	-	-
31.08	0.87	33.33	0.93	..	..	..	..	-	-	-	-
15.73	0.44	19.84	0.56	..	..	..	..	-	-	-	-
563.37	**15.73**	**592.95**	**16.62**	**..**	**..**	**..**	**..**	**-**	**-**	**-**	**-**
16.82	0.47	24.85	0.70	..	..	..	..	-	-	-	-
2.91	0.08	2.23	0.06	..	..	..	..	-	-	-	-
-	-	-	-	..	..	..	..	-	-	-	-
5.83	0.16	5.47	0.15	..	..	..	..	-	-	-	-
25.56	0.71	32.54	0.91	..	..	..	..	-	-	-	-
8.45	0.24	5.79	0.16	..	..	..	..	-	-	-	-
12.05	0.34	9.47	0.27	..	..	..	..	-	-	-	-
56.43	1.58	24.70	0.69	..	..	..	..	-	-	-	-
2.14	0.06	1.37	0.04	..	..	..	..	-	-	-	-
79.08	2.21	41.32	1.16	..	..	..	..	-	-	-	-
104.64	**2.92**	**73.86**	**2.07**	**..**	**..**	**..**	**..**	**-**	**-**	**-**	**-**
0.52	0.01	0.48	0.01	..	..	..	..	-	-	-	-
116.93	3.27	82.54	2.31	..	..	..	..	-	-	-	-
-	-	-	-	..	..	..	..	-	-	-	-
117.45	3.28	83.02	2.33	..	..	..	..	-	-	-	-
5.12	0.14	8.11	0.23	..	..	..	..	-	-	-	-
3.96	0.11	6.26	0.18	..	..	..	..	-	-	-	-
-	-	16.46	0.46	..	..	..	..	-	-	-	-
21.71	0.61	19.52	0.55	..	..	..	..	-	-	-	-
-	-	-	-	..	..	..	..	-	-	-	-
-	-	-	-	..	..	..	..	-	-	-	-
-	-	-	-	..	..	..	..	-	-	-	-
148.24	**4.14**	**133.37**	**3.74**	**..**	**..**	**..**	**..**	**-**	**-**	**-**	**-**
113.87	3.18	99.84	2.80	..	..	..	..	-	-	-	-
94.67	2.64	68.56	1.92	..	..	..	..	-	-	-	-
757.75	21.16	794.67	22.27	..	..	..	..	-	-	-	-
984.14	27.49	1 059.26	29.69	..	..	..	..	-	-	-	-
352.10	9.83	287.27	8.05	..	..	..	..	-	-	-	-
2 302.52	64.31	2 309.59	64.73	..	..	..	..	-	-	-	-
229.42	6.41	195.83	5.49	..	..	..	..	-	-	-	-
2 531.94	**70.71**	**2 505.42**	**70.22**	**..**	**..**	**..**	**..**	**-**	**-**	**-**	**-**
79.87	2.23	111.91	3.14	..	..	..	..	-	-	-	-
46.13	1.29	47.66	1.34	..	..	..	..	-	-	-	-
33.64	0.94	21.92	0.61	..	..	..	..	-	-	-	-
159.64	**4.46**	**181.49**	**5.09**	**..**	**..**	**..**	**..**	**-**	**-**	**-**	**-**
1.50	0.04	1.36	0.04	..	..	..	..	-	-	-	-
71.21	1.99	79.60	2.23	..	..	..	..	-	-	-	-
72.71	**2.03**	**80.95**	**2.27**	**..**	**..**	**..**	**..**	**-**	**-**	**-**	**-**
3 580.55	**100.00**	**3 568.04**	**100.00**	**..**	**..**	**..**	**..**	**-**	**-**	**-**	**-**

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 2000 and 2001

(US$ million at 2001 prices and exchange rates)

	Netherlands[1] 2000 $	%	2001 $	%	New Zealand 2000 $	%	2001 $	%
1.1 Industry	24.57	18.53	..	..	0.21	7.47	0.20	5.38
1.2 Residential, Commercial	14.27	10.76	..	..	0.14	5.04	-	-
1.3 Transportation	6.42	4.84	..	..	-	-	-	-
1.4 Other Conservation	4.69	3.53	..	..	0.08	2.97	0.08	2.13
TOTAL CONSERVATION	**49.93**	**37.66**	**..**	**..**	**0.43**	**15.49**	**0.28**	**7.52**
2.1 Enhanced Oil & Gas	2.79	2.10	..	..	0.47	16.81	1.30	34.77
2.2 Refining. Transp. & Stor.	1.77	1.34	..	..	-	-	-	-
2.3 Oil Shale & Tar Sands	..	..	..	..	-	-	-	-
2.4 Other Oil & Gas	2.03	1.53	..	..	-	-	-	-
Total Oil & Gas	6.58	4.97	..	..	0.47	16.81	1.30	34.77
3.1 Coal Prod., Prep. & Trans.	..	..	..	..	0.07	2.49	0.04	1.05
3.2 Coal Combustion	0.08	0.06	..	..	0.21	7.63	0.12	3.07
3.3 Coal Conversion	0.08	0.06	..	..	-	-	-	-
3.4 Other Coal	0.68	0.51	..	..	-	-	-	-
Total Coal	0.84	0.64	..	..	0.28	10.12	0.15	4.13
TOTAL FOSSIL FUELS	**7.43**	**5.60**	**..**	**..**	**0.75**	**26.93**	**1.46**	**38.90**
4.1 Solar Heating & Cooling	1.52	1.15	..	..	-	-	-	-
4.2 Solar Photo-Electric	21.19	15.98	..	..	-	-	0.08	2.24
4.3 Solar Thermal-Electric	-	-	..	..	-	-	0.10	2.64
Total Solar	22.71	17.13	..	..	-	-	0.18	4.88
5. Wind	5.53	4.17	..	..	0.10	3.58	0.10	2.58
6. Ocean	0.04	0.03	..	..	-	-	-	-
7. Biomass	13.51	10.19	..	..	0.24	8.47	0.39	10.33
8. Geothermal	0.89	0.67	..	..	0.53	19.15	0.87	23.25
9.1 Large Hydro (>10 MW)	..	..	..	..	-	-	-	-
9.2 Small Hydro (<10 MW)	..	..	..	..	-	-	-	-
Total Hydro	0.08	0.06	..	..	-	-	-	-
TOTAL RENEWABLE ENERGY	**42.76**	**32.25**	**..**	**..**	**0.87**	**31.20**	**1.54**	**41.04**
10.1 Nuclear LWR	2.83	2.13	..	..	-	-	-	-
10.2 Other Converter Reactors	0.63	0.48	..	..	-	-	-	-
10.3 Nuclear Fuel Cycle	1.90	1.43	..	..	-	-	-	-
10.4 Nuclear Supporting Tech.	0.46	0.35	..	..	-	-	-	-
10.5 Nuclear Breeder	-	-	..	..	-	-	-	-
Total Nuclear Fission	5.82	4.39	..	..	-	-	-	-
11. Nuclear Fusion	8.15	6.14	..	..	-	-	-	-
TOTAL NUCLEAR	**13.97**	**10.54**	**..**	**..**	**-**	**-**	**-**	**-**
12.1 Electric Power Conversion	7.22	5.44	..	..	0.48	17.23	0.38	10.04
12.2 Electricity Transm. & Distr.	1.77	1.34	..	..	-	-	-	-
12.3 Energy Storage	0.30	0.22	..	..	-	-	-	-
TOTAL POWER & STORAGE	**9.29**	**7.00**	**..**	**..**	**0.48**	**17.23**	**0.38**	**10.04**
13.1 Energy Systems Analysis	5.06	3.82	..	..	-	-	-	-
13.2 Other Tech. or Research	4.14	3.12	..	..	0.25	9.15	0.09	2.50
TOTAL OTHER TECH./RESEARCH	**9.20**	**6.94**	**..**	**..**	**0.25**	**9.15**	**0.09**	**2.50**
TOTAL ENERGY R&D	**132.58**	**100.00**	**..**	**..**	**2.78**	**100.00**	**3.74**	**100.00**

1. Netherlands has not provided data for 2001.
2. Portugal data for 2001 are not complete.
Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Norway				Portugal[2]				Spain			
2000 $	%	2001 $	%	2000 $	%	2001 $	%	2000 $	%	2001 $	%
0.24	0.54	0.11	0.26	0.19	13.82	..	..	3.54	7.80	2.69	6.02
1.32	2.97	1.22	2.86	-	-	..	..	-	-	-	-
-	-	-	-	-	-	..	..	0.19	0.41	0.56	1.26
-	-	-	-	-	-	..	..	-	-	-	-
1.56	**3.51**	**1.33**	**3.12**	**0.19**	**13.82**	**..**	**..**	**3.73**	**8.21**	**3.26**	**7.28**
5.14	11.62	4.19	9.80	0.06	4.47	..	..	-	-	-	-
2.03	4.59	1.71	4.01	-	-	..	..	1.32	2.91	0.54	1.20
-	-	-	-	-	-	..	..	-	-	-	-
16.75	37.84	15.07	35.24	-	-	..	..	-	-	0.08	0.18
23.93	54.05	20.97	49.05	0.06	4.47	..	..	1.32	2.91	0.62	1.39
-	-	-	-	-	-	..	..	0.09	0.19	0.02	0.04
-	-	-	-	0.24	17.34	..	..	0.78	1.71	0.43	0.96
-	-	-	-	-	-	..	..	-	-	-	-
-	-	-	-	-	-	..	..	0.68	1.50	1.08	2.41
-	-	-	-	0.24	17.34	..	..	1.55	3.41	1.52	3.40
23.93	**54.05**	**20.97**	**49.05**	**0.30**	**21.82**	**..**	**..**	**2.87**	**6.31**	**2.14**	**4.79**
0.60	1.35	0.27	0.62	0.34	25.07	0.04	4.12	5.52	12.15	2.93	6.55
0.63	1.43	0.81	1.90	0.00	0.27	0.07	6.70	2.86	6.30	1.99	4.44
-	-	-	-	-	-	0.13	12.62	0.60	1.33	5.09	11.39
1.23	2.78	1.08	2.52	0.34	25.34	0.25	23.52	8.98	19.77	10.01	22.38
0.90	2.03	0.72	1.69	-	-	0.07	6.27	2.38	5.25	2.36	5.27
0.36	0.81	0.22	0.52	0.15	10.70	0.18	17.17	-	-	-	-
0.87	1.97	0.79	1.85	0.16	11.45	0.24	23.09	3.40	7.49	3.18	7.11
-	-	-	-	0.06	4.20	0.09	8.41	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
1.81	4.08	1.00	2.34	-	-	-	-	-	-	-	-
1.81	4.08	1.00	2.34	-	-	-	-	-	-	-	-
5.17	**11.68**	**3.81**	**8.92**	**0.70**	**51.69**	**0.82**	**78.45**	**14.76**	**32.51**	**15.55**	**34.76**
-	-	-	-	-	-	-	-	1.61	3.55	0.82	1.83
-	-	-	-	-	-	-	-	-	-	0.76	1.69
1.91	4.32	1.67	3.90	-	-	-	-	5.00	11.01	5.09	11.37
5.38	12.16	5.00	11.70	-	-	-	-	5.67	12.48	6.66	14.89
-	-	-	-	-	-	-	-	0.75	1.65	-	-
7.30	16.49	6.67	15.60	-	-	-	-	13.03	28.69	13.32	29.78
-	-	-	-	-	-	-	-	9.09	20.03	8.20	18.33
7.30	**16.49**	**6.67**	**15.60**	**-**	**-**	**-**	**-**	**22.12**	**48.71**	**21.52**	**48.11**
3.04	6.86	6.48	15.16	-	-	..	..	-	-	0.32	0.72
2.01	4.54	2.06	4.81	0.01	1.02	..	..	0.15	0.34	1.13	2.53
0.33	0.76	0.42	0.99	-	-	..	..	1.26	2.77	-	-
5.38	**12.16**	**8.96**	**20.96**	**0.01**	**1.02**	**..**	**..**	**1.41**	**3.12**	**1.45**	**3.25**
0.93	2.11	1.00	2.34	0.01	1.02	0.22	21.55	0.51	1.13	0.81	1.81
-	-	-	-	0.15	10.70	-	-	-	-	-	-
0.93	**2.11**	**1.00**	**2.34**	**0.16**	**11.72**	**0.22**	**21.55**	**0.51**	**1.13**	**0.81**	**1.81**
44.26	**100.00**	**42.76**	**100.00**	**1.36**	**100.00**	**1.04**	**100.00**	**45.40**	**100.00**	**44.73**	**100.00**

Table B14 (continued)

IEA Government Energy R&D Expenditure by Country, 2000 and 2001

(US$ million at 2001 prices and exchange rates)

	Sweden[1]				Switzerland			
	2000		2001		2000		2001	
	$	%	$	%	$	%	$	%
1.1 Industry	..	..	..	..	..	..	..	..
1.2 Residential, Commercial	..	..	..	..	..	..	..	..
1.3 Transportation	..	..	..	..	..	..	..	..
1.4 Other Conservation	..	..	..	..	..	..	..	..
TOTAL CONSERVATION	**..**	**..**	**..**	**..**	**19.86**	**17.65**	**20.15**	**17.00**
2.1 Enhanced Oil & Gas	..	..	..	..	7.22	6.42	7.71	6.50
2.2 Refining. Transp. & Stor.	..	..	..	..	..	..	..	..
2.3 Oil Shale & Tar Sands	..	..	..	..	..	..	..	..
2.4 Other Oil & Gas	..	..	..	..	..	..	..	..
Total Oil & Gas	..	..	..	..	7.22	6.42	7.71	6.50
3.1 Coal Prod., Prep. & Trans.	..	..	..	..	-	-	-	-
3.2 Coal Combustion	..	..	..	..	-	-	-	-
3.3 Coal Conversion	..	..	..	..	-	-	-	-
3.4 Other Coal	..	..	..	..	-	-	-	-
Total Coal	..	..	..	..	-	-	-	-
TOTAL FOSSIL FUELS	**..**	**..**	**..**	**..**	**7.22**	**6.42**	**7.71**	**6.50**
4.1 Solar Heating & Cooling	..	..	..	..	..	..	..	..
4.2 Solar Photo-Electric	..	..	..	..	..	..	..	..
4.3 Solar Thermal-Electric	..	..	..	..	..	..	..	..
Total Solar	..	..	..	..	24.07	21.39	24.90	21.00
5. Wind	..	..	..	..	0.60	0.53	1.19	1.00
6. Ocean	..	..	..	..	-	-	-	-
7. Biomass	..	..	..	..	4.81	4.28	5.33	4.50
8. Geothermal	..	..	..	..	2.41	2.14	2.96	2.50
9.1 Large Hydro (>10 MW)	..	..	..	..	..	..	..	..
9.2 Small Hydro (<10 MW)	..	..	..	..	..	..	..	..
Total Hydro	..	..	..	..	3.61	3.21	4.74	4.00
TOTAL RENEWABLE ENERGY	**..**	**..**	**..**	**..**	**35.51**	**31.55**	**39.12**	**33.00**
10.1 Nuclear LWR	..	..	..	..	..	..	..	..
10.2 Other Converter Reactors	..	..	..	..	..	..	..	..
10.3 Nuclear Fuel Cycle	..	..	..	..	..	..	..	..
10.4 Nuclear Supporting Tech.	..	..	..	..	..	..	..	..
10.5 Nuclear Breeder	..	..	..	..	..	..	..	..
Total Nuclear Fission	..	..	..	..	12.04	10.70	11.86	10.00
11. Nuclear Fusion	..	..	..	..	15.05	13.37	14.82	12.50
TOTAL NUCLEAR	**..**	**..**	**..**	**..**	**27.08**	**24.06**	**26.67**	**22.50**
12.1 Electric Power Conversion	..	..	..	..	..	..	..	..
12.2 Electricity Transm. & Distr.	..	..	..	..	..	..	..	..
12.3 Energy Storage	..	..	..	..	..	..	..	..
TOTAL POWER & STORAGE	**..**	**..**	**..**	**..**	**15.05**	**13.37**	**16.00**	**13.50**
13.1 Energy Systems Analysis	..	..	..	..	..	..	..	..
13.2 Other Tech. or Research	..	..	..	..	..	..	..	..
TOTAL OTHER TECH./RESEARCH	**..**	**..**	**..**	**..**	**7.82**	**6.95**	**8.89**	**7.50**
TOTAL ENERGY R&D	**62.10**	**100.00**	**..**	**..**	**112.55**	**100.00**	**118.55**	**100.00**

1. Sweden has not provided a breakdown of the data for 2000 and has not provided data for 2001.
Sources: *OECD Economic Outlook*, OECD Paris, 2001, and country submissions.

Turkey				United Kingdom				United States			
2000		**2001**		**2000**		**2001**		**2000**		**2001**	
$	%	**$**	%	**$**	%	**$**	%	**$**	%	**$**	%
0.25	9.26	3.36	49.53	0.86	1.22	1.03	1.37	140.50	6.06	148.62	5.39
0.01	0.42	0.01	0.17	0.52	0.74	0.85	1.13	125.87	5.43	130.22	4.72
0.00	0.05	0.03	0.40	0.74	1.04	1.01	1.33	233.89	10.09	255.40	9.25
0.02	0.73	0.03	0.48	-	-	-	-	50.67	2.19	47.35	1.72
0.28	**10.47**	**3.43**	**50.58**	**2.12**	**3.00**	**2.89**	**3.83**	**550.92**	**23.77**	**581.59**	**21.07**
0.04	1.40	0.07	1.10	2.67	3.77	2.52	3.34	60.07	2.59	65.94	2.39
0.01	0.38	0.02	0.29	-	-	-	-	14.46	0.62	22.11	0.80
0.01	0.19	0.00	0.05	-	-	-	-	..	..	..	..
0.00	0.16	-	-	1.48	2.09	1.59	2.10	13.97	0.60	22.77	0.83
0.06	2.14	0.10	1.44	4.15	5.86	4.11	5.43	88.50	3.82	110.82	4.02
0.16	6.04	0.22	3.30	0.08	0.12	-	-	4.33	0.19	5.22	0.19
0.61	22.56	0.90	13.24	2.33	3.29	2.89	3.82	77.06	3.33	167.76	6.08
0.04	1.46	0.01	0.10	-	-	-	-	7.08	0.31	7.40	0.27
-	-	-	-	-	-	-	-	35.13	1.52	58.02	2.10
0.82	30.06	1.13	16.64	2.42	3.41	2.89	3.82	123.61	5.33	238.41	8.64
0.88	**32.20**	**1.23**	**18.08**	**6.56**	**9.27**	**6.99**	**9.25**	**212.10**	**9.15**	**349.23**	**12.65**
0.01	0.52	0.10	1.43	-	-	-	-	1.96	0.08	3.87	0.14
0.01	0.50	0.05	0.73	1.92	2.71	3.17	4.19	66.02	2.85	74.26	2.69
0.01	0.55	0.02	0.25	-	-	-	-	15.26	0.66	13.57	0.49
0.04	1.57	0.16	2.40	1.92	2.71	3.17	4.19	83.24	3.59	91.69	3.32
0.05	1.87	0.06	0.92	1.33	1.88	2.16	2.86	32.45	1.40	39.13	1.42
-	-	-	-	0.59	0.83	1.30	1.72	..	..	..	..
0.31	11.49	0.56	8.32	2.51	3.55	3.17	4.19	70.94	3.06	85.37	3.09
0.34	12.45	0.27	4.01	-	-	-	-	23.86	1.03	26.62	0.96
-	-	0.02	0.27	-	-	-	-	..	..	..	..
-	-	-	-	0.15	0.21	0.29	0.38	..	..	..	..
-	-	0.02	0.27	0.15	0.21	0.29	0.38	4.97	0.21	4.94	0.18
0.75	**27.38**	**1.08**	**15.92**	**6.50**	**9.18**	**10.09**	**13.35**	**215.44**	**9.30**	**247.76**	**8.98**
0.03	0.96	0.01	0.09	-	-	-	-	..	..	..	..
-	-	-	-	-	-	-	-	..	..	..	..
0.02	0.84	0.01	0.13	-	-	-	-	..	..	..	..
0.04	1.59	0.13	1.94	-	-	-	-	35.55	1.53	48.74	1.77
-	-	-	-	-	-	-	-	..	..	..	..
0.09	3.39	0.15	2.16	-	-	-	-	35.55	1.53	48.74	1.77
-	-	-	-	25.16	35.55	20.65	27.32	243.60	10.51	241.96	8.77
0.09	**3.39**	**0.15**	**2.16**	**25.16**	**35.55**	**20.65**	**27.32**	**279.16**	**12.05**	**290.70**	**10.53**
0.05	1.90	0.24	3.48	2.51	3.55	2.74	3.62	88.40	3.81	81.52	2.95
0.48	17.66	0.54	8.01	-	-	-	-	34.71	1.50	41.34	1.50
0.16	5.79	0.05	0.72	-	-	-	-	3.46	0.15	5.92	0.21
0.69	**25.35**	**0.83**	**12.20**	**2.51**	**3.55**	**2.74**	**3.62**	**126.57**	**5.46**	**128.78**	**4.67**
0.03	1.21	0.05	0.67	1.21	1.71	1.24	1.64	..	..	..	..
-	-	0.03	0.39	26.72	37.75	30.98	40.99	933.39	40.27	1 161.66	42.09
0.03	**1.21**	**0.07**	**1.06**	**27.93**	**39.46**	**32.22**	**42.63**	**933.39**	**40.27**	**1 161.66**	**42.09**
2.72	**100.00**	**6.78**	**100.00**	**70.78**	**100.00**	**75.58**	**100.00**	**2 317.59**	**100.00**	**2 759.72**	**100.00**

C

ANNEX

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The Member countries* of the International Energy Agency (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 sources is also a priority. A number of

* Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

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

The Producer Subsidy Equivalent (PSE) measures financial support for coal production. The PSE includes all support provided for the production of coal that the industry itself would normally be expected to cover in a competitive environment. The items involved include direct state payments, the value of protection provided by import constraints and the practical effects of special sales agreements.

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 world prices.

In the tables given in the individual country reviews, the total PSE is the sum of the relevant net budgetary payments to producers and the value of the indirect measures, as described below.

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, 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 by government-imposed limitations on coal imports, or 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.

Specific long-term arrangements between coal producers and major consumers, particularly electricity-generating utilities, may not 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 entered into these arrangements because it considered that to fulfil its own obligations to maintain electricity supplies, it required an assured long-term local source of coal supply, or because it entered into the arrangement for reasons of national policy.

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.

Selection of an appropriate reference price, against which the domestic price is to be compared, is critical to an accurate measurement of the degree of support provided through high prices.

The difference between the actual price received by domestic consumers and the reference price should be calculated for comparable coal qualities and for similar lengths of contract. Differences in thermal quality between domestic and imported steam coals should be adjusted by expressing prices (and quantities) in thermal-equivalent terms. When comparing coking coal, other properties, such as coke strength, should be taken into account.

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. However, some mines may require more support than the average and some less, perhaps none at all.

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

Country		*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000p*
France	Production (in million tce)	10.07	9.45	8.30	7.46	7.80	7.07	5.73	4.43	4.13	3.16
	Aid per tce (in FRF)	222	225	288	269	75	81	434	581	564	691
	Aid per tce (in US$)	39.42	42.51	50.79	48.41	14.95	15.73	74.41	98.69	91.76	97.15
Germany	Production (in million tce)	67.57	66.86	59.29	53.15	54.45	48.94	47.06	41.62	40.02	34.00
	Aid per tce (in DEM)	170	184	192	242	224	220.34	217	211	216.9	244.5
	Aid per tce (in US$)	102.40	117.93	115.93	149.20	156.15	146.41	124.94	119.83	118.2	115.4
Japan	Production (in million tce)	6.34	5.98	5.68	5.46	4.93	5.10	3.37	2.91	2.80	
	Aid per tce (in Yen)	17 289	15 649	17 192	17 184	16 878	15 553	16 849	13 772	15 107	..
	Aid per tce (in US$)	128.54	123.52	154.60	168.14	179.36	142.95	139.24	105.62	134.29	..
Spain	Production (in million tce)	11.60	12.39	12.33	12.39	11.94	11.95	12.07	11.00	10.34	10.38
	Aid per tce (in PTA)	6 354	6 073	6 133	10 370	11 593	11 058	11 591	12 624	11 376	12 652
	Aid per tce (in US$)	61.16	59.32	48.22	77.39	92.97	87.28	79.18	85.83	72.92	70.32
Turkey	Production (in million tce)	2.69	2.47	2.46	2.34	1.88	1.97	1.94	1.64	1.47	1.67
	Aid per tce (in '000 TL)	637	1 713	1 760	2 106	6 487	8 031	12 371	27 212	63 976	138 078
	Aid per tce (in US$)	151.61	248.32	160.02	70.66	141.95	98.79	81.60	104.54	155.8	220.95
UK	Production (in million tce)	78.11	69.75	56.41	41.23	46.97	43.10	41.70	35.42	32.06	27.5
	Aid per tce (in GBP)	14.45	15.51	3.45	5.03	2.76	2.67	4.30	0.00	0.00	2.15
	Aid per tce (in US$)	25.49	27.21	5.18	7.71	4.35	4.16	7.03	0.00	0.00	3.25

p Preliminary data, subject to revision.
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)

Country	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000p*
Power station steam coal (US$/tce)	52.00	51.81	44.70	43.68	50.20	48.64	47.89	41.28	36.80	36.61
Coking coal (US$/tonne)	59.55	57.93	56.15	54.20	57.82	57.50	57.53	55.41	47.83	47.50

* Cost, Insurance and Freight.
Source: European Commission.

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.

APEC	Asia-Pacific Economic Co-operation
ASEAN	Association of South-East Asian Nations
bcm	billion cubic metres
b/d	barrels per day
bcf/d	billion cubic feet per day
CCGT	combined-cycle gas turbine
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term "co-generation" is used
CIS	Commonwealth of Independent States
CO_2	carbon dioxide
COP	Conference of the Parties
EDF	Electricité de France
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.
EWG	Energy Working Group
FERC	Federal Electricity Regulatory Commission.
FSU	Former Soviet Union
GDP	gross domestic product.
GHG	greenhouse gas
GJ	gigajoule

IEA	International Energy Agency whose Members are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States
IEP	International Energy Program
IPCC	Intergovernmental Panel on Climate Change
IPP	independent power producers
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
JCC	Japanese crude cocktail
kb/d	thousand barrels per day
LNG	liquefied natural gas
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature
LSFO	low sulphur fuel oil
mb/d	million barrels per day
MBtu	million British thermal units
mcf/d	million cubic feet per day
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe
MW	megawatt of electricity, or one watt $\times 10^6$
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$
NEM	National Electricity Market
NETA	New Electricity Trading Arrangements
NFFO	Non-Fossil Fuel Obligation
OECD	Organisation for Economic Co-operation and Development.
OPEC	Organization of Petroleum Exporting Countries

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
PSA	production sharing agreement.
PSE	producer subsidy equivalent
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well
RTO	regional transmission organisations
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.
TRC	Tradable Renewable Energy Certificates
TW	terawatt, or one watt $\times 10^{12}$
TWh	terawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^{12}$
UNFCCC	United Nations Framework Convention on Climate Change
1Q	first quarter
2Q	second quarter
3Q	third quarter
4Q	fourth quarter

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, liquid biomass, biogas, 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 1995 prices and exchange rates.
[13] Toe per person.
[14] "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2000 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.

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