INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

2003 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 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 Austria, Hungary, Ireland, Italy, Japan and Switzerland conducted from October 2002 to June 2003. Shorter standard reviews are also included covering seven other member countries: Australia, Belgium, the Czech Republic, New Zealand, Norway, Spain and Turkey.

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, their policies on energy efficiency and energy R&D as well as developments in major non-member countries. Key statistical information is also included.

Claude Mandil
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 September 2003 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.

Jun Arima supervised preparations for this book and wrote the chapters on market trends and energy security. Many members of the IEA staff contributed to this book. Major contributions came from Antoine Halff, Lawrence Eagles (oil market trend), Fatih Birol, Gordon Duffus (energy security) Doug Cooke, Peter Fraser (electricity), Sylvie Cornot-Gandolphe (gas), John Cameron (coal), Jonathan Pershing, Kristi Varangu, Nicolas Lefevre (environment), Mitsuhide Hoshino (R&D), Alan Meier (efficiency), Xavier Chen (China), Ladan Mahboobi (India), Brett Jacobs (South-East Asia), Sylvie D'Apote, Anouk Honore (Latin America), Emmanuel Bergasse (Central and South-eastern Europe), Isabelle Murray (Russia), Dunia Chalabi (Saudi Arabia). Karen Treanton, Toril Ekeland and Pierpaolo Cazzola (key statistics and indicators), Monica Petit (figures), Marilyn Ferris and Sandra Martin (editing).

2002–2003 IN-DEPTH REVIEWS

Austria

Although the in-depth review for Austria was conducted in the 2001-2002 review cycle, the timing of its publication meant that the summary of conclusions was unable to appear in Energy Policies of IEA Countries – 2002 Review.

Team Leader: José Carvalho-Netto (Portugal). *Team members*: Louis Meuric (France), Kaj Stærkind (Denmark), Franz Söldner (EC), Jun Arima (IEA), Shigetaka Seki (IEA), Jonathan Coony (IEA).

Finland

At the time of publication this report is under preparation. The summary of conclusions and recommendations will be included in the 2004 edition.

Hungary

Team Leader: John Havard (United Kingdom). *Team members*: Helen Gratsia (Greece), Karina Veum (Norway), Timo Haapalehto (NEA), Olivier Appert (IEA), Alain Bilot (IEA), Pierre Audinet (IEA).

Ireland

Team Leader: Michael Lear (New Zealand). *Team members*: Stephanie Bauer (Germany), Pekka Tervo (Finland), Johannes Maters (EC), Jun Arima (IEA), Jonathan Coony (IEA).

Italy

Team Leader: Didier Houssin (France). *Team members*: Jeroen Brinkhoff (the Netherlands), Kjetil Wilhelmsen (Norway), Wolfgang Langen (Germany), Johannes Maters (EC), Jun Arima (IEA), Sylvie Cornot-Gandolphe (IEA), Pierre Audinet (IEA).

Japan

Team Leader: Hartmut Schneider (Germany). *Team members*: Samuel Baldwin (United States), Jordi Dolader i Clara (Spain), Alan Heyes (United Kingdom), Helen Ratcliffe (Australia), Peter Wilmer (NEA), Olivier Appert (IEA), Richard Baron (IEA), Lea Gynther (IEA).

Switzerland

Team Leader: Kazuyuki Katayama (Japan). *Team members*: Timo Ritonummi (Finland), Margrethe Slinde (Norway), Rober-Rush Price (NEA), Jonathan Pershing (IEA), Jun Arima (IEA), Lea Gynther (IEA).

STANDARD REVIEWS

Australia: Pierre Audinet; *Belgium:* Lea Gynther; *Czech Republic:* Emmanuel Bergasse; *New Zealand:* Jonathan Coony; *Norway:* Jonathan Coony; *Spain:* Lea Gynther; *Turkey:* Pierre Audinet.

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OVERVIEW OF ENERGY POLICY AND MARKET DEVELOPMENTS

INTRODUCTION

From 2002 to early 2003, energy security continued to be of great importance among energy policy-makers influenced by the imminent concerns in the oil market. In January 2003, OECD crude oil stocks fell below the lower part of the five-year forecast. A strike in Venezuela, starting in December 2002, reduced production and effectively closed the ports, causing exports to fall dramatically. Unrest in Nigeria and wide anticipation of war in Iraq caused great concern for a potentially broader disruption among oil producers in the Gulf. In addition, unusually cold weather in the northern hemisphere and increased import of heavy oil in Japan due to the temporary outage of 17 nuclear units tightened the oil supply demand situation.

The IEA monitored the market situation very closely, providing regular updates to its member countries. On the eve of the outbreak of hostilities in Iraq in February, the IEA circulated an update on the oil market situation and concluded that if oil producers increased their production, the market would be adequately supplied. Throughout this period, the IEA was in close consultation with its member countries, the industry, major oil-producing countries, in particular the Organization of Petroleum Exporting Countries (OPEC) and major non-member consuming countries, notably China. IEA member countries did not release their stocks, totalling several years' worth of Iraqi exports, but stood ready to respond promptly and massively if necessary. The market recognised this and consequently there was no price spike or supply disruption. As oil supply was secured, the consumers' sense of vulnerability diminished. In short, the emergency preparedness of the IEA was very effective.

However, energy security challenges which energy policy-makers need to confront are not limited to near-term risks related to oil. Growing gas demand and rising import dependency in most IEA countries mean that security of gas supply is also important. In addition to these external developments, an internal dimension of energy security has also risen in conjunction with market reform in the gas and electricity sector.

During the 1990s, there was hope that the liberalised gas and electricity markets would automatically provide security of gas and electricity supply. While the markets can give the right investment signals to generators that lead to timely investment, the California energy crisis showed that power markets are not able to ensure automatically security of supply. The blackout in the United States and Canada in August 2003 raised concerns about the adequacy of investment in the reliability of electricity networks. The heat wave in Northern Europe in August 2003 tested system limits. The reformed gas markets may not value security of supply either. With unbundling of gas supplies and transportation activities, investment – in particular in transit pipelines – may not correspond to the necessity. With market liberalisation and cost minimisation efforts, diversity of gas supplies may not be a company objective. Substantial investment which is necessary to develop new gas supplies and to deliver it to the market may be hindered because of regulatory uncertainty.

In this respect, the government needs to monitor the gas and electricity sector performance through enhanced dialogue between governments and all market participants. It is essential for energy markets to deliver efficient price signals and for related regulatory arrangements to allow an efficient response to investment needs. Where market responses are slow or inadequate, some form of safety net may be needed to address reliability requirements. Development and diffusion of cleaner technologies for energy supply and end-use is essential. For example, renewable energy technologies can further diversify the energy supply mix and new technologies such as hydrogen and carbon capture and storage can change the nature of future energy systems. This will substantially enhance long-term energy security as well as address environmental protection and economic efficiency.

Energy security issues are a global challenge and cannot be addressed only by IEA member countries. Between now and 2030, more than 60% of the increase in world primary energy demand is expected to come from developing countries. Under an increasingly global energy system, meeting these energy security objectives will be possible only if it applies to IEA member and non-member countries alike. According to the *World Energy Outlook 2002*, the global energy resource base is large enough to meet the world's growing demand during the next three decades. However, the necessary investment is massive and the bulk of it will be needed in developing countries and transition economies. The *World Energy Investment Outlook 2003* identified more than US$ 16 trillion needs to be invested to meet projected growth in energy demand. Sound macroeconomic management, removal of market barriers, establishment of a transparent, efficient and stable institutional and regulatory frameworks and good governance are indispensable to facilitate such investment. The growing energy demand from non-IEA member countries also suggests the critical importance of outreach and collaboration on energy crisis management involving major energy producers and suppliers. A broader dialogue between oil and gas producers and consumers at all levels is also essential for global energy security. The Eighth International Energy Forum (IEF), held in Osaka in September 2002, has made a substantial contribution towards this. Diffusion of technology to developing countries will also be critical.

All of these energy security challenges, namely near-term risk, new dimensions of energy security and global challenges, dominated discussions at the IEA Ministerial meeting in April 2003. Ministers reaffirmed their readiness to combat any disruption of oil supplies, including the judicious use of emergency oil stocks, demand restraint and other response measures. They also committed themselves to addressing longer-term energy security challenges through diversifying energy type, source and route and achieving greater energy efficiency. To this end, they emphasised the role of energy technology development, demonstration and deployment as well as international technology collaboration in such fields as energy efficiency, hydrogen and clean technologies with low pollution and carbon emissions. Noting an increasing reliance on natural gas in the energy mix and a growing import dependence on natural gas, they instructed the Secretariat to assess gas security issues and identify strategies, including securing diverse gas sources and routes as well as technology development. In this respect, the importance of collaboration between government and industry has been emphasised. Furthermore, ministers committed themselves to strengthen the policy framework permitting markets to meet global energy investment and trade needs and to promote an environment that will attract private investment. They also affirmed the increasing importance of non-member countries in world energy markets, welcomed an improved dialogue between producers and consumers and urged the acceleration of energy security co-operation with non-member countries, especially those critical to the global energy balance, recognising that security can only be assured through a more global framework.

In 2002, there was mixed progress in electricity market reform. Reforms continued to advance in IEA Europe. With the amendment of the Electricity Directive and a proposed regulation on cross-border electricity exchanges, all consumers in the European Union will be eligible to choose suppliers by 2007. The EU directive also envisages legal unbundling of a transmission system operator by 2004 and unbundling of a distribution system operator by 2007. Implementation of these measures could lead to the development of the world's largest integrated electricity market. On the other hand, progress in the United States remained subdued following California's experience and the subsequent concerns about risk management due to the Enron failure. In Canada, the Ontario government decided to re-regulate prices, reversing the market reform introduced in May 2002. In Australia, the Council of Australian Governments issued a report calling for swift reforms in the electricity and gas markets. Japan decided to expand the market opening to 63% by April 2005.

Market competition in the gas sector continued to spread in the European Union with the amendment of the Gas Directive, making all consumers eligible to choose suppliers by 2007. Japan decided to expand the contestable market to 44% by April 2005. On the other hand, there is a more cautious assessment of gas market liberalisation in the United States owing to deteriorating financial conditions of some market participants and shaken confidence in the markets. Only two states changed their retail unbundling status in 2002.

A the time when this book was written, the near-term future of the international climate change process remains uncertain. While 108 countries ratified the Kyoto Protocol by May 2003, its threshold for the entry into force has not yet been met. The US and Australia have announced their intention to remain outside the Protocol, and Russia, of which ratification is necessary for the entry into force of the Protocol, has not yet taken a formal decision. Despite such uncertainty, those countries that have ratified the Protocol have taken significant steps over several years to implement the agreement by various policies such as fiscal measures, regulatory instruments, voluntary agreements, tradable permits and RD&D. In particular, it is noteworthy that the European Union (EU) reached a political agreement on an EU-wide emissions trading scheme to be operative by 2005 and which will have a profound impact on the energy sector.

2002 was a significant milestone for multilateral discussions on sustainable development with the World Summit for Sustainable Development (WSSD), held from 26 August to 4 September 2002 in Johannesburg. Recognising that energy would play an important role in the Summit, the IEA contributed substantially throughout the WSSD preparatory process with the release of a brochure entitled *Towards Solutions: Sustainable Development in the Energy Sector.* The Plan of Implementation agreed at WSSD contains many references to energy, such as energy diversification, improved access to energy, energy education, producer-consumer dialogue and partnership with the private sector, most of which are consistent with the common position of IEA member countries in the above-mentioned brochure. At the Summit, some 300 "Type 2"activities, namely, voluntary partnerships among UN agencies, governments, industry, intergovernmental and non-governmental organisations, were announced, of which energy activities represent a significant number.

Most IEA member countries regard energy efficiency as one of the key policy tools to achieve greenhouse gas (GHG) reduction targets as well as energy security. These goals sometimes run counter to other policies such as de-regulation in the energy market which transfers responsibility for energy efficiency to consumers. However, the energy crisis in several countries such as New Zealand and California forced governments to reconsider their energy efficiency role and other forms of managing and forecasting energy demand. In 2003, IEA countries employed methods to promote energy efficiency, including adjusting energy prices, establishing financial instruments to encourage the use of efficient products and practices, mandating minimum efficiency levels and creating voluntary programmes.

Despite the critical role played by energy technologies, government energy R&D budgets have been pursuing a declining trend and industrial R&D investments have become increasingly short-term owing to market liberalisation. Greater and sustained commitment is needed for energy R&D, in particular for promising areas such as renewables, fossil fuels, hydrogen, nuclear, end-use and system optimisation. From 2002 to 2003, several IEA member countries launched new initiatives, in co-operation with the IEA, in such fields as CO_2 capture and storage, hydrogen and linkages between basic science and future energy technologies.

There have been various developments in major non-OECD countries in terms of energy security and energy market reform. This book contains a short introduction to such developments in China, India, South-East Asia, Latin America, Russia, Central and South-eastern Europe, and Saudi Arabia.

MARKET TRENDS[1]

ENERGY DEMAND: OECD

After its initial decline in 2001 since 1990, total primary energy supply (TPES) of OECD countries further declined to 5 321 million tonnes of oil equivalent (Mtoe) in 2002, down by 0.2% from the previous year, reflecting a delay in the recovery of the global economy. TPES decreased by 0.7% in OECD Europe

Table 1

Total Primary Energy Supply in OECD Regions

(Mtoe)

	1990	*2000*	*2001*	*2002*[1]
TPES TOTAL				
Total OECD	4 517	5 316	5 333	5 321
North America	2 261	2 705	2 682	2 678
Europe	1 625	1 768	1 802	1 789
Pacific	631	843	849	854
OIL				
Total OECD	1 901	2 166	2 177	2 153
North America	931	1 072	1 085	1 070
Europe	631	685	696	682
Pacific	340	408	397	401
GAS				
Total OECD	840	1 154	1 135	1 158
North America	517	657	623	638
Europe	258	390	403	410
Pacific	65	107	109	110
COAL				
Total OECD	1 058	1 088	1 107	1 101
North America	486	580	583	578
Europe	436	325	324	320
Pacific	136	184	200	203

1. Preliminary data.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

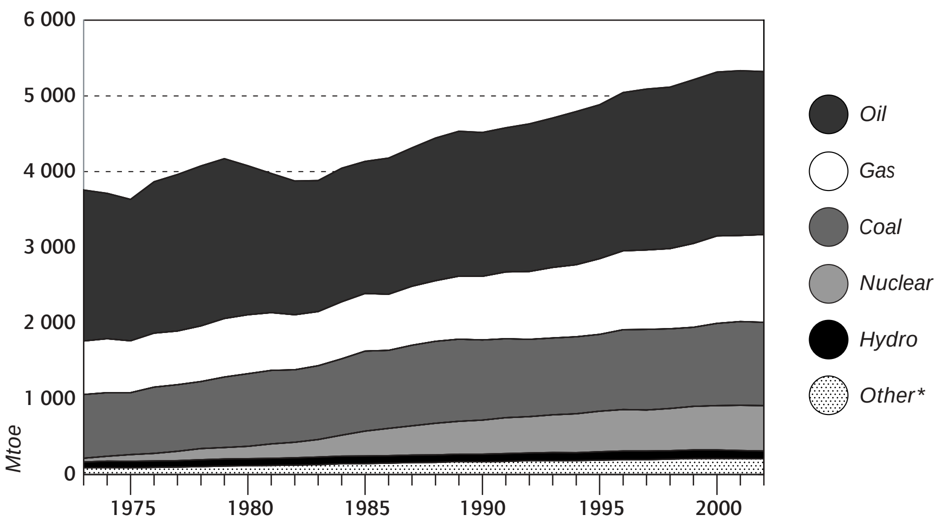
1. Owing to the availability of statistics, the sections on energy consumption and CO_2 emissions only present 2001 data.

and 0.2% in OECD North America, while it increased by 0.6% in OECD Pacific. Within each region, the situation differed among countries. In OECD North America, TPES decreased in Canada by 3.4% while it slightly increased in the US by 0.2%. In OECD Pacific, the strong growth of TPES in Australia (6.1%) and Korea (3.6%) offset the continuous decline in Japan (–1.9%). In OECD Europe, except for Finland, Norway, Spain and Turkey, all countries recorded negative or zero growth.

In 2002, oil remained the largest source of energy, *i.e.* 40% of TPES in OECD countries, followed by natural gas (22%) and coal (21%). While the share of natural gas decreased for the first time since 1986 from 22% in 2000 to 21% in 2001, it rose again in 2002 at the expense of oil, the share of which dropped from 41% in 2001.

Figure 1

Total Primary Energy Supply in OECD Countries, 1973 to 2002



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

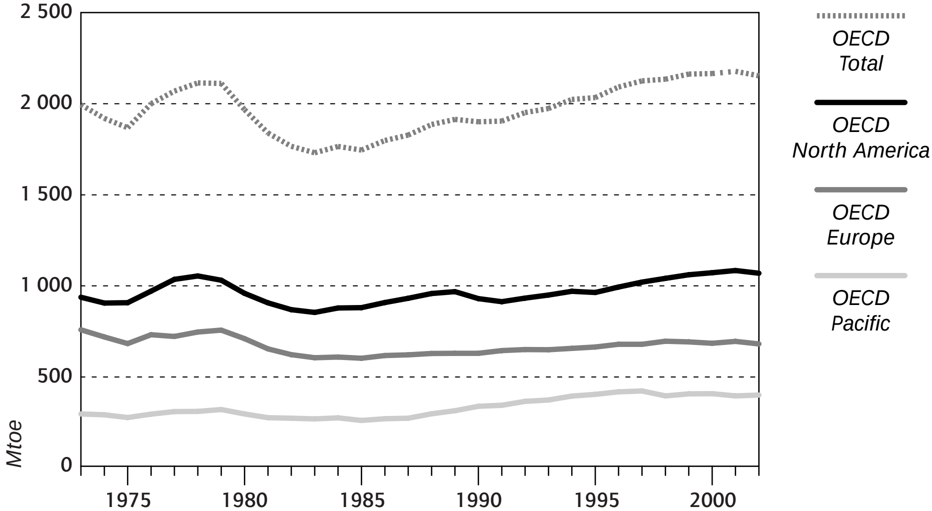
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

OIL

In 2002, overall oil consumption in the OECD continued to decrease, extending the trend set in 2001. For the full year, OECD oil demand declined by 1.1% to 2 153 Mtoe. However, the pace of contraction slowed notably over the course of the year. The drop in oil demand lessened compared with 2001 from the first quarter (1Q) to the third quarter (3Q). By the fourth quarter (4Q), demand growth had fully recovered. The rebound gained momentum in 1Q of 2003.

Figure 2

Oil Demand in OECD Countries by Region, 1973 to 2002



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

The decrease in 2002 partly reflected delays in the long-awaited recovery of the global economy. Throughout 2002, expectations of economic recovery were reportedly toned down and postponed. Weather factors also came into play with exceptionally mild temperatures in the winter of 2001-2002 across the Northern Hemisphere, further depressing demand. The following year, weather patterns shifted into reverse, with North America, Europe and Asia all suffering from colder-than-normal temperatures. As OECD economies remained sluggish through mid-2003, the contrast in temperatures was the main factor behind the dramatic recovery in winter oil demand.

Fuel switching to oil in Asia and North America compounded the effect of the weather. In the US, low natural gas supplies caused a winter rally in natural gas prices, boosting demand for residual fuel oil and heating oil from power generators and industrial users. In Japan, safety issues surrounding nuclear power generators of the boiling water reactor type caused a massive shortfall in nuclear power generation output, boosting utility demand for residual fuel oil and crude oil for direct burn used as boiler fuel in thermal power plants. In contrast, fuel switching to gas by electric utilities in France, Italy, Portugal and Spain undermined European oil demand. Those diverging dynamics are fully reflected in the sharply contrasting pace of oil demand growth across the OECD. Whereas OECD European oil demand decreased in all quarters of 2002, North American demand started recovering in 2Q and picked up momentum in the second half of the year. Demand in the OECD Pacific region fell in 1Q and 2Q, stayed roughly level in 3Q and peaked in 4Q. The contrast continued in 1Q of 2003, with consumption soaring in OECD North America and OECD Pacific, but inching marginally lower in OECD Europe.

However, it is important to note that the increase in consumption in overall OECD demand in late 2002 to early 2003 appears largely to reflect one-off and temporary factors rather than lasting shifts affecting the structure of the market. A return to more normal weather patterns would significantly curb demand growth in the winter of 2003-2004. Assuming that Japanese concerns about nuclear safety will eventually be put to rest, full reactivation of the country's nuclear power generating capacity will cause oil demand from the country's utility sector to switch back to the previous declining pattern. Rising liquefied natural gas (LNG) output in the Asia-Pacific region will also likely boost natural gas consumption at the expense of oil. Falling North American natural gas output may provide more lasting support to regional oil demand from the utility and industrial sectors. However, declines in North American gas output are expected to be at least partly offset by increases in local LNG supply and capacity expansions at US LNG import terminals.

Furthermore, recent shifts in the market's structure are more likely to curb oil demand growth than to boost it. Steep drops in air travel demand caused successively by the economic downturn of 2001, the terrorist attacks of September that year, the Iraq war and the severe acute respiratory syndrome (SARS) epidemic of 2003, will likely result in permanent demand losses following cuts in airline fleets and steep efficiency gains resulting from the permanent retirement of older, less efficient aircraft. In Europe, increases in natural gas-fired power generating capacity will permanently trim residual fuel oil demand, while the continued dieselisation of the economic fleet will also result in substantial efficiency gains.

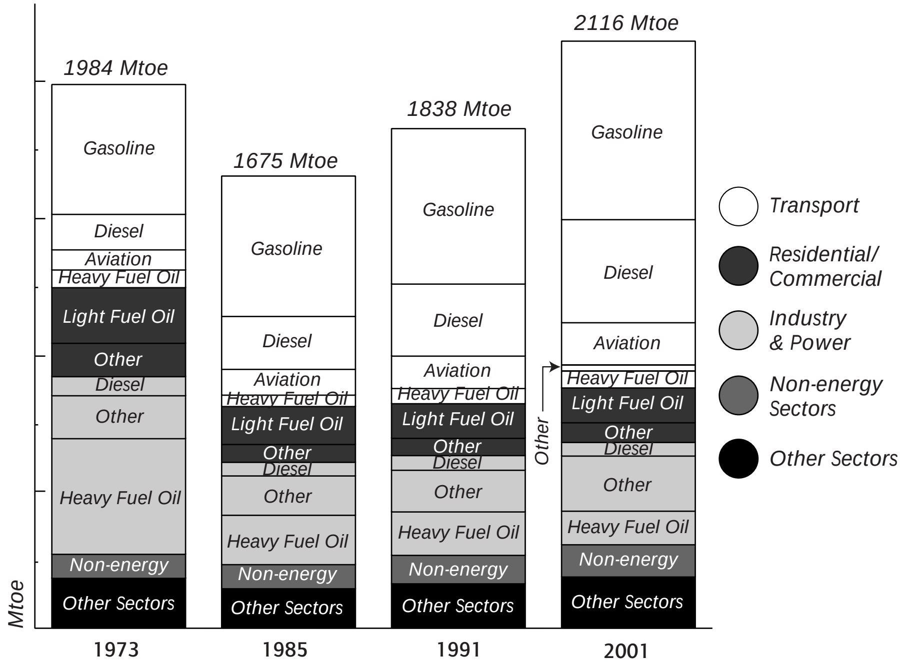
GAS

In 2002, natural gas demand in OECD countries was 1 158 Mtoe, up by 2% from 2001 after its first decrease in 2001 since 1987. This is due to the trend in OECD North America where gas consumption sharply decreased by 5.2% in 2001 and increased again by 2.4% in 2002. In the US, unusually cold weather boosted gas demand by household and commercial users while continuing high gas prices curbed gas demand by industrial customers. Some industrial plants, in particular aluminium producers, chose to close down their activity in view of the high costs of gas feedstock. Gas consumption in the US electricity sector continued to increase as new gas-fired power plants were put on stream as well as limited fuel switching possibilities because of environmental constraints.

Gas consumption in OECD Europe increased by 1.7% while it was much more marginal compared with the steady growth over previous years. This marginal

Figure 3

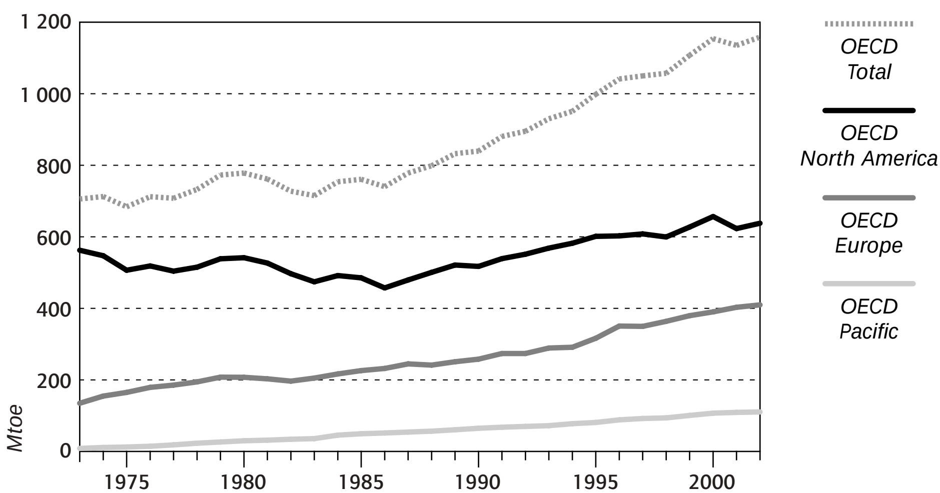
Consumption of Oil Products by Sector in IEA Countries, 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Figure 4

Natural Gas Demand in OECD Countries by Region, 1973 to 2002



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

increase was due to extremely warm weather conditions and the poor economic situation which influenced gas sales to industry and power generation. The rate of growth differed between countries with negative to modest growth recorded in a few major gas-consuming countries, such as Italy, Germany, the Netherlands and the United Kingdom, while other markets, such as Portugal, Spain and Turkey, saw above-average growth.

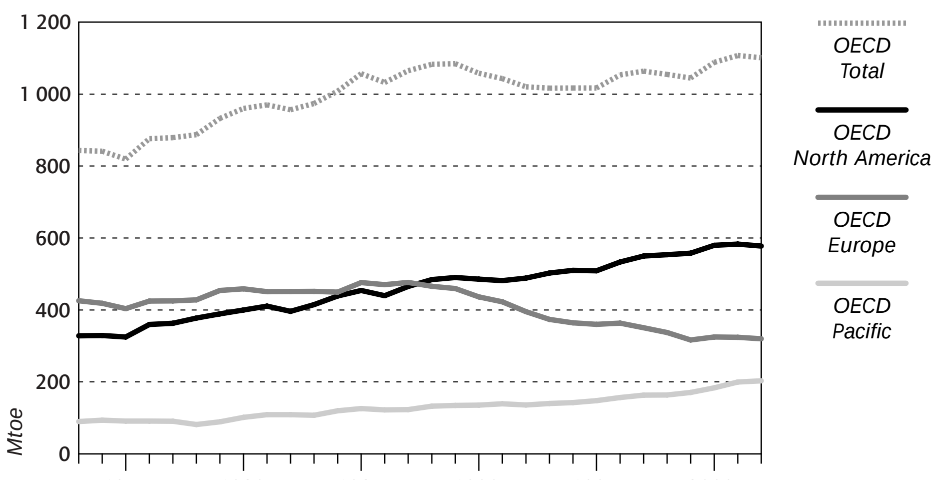
OECD Pacific gas demand showed a growth of 0.9%. The situation differed widely between Australia and Korea which increased their gas consumption, and Japan, where gas demand decreased owing to the continuing economic slow-down.

COAL

In 2002, coal demand in OECD countries was 1 101 Mtoe, down by 0.5% from 2001 after an increase of 1.7% from 2000. This reversal is mainly attributed to the development in OECD North America where coal demand decreased by 0.9% in 2002. A decrease of 3.8% in coal power generation in the US led this trend. Coal demand in OECD Europe continuously decreased by 1.2% as a result of pressure from the European Union to reduce subsidies for domestic coal production and for consumers, increased environmental awareness and growing natural gas penetration. Coal demand in OECD Pacific increased by 1.5%, led by Australia. In Japan, while coal demand increased in the power

Figure 5

Coal Demand in OECD Countries by Region, 1973 to 2002



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

sector owing to the outage of nuclear power plants, it was offset by the decrease in the industrial sector which made Japanese coal demand stable compared to the previous year.

ENERGY CONSUMPTION BY SECTOR: OECD

In 2001, total final consumption (TFC) in OECD countries was 3 657 Mtoe, 0.6% down from 2000. This is the first decline since 1990 and can be attributed to various factors, not least the economic slow-down in the US and global economies, warm weather, volatile energy prices and the terrorist attacks of 11 September. On the other hand, TFC increased by 18% over its 1990 level.

Table 2

Total Final Consumption in OECD Regions

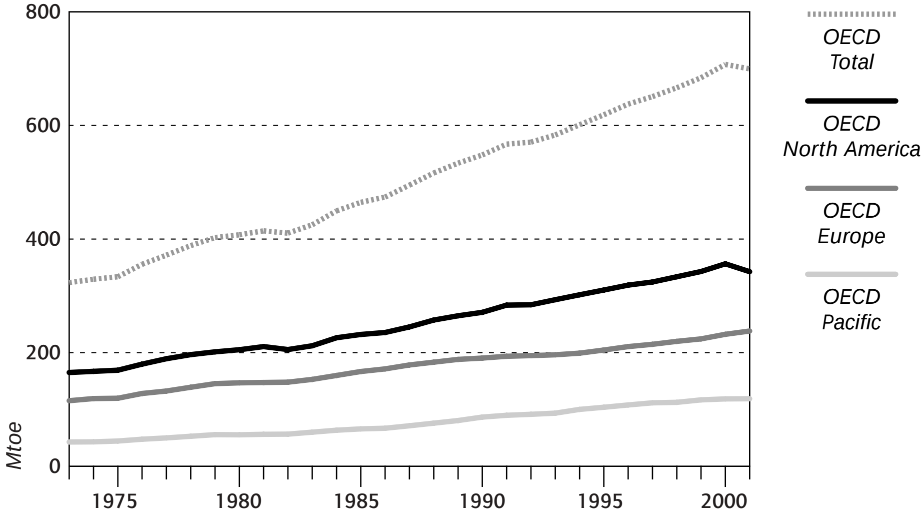
(Mtoe)

	1990	*1999*	*2000*	*2001*
TFC TOTAL				
Total OECD	3 106	3 564	3 677	3 657
North America	1 533	1 770	1 858	1 819
Europe	1 148	1 248	1 260	1 279
Pacific	425	546	560	559
INDUSTRY				
Total OECD	1 085	1 198	1 260	1 225
North America	478	549	596	574
Europe	421	415	432	424
Pacific	187	233	232	227
RESIDENTIAL/COMMERCIAL				
Total OECD	1 033	1 164	1 196	1 209
North America	478	532	561	545
Europe	432	473	466	492
Pacific	123	160	169	172
TRANSPORT				
Total OECD	988	1 203	1 221	1 223
North America	578	689	701	700
Europe	295	360	362	363
Pacific	115	154	158	160

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Figure 6

Electricity Demand (Final Consumption) in OECD Countries by Region, 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Petroleum products accounted for the largest share in TFC (53%), followed by gas (20%), electricity (19%) and coal (3%). From 2000 to 2001, the share of oil slightly increased from 52% to 53% at the expense of natural gas. This is mainly due to the sharp decrease in natural gas consumption in OECD North America by 7.3% as a result of a price hike at the beginning of 2001. This shows a clear contrast with OECD Pacific and OECD Europe where natural gas consumption increased by 3.3%.

Table 3

Electricity Consumption

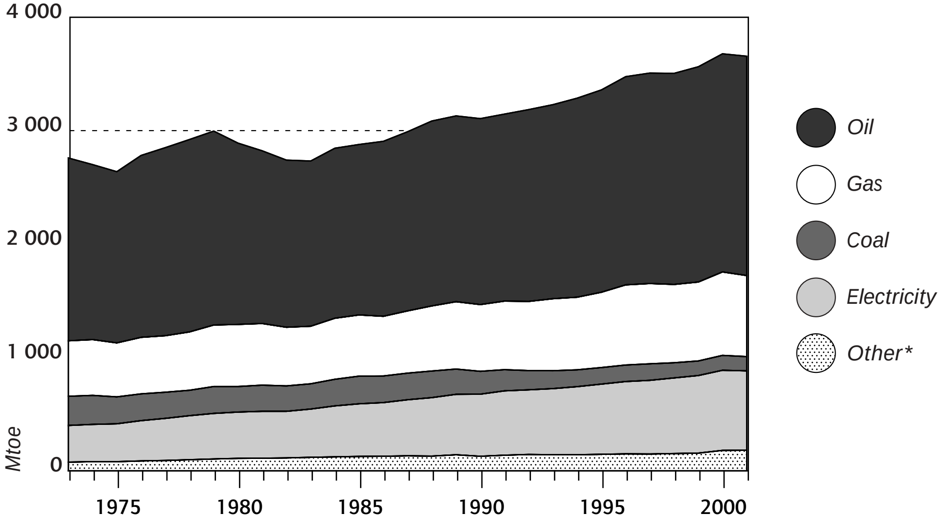
(Mtoe)

	1990	*1999*	*2000*	*2001*
Total OECD	548	684	707	700
North America	271	343	356	343
Europe	190	224	232	238
Pacific	87	117	119	119

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Figure 7

Total Final Consumption in OECD Countries by Source, 1973 to 2001



* includes geothermal, solar, wind, combustible renewables and wastes.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Electricity consumption in OECD countries was 700 Mtoe, down by 1% from 2000. This trend is most apparent in OECD North America where electricity consumption decreased by 3.7% during this period mainly as a result of the electricity crisis in California. On the other hand, electricity consumption increased by 2.6% in OECD Europe and remained stable in OECD Pacific. North America accounted for 49% of total OECD electricity consumption, followed by Europe (34%) and Pacific (17%).

As a consequence, TFC in OECD North America decreased by 2.1%, while it increased in OECD Europe by 1.5%. TFC in OECD Pacific remained almost unchanged.

INDUSTRY SECTOR

In 2001, OECD energy consumption in the industry sector was 1 225 Mtoe, decreasing by 3% from 2000. In particular, the decrease in OECD North America was sharper (–3.7%) than those of OECD Europe (–2.0%) and OECD Pacific (–2.1%). This clearly reflects the economic slow-down in the US and global economies as well as the terrorist attacks of 11 September and volatile energy prices. In the mid-term, between 1990 and 2001, consumption growth was stronger in OECD Pacific (21%) and OECD North America (20%), compared with OECD Europe (7.1%).

From 2000 to 2001, gas and electricity consumption dropped by 6.8% and 2.9% respectively, led by a sharp decrease in OECD North America by 11% and 5.6%. This is a clear contrast with OECD Europe and OECD Pacific where gas and electricity consumption remained almost stable. Coal consumption also dropped by 4.4%, but this trend was mainly led by a sharp decrease in OECD Europe of 11%. Coal consumption in OECD North America and OECD Pacific was stable.

In 2001, the industry sector accounted for 41% of total consumption in OECD Pacific, 33% in OECD Europe and 32% in OECD North America.

In 2001, petroleum products accounted for 38% of industrial energy consumption followed by natural gas (24%), electricity (22%) and coal (8.8%). However, the structure of energy use differed between regions. In OECD North America, the share of petroleum products was the largest (35%), followed by gas (29%), electricity (20%) and coal (5.9%). OECD Europe has a similar structure with petroleum products (35%), gas (26%), electricity (24%) and coal (9.9%). On the other hand, in OECD Pacific, the share of petroleum products was much higher (50%), followed by electricity (23%), coal (14%) and gas (9.7%).

RESIDENTIAL/COMMERCIAL SECTOR

In 2001, energy consumption in the residential/commercial sector in OECD countries was 1 209 Mtoe, up by 1.1% from 2000. However, the development from 2000 to 2001 differed substantially by region.

In OECD North America, energy consumption in this sector decreased by 2.7% while OECD Europe and OECD Pacific experienced an increase of 5.6% and 1.3% respectively. Most of the decrease in OECD North America was observed in gas (4.4%) and electricity (2.8%) owing to the price hike of natural gas and the Californian power crisis.

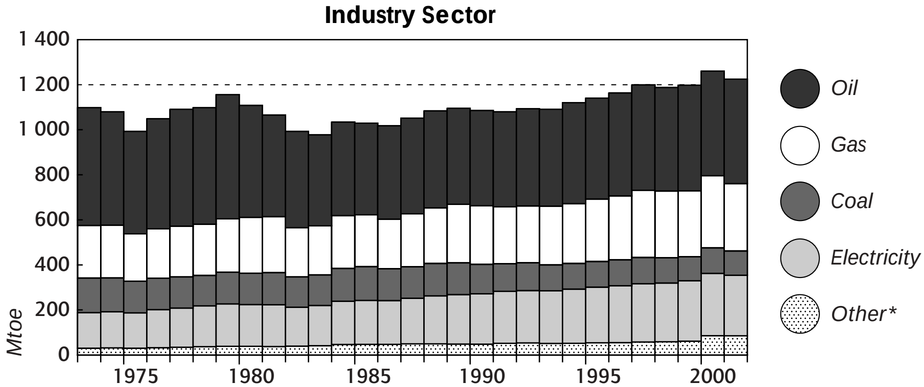
From 1990 to 2001, consumption growth was much stronger in OECD Pacific (40%) than in OECD North America (14%) and OECD Europe (14%).

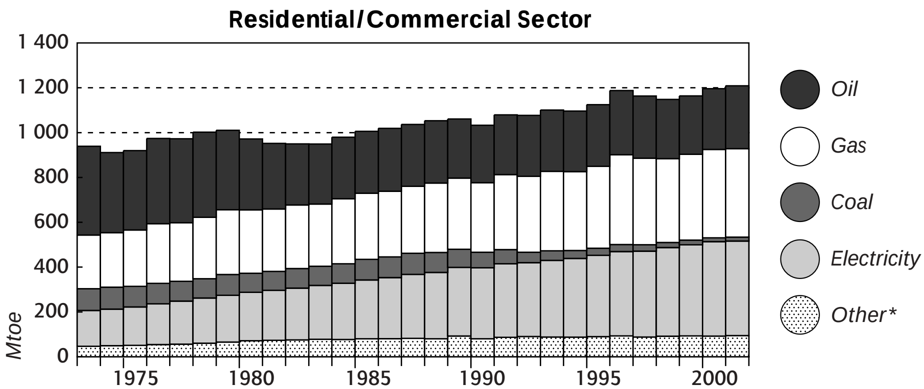
In 2001, the residential/commercial sector accounted for 38% of total final consumption in OECD Europe, 31% in OECD Pacific and 30% in OECD North America.

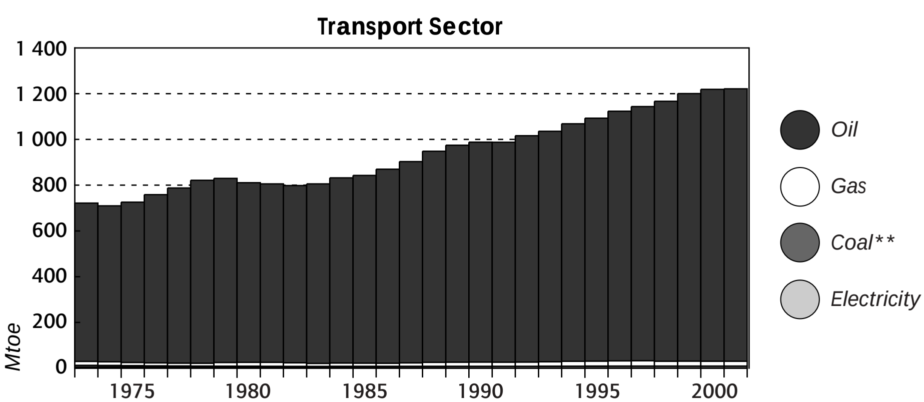
Fuel use structure also differed considerably between regions. In 2001, the share of petroleum products in OECD Pacific was the largest (44%), followed by electricity (38%) and gas (14%). On the other hand, electricity accounted for the largest share in OECD North America (41%), followed by gas (38%) and petroleum products (16%). In OECD Europe, gas held the largest share (33%), followed by electricity (27%) and petroleum products (24%).

Figure 8

Final Consumption by Sector and by Source in OECD Countries, 1973 to 2001







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

** negligible.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

TRANSPORT SECTOR

In 2001, TFC in the OECD transport sector was 1 223 Mtoe, almost the same level as in 2000, a clear contrast with the robust growth since 1991.

In the mid-term, between 1990 and 2001, the growth of consumption was strongest in OECD Pacific (39%), followed by OECD Europe (23%) and OECD North America (21%).

OECD North America accounted for 57% of the OECD's total transport demand, followed by OECD Europe (30%) and OECD Pacific (13%). However, transport demand in OECD North America slightly decreased from 2000 to 2001, the first decrease since 1991, while those in OECD Europe and OECD Pacific slightly increased. In OECD North America, demand for jet fuel plummeted after 11 September, offsetting the demand increase of gasoline, fuelled by strong sales of sports utility vehicles and a switch from air to road transport.

The share of oil has remained at 97% and gas and electricity shares were stable at 1.7% and 0.7% respectively. Penetration of natural gas was strongest in OECD North America at 2.9%, while very weak in other OECD regions at 0.2%. On the other hand, OECD Europe and OECD Pacific had electricity shares of 1.7% and 1.3% respectively, while OECD North America had only 0.1%.

WORLD ENERGY PRODUCTION

OIL

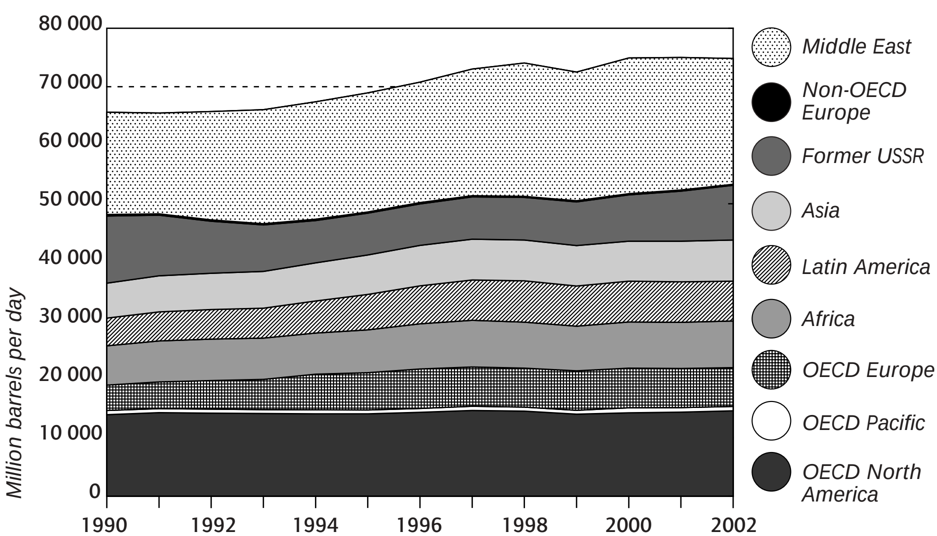
World oil production totalled 76.5 million barrels per day (mb/d) in 2002, 0.2% lower than in 2001. However, non-OPEC production was 1.37 mb/d higher in that year, the sharpest annual increase since the mid-1980s. By far the largest contribution to higher non-OPEC supply was that from the former Soviet Union (FSU) which was 811 thousand barrels a day (kb/d), or 9.5% higher than in 2001, with Russia contributing 644 kb/d of the increase. Production from North America was 209 kb/d (1.5%) higher, largely due to increased Canadian offshore east coast production and higher synthetic crude oil supply. African production was up by 217 kb/d (7.8%) with a significant increase due to higher Angolan production. Both China and Latin America recorded gains of around 100 kb/d, representing increases of 2.8% and 3.1% respectively. In the case of Latin America, a sharply higher output from the deep water in Brazil offset production losses elsewhere. On top of these non-OPEC increases, the combined output of OPEC natural gas liquids (NGLs), condensates and non-conventional crude was up by 373 kb/d, or 12%, compared to 2001. Set against these increases, however, were reductions in supply in the North Sea, OECD Pacific and non-OPEC Middle East.

The most significant supply reduction in 2002 was the 1.9 mb/d fall seen in OPEC crude oil production. The 2002 average production of an estimated 25.1 mb/d was the Organization's lowest annual level since 1994. The reduction in OPEC supply was in part the result of a succession of quota reductions made over the course of the previous year and also disrupted Iraqi supplies. The target production level for OPEC-10 (excluding Iraq) of 21.7 mb/d for January 2002 remained in force, at least on paper, throughout the year, with an increase to 23 mb/d only being agreed in December 2002 in light of a supply disruption in Venezuela. OPEC production hit a low of 23.6 mb/d in April 2002, coinciding with a sharper drop in Iraqi production. Iraqi production and exports remained constrained through 3Q, but total OPEC supply recovered from this April low to average 25.3 mb/d by July and 26.5 mb/d by November.

In 2002, the Middle East accounted for 29% of world production followed by OECD North America (19%), FSU (13%), Africa (11%), Asia (9.4%), Latin America (9.1%) and OECD Europe (8.8%).

Figure 9

World Oil Production, 1990 to 2002



Source: Oil Market Report, IEA.

GAS

World production of gas grew moderately to 2 618 billion cubic metres (bcm), up 0.9% over 2001, a lower growth than in previous years. Russia and the US continue to be the largest producing countries in the world, accounting for about one-quarter each of global gas production.

In 2002, all areas, except North America and Central Europe, increased their production. A major share of the incremental output can be attributed to strong increases in Europe (Norway), FSU (Russia), Middle East (Saudi Arabia and LNG producers) and Asia-Pacific (China and LNG producers).

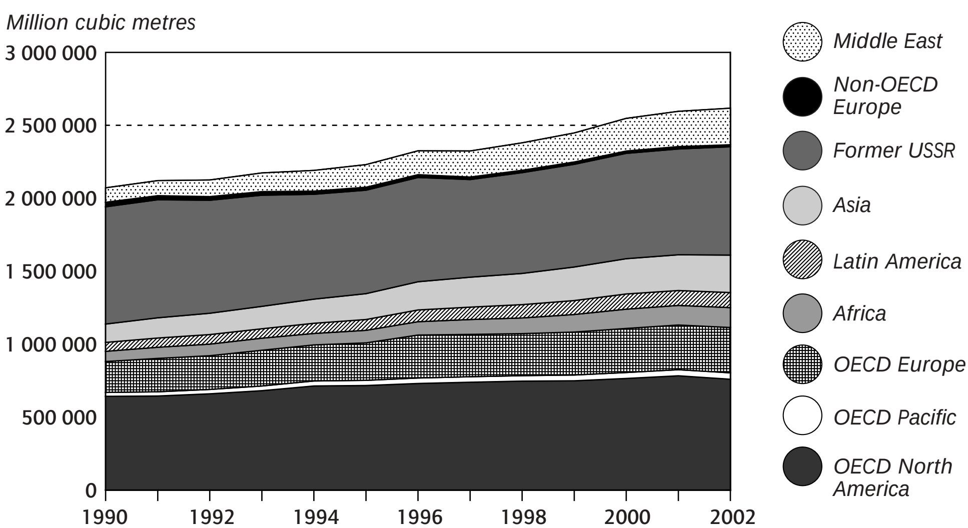
During 2002, US gas production decreased by 3.8 % to 539 bcm. Some of the reduction is due to outages in September and October related to hurricane activity. Lower natural gas prices at the beginning of 2002 reduced production and resource development incentives relative to 2001.

In 2002, OECD European production increased by 1.6 % to 311 bcm. UK output continued to fall (–2.8% compared with 2001) owing to warm weather and lower net exports. Dutch production also decreased in 2002 (–3.2%). While UK and Dutch output decreased, Norwegian gas production increased by 20%. In 2002, there were 45 fields in production on the Norwegian Shelf, of which 40 were in the North Sea and five in the Norwegian Sea. During the course of 2002, the Tune, Vale and Sigyn fields in the North Sea were put into production. Troll production amounted to 26 bcm in 2002. OECD Pacific gas production increased by 4.8%, led by Australian production and exports.

Russian production increased by 2.5% to 595 bcm. The increase in production of the Zapolyarnoye field compensated for the decline of the three major producing fields (Urengoy, Yamburg and Medvezhye). Turkmen gas production soared to 53 bcm reflecting higher exports to the Ukraine and Iran.

Figure 10

World Natural Gas Production, 1990 to 2002*



* 2002 data are provisional for the OECD and are estimates for non-OECD countries.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003, and *Energy Statistics of Non-OECD Countries*, IEA/OECD Paris, 2003.

Asia-Pacific, China, Indonesia and Malaysia saw gas production increase. In response to growing LNG exports and domestic demand, gas production in the Middle East also increased by 3.8%. In particular, production in Saudi Arabia increased with the addition of new non-associated gas wells to the Master Gas System.

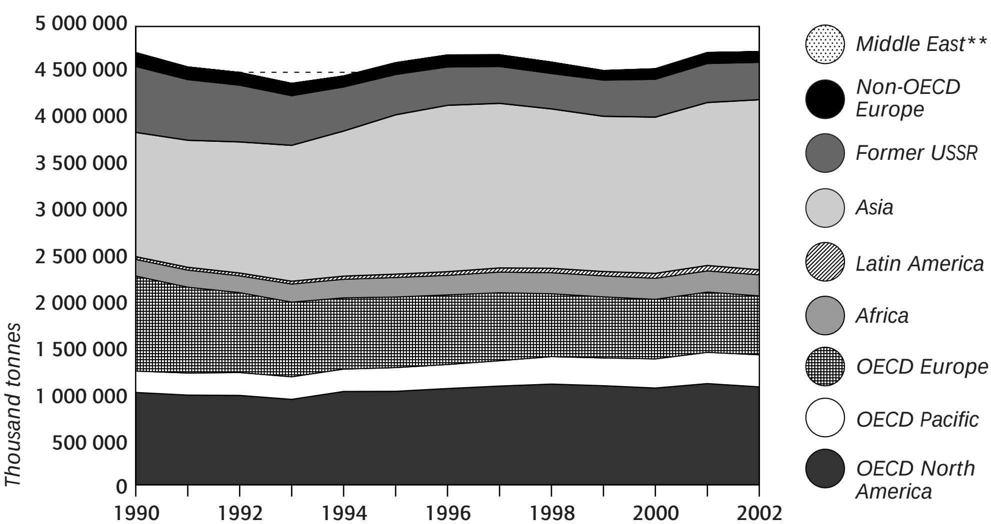
In 2002, OECD North America accounted for 29% of world natural gas production, followed by the FSU (28%), OECD Europe (12%), Middle East (9.6%) and Asia (8.4%).

COAL

In 2001, world coal production was 4 713 million tonnes (Mt), up 0.3% from 2001. Chinese coal production surged by 4.6%, becoming the second-largest coal exporter. This is a clear contrast with the successive years of production decline from 1996 to 2000 due to the restructuring of local coal industries. Excluding China, world coal production decreased by 8.5%. Production in the FSU fell by 3.4%, while it grew from 1999 to 2001 after a continuous decline since 1990. While coal production in OECD North America increased by 4.7% in 2001, it decreased again by 3.4% in 2002. Coal production in OECD Europe continued to decrease by 2.4%. Coal production in OECD Pacific increased by 3.1%, led by Australia.

Figure 11

World Coal Production, 1973 to 2002*



* 2002 data are provisional for the OECD and are estimates for non-OECD countries.

** negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003, and *Energy Statistics of Non-OECD Countries*, IEA/OECD Paris, 2003.

In 2002, Asia accounted for 39% of world coal production followed by OECD North America (23%), OECD Europe (13%) and the FSU (8.6%).

ELECTRICITY: OECD

In 2002, electricity generation in OECD countries was 9 658 TWh, up by 1.7% from 2001 despite the slight decrease of TPES during the same period. Gas, oil and coal-fired generation rose by 7.4%, 1.8% and 0.9% respectively. Nuclear power also increased by 0.2%. In Japan, nuclear power generation dropped by 2.4% after the outage of nuclear power plants as a consequence of data falsification problems. Because of the shortfall of nuclear power generation, oil, coal and gas power generation in Japan increased by 7.7%, 3.6% and 2.4% respectively. Electricity generation from hydropower decreased by 1.6%, mainly because of dry weather conditions in Nordic countries. Although electricity generated from other renewables grew substantially by 13%, its share is still marginal at 2.5%.

Shares in electricity generation in OECD countries were as follows: coal 38%, nuclear 24%, gas 18%, hydro 13% and oil 6%.

In the last decade, 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 UK and Italy. Dependence on coal in the US and Germany is still much higher than the OECD average.

Table 4

Electricity Generation by Source, 1992 and 2002[1]

(TWh)

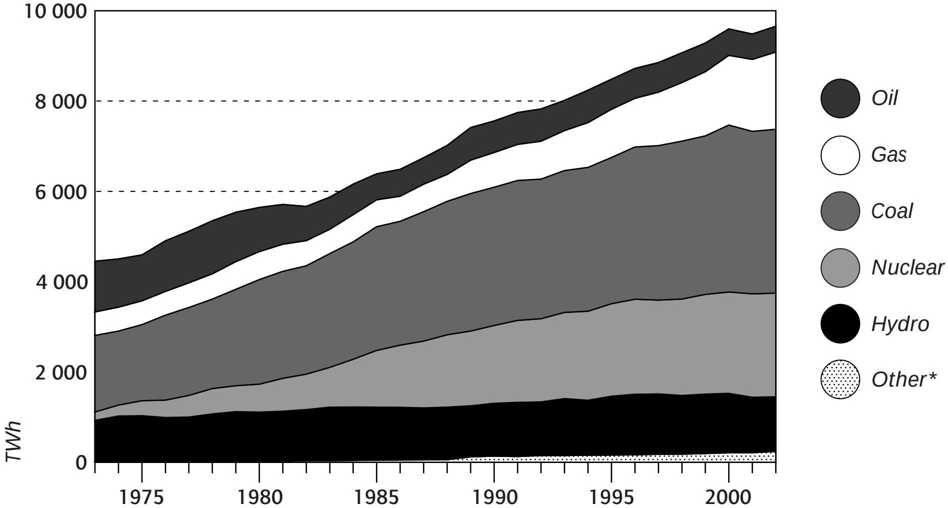
	France		*Germany*		*Italy*		*Japan*		*United Kingdom*		*United States*	
	1992	*2002*	*1992*	*2002*	*1992*	*2002*	*1992*	*2002*	*1992*	*2002*	*1992*	*2002*
Coal	38	28	305	302	25	41	138	284	194	126	1 741	1 971
Oil	9	8	13	6	116	76	251	154	30	6	107	97
Gas	3	17	33	56	35	109	175	250	13	150	427	716
Nuclear	338	437	159	165	–	-	223	295	77	88	656	823
Hydro	69	61	17	23	42	40	83	80	5	5	254	248
Comb. Renewables	2	4	6	28	4	10	19	23	1	7	86	93

1. Preliminary data.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Figure 12

OECD Electricity Supply by Source, 1973 to 2002



* includes geothermal, solar, wind, combustible renewables and wastes.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

ENERGY PRICES

CRUDE OIL

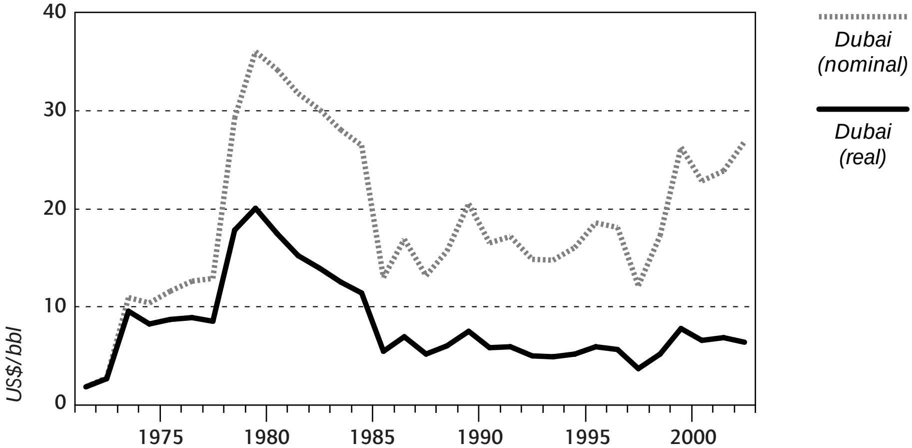
Average crude oil prices for 2002 rose slightly over 2001 levels, but at the end of 2002, prices were significantly higher as tighter stocks, speculation over a war with Iraq and Venezuelan supply disruptions bolstered values. Average prices for the three main marker crudes were $26.16 per barrel for West Texas Intermediate (up 23 cents from $25.93 in 2001), $25.19 per barrel for Brent (up 42 cents from $24.77 in 2001) and $23.85 per barrel for Dubai (up $1.05 from $22.80 in 2001). However, it should be noted that WTI prices ended 2001 at $19.84 per barrel, and had risen to $31.25 by the end of year 2002.

Prices rallied at the beginning of 2002. OPEC tightened supplies to the world market, drawing down crude and product stocks in OECD countries. The recovery in global growth was, however, less dramatic than many had expected.

Meanwhile, OPEC responded aggressively to the sharp decline in prices in late 2001 by dramatically cutting output. Non-OPEC countries, Russia, Mexico, Norway and Oman, agreed to support OPEC's output cut. Although their contribution did not in the end represent a huge number of barrels, the positive sentiment generated by their involvement helped towards the goal of higher oil prices.

Figure 13

Crude Oil Prices, 1972 to 2003*



Note: Crude oil prices are annual averages of Arabian Light (1972 to 1984) and Dubai first month (1985 to 1999). Real oil price is based on 1972 dollars. Real price for 2002 data point is estimated by year to date average price divided by deflator.

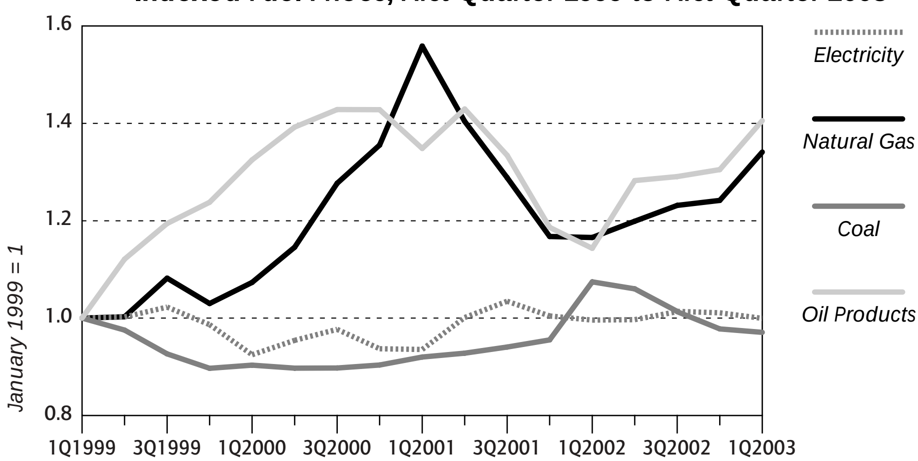
* 2003 = estimates.

Source: IEA.

Fears of a war with Iraq had been increasing since the 11 September terrorist attacks on the United States. The issue continued to grow in importance throughout the year, culminating in the United Nations Resolution calling on Iraq to account for its weapons of mass destruction.

Figure 14

Indexed Fuel Prices, First Quarter 1999 to First Quarter 2003



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

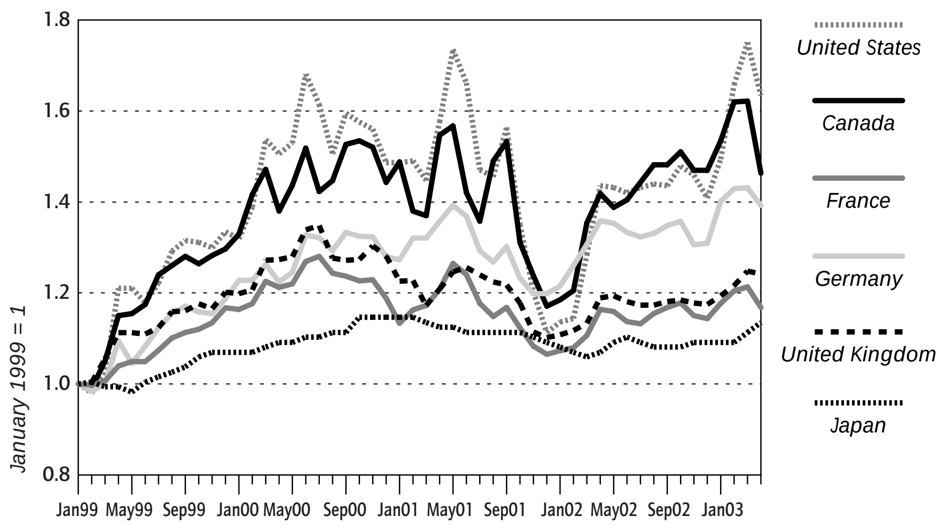
Shortly after the UN weapons inspectors had resumed their work in Iraq, opponents of the Venezuelan President Hugo Chavez organised a general strike. Venezuela's domestic oil production fell from around 2 655 mb/d in November to 0.7 mb/d by the end of 2002, removing supplies to the US market in the middle of a harsh winter.

GASOLINE

In 2002, gasoline prices broadly followed crude oil prices, but with some regional variations. Average gasoline prices fell by 8.1 cents per barrel in Europe and by 69 cents per barrel in the US. They were, however, $1.32 higher in the Singapore region. The US and European markets were characterised by the absence of the spikes and volatility that had been seen in the previous two years. Part of this was due to the Bush Administration easing environmental restrictions to reduce the threat of a crisis in the late summer of 1991 and to the fact that refiners had enjoyed a further year to put in place their new blend reformulated gasoline production facilities. Perhaps more important was the improvement in crude oil supplies in late 2001 which allowed refiners to replenish gasoline stocks in the first quarter of the year. There was, therefore, less concern over a pre-summer gasoline supply squeeze.

Figure 15

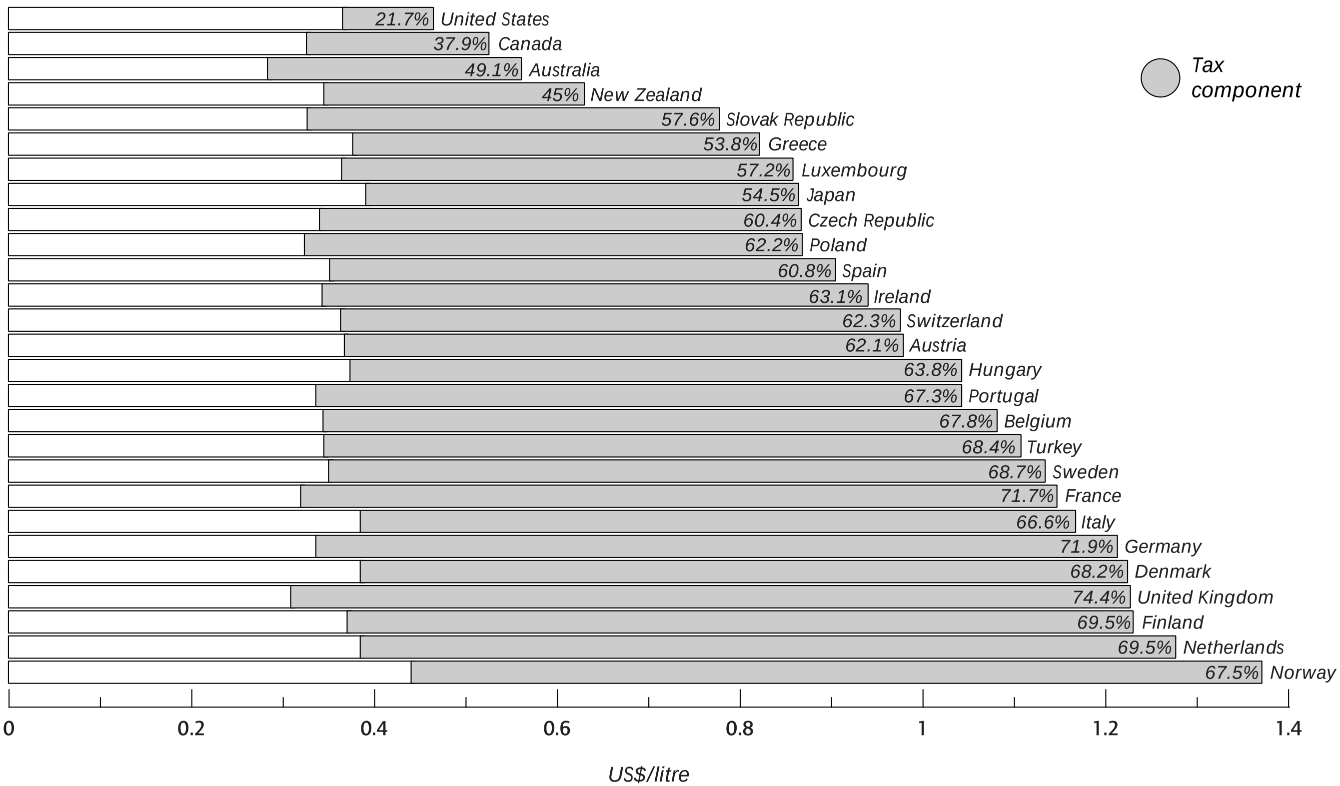
Gasoline Price Trends in Selected IEA Countries, January 1999 to April 2003



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 16

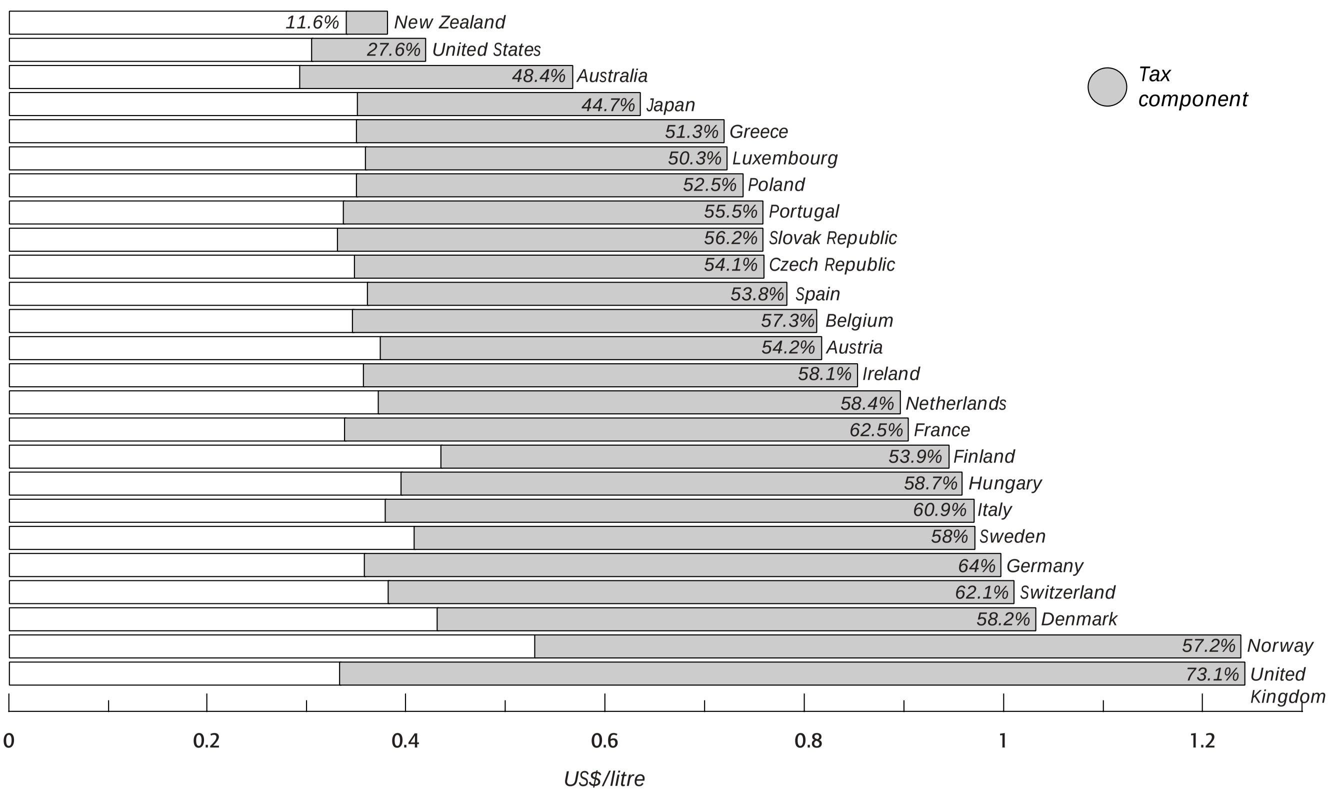
OECD Unleaded Gasoline Prices and Taxes, First Quarter 2003



Note: data not available for Korea and Mexico.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 17

OECD Automobile Diesel Prices and Taxes, First Quarter 2003



Note: Data not available for Canada, Korea, Mexico and Turkey.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

A lack of volatility also occurred despite a general backdrop of higher motor gasoline demand in the US. This was partly due to a continued switch away from airline travel after 11 September as well as the continued trend towards low-efficiency sports utility vehicles. In 2002, in the Far East, average gasoline prices improved, helped by strong regional demand and lower refinery runs in the region, particularly by Korean refiners.

DIESEL

Average diesel prices were lower in 2002 than in 2001, and followed the general trend in crude oil prices, starting weak, but rising sharply towards the end of the year. Middle distillate inventories in OECD countries (which include road diesel and space heating oil) fell sharply in the second half of the year as low refinery margins, caused by the OPEC output curbs, forced refiners to maintain refinery throughput at low levels. High natural gas prices continued to encourage the recent trend to fuel switching, but throughout the year diesel demand showed only a modest increase of 0.8% in the major economies for which data are available. Regionally there was an exceptional 10% jump in demand in Korea, with France, Italy and the UK showing more modest growth. Diesel demand remained level in the US, but fell in Mexico and Japan by 2.8% and 2.6% respectively.

SPACE HEATING OIL

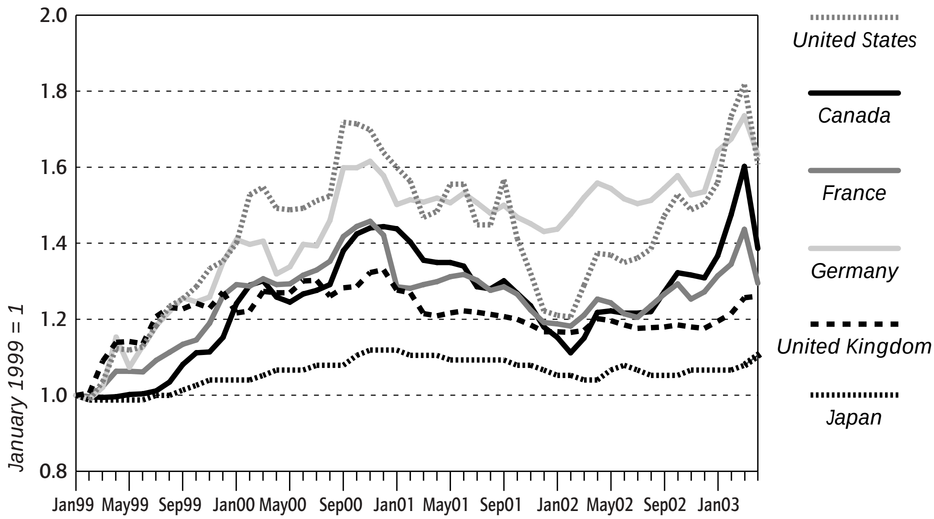
Average prices for space heating oil fell sharply in 2002 compared with 2001 levels. The relatively mild winter in 2001/02 and the postponement of consumer-level restocking in key countries helped to moderate demand in the summer and most of the second half of the year. Even the impact of a very cold winter in the US in 2002/03 did not really start to take effect until the end of the year as consumer stocks became depleted. In 2002, heating oil demand actually fell by 2% year-on-year in the US. More dramatic demand falls were seen in France and Germany, with offtake down by 7.8% and 8.9 % respectively, leaving the market with a net 3.5% fall in demand in major economies. The sluggish offtake led to sustained average price falls in nearly all regions.

NATURAL GAS

In 2002, the average import price decreased in the US to $3.15/million British thermal units (MBtu) (down 29% from $4.43 in 2001). Import prices

Figure 18

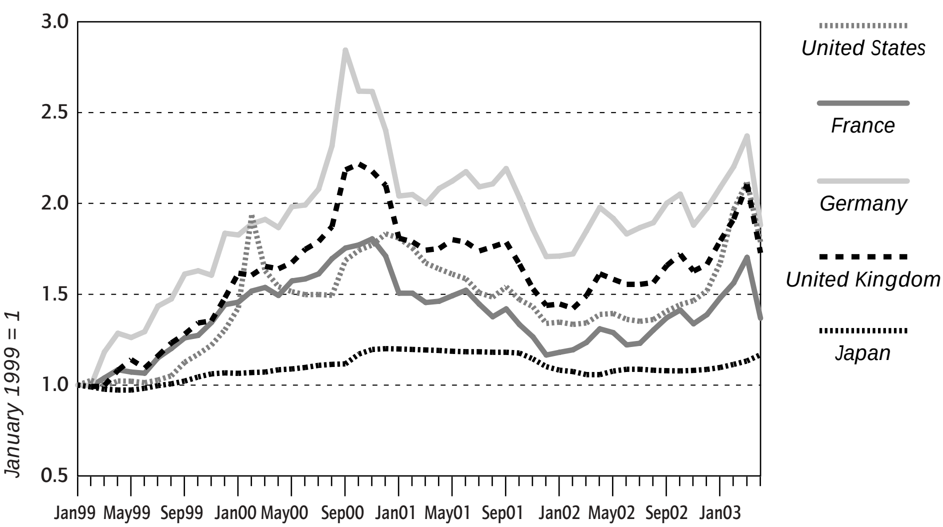
Diesel Price Trends in Selected IEA Countries, January 1999 to April 2003



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 19

Space Heating Oil Price Trends in Selected IEA Countries, January 1999 to April 2003



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

are based on the evolution of prices on the US spot market (Henry Hub) and therefore reflect its volatility. In 2001, sharp increases were observed owing to local supply and demand conditions. As from 4Q 2001, prices at Henry Hub started to collapse because of a mild winter and economic recession. From April 2002, there was again an upward trend to US$ 4/MBtu in December 2002 as supply tightened. In 1Q 2003, prices again rose dramatically ($19 in March 2003) and since then have remained at well above historical levels ($5 to $6) as US supply remains tight and storage levels low.

Import prices in Europe also decreased in 2002 but not as sharply as in the US. EU gas import prices by pipeline averaged US$ 3/MBtu, compared with an average US$ 3.52/MBtu in 2001, a decrease of 17.3%. This reflects, with an approximately six-month time lag, the movement of gasoil and LSFO prices (to which the price of imported gas is indexed) in European contracts. As gas prices decreased in 2002, gasoil and low sulphur fuel oil (LSFO) prices began to rise in February/March 2002 and natural gas recovered its competitiveness with other energies.

In Japan and Korea, imported liquefied natural gas (LNG) prices slightly decreased in 2002 compared with 2001. In Japan, cif LNG import prices amounted to US$ 4.32/MBtu on average, compared with US$4.64/MBtu in 2001. Prices are based on the Japanese crude cocktail (JCC) and reflect the evolution of JCC with a time lag shorter than the European one. In Korea, imported LNG prices decreased to about US$ 4.3/MBtu in 2002 compared with US$4.95/MBtu in 2001.

End-use prices for natural gas in the US increased throughout the year 2002, even though prices increased by 27.6% from 1Q 2002 to 1Q 2003. On the other hand, end-use gas prices in OECD Europe were almost stable during the same period reflecting long-term contracts. End-use gas prices in OECD Pacific were also stable.

Table 5

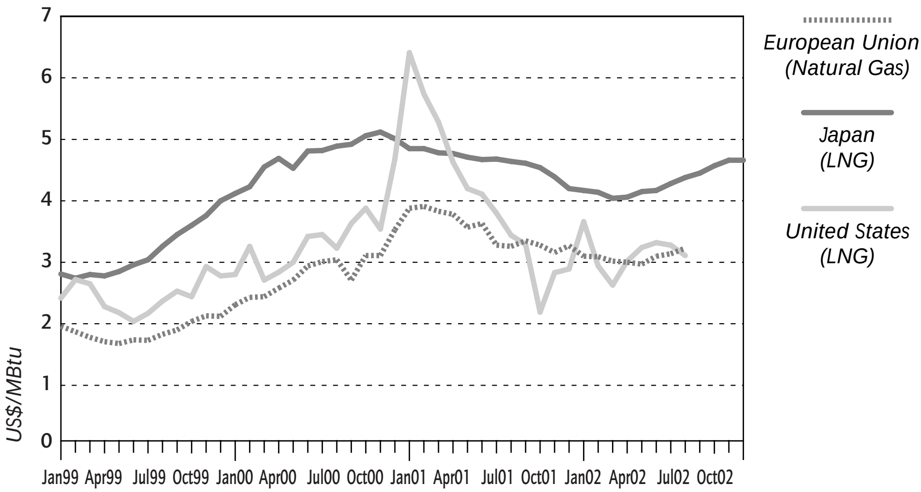
Quarterly Natural Gas Price Indices

	OECD	*North America*	*Europe*	*Pacific*
1Q2002	117.9	121.4	113.9	112.5
1Q2003	135.7	155.0	113.5	113.2

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 20

Gas and LNG Import Prices in the European Union, Japan and the United States, January 1999 to December 2002

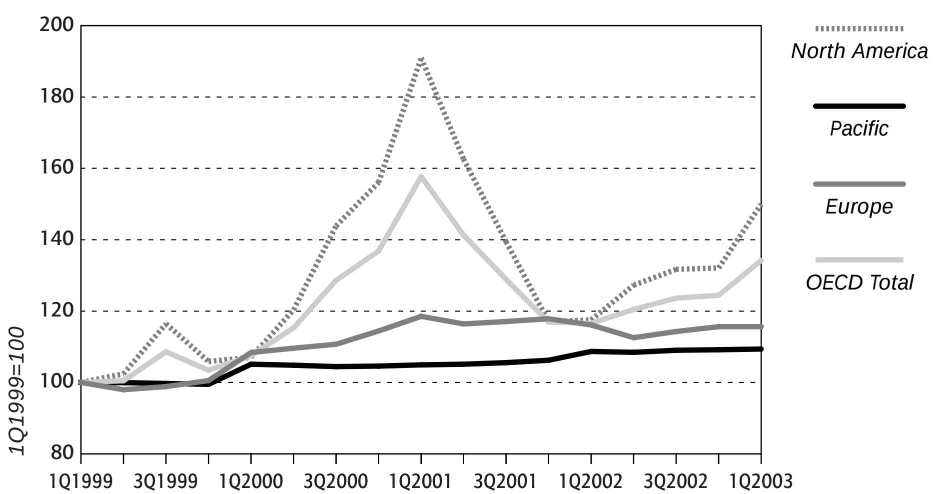


* Average import prices. Calculated average prices may not be comparable from one month to the other owing to differing components.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 21

End-use Gas Prices by OECD Region, First Quarter 1999 to First Quarter 2003

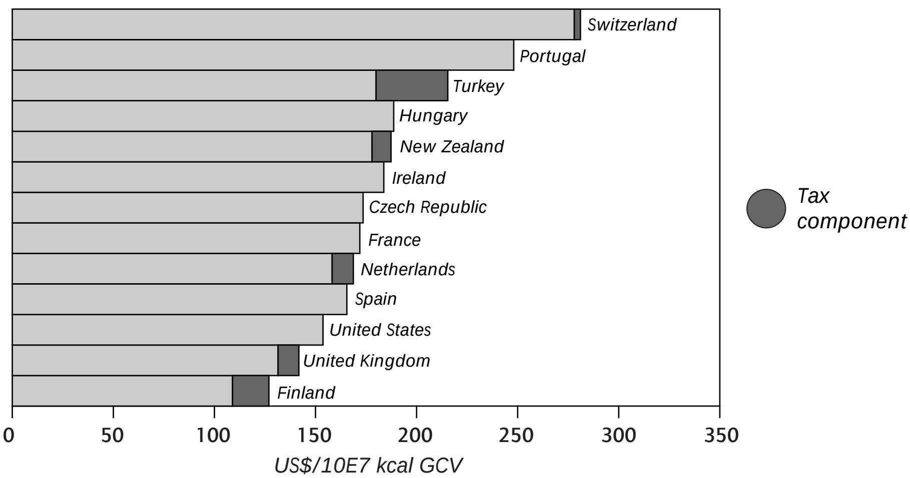


Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 22

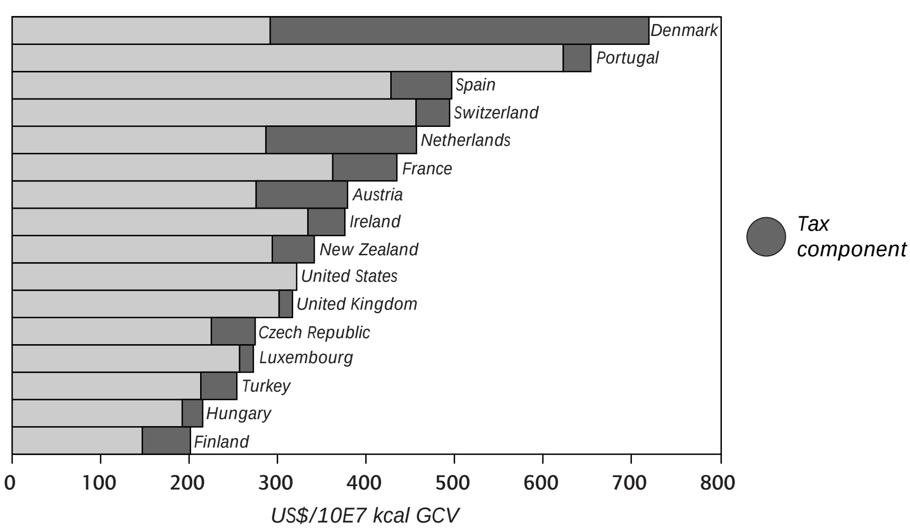
Gas Prices in IEA Countries, 2002

Industry Sector



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

Household Sector



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

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

COAL

Average steam coal prices in US dollar terms paid by consumers in 2002 fell in both European and Asian markets. This reflects the downward trend in prices for traded coal that set in during 2001, ending the rise which began in 2000.

The data on final consumer prices show a time lag. The real movements in steam coal prices are better illustrated by the movements in spot market prices. European spot prices increased in 1Q 2001 but then fell steadily, continuing to fall in 2002 so that by mid-2002 spot prices were as low as they were in 1999. They stabilised thereafter, and in the second half of 2002, moved up sharply as utilities bid for supplies in 4Q 2002 and helped on a cif basis by a marked hardening of shipping prices. Sea freight charges initially declined during 2001, easing the cost of imported coal, but then started to rise. Steam coal prices in the Asian spot market continued to rise during 2001 but followed the European market down from the end of 2001, and thereafter rose more gently.

Exchange rate movements adversely affected margins for Australian producers, in particular causing several major suppliers to announce production cuts in 2003, despite a potentially more favourable outlook for prices.

Coking coal prices are mainly settled in contract negotiations and show a much more complicated pattern. Prices for hard coking coal rose in 2001. Early and smaller settlements in 2002 by Japanese steel companies with Chinese and Russian suppliers showed some price falls, but North American prices in Europe showed variations with price increases for Canadian supplies to Germany, but elsewhere prices were stable or even reduced. More drawn-out Japanese negotiations with Australian suppliers resulted in price rises, as well as with Canada – but this was against the background of a Japanese price level set in 2001 at a lower level than for later customers. By contrast, Canadian supplies to Brazil have only retained the price set in 2000 or have dropped.

In early 2001, spot prices for steam coal reached a peak, falling back significantly before recovering again in 2002. Coking coal contract prices, which increased substantially for high-quality coals in 2001, show a more varied picture in 2002. Again, high-quality coals have seen some price increases. Trade also increased over 2001, and stabilised in 2002.

Table 6

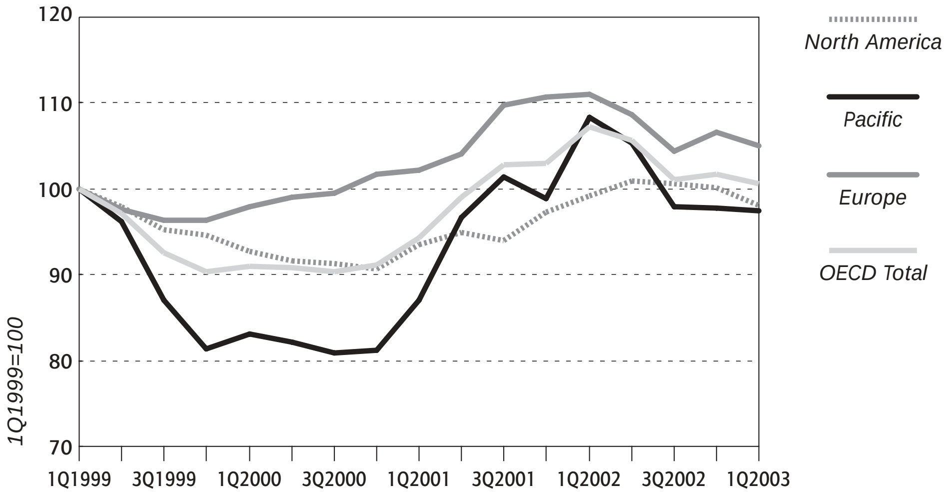
Quarterly Steam Coal Price Indices

	OECD	*North America*	*Europe*	*Pacific*
1Q2002	112.5	96.3	114.4	122.5
1Q2003	105.4	95.3	108.2	110.1

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 23

End-use Coal Prices by OECD Region, First Quarter 1999 to First Quarter 2003

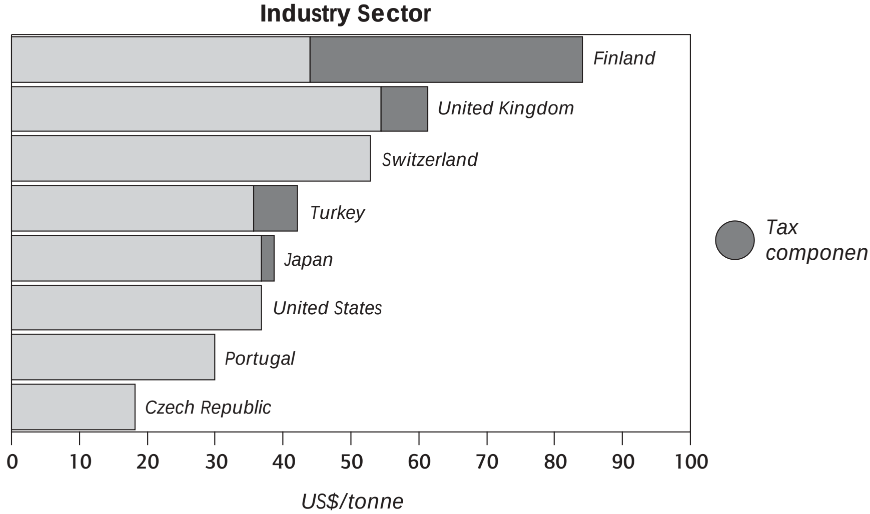


Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 24

Steam Coal Prices in IEA Countries, 2002

Industry Sector



Note: Brown coal price for the Czech Republic and Turkey. Data not available for Australia, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Spain and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

ELECTRICITY

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

Table 7

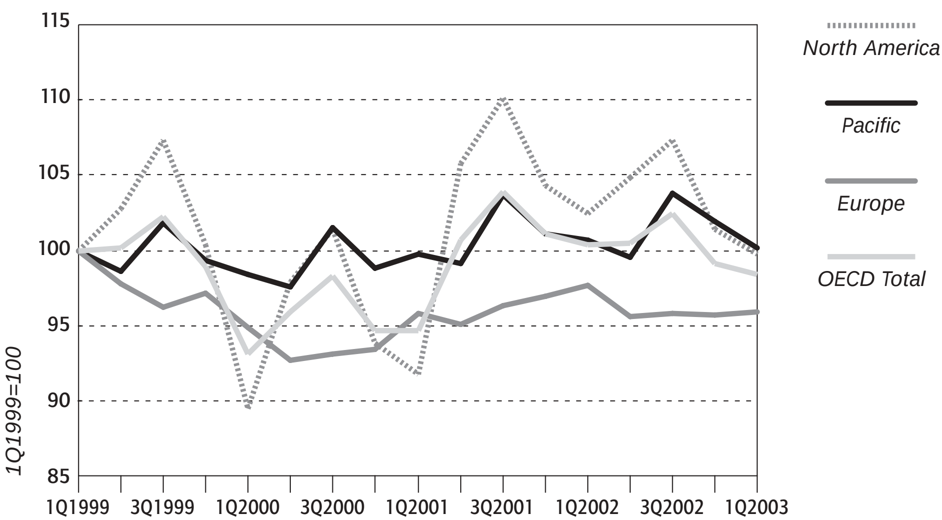
Quarterly Electricity Price Indices

	OECD	*North America*	*Europe*	*Pacific*
1Q2002	92.3	91.0	91.9	96.9
1Q2003	90.5	88.5	90.2	96.4

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 25

End-use Electricity Prices by Region, First Quarter 1999 to First Quarter 2003

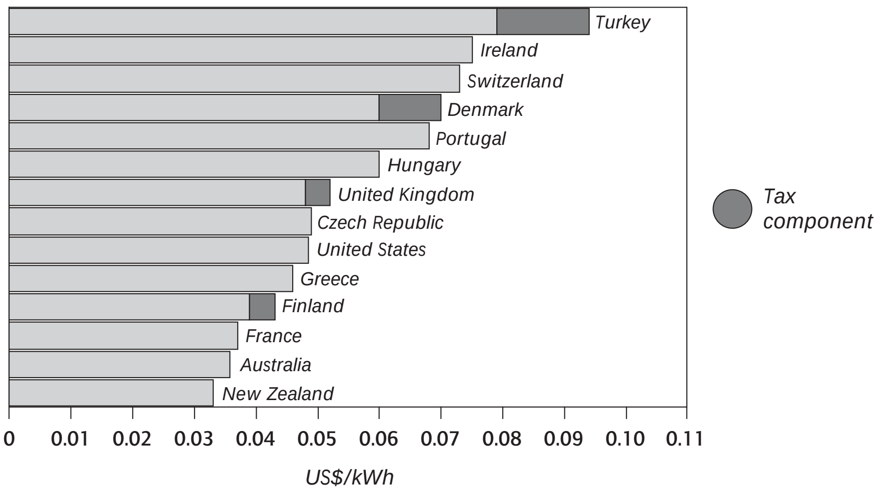


Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Figure 26

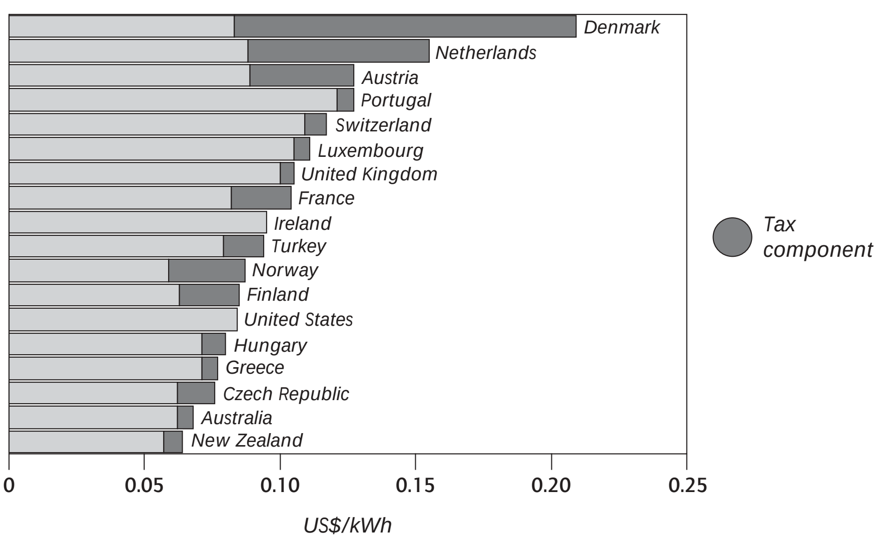
Electricity Prices in IEA Countries, 2002

Industry Sector



Note: Price excluding tax for the United States. Data not available for Austria, Belgium, Canada, Germany, Italy, Japan, Korea, Luxembourg, the Netherlands, Norway, Spain and Sweden.

Household Sector



Note: Price excluding tax for the United States. Data not available for Belgium, Canada, Germany, Italy, Japan, Korea, Spain and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

ENERGY INTENSITY AND CO_2 EMISSIONS

ENERGY INTENSITY

In IEA member countries, energy intensity expressed as total primary energy supply (TPES) divided by gross domestic product (GDP) in purchasing power parities (PPPs) fell by 5.2% in 2002 from the 2001 figure. From a mid-term perspective, it fell by 10% from the 1990 figure.

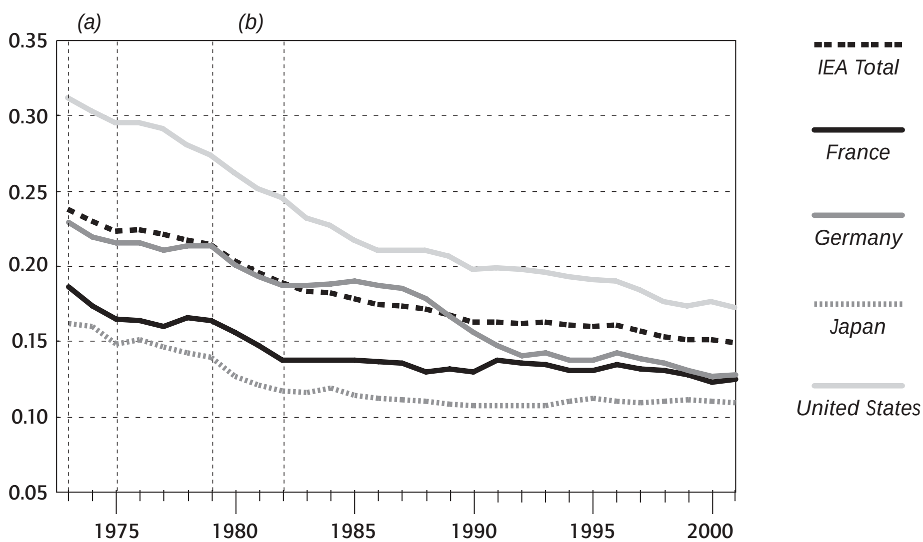
While such overall improvement of energy intensity can be observed, its development is different among countries. Energy intensity in the US decreased by 15% between 1990 and 2002, but remains 39% higher than the IEA average in 2002. Energy intensity also fell by 19% in Germany and by 4.5% in France. On the other hand, energy intensity in Japan increased by 4% during the same period while remaining 50% lower than the IEA average.

As a result, the gap between North America, Europe and Pacific has been gradually narrowing. In the 1990s, the drop in energy intensity during 1996-2002 was more rapid (1.6% per year) than during 1990-1996 (0.2% per year).

Figure 27

Energy Intensity in Selected IEA Countries, 1973 to 2001

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



(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, 2003, and *National Accounts of OECD Countries*, OECD Paris, 2003.

CO_2 EMISSIONS

Energy-related CO_2 emissions in IEA member countries rose by a little over 0.5% in 2001, reaching more than 11.8 billion tonnes, up by 14.5% compared to 1990 levels. Aggregate emissions for IEA Europe rose by 3% between 1990 and 2001, while emissions rose by close to 18% in IEA North America and by over 29% in IEA Pacific over the same period. Increased power generation (CO_2 emissions from energy production rose by 23% in North America, 5% in Europe and 43% in the Pacific) and rising demand for road-based transport (CO_2 emissions from the transport sector rose by 21% in North America, 19% in Europe and 39% in the Pacific) are the principal reasons for these rising emission trends. The relatively small rise in emissions in Europe is largely due to significant emission reductions in several European countries as a consequence of major economic changes that occurred during the 1990s. This is notably the case in the Czech Republic, Hungary and Germany. Significant shifts in the power generation fuel mix have also contributed towards a reduction in GHG emission levels.

On average, CO_2 emissions from the industry sector represent less than 15% of total energy-related emissions of IEA countries. Since 1990, total emission levels from the industry sector have declined marginally. Nevertheless, in some countries, notably Germany and the UK, emissions have dropped significantly owing to fuel switching to less carbon-intensive fuels as well as to structural changes.

The transport sector share of energy-related emissions ranges from as little as 12% in the Czech Republic, to over 45% in Sweden. On average, it represents about 27% of IEA energy-related CO_2 emissions. Transport-related emissions have continuously increased over the past decade. In 2001, emissions from the transport sector were 13% above 1990 levels, with the US alone accounting for over 50% of the total share. This trend is expected to continue as demand in the transport sector grows and alternative fuels and vehicles are not expected to enter the market in the near future.

Energy production is by far the most significant source of energy-related CO_2 emissions (over 43%) in most IEA countries. On a country level, this value ranges from over 60% in Australia to less than 7% in Switzerland where fossil fuel plays only a marginal role in heat and power generation. Although the carbon content per unit of energy produced has remained more or less stable over the past decade, total emissions from energy production have risen by over 25% since 1990 in IEA countries. This is mainly attributable to the building of additional power generating capacity, principally in North America and to a lesser extent in the Pacific region.

(Text continues on page 53.)

Table 8

Energy-related CO_2 Emissions in IEA Countries

(Excluding International Marine and Aviation Bunkers)

(million tonnes of CO_2)

	1990	*2001*	*% change 1990-2001*	*2010*	*% change 1990-2010*
Canada	430	520	20.76	542	25.87
United States	4 826	5 673	17.56	6 736	39.59
North America	**5 256**	**6 193**	**17.82**	**7 278**	**38.47**
Australia	260	370	42.33	390	50.08
Japan	1 019	1 132	11.15	..	..
Korea	226	436	92.68	..	..
New Zealand	22	33	47.35	34	51.61
Pacific	**1 527**	**1 971**	**29.06**	**..**	**..**
Austria	57	67	17.82	65	15.81
Belgium	107	120	11.89	114	7.00
Czech Republic	154	119	-22.80	103	-32.93
Denmark	51	50	-0.22	64	26.27
Finland	55	60	9.55	59	7.24
France	353	385	9.12	462	30.96
Germany	964	850	-11.82	839	-13.03
Greece	71	90	27.73	118	67.50
Hungary	71	56	-20.12	58	-17.33
Ireland	30	43	42.47	46	51.02
Italy	400	425	6.30	429	7.12
Luxembourg	10	8	-19.68	8	-21.59
Netherlands	157	177	12.94	169	7.80
Norway	29	38	32.95	..	..
Portugal	40	59	49.08	60	51.91
Spain	207	286	38.30	337	63.15
Sweden	51	48	-6.10	50	-3.21
Switzerland	42	44	5.59	43	4.58
Turkey	129	188	45.97	406	215.44
United Kingdom	560	541	-3.48	538	-4.00
IEA Europe	**3 535**	**3 655**	**3.38**	**..**	**..**
IEA Total	**10 318**	**11 818**	**14.54**	**..**	**..**

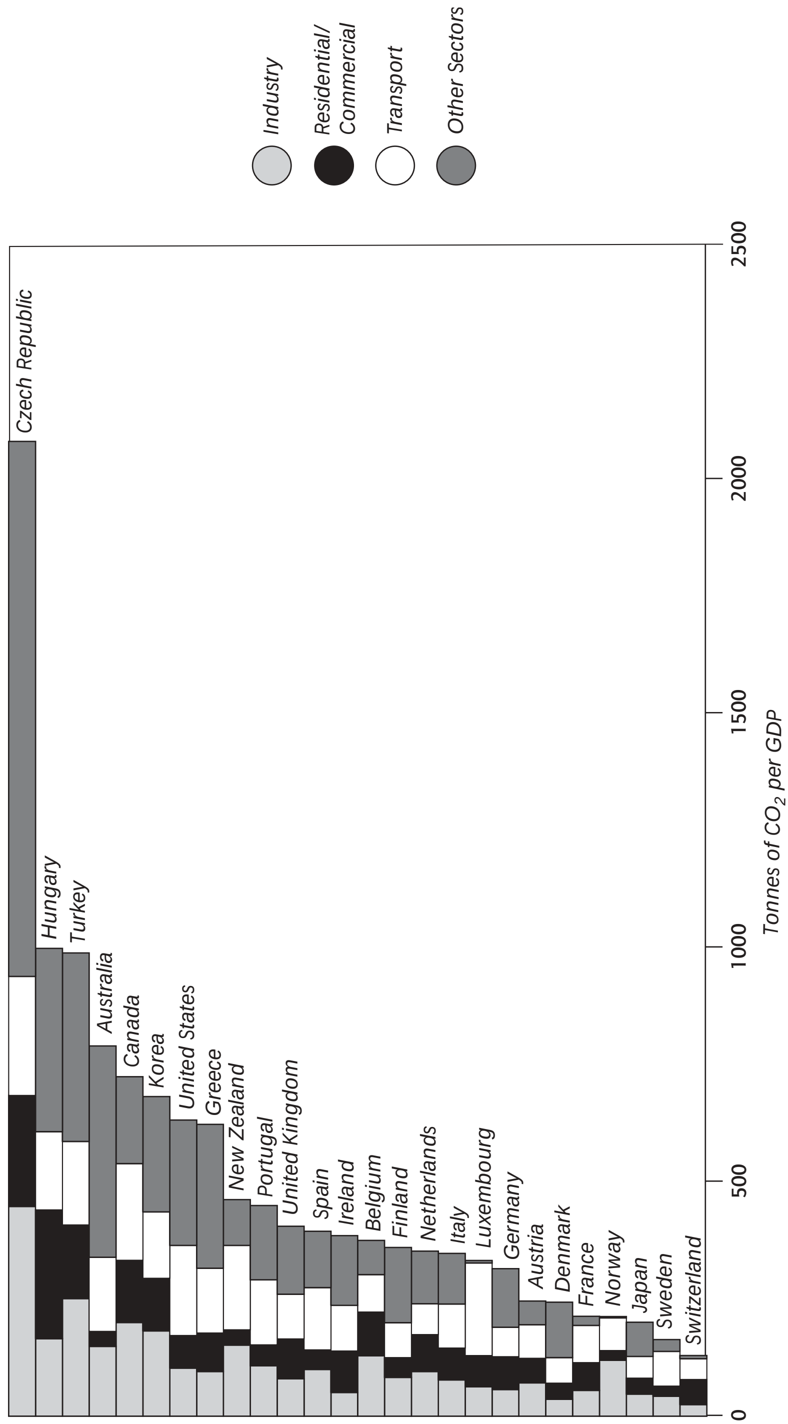
Note: "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach. In accordance with the IPCC methodology, emissons from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2001 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. Because of differences in methodology and definitions in estimating energy-related CO_2 emissions, the IEA statistics and official Norwegian figures differ from one another. Norway's statistics show that in 1990 energy-related CO_2 emissions were 28.4 million tonnes and in 2001 they were 34.4 million tonnes, for an increase over that time of 21%.

Sources: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2003, and country submissions.

Figure 28

CO_2 Emissions per GDP by Sector in IEA Countries, 2001

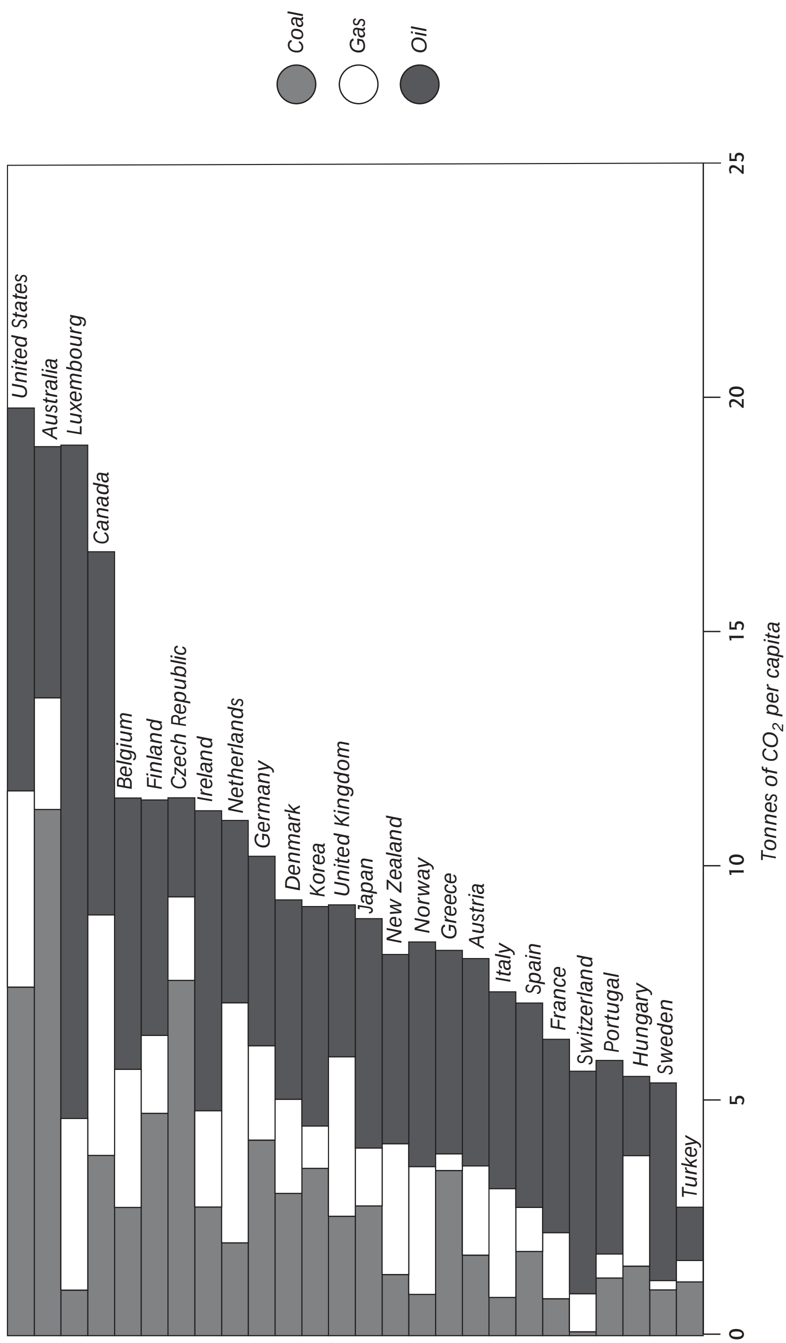
(CO_2 emissions/GDP using 1995 prices and exchange rates)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003, and *National Accounts of OECD Countries*, OECD Paris, 2003.

Figure 29

CO_2 Emissions per Capita by Fuel in IEA Countries, 2001



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003, and *National Accounts of OECD Countries*, OECD Paris, 2003.

Figure 30

Energy-related CO_2 Emissions by Sector in Selected IEA Countries, 1990 to 2001

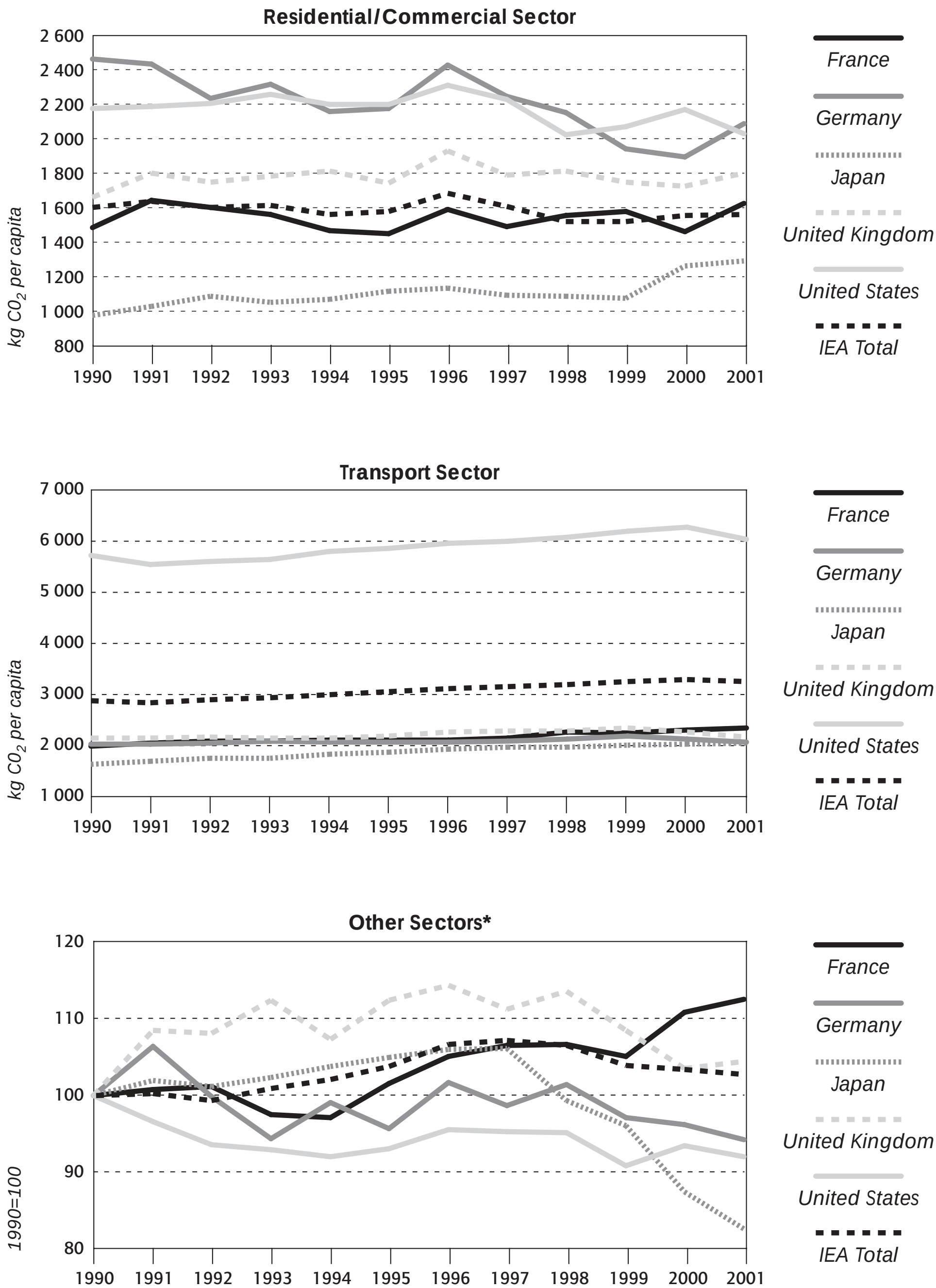
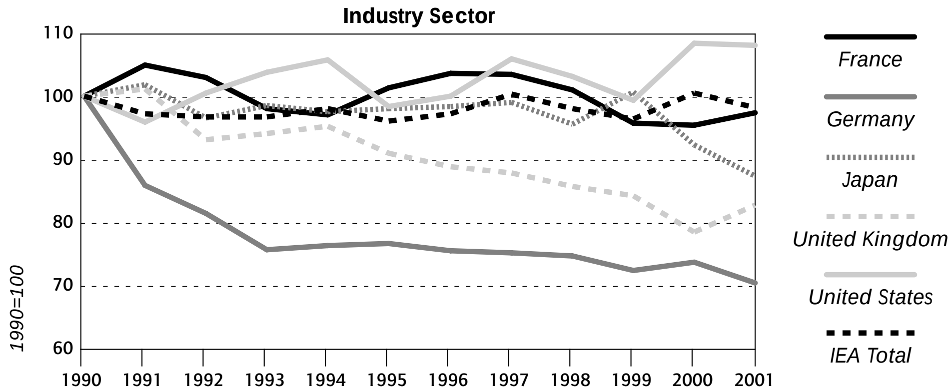
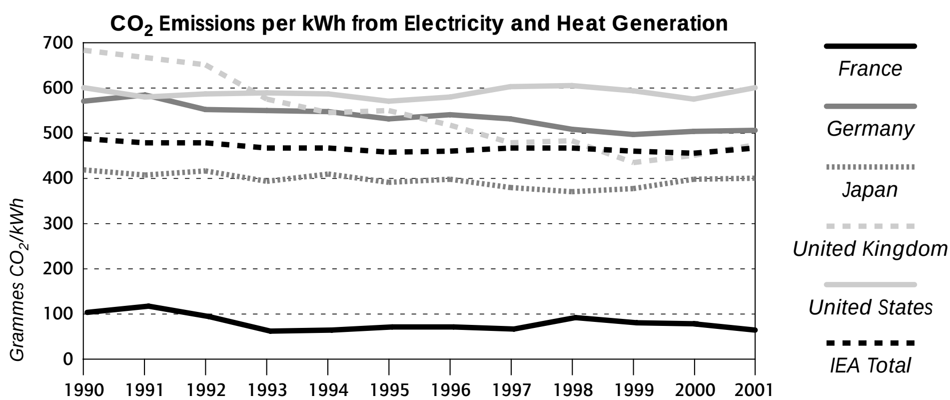


Figure 30 *(continued)*

Energy-related CO_2 Emissions by Sector in Selected IEA Countries, 1990 to 2001





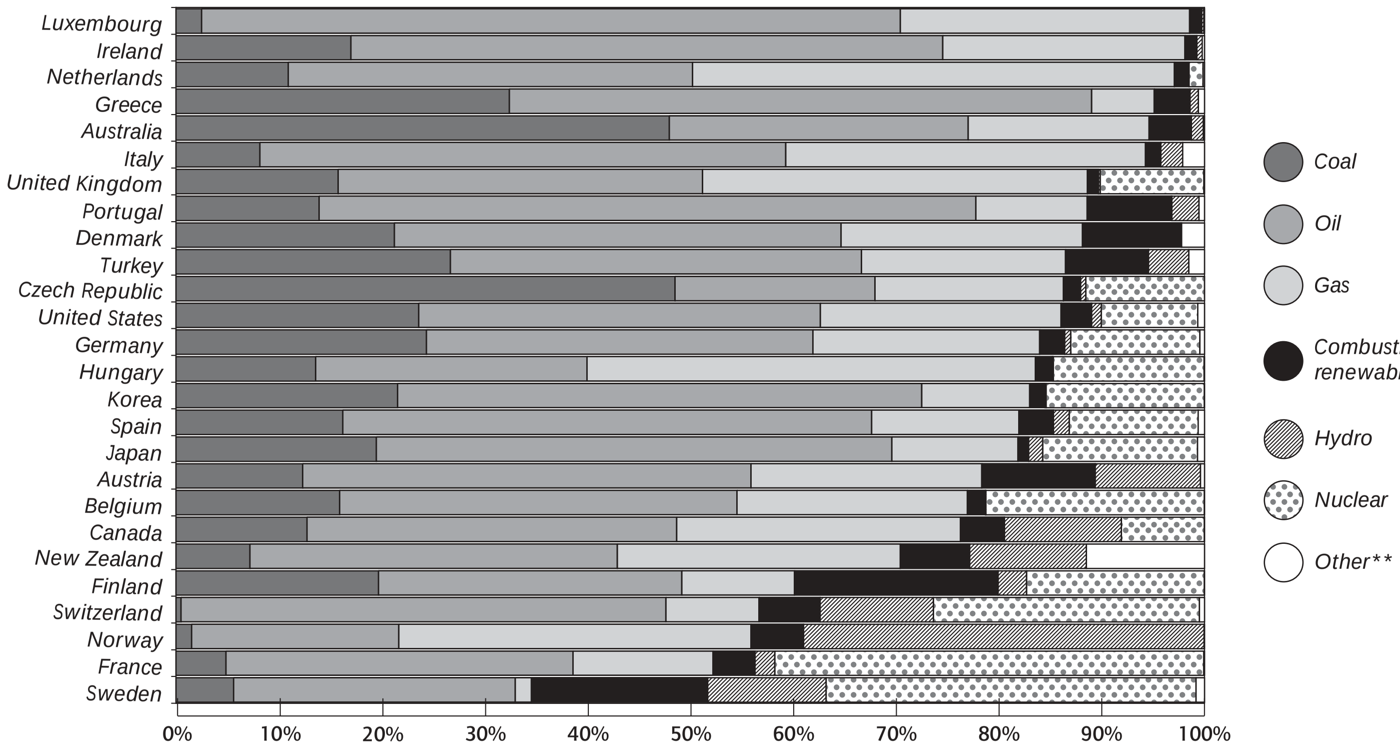
* includes other energy industries, agricultural sector, other non-specified sectors and non-energy use in other sectors.

Sources: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2003, and *National Accounts of OECD Countries*, OECD Paris, 2003.

Emissions from the residential/commercial sector represent approximately 8.5% of total energy-related emissions in IEA countries. Per capita emissions from this sector have remained more or less stable since 1990, notwithstanding expectations that this sector could provide significant scope for reductions. While current and previous policies may be responsible for the lack of growth in the sector, further measures to promote energy efficiency in buildings and appliances will be necessary to bring about any additional emission reductions.

Figure 31

Total Primary Energy Supply in IEA Countries, 2002*



* preliminary data.

** includes geothermal, solar, wind, and ambient heat production.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

ENERGY SECURITY

From 2002 to early 2003, energy security continued to be of high importance among energy policy-makers inspired by the imminent supply security concerns in the oil market due to political, military and social events in producing countries. At the same time, there is growing recognition that energy policy-makers must address a much broader agenda than near-term oil supply risks. This includes long-term security of oil, gas and electricity supplies under the liberalised markets, growing dependence on oil and gas imports, uncertainties about necessary investments to meet projected energy demand and the global dimension of energy security.

NEAR TERM RISKS

THE CHANGING DIMENSIONS OF THE OIL MARKET: TODAY'S RISKS IN A GLOBALISED MARKET

The oil market remains volatile. It faces considerable economic variability as well as global uncertainty. New dimensions of risk have emerged, including terrorist attacks and political instabilities as witnessed by the recent supply interruptions from Venezuela and Nigeria and the war in Iraq. These risks are coupled with an oil market which is now global, liberalised and increasingly competitive. In this context, industry has had to improve its economic efficiency, including embracing "just in time" type of stockholding practices and reducing excess capacity. Total OECD oil industry stocks declined in 2002 by 155 mb or 6% below end-2001 levels. While reducing costs, this has had the negative effect of reducing supply chain flexibility. At the same time, OPEC producers have used supply production quotas to maintain high prices, further discouraging industry from holding costly stocks above their needs. The market is fragile and stretched with short-term volatility and significant price spikes often occurring. OPEC members increased their production responding to the recent disruption of supply from Venezuela and Nigeria and the war in Iraq. On the other hand, their effective spare production capacity after the war in Iraq is much lower, which would reduce flexibility in the oil market.

IEA'S RESPONSE TO THE NEW CHALLENGES OF THE OIL MARKET

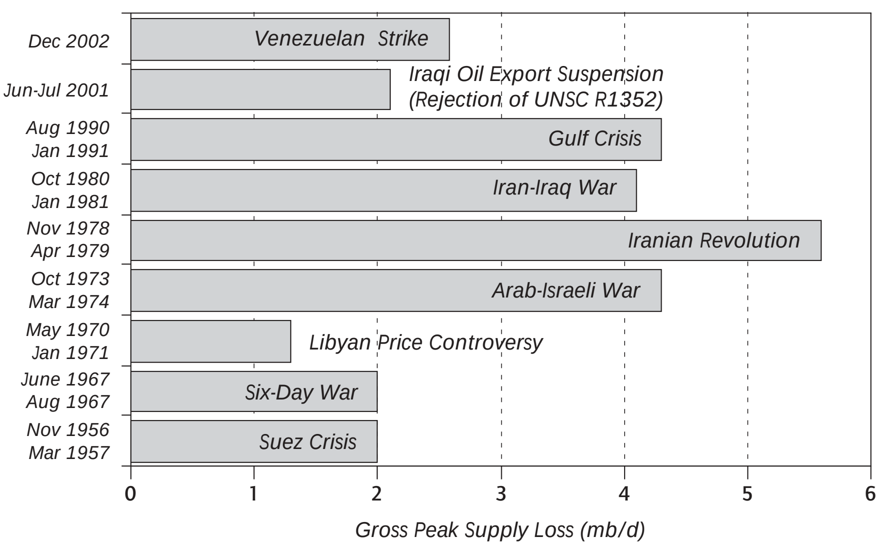
The IEA's broad global membership is a key factor in determining its collective energy security as interdependency in the global oil market means that regional disruptions have a potentially worldwide impact.

As oil markets have evolved and created new challenges since the founding of the IEA, the underlying International Energy Program (IEP) Agreement obligations to share oil in an emergency are now reinforced by frameworks for the flexible use of measures which can be readily gauged to particular circumstances. The IEA has tools to manage short-term oil supply disruptions such as the co-ordinated use of stockdraw, demand restraint measures, fuel switching and surge oil production. Of these, stockdraw is considered the most effective and rapid measure to cope with severe supply disruptions and IEA countries hold some 3.6 billion barrels of oil stocks.

The formal sharing system has not been deployed as yet and IEA's flexible framework reflects the belief that, under normal circumstances, the market mechanism is fully capable of determining the most efficient initial physical reallocation of supplies in any given crisis scenario. Collective action on stocks provides a strategic safety net to reinforce the market.

Figure 32

Examples of Major Oil Supply Disruptions



Source: IEA.

IEA member States who are net importers have a treaty obligation to hold 90 days of net imports. The twelve member countries holding government/public reserve stocks alone account for nearly 1.3 billion barrels which could cope with the largest historical supply disruption. Moreover, these government-controlled stocks are separate from the market and, therefore, could send a powerful signal when released.

In January 1991, the IEA effectively used co-ordinated stockdraw and other measures during the Gulf War. These measures were also used to tailor plans for a potential disruption response in the wake of the year 2000 roll-over, the 11 September terrorist attacks and, most recently, were in place should the need have arisen in the context of the military intervention in Iraq.

Notably, the IEA's new decision-making procedures guarantee very rapid assessments and proper consultation with IEA members, the industry and major oil-producing countries, and facilitate timely activation of response measures. IEA also contacted and collaborated with non-member consuming countries, notably China.

Throughout the period of hostilities in Iraq in early 2003, the IEA was ready to act in co-ordination with oil-producing countries, in particular with OPEC countries, and the markets were aware of this. The possible risk of a supply disruption, therefore, was minimised and price spikes and their duration were limited.

NEW DIMENSION OF ENERGY SECURITY

SECURITY OF ELECTRICITY AND GAS SUPPLY

Security of energy supply concerns of IEA governments were in the past focused on protection against the geopolitical risks of oil supply. Solutions were found by diversifying oil supply sources and the fuel mix into coal, nuclear, gas and renewable energy. With effective options to promote supply security, government policy turned more towards economic efficiency and market reform.

Growing gas demand and rising import dependence in most OECD countries means that gas supply security is increasingly becoming a concern. Whereas gas reserves are sufficient to cover the expected increase in demand, consuming countries will have to import gas that may not be geographically diversified and may be located in politically unstable regions. These factors raise traditional energy security concerns. Supply concerns do not stop at the border but extend down to final consumers. In addition to these external developments, an internal dimension of energy security has arisen in conjunction with market reform in the gas and electricity industries.

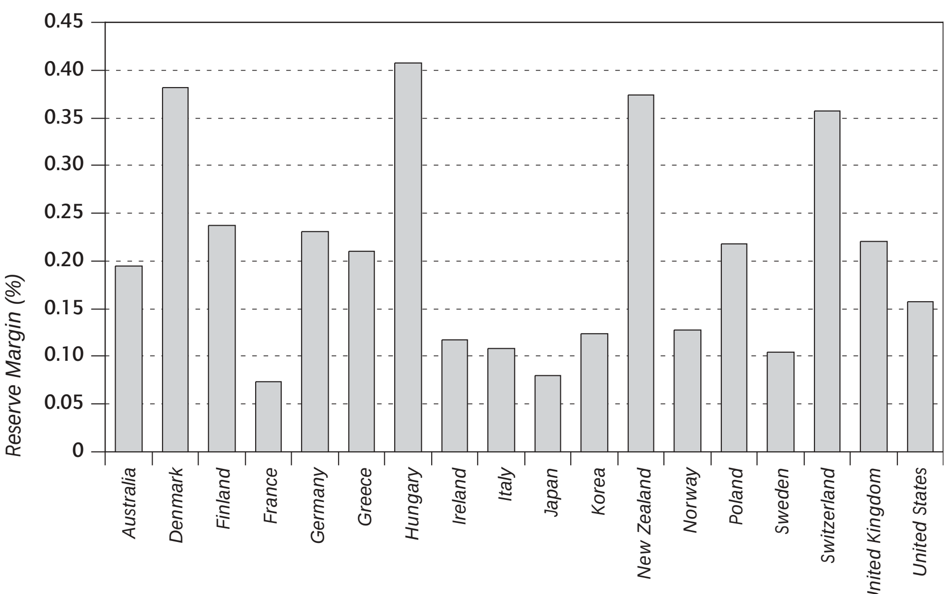
All recent electricity and gas reforms are based on the introduction of third-party access (TPA) to networks and the liberalisation of some activities. TPA establishes an obligation for an operator of an electrical or gas network to provide access to users of that network. Liberalisation allows for competition in the generation and retailing of electricity or in the production and transmission of gas. During the 1990s, the hope was that liberalised electricity and gas markets would automatically ensure security of gas and electricity supply all the way to the final consumer. The reality is more complex.

A key sign of an efficiently functioning electricity supply industry, relatively capital-intensive, is an efficient allocation of capital. A recent IEA publication, *Security of Supply in Electricity Markets: Evidence and Policy Issues*, examined the question of the adequacy of investment levels in seven reformed markets. Its main conclusions are as follows:

- Substantial investment has taken place in OECD electricity markets.
- Reserve margins have fallen generally, consistent with the improvement of allocative efficiency.
- Investment in new capacity favoured the most economic option; natural gas, where this was available, but also coal, where this option was less expensive.
- It was too early to conclude whether investment in electricity generation would mimic "boom and bust" cycles observed in other industries.
- Markets may increase flexibility on the demand side (*e.g.* through load-shifting or distributed generation) which would reduce the size of reserve capacity required.

Figure 33

Reserve Margins in IEA Countries, 2000



Source: *Security of Supply in Electricity Markets: Evidence and Policy Issues*, IEA/OECD Paris, 2002.

The results of the study suggest that markets can give the right investment signals to generators and lead to timely investment. It is equally clear from the evidence presented in that report that adequate investment cannot be taken for granted.

As events in California showed, market reform is not always well designed and reformed markets will not automatically ensure security of supply. Certain recent developments underline concerns about security of supply:

- In the Nordic electricity market, supplies have been very tight this winter owing to a lack of rainfall. As a consequence, winter prices were more than double normal levels. Power shortfalls were averted through a combination of substantial imports of electricity into the Nordic region and conservation by consumers in response to increased prices.
- In New Zealand, a second drought in three years has led to higher power prices during April-June 2003 and concerns about shortages. While shortages were averted thanks to a conservation programme and additional rainfall, the government has promised policy changes to avoid future power shortages during low rainfall years.
- In Italy, hotter weather and growing electricity demand for air-conditioning caused an electricity supply shortage in June 2003. To cope with this, the government lifted emission restrictions so that old power plants could be brought back into service. A major blackout occurred in September 2003.
- In Japan, the shutdown of 17 nuclear power plants of the Tokyo Electric Power Company raised the threat of severe power shortages in the Tokyo area in the summer of 2003. Shortages were averted because of unusually cool summer weather.
- In the US and Canada, the largest blackout occurred in August 2003 taking 61 800 MW off-line and affecting 50 million people. The US and Canadian governments have set up a task force to study the causes of the outage and what can be done to prevent a recurrence.
- The heat wave in Northern Europe in August 2003 tested system limits as summer electricity demand reached unprecedented levels when at the same time thermal power plant output (both nuclear and fossil fuel) had to be curtailed because of the raised temperature of the cooling water.

Additional dimensions of security of energy supply will have to be addressed by policy-makers:

- The price mechanism is now a central tool in ensuring security of supply. With liberalisation, consumers have a choice of supplier and contract type. Some large consumers may opt for contracts related to wholesale or spot prices and they may choose to arrange cover to avoid extremes in prices to which they would otherwise be exposed.

- The traditional low rate of return of the gas and electricity sectors, combined with increased regulatory uncertainty in many IEA countries, has substantially lowered the attractiveness of the sector for investors. In particular, it is difficult to induce construction of larger generation projects with high up-front costs and long-term construction periods, as with nuclear and hydro.

- Different views exist among policy-makers regarding the desirability of ensuring an adequate security of electricity supply through some form of extra payments by users for peaking generating capacity. In the US, such systems have found favour in particular markets and have been supported by the US Federal Energy Regulatory Commission. However, government reviews of three other established electricity markets (Nordpool, UK, Australia) have all determined that such payments were not needed.

Similarly, transition from *de facto* monopolies to competition in the gas markets has created uncertainties. In the past, in most countries, governments delegated responsibility for security of supply to one single actor, either a *de facto* monopoly state-owned gas company, or a private company with exclusive concession rights. This entity was responsible for security of gas supply across the whole gas market. With market liberalisation, each supply company is only responsible for its own customers and usually to its private shareholders, focusing on efficiency and profitability. Reformed gas markets may not by themselves value security of supply. With the unbundling of gas supply and transportation activities, investment in capacity may no longer correspond to what is necessary to transport new supplies. Transit pipelines are a particular issue. With market liberalisation and cost reduction efforts, it is no longer certain that diversification of gas supplies will be a company objective. While substantial investment is needed to develop new gas supplies and to deliver them to the market, regulatory uncertainties of the sector are perceived as an additional risk by investors, making financing of new investments more difficult.

THE ROLE OF GOVERNMENTS

Governments can address increasing import dependence on natural gas, as well as reliability of gas and electricity supplies to the final customer, by articulating security of supply objectives and clearly defining the role and responsibilities of market players in meeting those objectives. Gas and electricity sector performance should be monitored with regard to these objectives requiring an increased dialogue between governments and all market participants, including companies and consumers and gas exporting countries. While governments should refrain from reintroducing elements of a planned economy, they should promote market-friendly instruments to minimise security of supply risks.

Recognising the national/regional level of gas and electricity markets, the definition and monitoring of security of gas and electricity supply must first take place at the national level, albeit with due concern for the tendency for increasingly interconnected markets to raise security of supply issues beyond national boundaries.

It is essential for energy markets to deliver efficient price signals and for related regulatory arrangements to allow for an efficient response to meet emerging investment needs. Where market responses are slow or inadequate, it may be necessary for governments to consider some form of "safety net" arrangement to address reliability requirements. The government also needs to ensure that policies encourage investment, where economically and environmentally sound, in developing primary indigenous resources. Development and diffusion of cleaner technologies for energy supply and end-use are also essential. For example, new transformative technologies, such as hydrogen and carbon capture and storage, can change the nature of future energy systems, and renewable energy technologies can add to the diversity of the energy supply mix. All of these would reduce dependence on supplies from politically unstable regions and help to enhance long-term energy security.

GLOBAL CHALLENGES FOR ENERGY SECURITY

GLOBAL ENERGY TRENDS

In the absence of changes in government or private-sector energy policies, world energy use will increase steadily through 2030 with more than 60% of the increase in world primary energy demand coming from developing countries. Such projected trends carry a number of important implications:

- Global energy trade will expand rapidly, principally because of the mismatch between location of demand and that of production. Major oil and gas-consuming countries will see their imports grow substantially, which will increase interdependence among nations.

- Huge amounts of additional investment from industrialised countries will be required in developing countries if projected energy demand is to be met. Timely mobilisation of investments will require the lowering of regulatory and market barriers and recognition of what will attract additional investment in the energy sector.

- Trade, investment and other important environmental challenges must be constantly reviewed and assessed if the goals of energy security and sustainability are to be achieved.

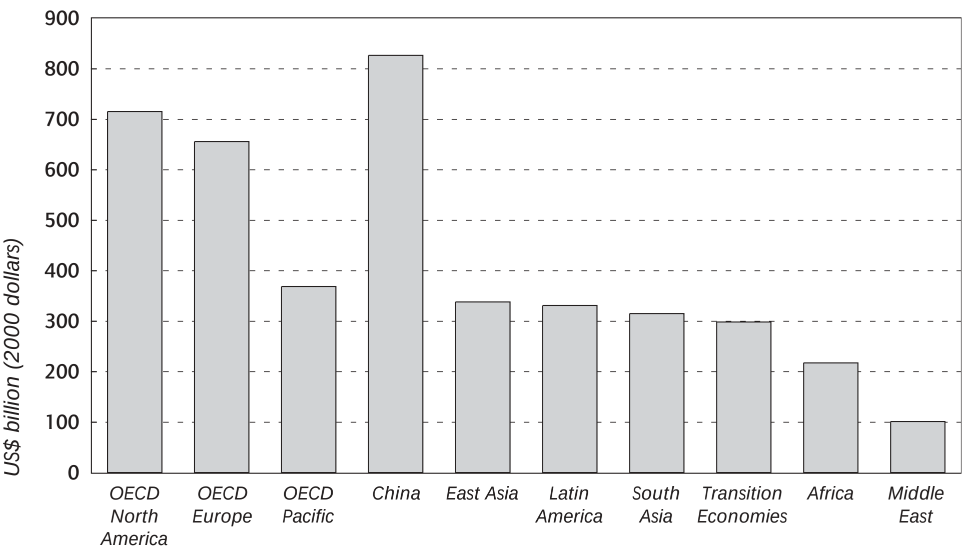
It is in this context of an increasingly global energy system that IEA countries strive to meet their energy security objectives. Meeting this objective will only be possible if applied to IEA member and non-member countries alike. All countries must increase their focus on diversity, efficiency and flexibility in the energy sector in order to establish the basic conditions for longer-term global energy security.

INVESTMENT CHALLENGE

The *World Energy Outlook 2002* indicates that the global resource base is large enough to meet the world's rising demand for at least the next three decades. However, the scale of investment required to meet the projected demand is massive and the bulk of this investment will be needed in developing countries and transition economies. The *World Energy Investment Outlook 2003* projects that more than $16 trillion needs to be invested in energy supply infrastructure worldwide over the next three decades to meet projected growth in energy demand (see box).

Figure 34

World Power Generation Investment, 2000 to 2030



Source: *World Energy Outlook*, IEA/OECD Paris, 2002.

Higher project development costs may also contribute to increased capital needs in some cases. The cost of adding new gas supply capacity in the world's main markets in North America, Europe and Asia could rise significantly as they are forced to turn to more remote and costly sources of natural gas.

Environmental concerns are also pushing up the cost of bringing new power generating capacity on line.

Global Energy Investment Outlook to 2030

The *World Energy Investment Outlook* identified that more than $16 trillion, or $550 billion per year, needs to be invested in energy supply infrastructure worldwide over the next three decades to meet projected energy demand growth. This is equal to around 1% of future global GDP and 4.5% of total investment on average. The investment will be needed not only to expand production and transportation capacity but also to replace existing and future supply facilities that will become obsolete or retired during the period to 2030.

- The electricity sector alone will need to spend almost $10 trillion, accounting for 60% of total energy investment. If those investments in the oil, gas and coal sectors that are needed to supply fuel to power station are included, the share of electricity reaches more than 70%. As world electricity demand will double by 2030, almost 4 700 GW of generating capacity needs to be built, costing $4.1 trillion, but investment requirements in transmission and distribution will be even greater, in contrast to past patterns.
- Total investment in the oil and gas sectors will each amount to more than $3 trillion, or 19% of the global energy investment. The projected increase in world oil demand from 75 mb/d at present to 120 mb/d in 2030 will require additions of new production capacity of 203 mb/d. Bringing all this capacity on stream will entail upstream investment of $2.2 trillion. A further $710 billion will be needed for tankers, pipelines and refineries, while development of non-conventional oil will cost $165 billion.
- The gas industry needs to add a cumulative total of 9 bcm/year of capacity over the next 30 years. Exploration and development investment will cost $1.7 trillion. Expected increase in inter-regional trade will call for rapid growth in cross-border supply infrastructure at the cost of $1.4 trillion.
- Investment requirements in the coal sector will be much smaller, at $400 billion, despite the fact that coal will account for nearly a quarter of world primary energy supply in 2030. Mining will account for 88% of the coal sector's investment requirements.

Almost half of total energy investment, or $7.9 trillion will take place in developing countries and 10% ($1.7 trillion) in Russia and other transition economies. However, 10% of the total investment will be devoted to projects in those regions to export fossil fuels to OECD countries. In the oil sector, more than 30% of the investments will be related to exports from non-OECD countries to the OECD. The corresponding share will be 20% for gas and 8% for coal. China alone will need to invest $2.3 trillion (14% of world total), 85% of which goes to the electricity sector. Africa has investment requirements of $1.2 trillion, slightly exceeding those in the Middle East, underpinned by the relatively high cost of developing oil and gas and continuing electrification. Nonetheless, energy investment needs will remain greatest in OECD North America.

The size of energy investment in the economy varies considerably across regions. It will amount to a mere 0.5% of GDP in the OECD as a whole. It is much larger in non-OECD regions. In Russia, the annual average energy investment requirements will exceed 5% of GDP, and Africa will need to allocate 4% of GDP to energy investment on average per year.

Investing in energy projects can be highly risky because of technical, economic and geopolitical factors. The growing interlinkages between energy projects, such as gas pipelines and power plants, increase these risks. Investment risks are particularly large in politically unstable regions. Returns on investment, therefore, often need to be higher than in other industries to compensate for this risk. Yet investment returns in the energy sector in recent years have often been below the average for the rest of industry, as well as more volatile. This raises major concerns about whether the required investment in the future will be forthcoming and, therefore, about long-term energy supply security.

There are concerns about the energy sector's access to capital. Financial resources will be sufficient on a global level to meet the projected energy investment of $16 trillion over the next three decades. However, financial resources are more limited and financial markets are less developed in developing countries and transition economies where energy investment needs will be larger, both in absolute terms and in relation to the size of their economies, than in OECD countries. As a result, there will be a considerable need for industrialised countries' financing in the energy sector. This is likely to be the case, for example, for upstream oil and gas projects in the Middle East and Russia which are expected to provide the bulk of additional capacity, even though restrictions on foreign direct investment may persist in some countries. New power plants and transmission and distribution networks in Africa, Asia and Latin America, where electricity demand will continue to grow very strongly, will also have to be largely financed by foreign investors. Securing finance will be critical to expanding access to electricity and alleviating poverty in the poorest developing countries.

Mobilising energy investment in a timely fashion will require governments to make the investment environment more attractive. This is a most pressing challenge in developing countries and transition economies. Stable and sound macroeconomic policies that keep down inflation and promote growth in the long term are fundamental to attracting capital. The removal of market barriers and the establishment of a transparent, efficient and stable legal, regulatory and institutional framework are also critical to giving investors confidence that contracts will be respected and that investments will be able to yield predictable and adequate returns. Harmonisation of trade and tariff rules are especially important in the realisation of cross-border pipeline projects. The freedom to repatriate capital and profits, the protection of intellectual property and effective policies on corporate governance, are also important factors affecting investment in the energy supply infrastructure. The situation on political governance, corruption, violence and violation of human rights also has a significant influence on the investment climate. In non-OECD countries, while financial risks in the export-oriented projects in the hydrocarbon sector may be fewer, it is very likely that the projects to supply domestic markets, typically electricity and downstream gas investment, will be the most difficult to finance.

EMERGENCY PREPAREDNESS BY NON-MEMBERS

The fact that the bulk of the increase in world primary energy demand is coming from non-member developing countries suggests the critical importance of outreach and collaboration on energy crisis management involving major energy producers and consumers. The economies of non-member countries are more vulnerable to energy supply crisis than those of industrialised countries owing to the higher share of energy costs in GDP. While several non-member countries, such as China and ASEAN countries, are beginning to pay more attention to emergency response measures, including oil stockpiling, there is still a great lack of vigilance worldwide. All countries need to put some thought into emergency preparedness, either through internal mechanisms or through international collaboration to the mutual benefit of all global market participants.

PRODUCER-CONSUMER DIALOGUE

Broadening and deepening the dialogue between oil and gas producers and consumers at ministerial, experts and bilateral levels will build confidence and improve mutual understanding of key issues for all participants. The Eighth International Energy Forum (IEF) held in Osaka in September 2002 made a substantial contribution to that dialogue.

A total of 65 countries and ten international organisations attended the 8th IEF. Twenty-four IEA member countries were represented at this high-level biannual ministerial forum. The principal outcomes were:

- An enhancement of mutual understanding and co-operative dialogue between energy producing and consuming countries.
- An agreement to meet again in 2004, with the 9th IEF being hosted by the Netherlands and co-hosted by Iran and Norway.
- An agreement to support, in principle, the establishment of a permanent secretariat for the IEF based in Riyadh.
- An agreement to make the Joint Oil Data Exercise permanent and to consider how it can be supported in the longer term.

As witnessed in the 8th IEF, a producer-consumer dialogue would entail increased focus on a regional dialogue, involving more partners, placing more emphasis on energy sources other than oil and gas and addressing some difficult issues like taxation and diversification. In this context, it would also be possible to explore methods of deepening interdependence between energy producers and markets, producers and international investors, producers and transit providers and industry/market operators (IPE/NYMEX) which provide liquidity needed for robust markets.

As seen during the war in Iraq, dialogue with oil-producing countries played a critical role in the effectiveness of emergency response measures. Furthermore, it will also improve longer-term energy security if interdependence between producers and consumers is maintained and deepened. Dialogue could also be expanded to include the broader range of energy infrastructure requirements worldwide. As mentioned above, there will be stiff competition for capital over the coming years and the massive investment needed for energy in developing countries is not likely to happen in the least attractive market for capital. Dialogue could identify partial solutions on difficult issues such as repatriation of capital, intellectual property, corruption, political governance, bureaucracy and competition, which may not appear central to energy security, but will greatly influence the flow of investments into the energy infrastructure.

TECHNOLOGY DEVELOPMENT AND DIFFUSION

The technology necessary to fuel development in the energy sector is often not available in developing countries, yet is critical in assuring secure supply, environmental protection and the alleviation of energy poverty. Both member and non-member countries can benefit from the development and diffusion of such technologies through the opening of new and profitable markets and the economies of scale that can be gained. Specific policies will be required if such technologies are to be successful.

2003 IEA MINISTERIAL MEETING

All challenges related to energy security dominated ministerial meeting discussions in April 2003. Ministers reaffirmed their readiness to combat any disruption of oil supplies, including through judicious use of emergency oil stocks, demand restraint and other response measures. They also committed themselves to addressing longer-term energy security challenges through diversifying energy type, source and route and achieving greater energy efficiency. To this end, they emphasised the role of energy technology development, demonstration and deployment as well as international technology collaboration in such fields as energy efficiency, hydrogen and cleaner technologies with low pollution and carbon emissions. Noting increasing reliance on natural gas in the energy mix and growing dependence on imported natural gas, Ministers instructed the Secretariat to assess gas security issues and to identify strategies, including securing diverse gas sources and routes as well as technology developments. The importance of collaboration between government and industry has been emphasised in this respect. Furthermore, Ministers committed themselves to strengthening the policy framework permitting markets to meet the global energy investment and trade needs and to promote an enabling environment that will attract private investment. They also affirmed the increasing importance of non-member countries in world energy markets, welcomed improving dialogue between producers and consumers and urged the acceleration of energy security co-operation with non-member countries, especially those critical to a global energy balance, recognising that security can only be assured through a more global framework.

ENERGY MARKET REFORM

ELECTRICITY

There has been mixed progress on electricity market reform since last year's review. Reforms have continued to advance in IEA Europe, with agreement to modify the EU Electricity Directive to achieve full market opening by 2007. Progress in IEA North America appears to have slowed, with relatively few US states pursuing electricity liberalisation and the Ontario government's decision to re-regulate prices in its recently deregulated market. Other IEA countries have continued to implement agreed reforms, some at a more subdued pace than others.

IEA EUROPE

EU Electricity Market Policy Developments

An amended electricity directive was passed by the European Parliament and Council in June 2003. Under these proposals, all non-household customers will be eligible to change supplier by 1 July 2004, with all consumers granted the freedom to choose suppliers by 1 July 2007. The directive requests legal unbundling of transmission system operators by 2004, and unbundling of distribution system operators by 2007. In addition, network access will be on the basis of published tariffs with the methodology for tariff-setting determined in advance by national regulatory authorities. From 1 May 2004, ten new countries will join the EU, increasing the size of the electricity market by 280 TWh at 2 655 TWh. A proposed regulation on cross-border electricity exchanges also has the potential to strengthen prospects for the development of an integrated European electricity market.

Implementation of these measures, if agreed by EU member States, as well as by new joining countries, could lead to the development of the world's largest integrated electricity market.

Progress in Implementing Electricity Market Reform

The EU Commission's second benchmarking report on the implementation of the internal electricity market notes that there has been general progress in market opening among EU countries, an improvement in the degree of unbundling of network operators and greater clarity and transparency in regulation over the past twelve months. In particular, Spain, Denmark and Belgium (Flanders region only) have opened or are expected to open their markets to full competition in 2003. Further measures have been undertaken to unbundle transmission system operators in several countries, including Italy, Belgium and the Netherlands. However, unbundling of distribution networks has not progressed at a similar pace. Network charges also appear high in some countries and there is some evidence that balancing mechanisms may be hindering new entrants' participation. Wholesale market concentration is becoming a bigger issue in most countries. However, a recent divestment by ENEL has significantly reduced concentration in Italy.

In EU candidate countries, the unbundling of the transmission network has been mainly carried out by legal separation. In the Czech Republic, the State acquired 67% of CEPS, the transmission operator, from the power generation company CEZ which still owns 32% of CEPS. In Hungary, since February 2002, a company was created out of the dominant state-owned electricity supplier MVM to act as an independent system operator. This company, MAVIR, now operates the transmission grid, of which assets remain the property of MVM.

Progress in implementing electricity market reforms is summarised in Table 9.

In January 2003 the temporary mechanism to facilitate cross-border electricity trade was modified to introduce a single standard export tariff of 50 euro-cents per MWh.

Despite this agreement, there is still limited opportunity for cross-border trade owing to a lack of infrastructure and a lack of capacity co-ordination. Physical cross-border trade in electricity in the EU represented only around 9% of total electricity consumption in 2002, hardly sufficient to support the emergence of a competitive internal market. The EU Commission is expected to publish a paper by late 2003 with proposals to improve cross-border flows and to expedite related investments.

EU States have yet to fully implement the common guidelines on congestion management agreed in September 2001.

United Kingdom: Energy White Paper

On 24 February 2003, the government published a White Paper entitled *Our Energy Future – Creating a Low Carbon Economy*. The White Paper provides a long-term strategic vision for energy policy. It puts the environment as its main concern, while seeking to achieve the joint goals of energy security, competitiveness and addressing fuel poverty.

The White Paper states that liberalised and competitive markets will continue to be a cornerstone of energy policy. However, it notes that where energy markets are unable to create the right signals, the government will take steps to create appropriate incentives to encourage commercial responses consistent with its strategic policy objectives.

Table 9

Electricity Market Reform Progress in EU Countries

(October 2002)

	Declared Market Opening (% of total)	*Large Eligible Customers Switch (%, 1998-2001)*	*Full Market Opening (date)*	*Unbundling Transmission*	*Unbundling Distribution*
Austria	100	20-30	2001	Legal	Accounting
Belgium	52	2-5	2007	Legal	Legal
Denmark	100	>50	2003	Legal	Legal
Finland	100	Unknown	1997	Ownership	Management
France	37	10-20	2007	Management	Accounting
Germany	100	20-30	1998	Legal	Accounting
Greece	34	nil	2007	Legal/Management	Accounting
Ireland	56	10-20	2005	Legal/Management	Management
Luxembourg	57	10-20	2007	Management	Accounting
Italy	70	>50	2007	Ownership/Legal	Legal
Netherlands	63	20-30	2003	Ownership	Legal
Portugal	45	5-10	2004	Legal	Accounting
Spain	100	10-20	2003	Ownership	Legal
Sweden	100	Unknown	1998	Ownership	Legal
United Kingdom	100	>50	1998	Ownership	Legal

Source: EU Commission.

In particular, the White Paper establishes strengthening the contribution of energy efficiency and renewable energy generation as priorities for future energy policy. New measures to help achieve these priorities include increasing funding for renewable capital grants by £60 million, and a commitment to improve energy efficiency in public-sector buildings and procurement.

The White Paper indicates that the government's strategic policy directions for energy will necessitate further significant restructuring of the electricity sector. Some of its key messages in this context are as follows:

- The White Paper notes that national and local electricity grids, metering systems and regulatory arrangements will need to be restructured over the next 20 years to support the emergence of far more renewables and small-scale distributed electricity generation.
- Energy market development will need to be complemented by a planning system that is more helpful to infrastructure investment and new electricity generation, particularly renewables.
- Coal-fired generation will have an important part to play in widening energy diversity provided ways are found to reduce carbon emissions. The government will continue to support relevant research to develop cleaner coal technologies and for carbon capture and storage.
- The possibility of future new nuclear generation to meet carbon abatement targets is acknowledged.

Ireland: Proposed Wholesale Electricity Market Arrangements

On 30 April 2003, the Commission for Electricity Regulation published its proposed decision in relation to Ireland's electricity market trading arrangements. This sets out the new wholesale electricity market trading arrangements and proposes to replace existing transitional arrangements from 2005.

Key elements of the proposal are summarised below:

- **Central Market.** The wholesale market will be based on a mandatory centralised pool with electricity bought and sold through the market and system operator (ESB National Grid). The spot market will be an energy-only market, with no separate payments. The market clearing price will be determined *ex ante* and on the basis of the locational marginal price (*i.e.* nodal pricing). An upper and lower value of lost load price cap will apply to spot prices.
- **Risk Management.** Market participants may enter into bilateral financial hedging arrangements to manage risk exposure to the spot market.

- **Reserve Market.** The market and system operator will purchase reserves and may implement spot markets for some reserve products. Generators and load may provide reserve.

- **Generation Adequacy.** A safety net option to fast-track construction of new capacity will be developed to ensure that reliability can be maintained if required.

- **Dominance.** Measures will be implemented to mitigate market power. Although the details are yet to be determined, it is likely that a system of vesting contracts may be imposed on the market and system operator and that regulatory oversight will continue.

- **Spot Market Pricing.** Generators will sell electricity to the market and system operator on the basis of locational marginal prices, while purchases from the market and system operator will be at a uniform price, regardless of location, based on a single load-weighted average price.

- **Financial Transmission Rights.** The commission considers that the market should have access to financial transmission rights to hedge locational marginal pricing risks. Further consultation will be undertaken on the details and timing of implementation.

The final decision was published in July 2003 following a last consultation period.

Switzerland: Referendum Rejects Electricity Reform Proposal

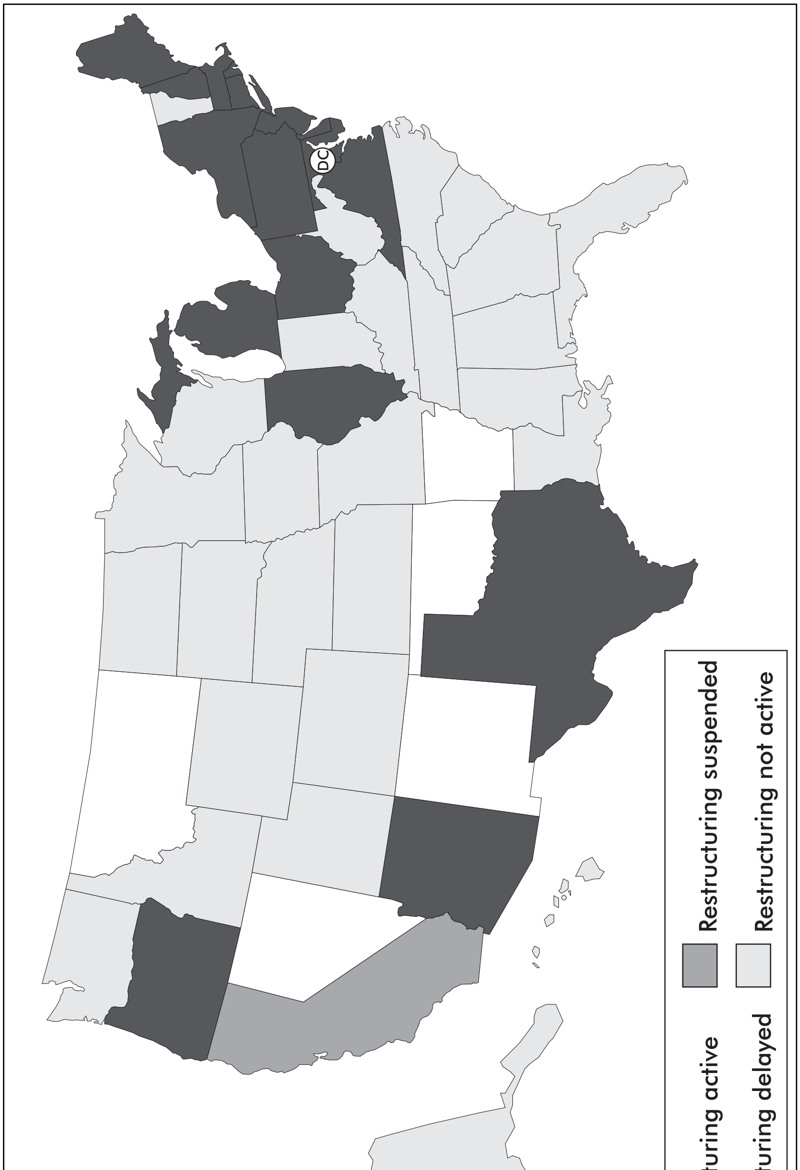
In December 2000, the Parliament passed laws to liberalise the electricity market. However, at a public referendum held on 22 September 2002, the legislation was rejected with a 52.6% majority. The government and key stakeholders are currently discussing how to proceed.

IEA NORTH AMERICA

The status of reforms varies by state and province in the US and Canada, 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 has remained subdued following California's experience of 2000/01 and the subsequent concerns about risk management in the wake of the Enron failure. Figure 35 indicates that 18 states are currently actively pursuing electricity restructuring in the United States. In Canada, the Ontario provincial government has reversed electricity market reforms introduced in May 2002 and reintroduced a regime of regulated prices for small consumers (discussed below).

Figure 35

Status of State Electric Industry Restructuring Activity, February 2003



Source: United States Department of Energy, *United States of America - FERC's Wholesale Power Market Platform Proposal.*

The United States' Wholesale Power Market

In April 2003, the US Federal Energy Regulatory Commission (FERC) issued a White Paper presenting a refined proposal for a wholesale power market platform. This proposal builds on earlier proposals for a standard market design (July 2002) and the creation of regional transmission organisations (1999). The proposal also incorporates FERC's response to comments received.

The Final Rule will focus on the formation of regional transmission organisations (RTOs), ensuring that all RTOs and independent system operators (ISOs) have good wholesale market rules in place. The Final Rule will permit a degree of flexibility in implementation to accommodate specific regional needs. Key features of the wholesale power market platform proposal include the following:

- **Independent Regional Grid Operation.** RTOs will need to be independent, have a regional configuration consistent with efficient market operation and development, possess day-to-day operational authority for the transmission networks under their control and be responsible for short-term reliability. FERC considers that structural separation of transmission operation from other contestable activities will be required to achieve an appropriate degree of independence. Overarching principles for independent governance will be included in the final ruling.

- **Transmission Planning Process.** RTOs and ISOs will be required to produce technical assessments of the regional grid and to support state siting authorities with necessary studies. The Final Rule will require a regional planning process to be put in place as soon as practicable.

- **Transmission Pricing Policies.** Costs associated with existing network assets will be recovered from consumers through network charges. Network access charges should permit customers to have access to a region at a single rate. The form of the access charge submitted for FERC approval may be determined by regional state committees. RTOs and ISOs should seek to eliminate payment of multiple access fees across RTO and ISO borders to facilitate trade and competition. Costs may also be directly assigned and recovered from users on an incremental basis, subject to FERC approval.

- **Market Power Mitigation.** Mitigation measures must protect against the exercise of market power without suppressing prices below the level necessary to attract needed investment. RTOs and ISOs must establish an independent market monitor to undertake market surveillance. Rules governing market participant conduct and penalties must be developed and should address: physical withholding of supplies; economic withholding of supplies; reporting on generator availability; accuracy of information provided to RTOs or ISOs and an obligation to provide information to independent market monitors; co-operation with market monitoring investigations; and the requirement that all bids designating physical resources are physically feasible. Specific rules should be tailored to the needs of each regional market.

- **Spot Markets and Ancillary Services.** RTOs and ISOs will be required to use a real-time spot market to resolve energy imbalances. RTOs and ISOs will be responsible for developing detailed market rules to be included in the report to FERC. RTOs and ISOs will be required to introduce a day-ahead market and various ancillary services when the market is ready. Day-ahead markets must be designed to work reliably with the related congestion management system.

- **Congestion Management.** Approaches to manage congestion should protect against market manipulation, promote efficient network use and support the use of lowest-cost generation. RTOs and ISOs should introduce a transparent market mechanism with efficient price signals to manage transmission congestion within one year of commencing operations. FERC's preferred approach would involve adoption of locational marginal pricing providing price signals for market-based resolution of congestion.

- **Firm Transmission Rights.** RTOs and ISOs that use locational pricing to manage congestion will be required to make firm financial transmission rights available to customers. Rights would be allocated according to existing contracts and service arrangements where this issue has not already been addressed. FERC will not require RTOs or ISOs to auction rights.

- **Resource Adequacy.** Minimum levels and the method for delivering resource adequacy will be determined by states through regional state committees. The approach adopted could draw on a mixture of generation, transmission, energy efficiency and demand response and be implemented by regulation or through a market-based approach such as a capacity market.

In May 2003, FERC scheduled a series of regional technical conferences to discuss possible timetables to address wholesale market design issues contained in the White Paper. The Final Rule was expected to be published in 2003, although the timing may be affected by a Bill currently before the US Senate which proposes to prohibit FERC from making the final ruling until 2005.

The US Department of Energy's report to Congress in May 2003 on FERC's original standard market design proposal suggests that it would save US consumers over $1 billion in the first six years following implementation. The benefits would result primarily from increased trading between regions, with more seamless grids and open markets enabling lower-cost power generation to displace higher-cost facilities.

Canada: Ontario's Electricity Market Reform Reversed

In December 2002, the Ontario government passed legislation allowing it to direct key elements of market development and to implement a series of regulated tariffs up to 2006. The legislation represents the government's response to tight market conditions and higher than expected spot prices which had emerged following the liberalisation of Ontario's electricity market in May 2002. Key elements of the new policy include the following:

- Wholesale electricity prices for all consumers using less than 250 000 kWh per annum are fixed at 4.3 cents/kWh to 2006. This includes eligible customers who signed supply contracts under previous market arrangements. The fixed price applies retrospectively. Eligible customers will receive rebates equal to any payments they have made in excess of the fixed tariff since market opening in May 2002. Arrangements for larger customers are yet to be confirmed, but the government has stated that such customers would be able to choose between the regulated price and a market price.
- Other charges, including retail electricity tariffs, will be determined by the Ontario government rather than the Ontario Energy Board (OEB). The government has empowered itself to order the OEB to modify any existing rate or licence condition without a public hearing. Proposals to change network-related tariffs and charges, or modify market rules, cannot be implemented without ministerial approval.
- The wholesale market will continue to operate and clear at the market determined wholesale price. The government will either pay or receive the difference between the wholesale price and the regulated price.
- Tax breaks will be provided to investors in renewable energy generation, including exemptions from provincial taxes and corporate taxes, waiving of sales taxes on related equipment purchases and a ten-year holiday on property taxes.

IEA ASIA-PACIFIC

Australia: Energy Market Review Final Report

On 20 December 2002, the Council of Australian Governments Energy Market Review delivered its final report entitled *Toward a Truly National and Efficient Energy Market*. The review notes that while the reforms of the past decade have been beneficial, serious deficiencies remain. The review concluded that there is a pressing need to achieve a competitive, transparent national market which provides efficient price signals for all market participants. Key recommendations relating to electricity market reform include the following:

- Establishment of a National Energy Regulator to encompass the energy regulation roles of the Australian Competition and Consumer Commission (ACCC), the state regulators, the National Electricity Code Administrator and the National Competition Council.
- The independent market and system operator (the National Electricity Market Management Company, NEMMCO), to acquire new responsibilities, including facilitating the management process of the electricity code change and transmission network planning.

- Replacing existing regional pricing arrangements with locational marginal pricing and overhauling transmission regulation to ensure that network operators are more responsive to the needs of the contestable market.
- Restructuring of government-owned generation portfolios to promote more efficient and sustainable competition across the National Electricity Market (NEM).
- All states and territories to implement customer choice of energy supplier to work towards removing retail price caps and other market distorting arrangements.
- All states and territories to mandate the installation of interval meters.
- NEMMCO to introduce a "pay-as-bid" mechanism for load reduction into dispatch and pool price-setting to encourage demand-side involvement in the NEM.

Estimates published in the final report suggest that implementation of the proposed reform package could increase real Australian gross domestic product (GDP) by approximately $2 billion per annum in 2010 (around 0.5%). Over five years, the increase in GDP is estimated to be in the order of $7 billion.

The Council of Australian Governments is expected to formally respond to the final report around late 2003.

New Zealand: New Electricity Commission

In May 2003, the New Zealand government announced the establishment of an Electricity Commission. The commission is responsible for contracting with electricity generators to provide reserve power for release during dry years. Contracted reserve power would be withheld from the market during normal years to minimise distortion of market operation. Consumers are expected to face an additional cost of less than 0.5% per unit of electricity purchased. Sufficient reserve generation is expected to be built up over a three-year period to achieve security of supply for a 1-in-60 dry year event.

The commission's other responsibilities include:

- Ability to require generators to offer long-term hedging contracts for a certain proportion of their capacity where the commission believes insufficient incentives exist for new generation investment.
- Undertaking forecasting for future electricity supply and demand.
- Establishing methodology to enable investment in the national grid.
- Establishing demand-side energy exchanges to allow consumers to resell contracted electricity.

Japan: Electricity Industry Committee Reform Proposals

In February 2003, the Electricity Industry Committee, an advisory body to the Ministry of Economy, Trade and Industry (METI), presented its proposals for changes in the regulatory regime. Based on these proposals, the government drafted a new law amendment passed in the Diet on June 2003. Proposals include the following:

- Regulation of transmission, system access and operation will be established. Establishing legislative measures for account unbundling and information firewalls from April 2005. The regulatory capacities of the METI will be reinforced. A Neutral Transmission System Organisation (NSO), with participation from incumbent market players and new entrants, will be established to handle electricity transmission issues. The NSO will be appointed and supervised by the government.
- Rules will be established for settlements among utilities to assure impartiality in cost-sharing and cost-recovery. A nationwide power exchange, operating on a voluntary basis and including day-ahead market and forward markets, will be established.
- Nuclear power, hydropower and geothermal energy will benefit from priority dispatching to the network to promote investment in these technologies. The government will also plan measures to encourage the industry to invest in adequate transmission capacities.
- The criteria which METI uses to judge whether transmission charges are appropriate will be clarified.
- Measures will be taken to enable new entrants access to load data possessed and collected by the incumbent utilities to assist them in meeting balancing power rules and to propose attractive offers for potential new clients with consideration given to information security.
- A timetable for retail liberalisation will be accelerated with the next step in April 2004 to high-voltage consumers whose connected load is at least 0.5 MW, bringing the market opening to 40%. In April 2005, all high-voltage consumers would gain eligibility, increasing the market opening to 63% of the total retail market. The final step, full opening to the smallest consumers, is envisaged but would be subject to further consideration beginning in April 2007.

GAS

While market competition continues to spread in OECD Continental Europe and Pacific, a more cautious assessment of gas market liberalisation is taken in the US because of deteriorating financial conditions of some market participants and shaken confidence in the markets.

IEA NORTH AMERICA

The US wholesale gas market is highly competitive. Thousands of producers, independent marketers, pipeline affiliates, local distribution companies (LDCs) and end-users compete to buy and sell gas at the wellhead and at market centres, or "hubs" located across the country. In recent years, the retail market has opened more to competition as various states have initiated retail unbundling programmes to allow residential natural gas users to select their suppliers. The nature of these "customer choice" programmes varies widely from state to state. 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.

Table 10

Status of US Natural Gas Industry Restructuring at the Retail Level, by State, as of December 2002

Residential Natural Gas Restructuring Status	*States*
Statewide unbundling – 100% eligibility	DC, NJ, NM, NY, PA, WV
Statewide unbundling – implementation phase	CA, CO, GA, MD, MA, MI, OH, VA
Pilot programmes/partial unbundling	FL, IL, IN, KY, MT, NE, SD, WY
No unbundling – considering action	IA, KS, ME, MN, NV, NH, OK, SC, TX, VT
No unbundling	AK, AL, AR, AZ, CT, HI, ID, LA, MS, MO, NC, ND, OR, RI, TN, UT, WA
Pilot programme discontinued	DE, WI

Source: EIA website.

In 2002, only two states changed their unbundling status. Michigan is in the process of implementing voluntary customer choice programmes virtually statewide and Florida approved two experimental pilot programmes for residential transportation service. Most enrolment increases in 2002 can be attributed to the expansion of existing programmes into new geographic areas or new enrolment caps as part of an approved phase-in to systemwide choice programmes. Eligibility numbers doubled in Michigan, nearly tripled in Virginia, increased more than fivefold in Wyoming and nearly sevenfold in Illinois.

According to a report by the Federal Energy Regulatory Commission (FERC)[2], the state of competitive natural gas markets is sound and competitive forces continue to produce tangible economic benefits for customers. However, there is a need for vigilant market supervision to ensure competition continues to work in the best interest of customers and market participants. The FERC's report cites five main challenges facing today's wholesale gas markets:

- Deteriorating financial conditions of market participants. Many past leaders of energy trading are either out of business or retrenching and their problems have also adversely affected other natural gas companies. This serious financial situation might create delivery problems in the longer term.

- Need for management of credit exposure. Introducing more sophisticated credit management approaches in gas markets, including over-the-counter credit clearing, will be critical for the successful control of risks associated with volatile gas prices.

- Shaken confidence in price discovery methods. There are increased concerns about the credibility of published natural gas price indices and, therefore, about the efficiency of gas markets.

- Continuing need for efficient investment in infrastructure. Production has not responded in a major way to recent price signals. With gas supplies tight and prices high, more storage and pipelines are needed to operate efficiently.

- Continuing potential for manipulation. The potential for manipulation of energy markets remains a concern. Solutions require a commitment to vigilant supervision.

In order to remove economic and regulatory barriers to the development of onshore LNG import terminals, FERC adopted a different policy for regulation of new LNG projects where markets are competitive and other specific criteria are met. Commission-approved cost-based rates or an open access tariff for the new terminal service are not required. The first project to benefit from the new legislation will be the Hackberry LNG project in Louisiana if construction and operation of the terminal are authorised.

IEA PACIFIC

In Japan, the METI plans to continue to liberalise the gas market by increasing the number of eligible customers. Consumers must currently use over a million cubic metres a year before they can choose their own supplier, with eligible users accounting for 40% of national demand. The intention is to allow the

2. *2003 Natural Gas Market Assessment*, FERC, January 2003.

users of over 0.5 million cubic metres a year, such as large hospitals and hotels, to choose their supplier in the year ending in March 2005, expanding the contestable market to 44% of total demand. It is intended that the users of over 0.1 mcm a year will subsequently become eligible in the 2007 financial year. The amount of gas sold to customers in these two categories would exceed 50% of total annual sales at the top 10 gas utilities. To encourage new gas providers to enter the liberalised market, all current providers would have to allow entrants to use their pipelines. At present, only the top four firms are obliged to do so. To ensure fair and transparent third-party access to pipelines, the government proposes accounting separation and information firewalls between gas transportation activities and other activities of gas utility companies. Market opening for all consumers would be determined on the basis of an evaluation of the success in market liberalisation for larger consumers, the prevailing gas supply situation, the status of market reform in other energy sectors and international experience in gas market liberalisation. The METI presented an amendment of the Gas Utility Law to the Diet (Japanese Parliament) which was passed on 11 June 2003.

The Council of Australian Governments issued a review calling for sweeping reforms in the electricity and gas markets to break down state lines and deliver lower prices. The review found that, although energy reform over the past decade has delivered significant benefits, more work must be undertaken to create a truly national market. The report recommends a single energy regulator and emissions trading scheme to be established within three years together with an increase in interstate electricity transmission links.

The New Zealand government is preparing a policy package designed to increase efficiency and reliability in gas production and transportation, and improve fairness for gas customers.

IEA EUROPE

Amendment of the EU Gas Directive

On 25 November 2002, a political agreement was reached by the Energy Council in Brussels. It provides for an acceleration in gas and electricity market opening, establishes provisions on the unbundling of transmission and distribution operators, public service obligations, regulatory tasks and third-party access to storage. The timetable for market opening follows a two-step approach, with deadlines on 1 July 2004 for non-household users and 1 July 2007 for household users. This process will take account of a report assessing the impact of liberalisation to be presented by the European Commission in 2006. The agreement provides that gas transmission and distribution system operators (TSOs/DSOs) should be independent, in terms of their legal form, from activities not related to transmission and distribution respectively. Ministers agreed to create an obligation to implement legal unbundling of transmission by July 2004, while distribution will be unbundled by July 2007. This obligation does not imply unbundling of ownership in vertically integrated companies. The agreement provides that access to storage, line-pack and ancillary services would be guaranteed and may be negotiated or regulated. The agreement also provides for the establishment of a regulator with *ex ante* functions (tariffs). Member States shall designate one or more competent bodies with the function of regulatory authorities. The agreement calls for improved public service obligations and requests monitoring of supply security (a balance between demand and supply and possible minimum level of investment).

Although the amendments introduced major changes, several EU member States already apply the provisions included in the new directive.

Table 11

Natural Gas Market Reform Progress in EU Countries

(October 2002)

	Declared Market Opening (% of total)	*Large Eligible Customers Switch (%, 1998-2001)*	*Unbundling Transmission*	*Unbundling Distribution*
Austria	100	<2	Legal	Legal
Belgium	59	Unknown	Legal	Legal
Denmark	35	2-5	Legal	Legal
Finland	0	–	–	
France	20	20-30	Accounting	Accounting
Germany	100	<10	Accounting	Accounting
Greece	0	–	–	–
Ireland	82	20-30	Management	Management
Italy	100	10-20	Legal	Legal
Luxembourg	72	5-10	Accounting	Accounting
Netherlands	60	30-50	Management	Legal
Portugal	0	–		
Spain	100	20-30	Ownership	Legal
Sweden	47	<2	Accounting	Accounting
United Kingdom	100	>50	Ownership	Ownership

Source: EU Commission.

Second Benchmarking

The EU published its second benchmarking report on the implementation of the internal electricity and gas markets. The European Commission report claims that there has been less progress for gas since 2001 than for electricity and finds five significant barriers:

- Different rates of market opening among States continue to reduce the scope of benefits to customers from competition.
- Inappropriate tariff structures and large and unexplained disparities in network access tariffs between countries and regions for transportation and distribution transactions which form a barrier to competition and provide revenue for cross-subsidies.
- Lack of transparency regarding the availability of infrastructure capacity.
- Concentration of gas production and imports in several companies and slow development of gas trading hubs.
- Balancing regimes which are unnecessarily stringent, being non market-based and not reflective of the costs incurred.

Proposal for a Directive on Security of Gas Supply

In September 2002, the EU proposed a "Directive on security of gas supply" suggesting measures aimed at ensuring the proper functioning of the EU internal gas market by safeguarding security of the EU gas supply. The directive would complement the new gas directive. Discussions of the proposal with EU member States continue.

Gas Hubs

Although the development of gas hubs in continental Europe is just beginning, there were important developments in Germany and the Netherlands during 2002. On 1 January 2003, Dutch Gas Transport Services (GTS) introduced the title transfer facility (TTF) system, a virtual hub for the Dutch market similar to the National Balancing Point (NBP) in the United Kingdom. Eurohub, the Dutch hub operator at Bunde-Oude-Statenzijl-Emden, is likely to merge into the overall Dutch TTF. Eurohub is more sophisticated and covers all the Dutch border points. The third hub, MW Europe Hubco, operated by Germany's Ruhrgas and BEB, and Norwegian Statoil, has experienced an increasing number of trading transactions during the year allowing publishing price indices to commence at Bunde.

UK's Energy White Paper

The UK's Energy White Paper, published in February 2003, focuses on creating a low-carbon economy with environment at the centre of the authorities' energy policy. It places greater focus on international aspects of energy policy in addressing climate change, promoting liberalisation and producer/consumer relations and innovation.

The White Paper recognises that, because of the decline of gas reserves, the country will shift from being a net exporter to being, once again, a net importer potentially more vulnerable to price fluctuations and interruptions in supply caused by regulatory failures, political instability or conflicts in other parts of the world. This new situation requires a different approach to gas policy, more focused on external relations and substantial investment to build additional connections to external supply sources.

COAL

Important changes have occurred in the international coal market over the last year, most directly concerning non-member countries, but having implications for IEA countries. For example, China has emerged as the world's second-largest coal exporter (after Australia) giving added strength to security of international coal supply and pushing prices down. Competing exporters have responded positively to the competitive challenge of Chinese exports by also expanding output. Russia's coal industry reform programme continues consistent with reported government policy to free up gas resources for export to Europe and so contributing to security of European gas supply. On the other hand, the potential impact of Russia's policy to free up natural gas for export through the increased domestic use of coal remains to be seen.

Japan and Korea have directly benefited from Chinese exports because of the freight advantage China has over competing suppliers to these markets, but Europe also benefits because coal from suppliers such as South Africa have lost their market share in Asia, making more coal available to European consumers. Reliable, low-cost coal imports continue to make inroads into European markets.

Among IEA countries, Australian producers have not only maintained output, but have also closely matched output with demand, so avoiding price volatility and providing a more predictable basis for investment. US producers continue to focus interest on the domestic market because of low international prices. In New Zealand, the coal industry is expanding output, helping to offset the impact of declining gas resources.

GOVERNMENT FINANCIAL SUPPORT FOR COAL PRODUCTION

A number of IEA countries give varying degrees of financial and other assistance to their indigenous coal producers. In most cases, the grounds for support are based on a pragmatic concern to maintain employment and regional economic activity. Security of supply and support for industrial development based on coal-mining technology are emerging as more sophisticated justifications for support.

In 2001, Japan closed its last coal mine, but reopened it in 2002. The last government-supported coal mine in Canada, on Cape Breton, was also closed although Canada continues to be a coal producer. Production is expected to continue to be subsidised in the Czech Republic, Turkey and Norway. The future of coal subsidies in EU countries is the principal concern because of the scale of the production involved. Outside the EU, subsidised production amounts to less than 25 Mt in IEA countries. France, Germany, Spain and the UK continue to provide support for coal production with EU approval and total production in these countries is about 85 Mt.

Policy on aid given to European coal has evolved from its original objectives. 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 a reduction in production capacity, and resulting unemployment, is carried out in a manner as socially acceptable as possible.

State aid has shifted away from operating aid (*i.e.* aid to producers that could improve their economic viability, or at least reduce their losses) to help reduce production or for mine closures.

The outlook in EU countries is for a continuing fall in subsidised production. 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 fell by well over half. France has, proportionately, seen the biggest contraction and the UK has seen the largest absolute decline.

The policy approach taken in the EU has improved steadily, but the most recent changes suggest an unspecified level of subsidised production will be maintained. For example, the EU requires 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 only supplies about 30%.

France is on target to end coal production in 2005 and reports suggest that, because of technical mining problems and accumulating losses, production may end earlier by mid-2004. In Spain and Germany, average production costs are around three times the world market price and production has been reduced in line with reductions in aid. German industry is pressing hard for a continuation of subsidies and reduced reliance on imported coal. Only in the UK 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 are now justified, in part, by the need to continue support for social and regional adjustment as coal production is reduced where it is uncompetitive. 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 will be replaced by aid to "safeguard resources". Mines not in this category would be subject to closure by 31 December 2007. By 31 December 2006, however, the Commission is required to submit revised proposals for the regime to apply from 2008 to 2010.

It is clear that, while state aid may have been successful in dealing with social problems and in evening out short-term market movements, it has not been successful in providing a long-term economic future for the greater part of the industry. In practice, almost every time there has been a reduction in state aid, production has been reduced by closing mines rather than any improvement in productivity achieved by reducing costs. The new policy approach runs the risk of establishing an industry with a core of uneconomic mines that have little prospect for improvement. Some UK mines approach international cost levels, but the majority will remain overwhelmingly uncompetitive.

Other Major Coal Policy Measures

In Japan, a new coal tax has given rise to uncertainty about government intentions. In November 2002, the METI announced a proposal to impose a tax on thermal coal which had previously been tax-free. The new tax will apply from financial year (FY) 2003. The tax rate will be raised gradually from ¥ 233 per tonne in 2003 to ¥ 700 per tonne in 2007, *i.e.* from US$ 1.90 to US$ 5.70 per tonne. The new tax is reported to be a rearrangement of the energy tax system as a whole and not intended to reduce the use of thermal coal in Japan, although this might be expected to result.

CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

CLIMATE CHANGE

BACKGROUND

The past few years have seen a significant level of climate change mitigation effort. A broad range of policies including fiscal measures, tradable permits, voluntary agreements, R&D and outreach and information exchange programmes have been developed. The trend is increasingly focused on implementation of policies that have been planned since the completion of the negotiations of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), which are geared to helping countries meet their goals.

However, notwithstanding these efforts, the near-term future of the international climate change process remains uncertain. In spite of the ratification in August 2003 by 112 countries, including 31 Annex I countries, the threshold for the entry into force of the Kyoto Protocol has not yet been met[3]. Two countries have announced their intention to remain outside the agreement, namely the US and Australia, representing 36.1% and 2.1% of Annex I emissions respectively. Nevertheless, Australia has announced its intention to meet its target in the first commitment period. A third country, Russia (representing 17.4% of Annex I emissions), must ratify if the agreement is to take effect, but has not yet taken a formal decision to do so. This uncertainty is taking a toll on the credibility and momentum of the process as a whole. Not only will an agreement without the US (the world's largest emitter of greenhouse gases) inevitably mean lower overall reductions, but its opposition, based on concerns about domestic implementation costs and the non-participation of developing countries, have led many observers and experts to reconsider the long-term potential of using the Protocol structure without significant future modifications.

Despite uncertainty in the international process, those countries that have ratified the Protocol have taken significant steps over the past several years towards implementing the agreement. Within the international negotiating process, consensus was reached on key issues, including how to implement the flexible mechanisms (emissions trading, joint implementation and the clean development mechanism (CDM)), and on methods to account for national

3. Annex I Parties include both OECD countries and countries with "economies in transition", that is, the Russian Federation and several other Central and Eastern European countries. The provisions for entry into force call for 55 countries, including those representing at least 55% of emissions of the Annex I group, to ratify before the agreement takes effect. Currently, although more than enough countries have ratified, the Annex I Parties to the Protocol represent only 44.2% of the group's emissions.

emissions and "sinks" in land use, land use change and forestry (LULUCF). In August 2002, the Executive Board of the Protocol's CDM was established and applications were accepted for accreditation as "operational entities" responsible for checking whether projects conform to CDM rules and for validating proposed projects. The eighth Conference of the Parties (COP8) to the UNFCCC, held in New Delhi, India in late October 2002, was the first COP meeting held since the Kyoto Protocol framework had been finalised. The Delhi Declaration highlighted the importance of taking steps to address not only mitigation of climate change, but also adaptation to its unavoidable effects. The Declaration also emphasised issues of sustainable development, the focus of the Johannesburg Conference in September 2002.

The result of the process to date suggests that, should Russia decide to ratify, implementation of the Protocol may be relatively "on-track". In fact, while the projection of future emissions is subject to considerable uncertainty, assuming that full emissions trading is allowed and that the US remains outside the Protocol, the Annex I Parties would be able to comply with their commitments under Kyoto with only modest additional steps beyond those already taken.

National policies have continued to move forward over the past year. While many of these have been explicitly taken to meet Kyoto objectives, others are the result of domestic efforts that are independent of Kyoto. Among these are sub-national programmes implemented at state level in the US and Australia. Others include programmes likely to continue whether or not the Protocol enters into force, such as the emissions trading programmes being planned by the EU and the voluntary programmes that are a centre-piece of German and Japanese efforts.

However, while it is still too soon to judge the effectiveness of these efforts, recent announcements by governments suggest that they are still inadequate – either to meet the near-term goals agreed under Kyoto, or the more stringent and longer-term objectives of climate stabilisation that are the basis of the UNFCCC. For example, the European Environment Agency reported that CO_2 emissions rose by more than 1.5% between 2000 and 2001 alone, and without additional measures would continue to grow[4]. Similarly, reports from Canada suggest that Canadian emissions are growing even more rapidly, with an increase in CO_2 of more than 21% since 1990[5].

IMPLICATIONS FOR THE ENERGY SECTOR

The implications of climate policy for the energy sector continue to be significant. The burning of carbon-rich fossil fuels – coal, oil and gas – for the production of energy generates over 80% of anthropogenic GHG emissions.

4. http://reports.eea.eu.int/technical_report_2003_95/en/ECinvUNFCCC2003_15april2003_annex4.zip
5. See http://ghg.unfccc.int/

Efforts to mitigate climate change have, therefore, unsurprisingly focused on reducing energy-related emissions. While policies have largely been driven by environmental concerns, they can be expected to have increasingly important impacts on developments in the energy sector.

Two distinctive policy approaches have been applied: using less energy (*i.e.* reducing energy intensity) and switching to less carbon-intensive energy sources (which itself can be subdivided into switching to low- or zero-emission energy sources, and switching from one fossil fuel to another less carbon-intensive fuel[6]). Policies and measures to implement both approaches have been widely applied in IEA member countries.

A relatively recent addition to the list of policy options has been sequestering carbon. Although still at an early stage, coupling the use of conventional fossil fuels with carbon capture and storage technologies is rapidly emerging as an attractive alternative. Various technologies, both pre- and post-combustion, are now available for CO_2 use, separation, transport and underground storage. Although costs remain high, and the long-term environmental consequences are not entirely certain, the prospects of these technologies are nevertheless promising.

CLIMATE CHANGE POLICES IN IEA COUNTRIES

Although the Kyoto Protocol has yet to come into force, IEA member countries have nevertheless been very active in developing policies and measures to reduce GHG emissions. In an effort started in 1999, the IEA systematically reviews and classifies information on policies and measures taken or planned to reduce GHG emissions from the energy sector[7] offering a continuous follow-up of the climate change mitigation policy-making process. Although the number of measures taken or planned in 2002 is smaller than in previous years, several major policies have nevertheless been implemented.

FISCAL MEASURES

Fiscal measures are an important component of the policy mix developed by IEA member countries to reduce GHG emissions, representing almost one-third of all new measures taken or planned in the past four years. To date, the vast

6. When energy conversion rates are equal, a shift from coal to oil implies a reduction in emissions of 26%, from oil to gas of 23.5%, and from coal to gas of 43% per unit of primary energy. Reductions can be even greater when considering specific technologies. For example, the advantage of natural gas is increased by the higher conversion efficiency of combined cycle gas turbine technologies over oil or coal-fired power plants.

7. The database on "Dealing with Climate Change" policies and measures is accessible on http://www.iea.org/envissu/index.htm

majority of fiscal measures have been set up to support the development of emerging low carbon technologies rather than to impose a direct cost on fossil fuel sources.

In 2002, only a small share of all new fiscal measures implemented were energy or carbon taxes. These include, for example, the development of a new tax scheme on fossil fuels in Japan under which LNG and LPG taxes would be increased and a coal tax would be introduced. In Sweden, the carbon dioxide tax rate was raised from SKr[8] 530 per tonne to SKr 630 per tonne and the energy tax on electricity went up by SKr 0.012 per kWh (labour taxes were reduced by a compensatory amount).

As in previous years, the vast majority of fiscal measures taken or planned in 2002 have been developed to provide incentives for the deployment of low carbon technologies, namely renewable energy sources and energy efficiency improvements. These measures usually take the form of grants, preferential loans or special funds. In the field of renewable energy technologies, Canada introduced a new wind power generation incentive in 2002 with the aim of producing 1 000 MW of electricity from wind by 2007. South Korea introduced a broad renewable energy subsidy scheme, while the UK launched capital grant schemes for several renewable energy technologies. Energy efficiency improvements and fuel switching in the transport sector were also supported through government incentives and subsidies. One of the largest programmes adopted was that of Germany which introduced a new Combined Heat and Power (CHP) Law under which bonus payments are offered to CHP operators. The new Intermodal Freight Transport (Marco Polo) financial assistance scheme, developed by the EU, is another that is expected to provide significant incentives to improve transport efficiency. Some countries (*e.g.* Canada, France and Spain) also developed funds for renewables or energy efficiency technologies in order to promote market-based approaches to technology development.

Tax credits, exemptions and reductions also played an important role in supporting clean technologies. France, for example, introduced such tax treatments in 2002 to promote energy efficiency and the use of renewable energy-based equipment in the building sector. These tax mechanisms are also used in the transport sector to encourage consumers to purchase less carbon-intensive fuels (as was the case in Italy for the tax exemption established for biodiesel in 2002).

While economic efficiency arguments would support increasing fossil fuel prices as a policy choice to reduce their use, the preference for the development of new technologies can be traced to political concerns over the public acceptability of additional taxes, as well as concerns related to the impact of price increases on competitiveness.

8. For information: 1 SKr (Swedish krona) = 0.11 euro.

REGULATORY INSTRUMENTS

Regulatory policies are another important policy tool to reduce GHG emissions and have been increasingly used by IEA countries over the past couple of years. Although often considered as inflexible, regulatory measures offer a high level of certainty on the achievement of emissions reductions.

Mandates and standards are often used to promote energy efficiency or renewable sources of energy. For retail goods, such as motor cars and electric appliances, governments tend to use two approaches to improve energy efficiency. One consists of setting minimum energy efficiency standards that must be met in order to sell goods on the domestic market of a country. Such a scheme was developed in 2002 in New Zealand where minimum energy performance standards (MEPS) were introduced for household appliances. Another approach is to require the mandatory labelling of the energy performance of goods. This approach offers more flexibility to the manufacturers as it rests on public awareness to promote energy efficiency. Following an EU directive passed in 2000, such labelling schemes were introduced in France and Switzerland in 2002 where new regulations require that information on fuel consumption and CO_2 emissions of vehicles be made available to potential buyers at car sales points. For household appliances, labelling of electricity consumption has become mandatory in 2002 in several countries, including Hungary, Sweden and Turkey, although, compared to minimum efficiency standards, the outcome of such measures is uncertain. For this reason, both approaches are often developed jointly, as was the case in New Zealand where the MEPS has been coupled with a labelling scheme.

Mandates and standards are also extensively used in the building sector. In 2002, a new directive came into force at the EU level on the energy performance of buildings. In Ireland and Japan, regulations were also enforced to reduce the overall energy requirements of buildings.

2002 also marked the adoption of a number of renewable energy mandates. Minimum mandatory quotas of electricity to be produced from renewable sources were developed in Japan and Belgium, as well as in several states in the US, including California and Massachusetts. These measures are part of a broader international effort developed over the past few years to support renewable energy sources. Similar renewable energy quotas have already been set in Australia and at the EU level over the past few years.

Regulatory policies form another very important category of regulatory instruments, the share of these having increased over the past few years and, in 2002, several major policies were introduced in several IEA member countries. In Finland, for example, the Parliament decided to approve a government decision in favour of the construction of a fifth nuclear power plant unit. This is the only measure taken or planned in IEA countries in 2002 in relation to the construction of a nuclear power plant. The Norwegian government put forward a strategy in 2002 to increase the use of domestic natural gas in combination with carbon dioxide capture and storage. This is particularly significant, as this is one of the first major national proposals to use carbon capture and storage technologies on a large scale. In 2002, the EU also proposed a much-awaited directive on combined heat and power, and Japan and Korea introduced revisions to existing regulations to increase the support of energy efficiency measures and the development of renewable energy sources.

VOLUNTARY AGREEMENTS

Voluntary agreements are commonly introduced as a more co-operative and less rigid way of reducing GHG emissions than regulatory measures. Such agreements have most frequently been set up with the industry sector. In 2002, voluntary measures continued to play an important role in Europe and North America, while no new significant voluntary measures were developed in IEA Asian countries. In France, a new voluntary agreement framework includes fines for companies that do not achieve the targets set under the scheme, making it something of a hybrid voluntary/mandatory scheme. In the US, the government introduced the Climate Leaders Programme, a government/industry partnership, which aims to encourage businesses to develop GHG emissions inventories for their activities and then set long-term emissions reduction goals. Such programmes are likely to play an increasingly important role in the US, where voluntary agreements form a central pillar of the US alternative to the Kyoto Protocol presented by the US Administration in early 2002. The extent of these efforts increased with the introduction of additional voluntary programmes in the first half of 2003 and through planning for future additional measures.

Because of their non-binding nature, the emissions reduction potential of such voluntary agreements is uncertain. Nevertheless, such measures offer a high degree of flexibility, particularly important to industry sectors exposed to international competition. In addition, voluntary agreements can play an important role in increasing public awareness and stimulating action.

TRADABLE PERMITS

The appropriate use of market instruments has been a central theme in international and national debates on strategies to mitigate climate change. Although such measures are recognised for their economic efficiency, countries' inexperience in using such options to reduce GHG emissions, as well as the complex framework needed to fully exploit the flexible nature of these measures, have led to a slow start in their use. However, such measures are increasingly being developed by IEA countries, and 2002 confirmed the pivotal role market instruments will likely play in climate mitigation strategies, both nationally and internationally. Although most tradable permit measures were developed in the EU region over the past four years, in 2002, significant steps were taken in Japan and South Korea to develop market-based instruments.

2002 was a particularly significant year for emissions trading with perhaps the most far-reaching proposal emerging from the EU. After many years of consultation, including the release of a Green Paper in 2000 and a proposed directive in 2001, in December 2002, the European Council of Environment Ministers reached a political agreement on an EU-wide scheme. Although final reconciliation remains to be undertaken between the EU Council version and that of the Parliament, agreement is expected by the end of 2003. When completed, the directive will establish a framework for GHG emission allowance trading with a system to become operative within the Community by 2005. In the interim, countries are actively developing domestic allocation plans which, under the directive's rules, must be completed by 2004.

While the EU-wide system has been under intense negotiations, a number of EU member States have simultaneously been developing their own, separate, national programmes. In April 2002, the first domestic CO_2 trading scheme was officially launched in the UK. It was set up under a voluntary framework both to enable the business sector to gain practical experience with emissions trading and to assist in achieving the UK's Kyoto Protocol target. The Netherlands is also actively developing its own trading scheme. Outside of the EU, Japan and Korea have both started to plan domestic trading schemes.

In addition to the GHG cap-and-trade schemes mentioned above, two other types of tradable permit schemes have been developed to reduce GHG emissions. Tradable renewable energy certificates (TRCs) and project-based emissions reduction units under the Kyoto Protocol flexible mechanisms – namely the CDM and Joint Implementation (JI) – are receiving increasing policy attention.

In 2002, Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) decided to establish a Testing Ground Facility to initiate, develop and carry out projects aimed at reducing carbon dioxide emissions from the energy sector in the Baltic Sea region. Japan, Korea and Spain also set up entities in 2002 to study the potential of CDM and JI to reduce emissions. Rule-making for project-based efforts is still at a very early stage of development. Thus, while these projects may provide significant low-cost emissions reduction opportunities, much will depend on the practicality of the framework developed for their use at both the national and international level (the latter largely depending on ratification of the Kyoto Protocol).

TRC systems are increasingly being used to promote renewable energy sources. Such schemes are based on the combination of a mandatory renewable energy production target and a tradable renewable energy certificate scheme. Using TRCs, electricity producers have the flexibility to meet their targets either by generating electricity from renewable energy themselves, or through the purchase of renewable energy certificates from other producers. In 2002, such schemes were developed in Belgium and Japan and have also been proposed by the Swedish government.

POLICY PROCESSES

Together with fiscal measures, policy processes represent the most broadly used category of policy instruments. 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).

Planning policies are the backbone of GHG mitigation programmes. In the past few years, all IEA member countries have developed national, regional or sectoral climate change strategies highlighting the fact that climate change is now higher on the political agenda of all IEA countries as we approach the entry into force of the Kyoto Protocol. These strategic plans set out the co-ordinated set of actions to be implemented to reduce GHG emissions. In 2001 alone, 20 IEA countries developed, or were in the process of developing, national, regional or sectoral programmes. In 2002, the number dropped to ten, reflecting the imminent end of the planning period and that in the next few years the focus will increasingly shift to policy implementation. On a national level, these plans include the US climate change strategy, presenting the country's alternative plan to the Kyoto Protocol. Canada also released its Climate Change Plan to implement its decision to ratify the Kyoto Protocol and meet its Kyoto targets. New Zealand, Japan, Belgium and Italy also released their climate change strategies in 2002.

Planning policies also often involve the creation of specific institutions for the implementation of climate change measures. This was the case in Ireland, with the creation of "Sustainable Energy Ireland" to oversee the implementation of measures included in the Sustainable Energy Act passed in 2002. South Korea also plans to establish a centre for new and renewable energy development and dissemination. At the EU level, the "Intelligent Energy for Europe" programme also foresees the creation of an independent body to manage the programme.

Outreach policies aim to inform and advise people or organisations on how to reduce their GHG emissions efficiently. Although an essential aspect of the climate change mitigation process, apart from the labelling schemes mentioned above (see the Regulatory Instruments section), few new measures were reported for 2002. Nevertheless, ongoing programmes are still a very important component of climate change mitigation strategies.

RESEARCH, DEVELOPMENT & DEMONSTRATION (RD&D)

Funding for energy research and technology development is another traditional area of government intervention. New transformative technologies offer promising pathways towards sustainable development. Technologies also offer important means to significantly reduce GHG emissions by providing clean emissions-free energy supply and energy end-use. Although many analytical studies suggest that the private sector is best suited to pursue the commercial development of technologies, these investments only occur 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 low carbon technology, the current uncertainties regarding the Kyoto Protocol and potential second and subsequent commitment period obligations also tend to reduce private-sector involvement. In such a case, government intervention plays an essential role in filling the RD&D investment gaps by making strategic investments in novel technologies.

In 2002, a few countries, notably the United States, developed new RD&D schemes, mainly in hydrogen-based technologies. South Korea also established new research schemes in renewable energy technologies, energy efficiency and capture and storage technologies. Canada's investments in climate change technologies are over $1 billion in recent years.

OUTLOOK ON THE FUTURE OF CLIMATE CHANGE MITIGATION

As seen from the variety and stringency of the many measures described above, IEA member countries are active in developing programmes to further reduce GHG emissions. The ratification of the Kyoto Protocol by most IEA countries, coupled with the still increasing trend in national emissions, suggests that more stringent measures will likely be implemented in the near future to reduce emissions still further.

Support for renewable energy technologies and energy efficiency has formed the bulk of measures taken or planned over the past few years. Conversely, there continues to be relatively limited support for nuclear energy, although it remains attractive from a climate change point of view. Although several countries have expanded their nuclear power research programmes, Finland is the only country which has given the green light for the construction of a nuclear plant in 2002. One of the new elements of the policy mix has been the introduction of carbon capture and storage technologies as a viable option for reducing emissions while continuing to rely on a fossil fuel-based energy system.

A broad policy mix has been brought to bear on the problem of reducing emissions. Countries, depending on their particular national circumstances, rely to a greater or lesser degree on fiscal measures, regulatory and voluntary programmes, tradable permits, R&D and public outreach. However, it is clear that no single solution exists to the policy problem – and even countries that had been reluctant to adopt one or more of these tools are finding themselves with a portfolio approach in which all are being utilised.

Perhaps the most significant split in the policy arena is a function of the Kyoto Protocol. Countries having ratified the Protocol are increasingly introducing regulatory measures and taxes to achieve emissions reductions, while countries having withdrawn from the Protocol have placed significantly more emphasis on approaches with minimum market interference where RD&D and voluntary agreements play a central role. With current emission trends and forecasts indicating that more action is needed to meet the Kyoto target, further regulatory and fiscal measures, in particular carbon/energy taxes and tradable permits (or emissions trading), will certainly be introduced in the near future by countries having ratified the Protocol.

The national and international effort to reduce GHG emissions is more than a decade old. The UNFCCC, with its goal of stabilising concentrations and its commitment to take policies and measures, was adopted in 1992. While international action continues, including through the negotiation of new rules to effectively implement the Kyoto Protocol, much of the recent focus has shifted to national implementation. As is clear from this review, numerous steps have been taken. However, it also remains clear that these steps have had only a limited effect on reducing the trends in emissions. The energy sector, at the heart of the climate emissions problem, is thus faced with difficult choices. Decisions will affect national and private investment and will determine how future energy services can be provided while limiting emissions.

According to the Intergovernmental Panel on Climate Change, concentrations of greenhouse gases in the atmosphere can only be stabilised if emissions are ultimately brought to near-zero levels. This, in turn, will require a radical reshaping of the energy sector. Medium- and long-term policies, only a few of which are on countries' agendas, will thus be critical to meeting these goals. However, if the level at which concentrations are to stabilise is not unacceptably high, near-term efforts must also be increased. The policies and programmes described here are clearly only a small, albeit critical, step in this larger effort.

SUSTAINABLE DEVELOPMENT

POLICY DIRECTION

2002 was a significant milestone for multilateral discussions on sustainable development, culminating in the World Summit on Sustainable Development

(WSSD) held from 26 August to 4 September in Johannesburg, South Africa. Energy featured significantly at that meeting and IEA member countries contributed in many ways to the final outcome.

The Commission for Sustainable Development (CSD), created as a result of the 1992 Rio Earth Summit and the main UN body responsible for the WSSD, has been meeting annually since 1993. At its 9th session in 2001, it focused on energy and transportation issues for the first time. In preparation for that meeting, the IEA Governing Board released a statement in which member countries agreed on a set of nine policy recommendations to help the energy sectors of members' economies make the fullest possible contribution to sustainable development. This consensus statement – elaborating on the IEA Shared Goals – was developed as input towards the longer-term World Summit negotiating process. The final outcome from CSD 9 included many elements consistent with the IEA Statement on Sustainable Development, including recognising: the centrality of energy in achieving sustainable development goals; wide disparities in energy consumption between countries; challenges of realising adequate new financial resources for energy investment; energy policies supportive of developing countries' poverty alleviation efforts; and enhancement of national energy markets that promote sustainable development. Governments also agreed to a continuing dialogue on issues relating to energy for sustainable development within the World Summit process.

Joint workshops between the IEA and the United Nations Environment Programme (UNEP) on energy subsidy reform in 2000 and 2001 were also effective in engaging developing countries in dialogue and policy planning on an issue central to both OECD and global agendas.

The energy community of the developed world, represented by IEA member countries, recognised the important role energy would play at the World Summit and in meeting development aspirations. The brochure *Toward Solutions: Sustainable Development in the Energy Sector* released in May 2002 prior to the final preparatory meeting in Bali for the Summit, sets out their collective views on how sustainable development could be advanced in the energy sector. This brochure looks at eight key areas where action is needed and prescribes steps in each that can be taken to address the problems. Background documents were also prepared addressing each of the topic areas:

- Energy security.
- Improving energy efficiency.
- Using more renewable energy.
- Making markets work.
- The important role of technology and research.

- Increasing access to energy.
- Sustainable transportation.
- Addressing environment, health and safety concerns.

In May 2001, the UN Secretary-General, Kofi Annan, in an effort to further focus and catalyse WSSD directions, set out five priority areas for action at the WSSD: water and sanitation; energy; health; agricultural productivity; biodiversity and ecosystem management. These became known as the "WEHAB Initiative" with energy again figuring prominently.

Many of the energy elements that were agreed at the fourth and final preparatory meeting for the Summit held in Bali, Indonesia (27 May to 7 June 2002), closely mirror the recommendations put forward by IEA governments in the brochure *Toward Solutions*. For example, governments agreed to:

- Establish domestic energy efficiency programmes.
- Accelerate development, deployment and dissemination of cleaner energy technologies.
- Promote increased R&D in various energy technologies.
- Support efforts to improve the functioning and transparency of energy markets.
- Employ policies to reduce market distortions such as restructuring taxation and phasing out harmful subsidies.
- Develop and disseminate alternative energy technologies with the aim of giving a greater share of the energy mix to renewable energies.

There were two formal outcomes from the World Summit – the Johannesburg Declaration and the Plan of Implementation. Outside formal negotiations, a number of voluntary initiatives – called Type 2 Outcomes – were also announced.

The Johannesburg Declaration is a four-page document containing the overarching political commitments reached at Heads of State level. The Plan of Implementation provides the framework for the realisation of the political objectives, containing 11 chapters. Energy issues gathered considerable attention from the outset of the negotiations. Public focus centred on a few outstanding contentious issues from the preparatory meetings, namely, targets for renewable energy, phasing out energy subsidies, and energy access. These issues were only resolved at the Heads of State level at the very end of the Summit without establishing any quantitative global targets or timetables. Nevertheless, a large number of energy provisions were ultimately agreed. There are over 50 paragraphs or sub-paragraphs that contain references to energy, most of which are consistent with, if not identical to, the common positions adopted by IEA countries in the above-mentioned brochure *Toward Solutions*. In the Plan of Implementation, governments have also agreed to:

- Diversify energy supply.
- Improve access to modern biomass technologies and fuel wood sources and support the transition to cleaner use of gaseous fossil fuels.
- Promote education about available energy sources and technologies.
- Strengthen dialogue forums among regional, national and international energy producers and consumers.
- Develop partnerships with the private sector.

ACTIVITIES

A new and innovative feature of the Summit was the announcement of some three hundred "Type 2" outcomes: voluntary partnerships among UN agencies, governments, industry, intergovernmental and non-governmental organisations. Energy activities represent a significant number of these, often accompanied by financial commitments for their implementation. IEA countries are partners in a number of these initiatives including:

- *EU Energy Partnership*, a country-driven initiative with a focus on reducing poverty through the provision of energy services (700 million euros).
- *Global Initiative on Gas Flaring* (Norway/World Bank), to reduce flaring and improve access to natural gas.
- *Mediterranean Renewable Energy Program* (IEA/UNEP/Italy/France), to help alleviate poverty by providing modern energy services and to increase the contribution of renewable energies to help climate change mitigation efforts.
- *Energy and Environment Partnership with Central America* (Finland/Central American governments), to promote the use of renewable energy sources and clean technologies in the region and make energy services more accessible to the poor.
- *Renewable Energy and Efficiency Partnership* (UK), to accelerate deployment of renewable energy and energy efficiency systems.
- *Renewable Energy-based Rural Electrification Initiative* (Japan/Fiji), to promote and develop renewable energy technology appropriate to the marine and tropical environment of the Asia-Pacific region.
- *Powering Sustainable Development* (US/Australia), to develop national energy strategies, engage the private sector and leverage investment in clean and efficient energy projects.

- *Energy Literacy Initiative* (Japan/UNEP/World Bank), to promote energy education globally and facilitate the appropriate use of energy.
- *Fostering Regional Energy Co-operation in APEC: Energy for Sustainable Development* (Asia-Pacific Economic Co-operation, APEC, countries), to pursue new initiatives in APEC to improve regional energy security in the short and long term, to improve access to energy and examine new technical responses to improving the environment and to explore new financing mechanisms for infrastructure.

The Mediterranean Renewable Energy Program (MEDREP)

The IEA, UNEP and the Italian and French governments are examining a sustainable renewable energy market system for the greater Mediterranean region. The initiative seeks to remove project, policy and trade barriers and strengthen the market system within the region. The programme has three main themes: 1) tailoring of financial instruments and mechanisms to support projects; 2) strengthening of policy frameworks; and 3) building a strong private-sector infrastructure. The initiative was launched in June 2002 and is expected to run to 2010. It has numerical objectives that are to be achieved by 2010: 60 million people supplied with new renewable energies in the European Mediterranean countries and 40 million in southern and middle-eastern Mediterranean countries (www.medre.org).

BEYOND JOHANNESBURG

As noted, governments in Johannesburg agreed to undertake a long list of actions in the energy sector. Although these outcomes are not legally binding – no treaties were signed – a political commitment at the highest level of government was made to implement these activities. Energy issues were accorded recognition as the key to development and poverty alleviation along with basic needs such as water and sanitation. There has been some progress in implementing the Summit outcomes, but the energy and sustainable development issues have not been accorded the level of attention seen in the lead-up to the Summit.

The first meeting of the CSD post-Johannesburg was held in New York from 28 April to 9 May 2003. This meeting concluded with the adoption of the CSD's multi-year programme of work for the period 2004-2017. Each two-year cycle will consist of a review session and a policy session with the objective of mobilising action. Water, sanitation and human settlements will be the themes for the first period 2004/05. Energy was seen as the second most important issue (after water) in the discussions at CSD 11. Consequently, energy for sustainable development, along with related issues of industrial development, air pollution/atmosphere and climate change are to be addressed in the second cycle (2006/07).

Twenty-one partnership initiatives in energy were announced for the Summit and two have been added since. Of these, 15 have provided formal updates informing that they have been initiated with sufficient funds to cover initial planned activities in 2002-2003. However, most are still seeking additional funds to take their partnerships to the end of their planned terms.

Another initiative, launched by the EU at the World Summit, was the formation of a coalition of like-minded countries and regions committed to delivering renewable energy targets and timetables as agreement on these could not be reached in the final outcome of the Summit. The coalition includes both developed and developing countries from Africa, Latin America, the Caribbean and other non-EU European countries. Although a large number of countries joined the initiative post-Johannesburg, since the Summit, there have been no collective announcements from members of the like-minded group on the form their targets and timetables might take. Progress may be made in advancing discussions among group members at a meeting hosted by Denmark on renewable energies in the summer of 2003 and at a world conference on renewable energy to be hosted by Germany in June 2004 in Bonn.

The OECD, within the context of cross-cutting activities on sustainable development, has widened the existing peer reviews of economic policy undertaken in the Economic and Development Review Committee to include sustainable development themes. A framework for the reviews was developed, including a relevant set of indicators covering seven themes including GHG emissions and natural resource management. These comprise energy indicators such as the use of renewables in electricity generation, GHG emissions from electricity and reducing emissions of atmospheric pollutants. Economic surveys of member countries began in April 2002 and, as of September 2003, the Secretariat has prepared draft sustainable development sections for 28 member countries. Countries, on the basis of a proposal by the OECD Secretariat, choose three of the seven themes for their own reviews. Of the 28 reviews, climate change was the theme chosen by most countries (20), and air pollution was chosen by 15 countries.

The IEA has also been working on producing sustainable development indicators to assess energy efficiency developments and CO_2 emissions. Based on detailed activity and end-use energy data from IEA statistics and national sources, a database with information for most IEA countries is being developed.

IEA Ministers, at their most recent biannual meeting held on 28-29 April 2003, reinforced the importance of moving forward from Johannesburg and implementing the energy commitments made there.

"We acknowledge the importance of, and our commitment to, implementing the agreements reached at the Johannesburg World Summit on Sustainable Development of September 2002. We particularly commit ourselves to enhance the role of renewables and other lower carbon-emitting sources of energy in the energy mix, and work to shape a future where basic energy services will be available to an increasing number of the world's citizens. We will continue our efforts to mitigate the impact of energy use on the global environment, and in particular on the global climate system, consistent with our efforts under the UN Framework Convention on Climate Change. We will continue to stimulate the development of new market-oriented instruments essential to reaching our sustainable development goals at lower costs. We also call for the further development of technologies needed to meet these goals, and to this end, with the help of the Secretariat, call for a review of the focus of our cooperative R&D programs in strategic areas. We reaffirm our commitment to promoting a sustainable energy future, meeting the social, environmental and economic challenges this entails."

ENERGY EFFICIENCY

GENERAL TRENDS IN EFFICIENCY POLICIES

The energy market consists of suppliers and consumers and, for every unit of energy supplied to the market, a unit is consumed. In spite of this equality, the overwhelming majority of energy policies are directed towards influencing the supply side of the market. This asymmetry is not surprising because the energy supply market generally consists of large, easily identifiable elements. In contrast, the consumption side is extremely diffuse. Policies to influence energy consumption are similarly difficult to establish and track because the results are often obscured by changes in consumer behaviour, quality of life, industrial structure, macroeconomic situation and so forth.

Nevertheless, most IEA countries regard energy efficiency as one of the key policy tools to achieve GHG reduction targets as well as energy security. For example, a UK White Paper issued in early 2003 assumes that energy efficiency can achieve about half of the GHG reduction targets up to 2020.

This stated goal sometimes runs counter to other policies, such as those to gradually liberalise and deregulate the energy markets. Deregulation typically transfers responsibility for energy efficiency to the consumer and relies on energy prices as the signal for action. However, the 2003 electricity crises in New Zealand and Norway, combined with earlier crises in California and elsewhere, have forced governments to reassess their role in energy markets. These reassessments have led to reconsideration of government roles in energy efficiency and other forms of managing and forecasting energy demand. California utilities have recently proposed a major expansion of their activities to promote energy efficiency.

The rapid run-up of oil prices, plus the possibility of oil shortages caused by the events in the Middle East, prompted many governments to implement various short-term oil conservation strategies with special emphasis on industrial consumers. Most of these are expected to ease as oil prices fall and the likelihood of dislocations and shortages diminish.

Governments have a range of tools available to encourage energy conservation and efficiency, including adjusting energy prices, establishing financial instruments to encourage the use of efficient products and practices, mandating minimum efficiency levels, creating voluntary programmes and energy rationing. In 2003, IEA countries employed all these tools (except rationing) to promote energy efficiency. Some of the highlights are described below.

MINIMUM EFFICIENCY REGULATIONS

Minimum efficiency performance standards are a proven strategy to reliably cut energy use at very low costs to the consumer. This mandatory approach has been used successfully for appliances, office equipment, motor vehicles and buildings. The standards must be regularly updated if they are to remain effective. The US has begun its third round of updates for some appliance standards (see Figure 36 for a demonstration of the long-term impact of efficiency standards for refrigerators), but most countries remain in their first or second round.

Energy use of domestic appliances and equipment represents a significant end-use of energy in all IEA countries and large efficiency improvements are technically feasible and highly cost-effective. Existing regulations have already been responsible for huge electricity savings. In the case of refrigerators, new units complying with the regulations typically consume half as much as those they replace.

Similar trajectories in efficiency have occurred for other regulated appliances (such as air-conditioners and washing machines). Further savings are possible as new technologies, such as increased use of sensors combined with microprocessor logic, become more flexible and cheaper. As a result, nearly every country operates some combination of mandatory and voluntary efficiency programmes applying to the domestic, commercial and transport sectors.

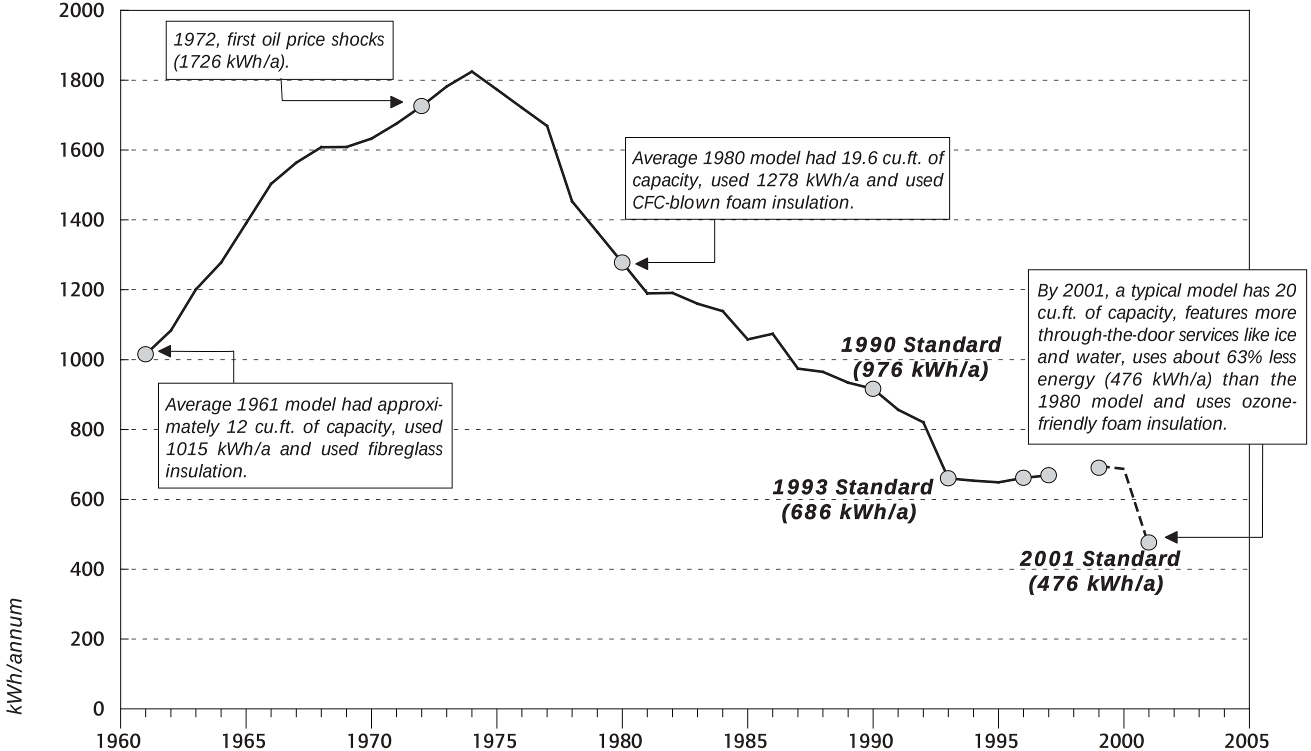
Mandatory efficiency standards were recently broadened or strengthened in Japan, the US and Australia. The Japanese TopRunner standards programme added several new products, including gas appliances and transformers. The TopRunner programme now covers appliances responsible for roughly three-quarters of residential electricity use. It is at present evaluating the impact before updating the levels. Both Australia and the US updated standards for several of its products in 2003.

Improving the efficiency of new residential and commercial buildings remains one of the most cost-effective strategies to reduce energy use. However, they are also among the most difficult to implement owing to the complexity of construction, the large number of groups involved and unique local requirements. Australia, for example, just completed its first national code. In Germany, the previously separate thermal insulation and heating installation ordinances were integrated in 2003, cutting space heating for new buildings by roughly 25-30%. The New Energy Conservation Ordinance provides the option for an overall optimisation of measures for thermal insulation on the one hand, and heat unit efficiency on the other. This approach relies on an integrated methodology as required by the EU Directive on the Energy Performance of Buildings. Meanwhile, the EU has directed all its members to establish building energy rating schemes. Similar programmes

Figure 36

Average Energy Use of Refrigerators in the United States, 1960 to 2005

(shipment weighted)



Note: the 2001 standard has been in force for over two years.

Source: *Cool Appliances: Policy Strategies for Energy-Efficient Homes*, IEA/OECD Paris, 2003.

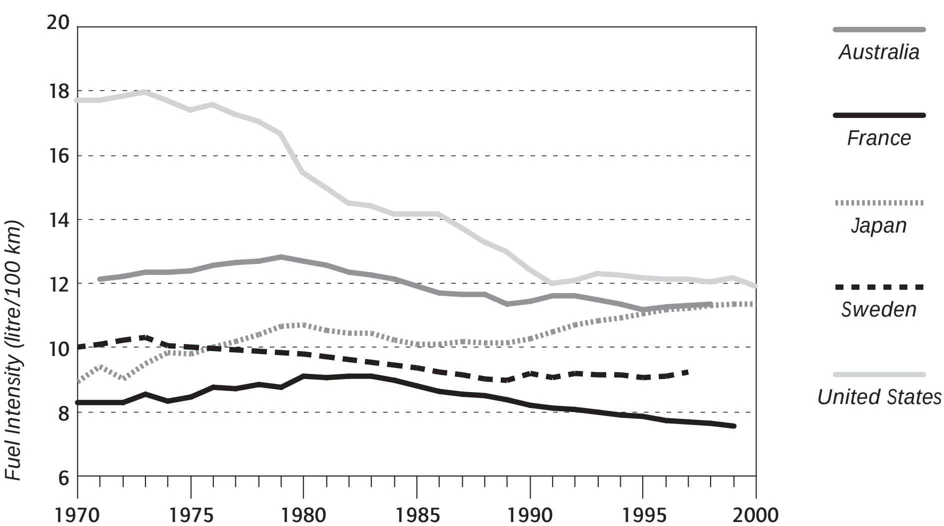
have recently been established or significantly upgraded in Japan and Australia. These rating and labelling systems will permit consumers to identify energy-efficient buildings, governments to establish rational policies to upgrade efficiency and track progress in energy conservation. Several countries are also directing their efforts towards stricter commercial building codes.

Efficiency standards for motor cars are approached differently in each country. Japan's comprehensive TopRunner programme includes motor vehicles, and recently imposed stricter standards after the performance of new vehicles approached the initial TopRunner levels. In the US, fuel efficiency of new light duty vehicles fell to a 22-year low with little improvement in fleet efficiency over the period (see Figure 37). In 2003, however, the US raised efficiency standards for light trucks by about 10%. In a separate action, California sought to indirectly increase efficiency for vehicles sold in the state by regulating vehicle emissions.

Figure 37

Fleet Average Fuel Economy of Cars and Personal Light Trucks in Selected IEA Countries

(litres/100 km using gasoline equivalents)



Source: IEA database.

Recent technological advances have set the stage for major increases in vehicle efficiencies. Hybrid vehicles have now been demonstrated to be technically feasible and economic in most cases. It is not yet clear if the shift to higher efficiency will be implemented through mandatory regulations or a combination of voluntary measures. The UK has introduced several financial measures this year to reduce transportation energy, notably a fee for vehicles entering London, plus restructuring tax incentives to encourage more efficient corporate cars.

VOLUNTARY EFFICIENCY PROGRAMMES

Voluntary programmes continue to play an important role in overall government efficiency policies in nearly all sectors. Voluntary programmes take many forms, from an agreement with an individual company regarding a single energy-intensive factory, to broad agreements covering dozens of groups and millions of products. Such agreements can either complement mandatory programmes or operate where regulatory mechanisms are unsuitable. Most voluntary programmes are initiated and administered by national governments, although states, cities and utilities can also be responsible. Firms are encouraged to participate by financial incentives (such as the UK's Carbon Trust) or by public recognition, technical assistance with developing competitive efficiency improvement strategies and other means of support.

With respect to motor vehicles, European manufacturers have agreed to cut specific emissions (which translates into fuel efficiency) of new vehicles from 185 gCO_2/km in 1995 to 140 g/km in 2008. Further negotiations this year may result in an even more ambitious target of 120 g/km by 2008.

Voluntary efficiency programmes in the industrial sector have already been established in nearly all IEA countries and most continue to be active. The UK's Carbon Trust offers reduced levies on energy prices for its participants, while Australia's Greenhouse Challenge Programme offers technical advice and recognition.

Most voluntary programmes are confined to a single country. However, a few, such as Energy Star, Blue Angel and Nordic Swan, operate internationally. The largest of these, Energy Star, establishes minimum efficiency specifications for PCs, printers, copiers and other office equipment (see Table 12).

Some voluntary programmes are designed to encourage the production and purchase of higher efficiency products with the eventual goal of market transformation. This occurs when manufacturers find it profitable to offer more high-efficiency products and cease production of less efficient ones. To date, the effectiveness of these programmes is highly variable.

Energy Star will soon require imaging products to meet higher efficiency specifications and has begun work on upgrading PC specifications. Energy Star has also announced its intention to establish specifications for domestic water heaters. These specifications are likely to encourage manufacturers to greatly increase production of heat pump water heaters, a technology capable

Table 12

Major Product Areas Covered by Energy Star in Different Countries as of 2003

Major Product Areas	*United States*	*Canada*	*Australia and New Zealand*	*Europe, Japan, Taiwan*
Office equipment (personal computers, displays, copiers, etc.)	x	x	x	x
Consumer electronics (televisions, video cassette players, digital disk players, etc.)	x	x	x	
White goods (refrigerators, dishwashers, washing machines, etc.)	x	x		
Heating and cooling equipment (air-conditioners, furnaces, heat pumps, fans, etc.)	x	x		
Building materials (insulation, windows, doors, high albedo roofs, etc.)	x	x		
Homes	x			
Commercial buildings	x			

of reducing electricity consumption by half. Since electricity consumption for water heating is one of the largest end-uses in many IEA countries, this programme could have a major impact on energy use in the next decade.

IEA member countries have continued their voluntary programmes, often updating them when circumstances warrant it. For example, the EU and domestic refrigerator manufacturers recently negotiated a voluntary agreement under which they will ensure that average efficiency would rise to the "A" level on labels by 2006. This year, Australian manufacturers updated all their labels (making it more difficult to achieve the highest rating) to reflect the appearance of equipment with higher efficiencies.

Several countries have initiated plans to increase the efficiency of transformers, from fist-sized units used in small consumer electronics to those serving large commercial buildings. Since essentially all electricity flows through a transformer (and often several transformers), the potential electricity savings are enormous, even from small increases in efficiencies. The policies have focused on the no-load, part-load and full-load efficiencies. Japan has used a regulatory approach, while the EU and Australia rely on voluntary programmes, and the US is seeking to use a combination of approaches.

TECHNOLOGY AND RESEARCH AND DEVELOPMENT POLICY

CRITICAL ROLE OF ENERGY TECHNOLOGY

If growing worldwide demand for energy services is to be met while enhancing energy security and stabilising GHG concentration in the atmosphere, the global economy, as well as the global energy sector, must be transformed into one relying extensively on advanced, efficient, low-emissions technologies for energy supply, transport, storage and use. Therefore, technology research and development play a critical role in meeting energy policy objectives, namely, energy security, environmental protection and economic growth.

Curbing the upward "business as usual" trend in energy sector GHG emissions shown in the *World Energy Outlook 2002* will require that new transitional technologies (those which integrate and interface with existing technologies) are deployed quickly so as to capture new capital stock investment as it is made. At the same time as new transformative technologies (those which will eventually replace existing technologies over the longer term) are being developed, the challenge is how to deploy these transformative technologies.

R&D FUNDING CHALLENGE

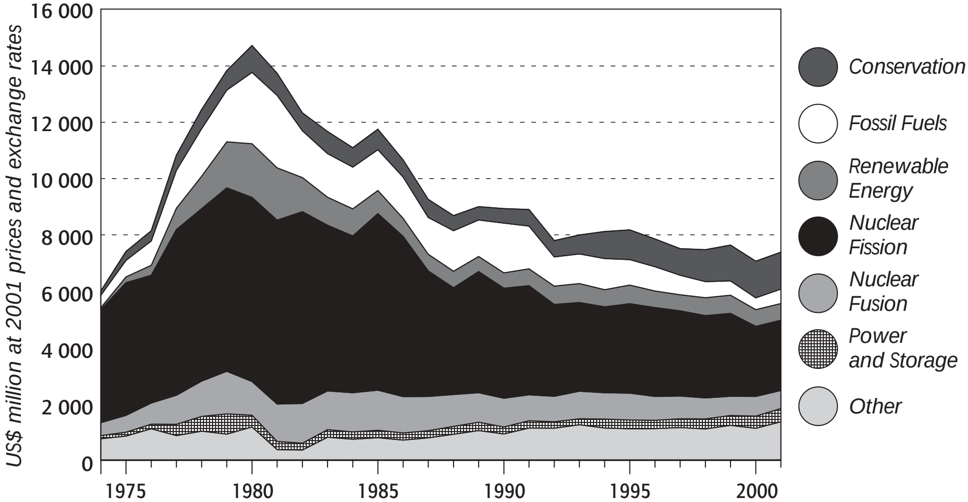
Despite the critical role to be played by energy technologies, the current level of energy R&D, both in the public and private sectors, is a cause of concern. After a significant increase from the mid-1970s to early 1980s, government energy R&D budgets in IEA countries have declined while there was a slight increase after 1997.

The government R&D budget for fossil fuels and nuclear fission has seen a significant drop since the early 1980s, while nuclear fission still has the largest share. On the other hand, R&D for renewable energy and power and storage, which peaked in the early 1980s followed by a decrease in the mid- to late 1980s, has been increasing through the 1990s. Energy conservation R&D has been constantly increasing. Industrial energy R&D investments have become increasingly short-term owing to market liberalisation and intensified competition.

Current levels of energy R&D and the predominantly shorter-term focus are not adequate given the magnitude of the challenges in terms of climate change and energy security. A greater and sustained commitment is needed to energy technology R&D and technology demonstration, to the underlying basic sciences and to market uptake of new technologies in order to ensure that low-carbon and low-cost technologies are available when needed.

Figure 38

Government Energy R&D Budgets in IEA Countries, 1974 to 2001



Source: Country submissions.

PROMISING AREAS FOR CLEAN TECHNOLOGY DEVELOPMENT

Many promising technologies are being developed or available to meet these challenges[9]. A network of energy technology experts from IEA member countries and the IEA Committee on Energy Research and Technology (CERT) has identified technologies that will play a central role in future energy systems.

RENEWABLE ENERGY TECHNOLOGIES

Each IEA country is endowed with different, substantial renewable resources and will choose its own mix of renewable energy technologies to support and develop. The key to growth in renewables will be the success of current and planned R&D and diffusion support efforts to reduce costs through "technology learning" in such areas as solar photovoltaics, solar thermal systems producing power and/or heat, advanced wind technology, bioenergy systems, geothermal energy, hydropower, ocean energy and eventually photolytic processes.

9. In the Communiqué of the IEA Ministerial Meeting in Paris on 28-29 April 2003, the importance of technology R&D was significantly emphasised and Ministers agreed to commit themselves to achieving greater efficiency both through national programmes and through international technology collaboration. Ministers visited with great interest the IEA Technology Fair where many of the Implementing Agreements displayed models, energy technology equipment, on-line information material, publications, posters, etc.

FOSSIL FUEL TECHNOLOGIES

Noting that fossil fuels will continue to dominate the global energy mix up to 2030, technology to switch to less carbon-intensive fossil fuels (particularly natural gas), more efficient fossil-fuel combustion technologies, technology on CO_2 separation, capture and storage, would play an important role.

HYDROGEN TECHNOLOGIES

As an energy carrier like electricity, hydrogen could play important and widespread roles in future energy systems such as:

- Fuel for direct combustion.
- Electricity production in fuel cells for both stationary use (power plants, buildings, industry) and transport.
- Electricity storage (hydrogen and electricity can be converted from one to the other using fuel cells and electrolysers, though with associated losses).

Like electricity, hydrogen can be produced from many sources: fossil fuels with CO_2 capture and storage, renewable sources and nuclear power. Depending on its source, its use can enhance energy security as well as reduce GHG emissions. Used with intermittent renewable energy technologies, it can also substantially expand the use of these technologies.

NUCLEAR TECHNOLOGIES

For countries that choose to use nuclear energy, nuclear fission technologies could contribute substantially to a low net emission energy system and help meet the significant projected growth in world energy demand. Nuclear fission reactors could serve both for stand-alone electricity generation applications and for production of electricity, hydrogen and high-temperature process heat. The size of nuclear fission's contribution to future energy systems will be determined by relative technology costs, public acceptance and progress in dealing with radioactive wastes.

Fusion energy could contribute significantly to large-scale electricity production during the second half of the 21st century. Major technical progress has been made in both the physics and the technology of fusion over the past decade. The next essential step is the construction of ITER, a 500 MW plant to demonstrate the scientific and technical feasibility of harvesting fusion energy.

END-USE TECHNOLOGIES

The built environment in the future can revolutionise efficiency in energy use for services such as heating, lighting and cooling, transforming itself gradually through modernisation and new construction. It can shift to renewable or non-carbon sources of energy and power. Future buildings could be sources of clean electricity, well integrated into a larger, power and resource grid with localised energy and environmental management systems and controls.

Transport systems in the latter half of this century could be dominated by vehicles, trains, ships and aircraft with very low CO_2 emissions. This scenario could feature a mix of vehicle types, for example fuel-cell vehicles powered by hydrogen, electric-powered vehicles, vehicles running on biofuels and hydrogen-powered aircraft. The hydrogen, biofuels and electricity used in transport would be produced with near-zero life cycle or well-to-wheel CO_2 emissions.

GREATER SYSTEM OPTIMISATION

Future industries and industrial facilities could adopt an increasingly integrated system approach featuring:

- Greater use of waste heat and plant-wide optimisation of energy sources and sinks.
- On-site generation of electricity with carbon separation and capture.
- Greater process efficiency, making use of revolutionary processes such as hybrid processes, bioprocesses and electricity-based processes as they emerge from R&D in areas such as nanotechnologies, micro-manufacturing and bioprocessing.

Advanced industrial processes could also exploit high-speed and high-capacity computing, robotics using biological/computer interfaces, artificial intelligence, wireless communications, power electronics and photonics. In the long term, continued R&D could yield increasingly bio-based chemical products.

THE ROLE OF THE IEA TO PROMOTE COLLABORATIVE EFFORTS

With a view to maximising the potential of these promising technologies, the CERT has four expert bodies: the Working Party on Fossil Fuels, the Working Party on Renewable Energy Techologies, the Working Party on Energy End-use Technologies and the Fusion Power Co-ordinating Committee. In addition, there are three expert groups on electric power technologies, R&D priority-setting and evaluation, and oil and gas.

Furthermore, the IEA provides a framework for collaborative energy research, development and demonstration projects known as Implementing Agreements. At present, there are 41 Implementing Agreements (http://www.iea.org/impagr/imporg/imagpub/Listof.htm). The CERT or the above four working parties deal with these agreements according to their fields. Recently, the framework of Implementing Agreements was strengthened to permit broader participation of the private sector and non-member countries.

INFORMATION CENTRES

- IEA Energy and Environmental Technologies Information Centre (EETIC), Centre for the Analysis and Dissemination of Demonstrated Energy Technologies (CADDET) and Centre for Greenhouse Gas Technology Information Exchange (GREENTIE).
- IEA Energy Technology Data Exchange (ETDE).

WORKING PARTY ON FOSSIL FUELS

- IEA Coal Research (Clean Coal Centre).
- Clean Coal Science.
- Enhanced Recovery of Oil.
- Fluidised Bed Conversion of Fuels Applied to Clean Energy Production.
- Greenhouse Gas R&D Programme.
- Fossil Fuel Multiphase Flow Sciences.

WORKING PARTY ON RENEWABLE ENERGY TECHNOLOGIES

- Bioenergy.
- Geothermal Energy Research and Technology.
- Production and Utilisation of Hydrogen.
- Hydropower Technologies and Programmes.
- Photovoltaic Power System.
- Solar Heating and Cooling Systems.
- Solar Power and Chemical Energy Systems (SolarPACES).
- Wind Turbine Systems.
- Ocean Energy Systems.

WORKING PARTY ON ENERGY END-USE TECHNOLOGIES

- Advanced Fuel Cells.
- Advanced Motor Fuels.
- Energy Conservation in Buildings and Community Systems.
- Energy Conservation and Emissions Reduction in Combustion.
- Energy Technology Systems Analysis (ETSAP).
- Demand Side Management.
- District Heating and Cooling.
- Energy Conservation through Energy Storage.
- Heat Pumping Technologies.
- Energy Conservation in Heat Transfer and Heat Exchangers.
- Advanced Materials for Transportation Applications.
- High-temperature Superconductivity on the Electric Power Sector.
- Hybrid and Electric Vehicle Technologies and Programmes.
- Process Integration Technologies.
- Advanced Energy-Efficient Technologies for the Pulp and Paper Industry.

FUSION POWER CO-ORDINATING COMMITTEE

- ASDEX Upgrade.
- Environmental, Safety and Economic Aspects of Fusion Power.
- Fusion Materials.
- Nuclear Technology of Fusion Reactors.
- Plasma Wall Interaction in Textor.
- Reversed Field Pinches.
- Stellarator Concept.
- Large Tokamak Facilities.

TECHNOLOGY TRANSFER

- Climate Technology Initiative (CTI).

RECENT TRENDS IN MEMBER COUNTRIES' ENERGY R&D POLICIES

Reflecting the greater recognition of sustainable development from 2002 to 2003, several IEA member countries and/or the IEA have begun new initiatives in fields such as CO_2 capture and storage, hydrogen, and linkage between basic science and future energy technologies.

CO_2 CAPTURE AND STORAGE

Several national and international R&D and demonstration programmes have been active in this area. For example, there are active major national programmes on CO_2 capture and storage in Australia, Canada, Japan, the Netherlands, Norway, the UK, the US and the EU.

IEA activities include the IEA Committee on Energy Research and Technology (CERT), the IEA Working Party on Fossil Fuels (WPFF), several Implementing Agreements (international collaboration agreements) including the Greenhouse Gas R&D Programme[10], the IEA Secretariat and the IEA Coal Industry Advisory Board. The IEA WPFF has undertaken a major initiative to foster development of CO_2 capture and storage technologies and has approved the "Zero Emission Technologies Strategy for Fossil Fuels". This timely and important initiative of the WPFF draws together national and international programmes on CO_2 capture and storage and allows for their efficient co-ordination. In June 2002, the IEA CERT adopted the Strategy as an activity in line with the CERT Strategic Plan and noted the Technology Status Report (*Solution for the 21st Century: Zero Emission Technologies for Fossil Fuels*, May 2002) produced by the WPFF. The conclusions of this report include the following:

- While many technical and engineering challenges lie ahead, focus should be on reducing costs and developing effective, safe and environmentally sound storage options.
- In addition to addressing these challenges, legal issues must be considered along with public health and safety.
- The viability of carbon sequestration as a GHG mitigation strategy hinges on an informed global community that is engaged in an open dialogue on issues both locally and internationally.

10. Members of the Greenhouse Gas R&D Programme include Australia, Belgium, Canada, the Commission of European Communities, Denmark, Finland, France, Japan, Korea, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the UK, the US, Venezuela and several sponsors: ALSTOM Power Technology, BP, Chevron Texaco, EniTecnologie SpA, EPRI, ExxonMobil, RWE AG, Shell International and TotalFinaELf.

HYDROGEN

Hydrogen energy and fuel cell technology are regarded as key advances that can contribute to energy supply security and environmental protection in the mid and long term in many IEA countries. The EU has announced a long-term €2 billion programme on renewable and hydrogen technologies under its 6th Framework Programme. The US recently announced a total of $1.7 billion over the next five years to develop advanced hydrogen production and storage technology, hydrogen-powered fuel cells for stationary and mobile applications, hydrogen infrastructure and advanced automotive technologies. The Japanese R&D budget for fuel cells and hydrogen has tripled since 1995, reaching $200 million in 2002. Both Japan and the US have developed roadmaps for the introduction and commercialisation of fuel cells and hydrogen technology. For example, Japan has a three-stage scenario, namely, groundwork and technology demonstration (2000-2005), introductory (2005-2010) and diffusion (after 2010). Canada, Italy, the UK and China also have R&D programmes in place or are expanding their investments. Iceland and Singapore are already committed to introducing hydrogen and fuel cells in their electricity and end-use sectors.

This emphasis is echoed in the private sector where investments in hydrogen technology have grown considerably over recent years, leading to technology development and demonstration projects for hydrogen-powered stationary and mobile fuel cells, advances in hydrogen production from low-emission sources such as natural gas and biomass as well as hydrogen fuel cell-powered vehicles.

The level of investments in technology R&D, infrastructure, codes and standards required for possible transition to the hydrogen economy in the mid to long term call for enhanced international co-operation. The US recently launched the International Partnership for the Hydrogen Economy (IPHE), which will provide a mechanism to organise, evaluate and co-ordinate multinational research, development and deployment programmes that advance the transition to a global hydrogen economy. Enhancing co-operation on hydrogen and fuel cells (basic materials, clean production, distribution, storage, infrastructure and safety) is also a key target of the 6th Framework Programme of the EU which also established a High Level Group (HLG) to advise on such matters.

Within the IEA framework, several Implementing Agreements have been working on hydrogen-related matters over the past two decades. A leading role is played by the Implementing Agreements on Production and Utilisation of Hydrogen and Advanced Fuel Cells, while other Implementing Agreements (Advanced Motor Fuels, Advanced Materials for Transportation Applications, Bioenergy and the Greenhouse Gas R&D Programme) provide contributions on specific topics.

In response to increased interest, the IEA also organised the workshop "Towards Hydrogen" in Paris on 3 March 2003 to assess hydrogen prospects and R&D

priorities and established the IEA Hydrogen Co-ordination Group, attended by 25 countries, to support and enhance co-operation in member countries and make recommendations for specific activities. The key messages from the current activities are:

- Considerable R&D efforts and investments are required to make available low-cost hydrogen production, storage and end-use technologies.
- Huge investments in infrastructures are needed to make hydrogen a major energy carrier.
- While hydrogen shows great potential, its commercialisation will require time, investments and improved co-ordination of international R&D efforts as well as appropriate governmental and industrial energy policies.

LINKAGE BETWEEN BASIC SCIENCE AND FUTURE ENERGY TECHNOLOGY

Advances in basic science are the foundation for progress on innumerable energy technologies. Creative linkages between basic research and applied technology development will pinpoint these activities. However, insufficient steps were taken to foster these linkages and the CERT decided to prompt a series of seminars to explore the linkage between basic research and future energy technology.

As a first step, the conference on “Linking Basic Science and the Development of New Energy Technologies” was held on 1-2 April 2003 in Paris[11]. This conference focused on advanced computing, biotechnology and materials sciences, including nanotechnology, and also examined the institutional challenges. While the borders between basic and applied sciences are increasingly blurred, the conference identified possible linkages in such areas as:

- Nanotechnology and hydrogen storage, fuel cells.
- Materials science and PV, high-temperature superconductivity.
- Advanced computing, oil and gas exploration and internal combustion.
- Biotechnology and hydrogen production.

11. The conference gathered 41 delegates from 13 countries and the EU. There were 25 speakers from Canada, France, Italy, Japan, Korea, the Netherlands, Norway, Sweden Switzerland, the UK and the US. The speakers included high-level professionnals such as Professor David King, Chief Scientific Advisor to the UK government and the Nobel Laureate, Professor Carlo Rubbia, ENEA, Italy.

The conference also identified important factors for creative linkages such as:

- Effective communication among stakeholders, namely, scientists involved in basic research, technology experts, policy-makers and the private sector (governments can play a useful role in bringing basic researchers and technology developers together).
- Global perspectives, including international collaboration and co-ordination.
- Appropriate funding.
- Involvement of different sectors and social science.
- Consideration of market conditions and institutional innovation.
- Science and technology capacity building.

ENERGY POLICIES IN NON-MEMBER COUNTRIES

CHINA

In March 2003, the Chinese Parliament elected a new leadership headed by Mr. Hu Jintao (President) and Mr. Wen Jiabao (Prime Minister). Consequently, government structure was also changed.

Responding to critics that China lacked a central energy policy co-ordinator since 1992 and recognising that central government needed to streamline energy policy responsibilities, the government announced on 26 March 2003 the creation of an Energy Bureau within the National Development and Reform Commission (NDRC). NDRC was established on the basis of the former State Development Planning Commission (SDPC) which absorbed part of the abolished State Economic and Trade Commission and State Council's Office for Restructuring the Economic System.

On 29 December 2002, the Chinese government took a major step in restructuring the country's electricity sector by disintegrating the State Power Corporation which managed almost all the country's power grid and owned 50% of the generation assets. These assets were distributed to other state-owned operators and eleven new or regrouped companies were established. These include: two for the power transmission business, the State Power Grid Company in the north and the China Southern Power Grid Company in the south; five in the power generation business, each having less than 20% of the market share in all Chinese regions, with the rest owned by independent producers; and four power-related service companies. The restructuring objective is to separate the power generation from transmission so that generators can compete against each other to sell their electricity. To oversee competition and to carry on reform of the power sector, an electricity regulator – the State Electricity Regulatory Commission – was created at the same time.

It remains an important challenge for China to introduce effective competition among power generators, all of which are state-owned, with fast-growing demand, a limited surplus generating capacity, a poorly interconnected power transmission grid system and lack of experience in power sector regulation. Electricity demand in China is booming, with a growth of 10% in 2002 and 17% in the first quarter of 2003. Chronic power supply shortages, thought to be a thing of the past, re-emerged in a number of provinces.

In the natural gas sector, China signed an interim agreement in July 2002 with a Shell-led international consortium to begin construction of the 4 000 km West-East Gas Pipeline, designed to bring natural gas from the

Tarim basin in the country's far west to Shanghai in the far east at 12 billion cubic metres (bcm) a year. The project is expected to cost US$18 billion, with $6 billion for the pipeline construction alone. The east section of the pipeline, linking the Ordos basin to Shanghai, is expected to be completed in early 2004, and the west section a year later. In August 2002, China awarded Australia with a 25-year LNG supply contract for the country's first LNG import project in Guandong province, with a first phase at 3 million tonnes (Mt) per year, to begin by 2005/06. Gas will come from Australia's North West Shelf. As part of the deal, the China National Offshore Oil Corporation (CNOOC) acquired a 25% interest in the fifth LNG train in the North West Shelf, which is to supply the Guangdong terminal. In September 2002, China signed a 25-year sales and purchase agreement with Indonesia to supply up to 2.6 Mt per year of LNG to the country's second terminal in Fujian. Gas will come from Indonesia's Tangguh gas field where CNOOC acquired a 12.5% interest.

These impressive deals clearly demonstrate China's desire to develop its natural gas market, although significant challenges lie ahead. These were described in detail in the IEA's report *Developing China's Natural Gas Market: the Energy Policy Challenges*, released in December 2002. According to the report, the major challenges facing the Chinese government and all gas market participants are the timely development of a downstream gas market, the improvement of local gas distribution, reform of gas pricing policies and the timely introduction of competition, coupled with a considerable degree of investment protection. Another area to be reconciled is the potential conflict of interests between gas and non-gas fuels among gas-market players and within the energy sector as a whole. The report calls upon the Chinese government to meet these complex challenges by developing a strong and coherent national energy policy for natural gas market development. It also suggests the establishment of a specialist energy department within China's central administration in recognition of the country's need for a co-ordinated energy policy.

In the oil sector, Chinese sources reported a total net oil import of 71.85 Mt in 2002, up by 10.7% over 2001. Imports met 30% of the country's oil needs in 2002. Following the country's 10^{th} Five-Year Plan, the government is continuing building up strategic oil reserves. It was reported that four sites have been selected for the first phase, with a target of 100 million cubic metres (62 million barrels) of crude oil storage capacity, although no firm schedule is provided. The implementation of the plan for strategic oil reserves will be one of the main key tasks for the newly established energy bureau within the NDRC.

In the coal sector, China produced a record high of 1 390 Mt of coal in 2002, which was 20 Mt higher than the 1996 level. It thus ended the coal production decline since 1996. Compared to 2001, Chinese exports of coal dropped while imports surged to 10.8 Mt.

In August 2002, the Chinese Parliament ratified the Kyoto Protocol. Although, as a developing country, China had made no commitment to reducing GHG emissions under the Kyoto Protocol, its ratification opened the way for the application of flexible mechanisms that the Protocol provides, in particular clean development mechanisms. Several initiatives on CDM are under way with Annex I countries of the Protocol.

INDIA

In recent years, the Indian government took important steps to introduce changes into the electricity sector in order to reform pricing and to put in place more market-based mechanisms. A key development was the passage of the 2001 Electricity Bill in May 2003, which was enacted from 10 June 2002 after being signed by the President of India. The new legislation will consolidate three existing acts: the Indian Electricity Act (1910), the Electricity Supply Act (1948) and the Electricity Regulatory Commission Act (1998).

The objectives of the new law are to consolidate the legislation relating to generation, transmission, distribution, trading and use of electricity. It seeks to establish measures conducive to the development of the electricity industry, to promote competition, to protect consumer interests and to supply electricity to all areas. The new legislation also addresses issues such as rationalisation of electricity tariffs, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies, constitution of regulatory commissions and establishment of an appellate tribunal.

The new law also redefines the functions and reach of the Central Electricity Authority, giving it a statutory basis. A new body, the Central Electricity Regulatory Commission, will have a similar position. It also makes it mandatory for all states to have within six months (if none exists) their own state regulatory body. In addition, electricity metering will be made mandatory with more stringent provisions in place, thus making the prevalent problem of theft a criminal offence.

In 2002, the IEA Secretariat produced two publications dedicated to the Indian energy industry: the Coal Industry Advisory Board (CIAB)'s *Coal in the Energy Supply of India* and *Electricity in India*. Both underscore the policy links between sectors and the vital role of coal in Indian energy supply, particularly as a fuel for power generation. A significant portion of future growth in global coal-fired power generation is expected to come from India, making reform of the coal and power sectors critical in attracting needed investment and in promoting economic growth. As a follow-up to these publications, a joint IEA/India Conference on "Coal and Electricity in India" was held in September 2003.

In recent years, India has sought to open the oil sector to private and foreign investment in order to increase its oil supply security. In the petroleum sector, the administrative pricing mechanism (APM) which governed the price of transportation fuels, LPG and kerosene since 1975, was dismantled in April 2002. The aim of this policy is to create a competitive market for petroleum products and free up the companies from government price controls, allowing them to move in line with international prices of crude oil. LPG and kerosene would continue to be subsidised with a fixed government subsidy for another three to five years.

Following deregulation of the oil sector in May 2002, the government introduced the "Petroleum Regulatory Board Bill". The bill establishes a Petroleum Regulatory Board and seeks to "protect consumer interests by fostering competition and fair trade, preventing profiteering by entities and ensuring adequate availability of petroleum products throughout the country by giving directions to companies". The bill covers refining, processing, storage, transportation, distribution, marketing and sale of petroleum and petroleum products, including natural gas.

India is currently examining the possibility of establishing strategic crude oil and petroleum products reserves to deal with unanticipated supply disruptions and improve oil security.

The Energy Conservation Act of October 2001 came into effect in 2002. The act provides for efficient energy use and its conservation. The Bureau of Energy Efficiency (BEE) was set up at the beginning of 2002 to co-ordinate with designated consumers and agencies.

SOUTH-EAST ASIA

ELECTRICITY AND GAS TRADE AND MARKET REFORM

The countries of the Association of South-East Asian Nations (ASEAN) are liberalising their energy supply sectors, albeit at differing pace and with differing objectives, including the form and level of government regulation and their regulatory agencies. For reasons of diversification, security and economy of supply, and reduction in GHG emissions, ASEAN countries are also planning and developing commercial cross-border electricity and gas interconnections to link their national grids. The 2002 ASEAN Energy Ministers' Meeting (AMEM) endorsed these two ongoing regional developments, known as the ASEAN Power Grid and the Trans-ASEAN Gas Pipeline. They also agreed to the establishment of the ASEAN Gas Consultative Council to address barriers to cross-border trade and to study regional regulatory and institutional frameworks.

The IEA/ASEAN Electricity and Gas Sectors Reform Workshop, held in Paris in April 2002, initiated dialogue between the IEA and ASEAN on trade and market reform. The workshop examined the restructuring experience of IEA member countries and where it could contribute to ASEAN restructuring policy, notably that of governing legislation, power and gas supply standards, regulatory institutions and cross-border regulatory frameworks.

The IEA has subsequently been invited to provide expert input to the region on national regulatory models for reforming the electricity and gas sectors. While many ASEAN countries have established regulatory agencies and their operating framework, many are also in an evolutionary process. There is a general interest to understand models being adopted by their neighbours and internationally. The IEA and the ASEAN will work closely on understanding the lessons and evolution of Europe's electricity and gas markets and their regulators.

Recognising the regulatory and institutional frameworks necessary for regional gas and electricity trade and in support of the AMEM 2002 decision on ASEAN regional gas and electricity trade, this project will also focus on regional regulatory frameworks for trade, their evolving functions, management and structure.

OIL SECURITY AND EMERGENCY PREPAREDNESS

The ASEAN governments recognise the importance of oil security policy and programmes to their increasing exposure to supply disruption and price volatility.

Thailand and the Philippines are the major non-oil-producing ASEAN members. In August 2002, Thailand's Energy Policy Office announced it had "… prepared measures to cope with a likely oil shortage and a jump in fuel prices …" including special funds to absorb the impact of oil price hikes and fuel allocation. Similarly, the Philippine Department of Energy announced a government and industry National Oil Contingency Plan to create an Energy Contingency Task Force, monitor commercial stocks and ration/allocate fuel.

While government-controlled oil stocks are particularly effective for short-term market stabilisation, ASEAN countries do not have such stocks. Some have mandated that stocks should be held by oil producers and importers, but the majority are commercial or operational stocks. ASEAN countries remain concerned about minimising the cost of stockholding, and various initiatives have been proposed within ASEAN for joint stockholdings.

Until very recently, regional oil security was an issue of considerable sensitivity among ASEAN countries, with considerable divergence of views. The 1986 ASEAN Petroleum Security Agreement (APSA) is based on oil sharing between the "haves" and the "have nots". However, it appears not to have been operationalised and is currently under review by the ASEAN Council on Petroleum (ASCOPE).

It is interesting to note that in the recent oil market tightness, the ASEAN oil producers, Malaysia, Brunei and Indonesia, committed to supply oil to the Philippines in case of an acute shortage, as provided for under the APSA agreement.

The revised APSA will also encompass medium- to long-term security measures, including diversification of energy sources and trading regional energy resources through links such as the Trans-ASEAN Gas Pipeline and the ASEAN Power Grid.

The IEA was invited to provide expert input to the review, and in July 2002, the review framework and recommendations were agreed by the annual ASEAN Senior Officials Meeting on Energy (SOME). The review is continuing.

In December 2002, high-level officials of the ASEAN and the IEA met for expert policy and technical discussions in the ASEAN+3/IEA Joint Workshop sponsored by the Japanese government. The forum focused on broader energy co-operation issues as they impact on energy security.

In September 2003, the ASEAN and the IEA met in Paris for the first time to initiate a 2003/2004 programme on "ASEAN Oil Security and Emergency Preparedness". This focused closely on regional requirements and how the IEA's unique policy and practical experience may assist in the development of national and regional security policy and practice. This includes back-to-back industry site visits of emergency facilities in France and neighbouring countries to learn practicalities firsthand.

SOUTH AMERICA

In the last few years, South America has emerged as one of the most attractive investment regions in natural gas exploration and production, pipelines, LNG facilities and gas-fired power generation. The continent boasts abundant and growing natural gas reserves. The need to diversify away from hydropower and oil is driving many countries to promote natural gas, especially in power generation. Several cross-border gas pipelines now link gas-rich countries with large energy-hungry markets in neighbouring countries. Many more are on the drawing board.

Most South American countries have carried out substantial reforms of their gas sectors, often as part of wider economic and institutional reforms. Privatisation of state-controlled utilities and assets and efforts to increase competition have successfully attracted many private companies. Steps towards regional co-operation and integration have not only facilitated cross-border energy trade, but have fostered stability and growth throughout the region, bolstering energy demand growth.

To contribute to such development, the IEA published *South American Gas – Daring to Tap the Bounty* in February 2003. The following are summaries of key countries contained in the publication.

ARGENTINA

Argentina is a net hydrocarbon exporter and has a mature domestic gas market. As a leader of the privatisation of state-owned utilities, Argentina implemented sweeping changes to its upstream and downstream gas industry in the early 1990s. Since then, growth in domestic gas demand has continued steadily. In recent years, the development of a regional gas pipeline network has enabled Argentina to increase gas exports to neighbouring countries and Argentine energy companies are looking increasingly to neighbouring MERCOSUR countries and beyond for investment opportunities. At the same time, many foreign companies have entered the Argentine oil and gas market, attracted by the favourable investment and tax environment and the prospects for regional expansion. The country's economic and financial difficulties are severely affecting the gas sector (as well as the rest of the energy sector). Companies, largely indebted in US dollars on the international markets, have seen their revenues in pesos devaluated by 400%. The gas distribution companies, already debilitated by three years of recession and affected by an increasing incidence of unpaid bills, are accumulating huge debts which their international mother companies are unwilling to cover. The situation is no less difficult in the upstream sector. With the devaluation of the peso, the wellhead price – which is determined by the spot price in Buenos Aires – has been falling drastically, in some cases below production costs.

BOLIVIA

With proven natural gas reserves that grew seven times since 1997, Bolivia is now the second-largest holder of proven natural gas reserves in South America after Venezuela, but the first in terms of non-associated gas reserves. Bolivia's geographical position and abundant gas resources make it ideally placed to become South America's gas hub and play a central role in Southern Cone energy integration. Thorough reforms in the mid-1990s have transformed the country's energy sector from state-owned monopolies to a predominantly private industry. The country's domestic energy market is small, but the prospect of supplying the region's largest and rapidly growing energy market – Brazil – has attracted a large number of foreign companies to Bolivia. The issue now facing Bolivia is how to monetise its gas reserves. Exports to Argentina and Chile are being explored, as well as LNG exports to Mexico and the US.

BRAZIL

Brazil is the largest energy market in South America, accounting for 40% of the continent's energy consumption. Historically, natural gas contributed very little to Brazil's energy mix, although the country has significant hydrocarbon resources. A severe drought-induced power crisis in 2001 exposed the vulnerability of a system that relies on hydropower for 90% of its electricity supply. The government aims to increase the share of natural gas in the energy mix to 12% in 2010, up from the current 4%, mostly as a result of new gas-fired generation. The recent opening of the upstream oil and gas sector to foreign investment should boost domestic natural gas production, but most of Brazil's natural gas supply is expected to come from imports. Since 1999, imported gas from Bolivia has been flowing through the 3 150 km Bolivia-Brazil pipeline, and several other pipelines are under construction or planned to bring gas from Argentina. However, the development of the Brazilian natural gas market has been slower than expected. In particular, uncertainties surrounding the structure and regulation of the electricity market, as well as the inherent complexities of introducing gas-fired power generation in a hydro-dominated power generation sector, have contributed to delaying several gigawatts of gas-fired power projects.

VENEZUELA

Venezuela, the world's sixth-largest oil producer, is moving to capitalise on its enormous natural gas resources. The country holds four trillion cubic metres of proven gas reserves, the eighth-largest gas reserve in the world and the largest in South America. However, 91% of Venezuela's current gas reserves are associated with oil, and much of the gas produced is reinjected into oil wells to boost crude oil production. Hence, gas production is very dependent on OPEC production quotas. The government is now pushing to develop non-associated gas reserves and increase the share of gas in the energy balance. The 1999 Gas Law opens the door to private investment in all gas-related activities except exploration and production (E&P) of associated gas. The first Venezuelan gas-only E&P licences were granted in June 2001 to private consortia which include four foreign and two local companies. Despite the undoubtedly large potential for natural gas development, investors' response has been subdued. Concerns remain over the issues of gas pricing, the government's focus on the development of local markets rather than exports and, last but not least, the country's current political and economic uncertainties.

MEXICO[12]

Mexico is the world's 13th-largest economy, the 5th-largest oil producer and the 9th-largest natural gas producer. Despite efforts at diversification, the Mexican economy remains heavily dependent on the national petroleum sector.

12. The description of Mexico is not given in the *South American Gas – Daring to Tap the Bounty*.

Oil and gas dominate Mexico's energy sector. In 2000, oil represented 76% of energy production, 62% of total primary energy supply (TPES), 65% of final energy consumption (TFC) and 48% of electricity generation. Gas, which represented only 14% of energy production, accounted for 22% of TPES, 11% of TFC, and 20% of power generation. About 5% of primary gas consumption was imported from the US in 2000, but this share is expected to rise in the coming years.

The state-owned oil and gas company Petroleos Mexicanos (Pemex) is the largest company in Mexico and the 5th oil-producing company worldwide (and one of the most profitable before taxes). Pemex retains exclusive control of natural gas exploration and production, processing and firsthand sales, but the downstream segment of the Mexican natural gas industry was liberalised in 1995. An amendment to the Constitutional Article 27 on Petroleum allowed the private sector to construct, operate and own natural gas transportation, storage and distribution systems. The reform also lifted the ban on gas imports and exports by private companies. Two other pieces of regulation enacted in 1995 defined the regulatory framework under which Pemex and private parties, both domestic and foreign, can participate in the gas industry and gave the Energy Regulatory Commission (CRE) responsibility for regulating the natural gas sector.

Gas Natural Mexico, a subsidiary of Repsol-YPF, is the largest natural gas distributor in Mexico. Despite the entry of a number of large private players in natural gas distribution, Pemex's exclusive control over gas supply has resulted in the state-owned company retaining a *de facto* monopoly over gas transportation.

Mexico has important natural gas resources. At the start of 2001, its proven natural gas reserves stood at 835 bcm, a 2.9% decrease with respect to 2000. In March 2002, Pemex announced the discovery of three new natural gas fields in the state of Veracruz – Lankahuasa, Playuela and Hap, located along the Mexican Gulf. Pemex estimates that these fields could represent up to one-quarter of total Mexican natural gas reserves.

In the year 2002, Mexico produced around 120 mcm/d of natural gas, of which 30% came from non-associated gas wells. The production of non-associated gas has been rising by 8.8% per year between 1992 and 2002, compared to 0.3% per year for associated gas. Despite Mexico's abundant natural gas reserves, lack of investment has left the country with insufficient production capacity to satisfy its growing consumption. As a result, Mexico has become a net importer of US gas – 16.8 mcm/d in 2002, rising to 18.3 mcm/d in the first quarter of 2003.

The Mexican government expects that energy demand will grow at an average annual rate of 4% between 2001 and 2010[13]. Demand for electricity is

13. Based on the following assumptions: GDP growth 5.2% per year, population growth 1.2% per year.

expected to grow by 6.3% annually, while gas demand (largely driven by electricity generation) is projected to increase by 8.1% per year during the same period, reaching 269 mcm/d in 2010 – from 122 mcm/d in 2000.

With stagnant production, rising demand and import bottlenecks, the country faces natural gas supply shortages. In the first six months of 2003, Pemex produced 108 mcm/d, while the national consumption was 122 mcm/d. According to Raúl Muñoz, Director-General of Pemex, Mexico will need to boost production by 50% as demand surges over the next four years.

To meet this increase in demand will require substantial investments to sustain the oil and gas reserve level and to expand gas and electricity infrastructure. Mr. Fox's government is conscious that reforms to increase private participation in the energy sector are essential. Meeting natural gas demand is an integral part of the country's overall energy policy. In 2002, the administration undertook measures to increase domestic production and to facilitate imports from diverse foreign suppliers. A mid-term election for Mexico's Congress took place in July 2003. President Fox's National Action Party (PAN) won only 30.5% of the vote, behind the 34.4% earned by the Institutional Revolutionary Party (PRI). The Party of the Democratic Revolution (PRD) won 20% of the vote. The result of the election will certainly cast a shadow on the country's politics for the next three years. President Fox has to face the opposition against his energy reforms from PRI and PRD since they had slowed down the privatisation process of the electricity and oil sectors in the past three years.

Recently, several foreign companies have proposed building LNG re-gasification terminals on both coasts of Mexico. The Mexican government is supportive of these projects since they would help diversify natural gas imports and reduce gas supply risks in the face of a demand expected to grow by 8% a year over the coming decade. In August 2003, the CRE granted three key permits for the construction of LNG terminals by private companies: one plant in the port of Altamira and two plants in the Ensenada region of northern Baja California.

RUSSIA

Whether Russia will play a significant role as a key oil and gas exporter depends on the political will to continue implementation of difficult reforms over the next decade to attract the necessary domestic and foreign investment in order to sustain and increase current production and export capacity. If energy-sector reforms are not made, it is uncertain that the energy sector can match increasing domestic energy demand during a period of strong GDP growth without significant new improvements in energy efficiency. GDP growth in 2002 was slightly above 4% after peaking in 2000 at 9%. Total investment requirements in the energy sector to 2020 are estimated by the Russian Ministry of Energy at between $480 billion and $600 billion.

ENERGY MARKET REFORM

Getting domestic "prices right" is the critical issue for both the electricity and gas sectors restructuring. This will especially ensure that the infrastructure of electricity and heating does not further deteriorate. It will also encourage more energy efficiency investments and allow Russia to unlock its huge potential for energy efficiency, which can in time lead to a reduction in domestic energy demand and consequent reduction in supply requirements. Energy efficiency investments are already being made by home-owners and industry, and this process will be given even more impetus if prices truly reflected costs. It would also provide opportunities and incentives for domestic and foreign companies to invest in the gas sector and in energy efficiency projects in Russia. Energy price hikes, however, are socially painful and will have to be addressed through adequate social policies. The experience in recent years shows that, in the short term, energy price increases negatively impact Russian industrial production growth. Again, the medium- to long-term solution is not to keep energy prices artificially low, but to restructure unprofitable enterprises.

Moves in 2002 to restructure the Russian gas sector have been hindered by energy security risks which could heighten. The Ministry of Economic Development and Trade (MEDT) is promoting a separation of transportation and dispatch from gas production as the first step to liberalisation. Gazprom is asking for the creation of a domestic gas market without any changes to the monopoly's structure, accounting for almost 90% of national gas production. It argues that otherwise Russia's energy supply could be threatened and investors driven away. Increasingly, Russian oil companies and independent gas producers are seeking more transparent access to Gazprom pipelines. Proponents of the MEDT strategy for gas sector restructuring and other potential gas suppliers within Russia clearly seek to supply export markets. Until domestic prices are increased, it is difficult to break apart the delicate system of cross-subsidies (high-value exports for low-value domestic supplies) which Gazprom has worked within for so many years. Given the politically charged steps needed for gas sector reform, despite a strengthening domestic debate, it is unlikely that any reforms will be passed until after the presidential elections in 2004.

The pace of reform depends to a large degree on future international oil prices. If oil prices remain high over the medium term, there will be little motivation to make difficult reform decisions. Market liberalisation will be slow, few changes will be made to the fiscal, legal and/or regulatory regimes and foreign investment will not be considered necessary. Gazprom will retain its monopoly power given that healthy export revenues will limit the need to raise domestic gas prices. There will be little incentive for energy efficiency. In this case, Russia could run the risk of facing an energy security risk as energy production would be hard-pressed to match growing consumption. All this changes if oil prices drop over the medium term. Russia then needs to attract foreign investment, reform its fiscal regime, increase domestic gas prices (to match lost export revenues from lower gas export prices), energy efficiency gains are realised and there are moves for gas sector restructuring. Enhanced co-operation with the IEA and the OECD at a time when Russia is implementing various key energy sector reforms could encourage the government to take difficult decisions and not make the same mistakes as IEA countries have in the past.

OIL SECTOR

During the 1980s, Russia was the largest oil producer in the world. While Russia almost halved its oil production from 11.4 mb/d in 1988 to 6.0 mb/d in 1996, since 1999 it has steadily increased its oil production from 6.1 mb/d to 7.6 mb/d in 2002. Most of this growth has been from reactivating idle wells and enhancing production at existing fields. It is uncertain how long Russian oil companies will be able to sustain growth rates based on "low-hanging fruit". In a high oil price environment, the shortcomings of the Russian fiscal structure are not evident. Until recently, the united stance by international majors investing in Russia could be undertaken only with production-sharing agreement (PSA) terms reinforcing the view that the Russian fiscal and legal regime was not attractive or stable enough to warrant long-term investments. The recent equity investment by BP to form a new Russian oil company – BP-TNK – followed by Shell stating it is willing to work without a PSA, should bring new impetus to reform the generic fiscal regime along with Russia's legal and regulatory regime. In the short to medium term, export capacity constraints are the key problems hampering expansion of Russian oil production. Investments face the added problem of Transneft's monopoly power and the lack of transparency in the transportation system, tariff-setting methodology and quality banks. Little reform is expected before the 2004 presidential elections.

NATURAL GAS SECTOR

An estimated one-third of the world's natural gas reserves remain in Russia's super-giant fields and in smaller fields adjacent to the super-giants, which ensure the availability of future supply. Russia also has a range of opportunities to import gas on commercially attractive terms from Central Asian and Caspian countries through established pipeline networks. On 10 April 2003, Gazprom signed a long-term agreement with Turkmenistan for gas purchases of 5-6 bcm in 2004, increasing to 70-80 bcm/year by 2009 up to 2028. Prices are set at $44 per thousand cubic metres until 2006, at which time they will be renegotiated. Clearly, this relieves pressure on Gazprom to invest in huge areas which are difficult to develop, ensuring supplies for the domestic and export markets. More importantly, this also dampens any momentum for reform and restructuring of the gas sector and for providing transparent and stable terms for third-party access to oil companies and independent gas producers.

ELECTRICITY SECTOR

Effective implementation of the electricity industry restructuring plan is essential for the sector to meet increasing electricity and heat demand. The six laws passed by the Duma and signed by President Putin in April 2003 are in line with the approach of many OECD countries in unbundling the electricity sector. It is expected to facilitate trade among regions and to form a sound basis on which competition and an open electricity market can build. Effective implementation of these laws over a vague timeframe set to 2009 will depend to a large extent on the strength and independence of federal and regional regulatory bodies to ensure a competitive "level playing field" for competition in all natural resource sectors and the electricity and heat industries. Regulatory bodies will need to ensure fair third-party access to the grid, transparent tariff-setting based on full costs, as well as clear licensing rules for new market players.

ENERGY EFFICIENCY AND THE ENVIRONMENT

With the current outlook for stronger economic growth, more effective implementation and funding for environmental protection will become possible. This is critical 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 2008-2012. The fact that GHG emissions are already lower than in 1990 has opened opportunities for emissions trading. With the outlook for economic growth, the Kyoto mechanisms, known as emissions trading and joint implementation, could raise revenues and attract investment.

CENTRAL AND SOUTH-EASTERN EUROPE

Preparation for EU membership has continued to largely influence energy developments in the region.

The first eight accession countries[14] have accelerated their market reforms in view of official membership in May 2004. These countries have largely achieved the separation of their government's policy-making process from regulatory enforcement and service operations. Their energy policies have continued to converge with IEA countries, notably in terms of security of supply, economic efficiency and environmental protection.

Accession countries have enhanced their security of supply through diversification of energy import sources and routes, fuel mix diversification, storage and emergency plans. Regulatory reforms have focused on cost-reflective pricing of

14. The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia.

transmission and final products. The opening of the electricity markets to competition has been initiated but has remained constrained by the dominance of monopolies, baseload overcapacity and persistent price distortions.

Despite improvements over the past decade, energy intensity remains much higher than the average in Western Europe, which is detrimental to customers by increasing energy prices. Thus, implementing ambitious energy efficiency policies will increase competitiveness for business and welfare for households, and shift resources to productive activities at low cost which pay for themselves over a short period. These policies generate environmental benefits and stimulate new services. However, with the exception of Slovenia, countries of the region have not yet prioritised energy efficiency, nor allocated sufficient resources.

On the other hand, substantial progress has been made in reducing the negative environmental impact of the energy sector and energy consumption. Measures include closure of the most inefficient units, fuel switching, filtering and tax incentives. The flexible mechanisms developed under the Kyoto Protocol have begun to emerge and appear as new opportunities for co-funding investment projects, notably in energy efficiency and renewable energy. As a prerequisite, countries need to develop procedures and institutions to identify priorities and appraise the projects. The Dutch carbon-trading schemes (ERUPT and CERUPT) have been among the most active programmes in the region through joint implementation (12 projects selected in 2003) and clean development mechanism (eight projects approved). Furthermore, the Prototype Carbon Fund (World Bank) has selected eight projects in the region.

In *Poland*, the largest energy-consuming country in the region, the energy mix continues to be dominated by coal (two-thirds of supply). In 2002, the government suspended the extension of the restructuring plan of coal-mining, although companies' deficits increased by one-third in 2002. Natural gas consumption has developed below expectations, which has led to a reduction in the volume contracted with Gazprom, Poland's sole supplier. No decisions have been taken on the construction of supply pipelines from the North Sea or of a transit pipeline (second Yamal branch).

In January 2003, the restructuring of the gas utility gained momentum with the creation of six regional distribution companies. The initial 33 electricity distribution companies have been progressively regrouped with the objective of forming eight companies. In 2002, RWE purchased a majority stake in Stoen, the Warsaw-based electricity generation company. The privatisation of the second refinery has not yet been concluded but its eventual integration with the dominant company will harm competition. The dominance of long-term electricity contracts in the wholesale market largely prevents an effective opening of the market to competition.

The *Slovak* energy sector has continued its restructuring. The regulatory body has strengthened its powers and is responsible for pricing. In January 2003, it increased natural gas prices by one-third with the objective of phasing out cross-subsidies by 2005.

Slovnaft, the main oil company, has continued its modernisation and is now majority-owned by the Hungarian MOL. In the other sectors, the partial privatisation process has continued in 2002 after the sale of the gas utility SPP for revenues, which accounted for 13% of GDP. Regional electricity distribution companies have been privatised to RWE, EDF and E.On.

Slovenia has strengthened its policies and institutions in view of EU membership and has made substantial progress on energy security and opening of the electricity market. In *Croatia*, the newly created regulatory body has to establish its power *vis-à-vis* the dominant energy companies. The partial privatisation of INA, the oil and gas company, is ongoing and has attracted increasing interest among international companies. The project to reverse the oil pipeline, Adria-Druzbha, should provide the Russian oil companies with more direct access to southern European markets.

In *Romania*, the electricity and gas sectors have been unbundled and the electricity market partially opened to competition. Nevertheless, energy reforms still need to gain momentum. Despite overcapacity, the country plans to commission a new nuclear power plant.

The *Bulgarian* government has continued its plans for energy sector reform. It launched the privatisation of regional electricity and gas distribution companies to be followed by thermal power plants. The regulatory authority has continued energy price adjustments in preparation for privatisation and market opening. The closure of the most unsafe nuclear power units by 2006 has been agreed with the EU, and the interruption of electricity exports to Turkey in 2003 may contribute towards a decision on closure.

In other South-eastern European countries, reforms have progressed more slowly but are expected to gain momentum by mid-2003 when all countries should announce their energy policies (in the framework of the Regional Energy Market/Athens process). Governments also need to establish and develop, under good governance principles, effective institutions to implement thorough and sustained regulatory reforms, as well as energy sector restructuring, in order to reach market fundamentals. These domestic efforts should converge in the medium term to effectively and transparently open electricity markets to domestic and then regional competition. The regional electricity market is expected to reduce supply-side costs by 10%, which is less than the energy savings on the demand side that are estimated at 30 to 40% of total consumption at low cost.

Overall, as in other economies in transition during the 1990s, energy demand in south-east Europe is expected to remain level or decrease as a result of pricing reforms, economic restructuring and energy efficiency improvements. Thus, investment needs in the sector may be limited because of an unfavourable investment climate which will allow these resources to be directed to other sectors.

MIDDLE EAST

ECONOMIC AND ENERGY POLICY IN THE KINGDOM OF SAUDI ARABIA

With oil and gas supplies from the Middle East region essential to meeting projected long-term demand and the issue of security of supply becoming ever more relevant, Saudi Arabia's economic and energy policies demand particular attention. The Kingdom's position as a leading oil producer and the holder of the world's largest crude oil reserves, together with its importance within the Middle East and OPEC, makes a brief assessment of the country timely and necessary.

Despite efforts to diversify, oil export revenues still represent around 80% of government income and 40% of the national GDP. Structural flaws in the economy were exacerbated during the oil price collapse in 1998 as the fundamental problems associated with an extensive welfare system, a bloated public sector, a large, youthful population and high unemployment were all clearly exposed. Since then, the government has begun the process of preparing the public for change and has launched its "open door policy", which involves a series of economic reforms as well as a partial opening of the energy sector in an effort to spur economic growth and attract international investment. One of the principal initiatives of the Saudi government has been the creation of an attractive investment climate, but there are still some sectors where international investment is prohibited. Although the implementation of the announced reforms has been slow, their introduction represented a major step in Saudi economic policy. Apart from structural changes in the investment process, the following sectors were earmarked for liberalisation:

- Corporatisation of the Saudi Telecommunications Company.
- Opening of the stock market to foreigners to invest through mutual funds.
- Restructuring of the electricity sector.
- Introduction of a real estate law allowing foreigners to own property in the Kingdom (except in Mecca and Medinah).

However, to date reform has been slow and many widely promoted processes of legislation such as a new tax code, new capital markets law, labour law as well as insurance law have not materialised. Moreover, negotiations on the $25 billion Gas Initiative, which is due to open the Kingdom to selected international energy companies for domestic production and consumption of natural gas, collapsed in its integrated form which included power, water and petrochemical projects in addition to gas exploration and production.

However, some progress was made with Core Venture Three, the third major gas exploration and production project which covers the 200 000 km^2 Rub al-Khali (Empty Quarter) in the south of the Kingdom. The bid for the US$ 5 billion Core Venture Three was originally won by a consortium comprising Royal Dutch/Shell and Total as well as US firm Conoco. However, in July, the Saudi government announced that the gas exploration and production project was to be conducted by Royal Dutch/Shell and Total. Investment for the project is believed to be less than US$ 5 billion and limited only to exploration of natural gas needed as fuel for the Kingdom's power and petrochemical production.

In addition, no tangible progress has been made on the issue of Saudi accession to the World Trade Organization (WTO). Privatisation plays a pivotal role in the government's long-term strategy to develop the private sector by enhancing the economy's competitiveness. A ministerial resolution issued in 1998 established the general privatisation strategy, driven essentially by the expansion of investment opportunities in the private sector. Its main objectives revolve around increasing the share of the private sector in total GDP, encouraging international and inward investment, enhancing the economy's competitiveness to WTO requirements and rationalising public expenditure. With 260 billion barrels of proven oil reserves and up to 1 trillion barrels of recoverable oil, Saudi Arabia's position as the holder of the world's largest oil reserves remains uncontested. At the 2001 output rate of 8.8 mb/d, Saudi Arabia has a reserve-production ratio of 85 years[15]. The Kingdom also owns 50% of the Neutral Zone, which contains 5 billion barrels of crude oil reserves. Production from the Neutral Zone is equally divided between Saudi Arabia and Kuwait.

In terms of energy policy, Saudi Arabia's oil policy is mainly characterised by:

- Continuing to have the largest oil reserves with production costs among the lowest in the world (officially at $1.50/barrel).
- Maintaining spare oil production capacity.
- Failing to dilute the pivotal role of crude oil in the Saudi economy.
- Preserving a stable political system.

14. BP Annual Statistics 2002.

Looking to the future, the maintenance of this spare oil production capacity is likely to remain a key element in Saudi oil policy. In this context, however, the issue of investment needs to be addressed as the Saudi government will weigh its options of either allowing foreign oil companies into the upstream sector or retaining Aramco's monopoly over the hydrocarbon sector and continuing to expand its production capacity.

Whereas upstream oil remains closed to foreign participation, international investment in the downstream oil sector is encouraged. Among areas of emphasis are joint ventures in oil refining, petrochemical industries, storage, efficiencies in oil production and refining, improved production of lubricants, engineering and support services, all of which add value and broaden the Kingdom's industrial base.

PART 2

THE COUNTRY REPORTS

IN-DEPTH REVIEWS: SUMMARIES

This part contains summaries of the findings and full list of recommendations of the 2002/2003 in-depth reviews for the following countries. Austria, reviewed in the 2001/2002 cycle, is included here because the report had not yet been published when the 2002 edition was released. The findings and recommendations reflect the situation when the report was drafted and finalised. The full reviews have been published separately.

AUSTRIA

team visit: April 2002; approval at the Standing Group on Long-Term Co-operation (SLT): October 2002

HUNGARY

team visit: October 2002; approval at the SLT: February 2003

IRELAND

team visit: November 2002; approval at the SLT: April 2003

ITALY

team visit: January 2003; approval at the SLT: June 2003

JAPAN

team visit: January 2003; approval at the SLT: June 2003

SWITZERLAND

team visit: November 2002; approval at the SLT: April 2003

AUSTRIA

The two most important developments in the Austrian energy sector since the last IEA in-depth review are the liberalisation of the electricity and natural gas markets, and the current and planned measures to meet emissions reduction targets under the Kyoto Protocol. Austria's commendable liberalisation in advance of European Union deadlines has lowered prices for larger customers but has had less of an impact for residences. Austria should extend liberalisation's benefits to all customer classes, particularly through lowering network tariffs and monitoring excessive market concentration. Austria's commitment under the Kyoto Protocol (13% reduction below 1990 levels) poses challenges, although the completion in 2002 of a comprehensive climate strategy is a clear step in the right direction. Immediate implementation of the measures included therein will help minimise the expense of emissions reduction. Emissions forecasts and their related macroeconomic projections should be revisited, especially as experience is gained in this area. In addition, international flexible mechanisms should be more fully incorporated into the core climate change strategy. The country continues to operate without significant energy supply security concerns, aided substantially in this by its extensive international energy trade.

Austria lies at the geographical heart of Europe. It is entirely landlocked with 2 562 km of borders shared with eight other countries. The Austrian government is a federal system with nine different Länder (or states), with responsibilities on energy policy shared between the federal and the Länder governments. The country has substantial hydropower resources which it has tapped to provide approximately 70% of its electricity needs. Austria also has domestic oil and natural gas resources, providing 9% and 23% of the country's demand for these fuels respectively. Oil and gas production from these domestic fields has declined over the last 20 years and is expected to decrease further as the fields become depleted.

Austria engages in substantial international energy trade. While it has energy exports, it is a net importer, importing approximately 65% of its total primary energy supply (TPES) in 2000. The country imports over 90% of its crude oil needs, nearly 60% of its diesel fuel and close to 80% of its natural gas needs. Austria is a net exporter of electricity but trade balances vary seasonally as Austria's hydropower capability fluctuates throughout the year. This international trade offers the lowest-cost solution to meeting the country's energy needs as well a viable means of enhancing energy security and revenue opportunities for the Austrian economy. Such trade will continue and should be encouraged as liberalisation in the region spreads and the EU enlarges by accepting neighbouring countries.

Austria faces no significant energy supply security problems. While its large import shares of oil, gas and (seasonally) electricity warrant continued monitoring of this issue, a number of factors combine to protect the country against energy shortfalls. These factors include a long history of uninterrupted imports from producing countries and the significant transmission/transportation capabilities between Austria and these producing countries. Austria has also taken steps domestically to ensure supply security, including the development of large gas storage capabilities, comprehensive emergency response measures for oil and a sizeable reserve margin capacity for electricity. The electricity regulator has the mandate to monitor electricity supply security, and forecasts sufficient capacity to meet demand for the next five to seven years.

Over the last several years, Austria has worked to liberalise its electricity and natural gas sectors. On 1 October 2001, all electricity customers were given the right to choose their supplier and on 1 October 2002, all natural gas customers were extended the same right. These market openings are well in advance of EU directives on the subject, making Austria the fifth EU country to offer supplier choice to all electricity customers and the third EU country to offer supplier choice to all natural gas customers.

Austria completed the liberalisation of its electricity sector through an amendment to the Electricity Industry and Organisation Act (EIWOG 2000). This law gave all customers the right to choose their supplier, created regulated TPA (third-party access) to the networks, established an independent electricity regulator (the E-Control Commission), and required utilities to separate their accounts into generation, transmission, distribution and retailing activities. The results of this liberalisation have been mixed and vary by customer class. While larger consumers have enjoyed reduced power prices, smaller customers have seen little or no change to their overall bills[1]. Less than 1% of residential customers have switched suppliers while 20% of larger consumers have done so. One impediment to residential supplier switching is the high distribution charges found in Austria. Access charges to the Austrian system, which account for approximately 35% of the average residential bill, are between 60% and 70% higher than the average of other European countries. High access charges can imply cross-subsidisation, in which companies overcharge for their regulated activities and use the excess revenues to subsidise competitive activities. While system access charges have already begun to fall since the market liberalisation, the regulator would like to realise further reduction of between 20-30% in coming years. This initiative is commendable and, if such efforts do not succeed in lowering access charges, Austria should consider more complete unbundling than the account unbundling currently in place.

1. The approximately 10% reduction in residential bills has been offset by a tax increase of roughly the same amount that was prompted by budgetary reasons.

The Austrian Gas Act opened 50% of the natural gas sector market (by volume) in August 2000, the date at which all gas generators and consumers with an annual consumption of over 25 million cubic metres (mcm) were given the right to choose suppliers. From October 2002, all consumers were given supplier choice. While negotiated TPA was initially used, this was switched to regulated TPA from October 2002. Austria will also establish an independent regulator by expanding the authority of the E-Control Commission. Although these commendable developments establish a solid framework for a successful liberalised gas sector, certain aspects of the market still threaten to undermine the success of this process. A study commissioned by the EU Directorate-General for Transport and Energy provides some insight into the market functioning thus far. While the study lauded the transparent TPA access conditions and the unbundling of the main incumbents, it also found that only one non-incumbent gas company is competing effectively in Austria and that customer switch rates were quite low. Difficulties in accessing network pipelines and long-term take-or-pay contracts were cited as factors for the limited activity in the liberalised market. The regulator should address disputes related to network access and the government should act to increase the liquidity of natural gas in the market by examing the effects that long-term gas contracts have on supply diversity and competition.

The role of Austrian utilities in the liberalised Central European energy electricity and gas market is evolving. While significant ownership stakes in these companies have been privatised in recent years, Austrian law still requires that government (at either the federal or the Land level) maintain majority ownership of the major energy utilities. In response to competition brought about by liberalisation, a number of incumbent Austrian utilities are forming alliances with one another. Such alliances can bring internal cost savings and help defer hostile take-overs by foreign firms, but they also reduce the number of competing companies. Austria introduced new regulations addressing market power which the Cartel Court will use to assess the market dominance of these allied Austrian companies. This is a positive step towards inhibiting any potential market power concerns that could stifle true competition.

Austria's most important energy-related environmental issue is its commitment to the Kyoto Protocol, which was ratified by the Parliament in March 2002. Under the EU's burden-sharing system, Austria has agreed to reduce its greenhouse gas (GHG) emissions by 13% below 1990 levels by the time of the first commitment period, 2008-2012. In order to help formulate a policy to reach this target, the federal government has commissioned a study which projects GHG emissions forecasts running through the year 2020. This study, Energy Scenarios up to 2020 (*Energieszenarien bis 2020)*, was conducted by the Austrian Institute for Economic Research (WIFO) on behalf of the Federal Ministry of Economic Affairs and Labour and the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The forecast reached the surprising conclusion that greater emissions reductions would result in improved macroeconomic conditions. As Austria gains experience in reducing emissions, it should revisit its forecasts in order to assess the validity of this conclusion and, if necessary, adapt its climate change strategy accordingly in order to reduce costs across the economy.

Austria has recently finalised the *Klimastrategie*, a comprehensive plan which outlines measures to reduce GHG emissions so as to reach its Kyoto target. The plan was passed by the government on 18 June 2002. The climate change strategy included therein was developed with the participation of the federal and Länder governments, as well as in consultation with the private sector. Emissions reduction measures were placed into six different categories, with space heating and transport measures accounting for more than one-half of the total projected emissions cuts. Kyoto flexible mechanisms (Joint Implementation, Clean Development Mechanisms and international emissions trading) have been incorporated into selected areas of the *Klimastrategie* and are expected to yield emissions reductions of 3 Mt of CO_2-equivalent by the time of the first Kyoto commitment period, 2008-2012. Many of the plans for flexible mechanisms involve new initiatives which will help establish the proper frameworks for such activities. As experience is gained with flexible mechanisms, Austria could look more closely at the costs and benefits those options offer, and refine its plans accordingly. In the meantime, Austria should proceed as quickly as possible to implement the most cost-effective measures included in the *Klimastrategie.*

Austrian energy intensity (as measured by TPES over the country's GDP) is below the average for IEA European countries. This is due in part to low energy intensity in the transport sector (resulting largely from a high share of diesel-fuelled vehicles in the Austrian fleet), an economy dominated by services rather than large energy-intensive industry, and efforts to reduce public energy use such as street lighting[2]. In April 2002, the government published the Austrian Strategy for Sustainable Development (*Die Österreichische Strategie zur Nachhaltigen Entwicklung*) which establishes the goal of reducing national energy intensity at a rate of 1% per year beyond the average energy intensity improvements seen in the EU from 1990-1997. This is a commendable but challenging goal to achieve. Ensuring co-ordination between the many diverse energy efficiency measures and institutions already in place would allow Austria to most effectively make progress towards this target. Effective monitoring of policy performance is also essential.

Austria makes substantial use of district heating (DH) and combined heat and power (CHP) plants. Such facilities provide 12% of the country's heating and 27% of its electricity. These plants are supported by regulations requiring local utilities to pay above-market rates for electricity coming from such plants. While CHP does have impressive energy efficiency qualities, many of the

2. The low energy intensity is also due to the statistical treatment of Austria's substantial hydropower.

Austrian CHP systems operate at relatively high costs. Faced with termination of the current subsidy system at the end of 2004, Austria needs now to debate the possibilities for other forms of support. These should include a gradual lowering of support levels and use of a benchmarking system involving minimum efficiency standards as ways of maximising CHP contributions to meeting environmental goals in a cost-effective way.

Austria makes substantial use of renewable resources in the form of large hydropower and biomass which in 2000 provided 12.6% and 10.9% of the country's TPES, respectively. Small hydropower facilities (<10 MW) provided 1.3% of the country's TPES while other renewable energy technologies (solar, wind, geothermal, biomass electricity generation and landfill gas generation) accounted for less than 0.5% combined. Small renewable energy technologies (*i.e.* excluding large hydropower and biomass) benefit from two separate support schemes. One scheme requires that electricity suppliers source a minimum percentage of their electricity from renewable energy technologies. Suppliers must get 8% of their power from small hydro facilities (<10 MW) and 1% (increasing to 4% by 2007) from other renewable energy technologies. The second support scheme is the feed-in tariff system. Utilities are obligated to purchase power from selected renewable energy technologies at above-market tariffs which are determined by the government. These tariffs were originally set by each individual Land, but legislation passed in July 2002 transferred this responsibility to the federal government so that now the feed-in tariffs can be made consistent across the country. This move will allow renewable resources to be used more efficiently around the country, providing the same level of renewable generation at lower overall cost. Austria could further lower costs by introducing a degression scheme into the feed-in tariffs whereby prices are gradually lowered to provide an incentive for producers to improve efficiency. The renewables policy should be regularly revisited.

RECOMMENDATIONS

The government of Austria should:

Energy Market and Energy Policy

- *Continue with the liberalisation of the electricity and natural gas sectors.*
- *Further clarify energy policy objectives in the context of market liberalisation, ensuring that policy tools fit the new policy environment.*
- *Continue the national debate between the desire for large Austrian utilities able to fend off hostile take-overs by foreign companies and the market concentration issues that such utilities raise.*

- *Review energy tax policies to prevent possible market distortion and send the right signals to consumers, taking into account the tax harmonisation efforts at the EU level.*

Energy and the Environment

- *Conduct regular monitoring of the implementation and actual emissions reductions of the proposed* Klimastrategie *measures under close co-ordination between relevant ministries and between the public and private sectors.*
- *Review the GHG emissions forecasts used as the basis for the development of climate change policy.*
- *Revisit the cost-effectiveness of various* Klimastrategie *policies as cost experience is gained through their implementation.*
- *Examine the transport sector to ensure its optimal contribution to overall GHG emissions reduction strategy.*
- *Ensure an appropriate mix of domestic policies and flexible mechanisms with a view towards minimising the economic cost of climate change mitigation policies for the whole economy.*

Energy Efficiency

- *Further improve co-ordination among the many bodies and programmes which address energy efficiency in the country.*
- *Institute an effective monitoring scheme for government-sponsored energy efficiency programmes to measure their efficacy in order to both improve them and ascertain their cost-effectiveness.*
- *Review the support scheme for CHP plants, including its continuation after 2004. Maximise CHP's cost-effective contribution to meeting environmental goals through such measures as a gradual lowering of the support levels in accordance with a benchmarking system which includes minimum efficiency standards.*

Renewable Energy

- *Explore the most cost-effective measures to achieve the country's targets for contributions from renewable resources.*
- *Explore the introduction of a degression scheme for the feed-in tariffs which lowers prices to consumers, encourages producers to reduce costs and provides investors with a measure of predictability for their revenue streams.*

- *Create a procedure by which renewable energy policies can be regularly revisited. This can be done as the costs of the minimum renewables percentage requirements become clearer.*
- *Weigh the current costs of renewable energy technologies against their respective long-term potentials when deciding the level of support each will receive.*
- *Ensure that electricity source labelling requirements provide customers with reliable information on the sources and costs of electricity generation options offered by different suppliers.*

Oil

- *Monitor OMV's (the largest domestic oil company) self-imposed price limitation on retail sales to ensure that it in no way impedes the current high level of retail competition by either distorting market prices or discouraging new entrants.*

Natural Gas

- *Ensure that non-discriminatory TPA is provided to the entire pipeline system and, if necessary, consider requiring the legal unbundling of all pipeline owners or the divestiture of assets to achieve this goal.*
- *Assess whether the development of large supply groups overly concentrates market power and, if necessary, consider laws for the Cartel Court to address such market concentration.*
- *Assess the impact of distribution tariffs on effective competition in the gas market and review which costs should be recovered through clear, transparent access charges which accurately reflect costs.*
- *Facilitate access to different sources of supply by promoting liquidity in the market; consider the role a gas-trading hub at Baumgarten could play in increasing supply liquidity.*

Electricity

- *Monitor and evaluate the performance of the full liberalisation, particularly the way in which price reductions are spread across customer classes.*
- *Continue to lower system access charges.*
- *Maintain the independence of the electricity regulator.*
- *Consider the option of further unbundling, if account unbundling has not ensured transparency, as well as the accurate reflection of costs in the pricing of the network services.*
- *Investigate the consolidation of the numerous distribution operators.*

- *Pay special attention to the issue of market power, particularly the definition of the relevant market in making any assessments.*

Energy Research and Development

- *Further clarify the objectives the R&D programmes are designed to meet in order to accomplish particular energy and environmental policy objectives and allocate resources appropriately, based on the national goal of expanded R&D expenditures.*
- *Enhance monitoring of progress in reaching the energy-related R&D goals Austria has established.*
- *Review energy R&D priorities in order to maximise the cost-effectiveness of finite government R&D expenditures in relation to mid- to long-term objectives in the energy sector.*

HUNGARY

The aim of Hungary's energy policy is to strike a balance between energy security, economic efficiency and environmental protection, in line with the IEA Shared Goals. In 1999, the "Hungarian Energy Policy Principles and the Business Model of the Energy Sector" (Resolution 2199/1999 VIII. 6) was published. This document promoted the following policy principles and objectives:

- Creation of an efficient domestic energy market functioning as an integral part of the single European energy market, but respecting national particularities, serving both economic competition and consumer protection.
- Preservation and augmentation of the security of energy supply.
- Enforcement of environmental protection requirements on both future developments and existing generating and energy-consuming plants.
- Improvement of public scrutiny and information, democratic control and, for the remaining monopolies, transparent price regulation.

Hungary continued its remarkable progress in energy market liberalisation since the last in-depth review, creating the conditions for an electricity market to develop on similar grounds as in other European countries, and paving the way for a natural gas market. A new Electric Power Act was passed in December 2001, introducing competition into the restructured power industry and making Hungarian legislation in this area compatible with EU directives. In 2003, the Hungarian electricity retail market will be partially opened to competition and then gradually fully opened by the time Hungary is admitted to the EU. A new gas law is being discussed and will probably be approved in 2003. This law will pursue the liberalisation of the gas sector, with an initial opening of the gas market to 25% of gas consumption, creating a new gas pricing mechanism and discontinuing the practice of setting prices for gas produced in Hungary. The government deserves full credit for its determination to pursue reforms. While the strong driving force in energy policy has clearly been the need to conform to the *acquis communautaire*[3] given the prospect of EU accession, it is also a step towards a more efficient energy system.

Despite these positive developments, Hungary faces a number of challenges. In the electricity sector, it needs to ensure that the state electricity generation and grid company (MVM) does not cause market distortions given its importance

3. The *acquis communautaire* is a term used to designate the current state of EU legislation and procedures.

in the market. In particular, existing long-term contracts of MVM should be monitored, since the company has access to low cost nuclear facilities, influencing effective competition. The independent system operator (MAVIR) was established in 2002, but the ownership of transmission lines remains with MVM. MAVIR's responsibilities need to be further strengthened. Capacity and transmission constraints are also causes of concern. Hungary is likely to encounter capacity constraints around 2005 when some of the old coal-fired plants will be closed in line with EU environmental directives. There could also be severe congestion in the interconnection between the Slovak Republic and Hungary. The government will need to monitor generation, transmission and interconnection capacities.

Security of natural gas supply is vital for Hungary given the high share of natural gas in the energy mix. It is therefore commendable to strive to open the Hungarian upstream market to increase indigenous gas production and facilitate competition. Domestic production prospects could be limited, because of uncertainties concerning the regulation of the natural gas market given the delayed implementation of the proposed Gas Act. The act should be adopted and implemented as quickly as possible. Limited gas-to-gas competition due to the strong dominance of Russian gas, uncertain future gas demand given uncertain electricity demand and the oligopolistic structure of gas distribution companies are fundamental constraints to the development of strong and healthy competition in the Hungarian natural gas market. The appropriate authorities, including the Hungarian Energy Office (MEH), should monitor the development of the gas market, in particular the implication of existing take-or-pay (TOP) contracts, limited sources of supply and interaction with stranded costs as market conditions develop.

While the new legislation has increased MEH's independence, key pricing decisions for non-eligible consumers are still a government responsibility. Despite recent efforts for prices better to reflect costs, a policy to keep energy prices low for certain categories of consumers for social reasons still exists. This policy has various harmful effects, such as discouraging energy saving and distorting fuel choices. Furthermore, low prices have discouraged investment by domestic energy firms such as MVM and the Hungarian oil and gas company (MOL) because the policy has caused financial losses and rendered economic viability of new investment uncertain. This could have serious implications for energy security. The government should provide a clear timetable with milestones for price increases to market levels for gas and electricity. To avoid possible conflicts of interest, it should give full responsibility to the MEH, not only to calculate prices, but also to set them.

As in many other transition countries, Hungary's energy policy has for a long time focused on the expansion of energy supply, while paying little attention to costs and economic efficiency. During the past decade, the government increased its emphasis on the demand side, but its primary focus remains largely on the supply side, *i.e.* securing supply, introducing competition in the energy markets and diversifying energy sources. Weak emphasis on the energy demand side could be problematic in the future. Final energy consumption has been quite stagnant in past years, largely because of economic restructuring, during which several energy-intensive industries shrunk and less energy-intensive industries emerged and grew. Economic restructuring is likely to slow down, which will lead to growth in final energy consumption, following a gradual increase of GDP per capita. In the future, some specific sectors of the Hungarian economy will require more focus on increased energy efficiency, in particular the building sector, small and medium-sized enterprises and the transport sector.

Renewable energy potential, though limited, largely remains to be developed in Hungary. Significant near-term potential lies in bioenergy resources and renewable municipal wastes for electricity and heat production, and in geothermal energy for heat. However, current grants and funds without clear technology or market priority may eventually support technologies that have little economic relevance in Hungary. Similarly, the use of a single feed-in tariff for electricity generated from renewable sources may end up supporting relatively high-cost renewable energy options while generating rents for lower-cost options. The current policy framework for renewables will need to be improved to better reflect cost-effectiveness.

RECOMMENDATIONS

The government of Hungary should:

General Energy Policy

- *Establish an indicative timetable for price increases to market levels for gas and electricity for non-eligible consumers.*
- *Address social hardship through social policy measures, not through energy prices.*
- *Establish a timetable for handing price control responsibilities to the MEH.*
- *Ensure that the Directorate-General for Energy is adequately staffed and has sufficient resources to administer the energy market liberalisation process.*
- *Organise, in a transparent fashion, the contributions of the different representative bodies of consumers of the network industries (electricity, gas, district heating) to avoid any risk that certain groups of consumers would have a favoured position in influencing government policy.*

- *Define a timetable to improve energy quality and reduce technical and non-technical losses.*
- *Devise indicators for monitoring the quality of energy supply (electricity, gas), in co-operation with all the energy stakeholders.*
- *Design and implement a system of improved measures (detection and sanctions or penalties) against electricity pilferage.*

Energy Efficiency

- *Continue to strengthen the close co-ordination among all energy efficiency plans involving national, European and international institutions to make optimal use of such expertise and funding.*
- *Provide the Energy Centre with an adequate budget, staff and executive powers to allow it to fulfil its tasks at both national and international levels.*
- *Investigate through the MEH and the Hungarian Competition Office whether heat prices are being set on a reasonable cost-reflective basis and, if not, devise and implement an appropriate solution to avoid price distortions between heat and power that would negatively affect investment in and modernisation of combined heat and power (CHP) and district heating systems.*
- *Give priority to strengthening energy efficiency in the building sector through the implementation of EU regulations on energy efficiency standards in the household sector, improve and enforce the mandatory thermal insulation standards and strengthen the programme for retrofitting the energy-inefficient housing stock.*
- *Strengthen energy audits in industry (including small and medium-sized enterprises), and measures to encourage the audited enterprises to implement recommended cost-effective measures.*
- *Establish and implement a comprehensive long-term energy efficiency Transport Plan with clear objectives supported by adequate cost-effective measures and investments funded over the long term to limit the growth of road transport. Include measures to stimulate investment in public transport, on driver behaviour (car labelling for example) and on the diffusion of cleaner fuels and low-emission vehicles.*
- *Strengthen the appropriate measures and capacities to carefully monitor and assess all the energy efficiency programmes and measures, and adjust them according to the changing economic context.*

Energy and the Environment

- *Establish a clear institutional framework for Joint Implementation (JI) projects to facilitate access of foreign investors and minimise transaction costs.*

Consider whether to use the existing emissions trading surplus under the Kyoto Protocol to encourage early investment in JI projects.

- *Consider broader participation in international emissions trading under the Kyoto Protocol and how the government can improve Hungary's environmental performance,* e.g. *through financing additional projects to reduce greenhouse gas emissions.*
- *Define a timetable for joining an emissions trading regime.*
- *Maximise transparency on environmental issues to encourage public acceptance.*
- *Continue to seek improvements in local pollutant emissions levels.*

Renewable Energy

- *Create a roadmap for renewable energy resource development, highlighting economic potential in priority technologies.*
- *Evaluate the added value of expanding technology co-operation through the IEA Implementing Agreements.*
- *Anticipate that the future level of support will gradually decline as viable technologies are identified and sustainable markets are developed.*
- *Work towards the introduction and development of market-oriented policy instruments as the mainstream for cost-effective exploitation of renewables.*

Fossil Fuels

Oil

- *Make sure that the relevant competition authorities continue to monitor whether oligopoly is developing in the regional market and if there is a need for regulatory action.*
- *Consider reducing the price distortion created by the relatively high excise duty on light fuel oil in order to diversify energy supplies for heating.*
- *Ensure the implementation of the law requiring that MOL submit the necessary data for the reporting requirement under international commitments.*

Gas

- *Adopt the proposed Gas Act as soon as possible to implement a stable regulatory tax and pricing regime as a means to reduce uncertainties for all market participants, including domestic gas producers.*

- *Price all gas in the wholesale market on a market-related basis.*
- *If the government decides to impose an "excess profits tax" to capture, for the public benefit, excess profits derived from gas production at facilities that have been fully written down, ensure that such a tax only captures genuine "excess" profits.*
- *Continue to monitor the effects on competition of existing TOP contracts, limited sources of supply and interaction with stranded costs.*
- *Set up the conditions to facilitate the decision by MOL (or others) to install additional gas storage facilities, keep this option under review in consultation with the MEH and allow tariffs to reflect storage costs.*
- *Address the social consequences of bringing gas prices to market-related levels through targeted social policy measures.*
- *Develop a contingency plan for possible supply disruption, to ensure that appropriate co-ordinated emergency arrangements are put in place to avoid gas supply shortfalls, and for the safe reconnection of consumers in the event of a gas supply shortfall.*

Electricity and Nuclear

Electricity

- *Give MAVIR more extensive responsibilities in the management and operation of the network and strengthen MAVIR's responsibilities as an independent system operator.*
- *Ensure that balancing services provided by MAVIR are priced on a competitive basis.*
- *Ensure that appropriate arrangements are made for MAVIR to monitor the adequacy of the transmission network cross-border interconnection capacity.*
- *Monitor the development of competition to avoid excess market power exerted by companies through long-term contracts.*
- *Address the problem of electricity pilferage.*
- *Review the arrangements for price caps as a means of price regulation, ensuring that social objectives are pursued through means other than energy prices.*
- *Strengthen the MEH's autonomy in regulating electricity.*

Nuclear

- *Take decisions on the nuclear waste disposal framework as soon as possible, consistent with a full safety assessment.*

- *Continue to ensure a high level of safety and maintain public confidence in nuclear plant operations, by securing the independent position of the Hungarian Atomic Energy Authority (HAEA) to regulate nuclear safety.*
- *Take the necessary steps to separate the management of the Public Agency for Radioactive Waste Management (PURAM) from HAEA in order to clarify the relationship between the safety regulator and the licensee.*

Research, Development and Demonstration

- *Design and implement a comprehensive energy RD&D strategy integrating the existing fragmented programmes and clearly setting priorities.*
- *Consider joining IEA Implementing Agreements.*

IRELAND

Since the last IEA in-depth review four years ago, a number of important developments have taken place in the Irish energy sector. Ireland has initiated reform of both the electricity and natural gas markets. While work remains to be done in this process, considerable progress has already been achieved. The basic regulatory framework for both markets has been established and an independent regulatory body has been put in place. In addition, in November 2000, Ireland published the National Climate Change Strategy (NCCS), providing a blueprint for the country to meet its Kyoto greenhouse gas targets. The country has begun implementing the policies and measures contained therein although much work remains to meet the challenging emissions target.

Concurrent with these two commendable developments has been a rapid increase in energy demand resulting from an impressive level of economic growth. This high rate of energy demand growth has occasionally strained the country's energy infrastructure and, while these constraints are generally being addressed, they increase concerns about the country's overall energy security. These concerns are fuelled in part by the country's lack of substantial domestic energy resources and consequent high level of imports. In 2000, only 15% of the country's energy came from indigenous sources. The country's relative isolation and lack of extensive international energy connections also exacerbate Ireland's vulnerability to supply disruptions and/or price spikes.

Market reform of the electricity sector began with the Electricity Regulation Act 1999 and was further advanced by the European Communities (Internal Market in Electricity) Regulations 2000 (S.I. 445 of 2000). Much of the impetus for this reform came from the need to comply with the EU directive on the internal market rather than from any parties within Ireland. Currently, all customers with annual capacity greater than 1 GWh per annum are free to choose their electricity supplier; this covers about 1 600 customers, or 40% of the market by volume. All customers, regardless of capacity, are free to source their power from a supplier who provides electricity from renewable sources or combined heat and power plants. Ireland envisions 100% market opening by 2005. The Commission for Energy Regulation (CER), a legally independent regulator, was established with a mandate to oversee important aspects of the market reform process. In addition, a transmission system operator has been established to operate and administer the country's high-voltage transmission lines. Any eligible party may gain non-discriminatory access to these lines at cost-based rates determined by the CER.

These developments are commendable and the reform process is certainly headed in the right direction. Nevertheless, a number of obstacles remain before Ireland can fully benefit from reform of the electricity sector. One major problem has been the lack of interest in the Irish market from viable, committed new entrants. While this absence can be ascribed in part to the poor global investment climate in the private power sector, much of it is related to the particular characteristics of the Irish market. For one thing, the Irish market is the smallest in the EU (excepting Luxembourg), making it less attractive for entry. While Ireland cannot, of course, arbitrarily increase the size of its market, it can effectively do so by augmenting connections with other markets, primarily Northern Ireland and, perhaps, Wales. Another perceived impediment to new entrants is the still dominant role played by the incumbent utility, the Electricity Supply Board. With regard to the company's vertical integration, ESB has assets and operations in the generation and distribution market segments, subsidiaries which sell to both regulated and unregulated end-users, and ownership of the country's national transmission grid. In addition, it appears that ESB still has some power to influence transmission system planning. The current arrangement for separation of grid operation and ownership should be carefully monitored. In terms of horizontal market concentration, ESB currently owns between 85 and 90% of the total national generating capacity. ESB has stated its commitment to reduce this percentage to 60% by 2005 but no obligation to do so exists and, in any event, such a large market share would still give the company market power to influence prices to its benefit. The government needs to review ESB's role in the liberalised electricity sector to address the impression that the company could unfairly influence the market to the disadvantage of new entrant competitors. In general, the government is encouraged to explicate more clearly its vision for the ultimate shape of the reformed electricity sector, as lingering uncertainty over the final shape of rules and regulations is also deterring new entrant competitors.

While continued improvement of the structure and regulations for a successful long-term market reform will continue to be important, the most pressing matter is the expected need for new electricity generating capacity in the short term. Since investment in a new generating plant by independent companies has been below expectations, the country could face a generation shortfall in 2005, or even possibly in 2004. Given the long lead times for developing and building large power stations, it is unlikely that a fully independent power plant will be on line in time to address this coming need. As a result, the government must take steps to encourage the required capacity to enter the market in time. It can do so by means of a capacity inducement such as a short-term or partial off-take contract. Such inducements would ideally bring a non-ESB plant to the market at a minimal cost to consumers without impeding the long-term development of a reformed, competitive electricity sector. As a concurrent development, demand-side management of electricity would reduce the need for new capacity.

Reform of the natural gas sector is also moving in the right direction. As of 1 January 2003, all customers with an annual demand greater than

500 000 standard cubic metres were free to choose their own gas supplier. This covers about 250 of the largest gas customers in Ireland, accounting for over 85% of the market by volume. The mandate of the legally independent electricity regulator has been expanded to include jurisdiction over gas market reform. In addition, regulated third-party access to the incumbent's transportation grid is guaranteed for all eligible customers.

These developments have been too recent to draw any meaningful conclusions regarding the success of the reform effort in the gas sector. While some of the largest customers are engaging in self-shipping, it remains to be seen whether the small or even mid-size customers will switch suppliers or negotiate lower rates with the incumbent. There have, however, been some positive signs that competition is developing. The production from a new domestic gas field has been sold to a new entrant who will use this gas to compete in the Irish market, and another domestic gas field is scheduled to come on-line in 2005, creating further possibilities for competition. Despite these desirable developments, Ireland's finite supply sources (gas from the United Kingdom and a limited number of domestic sources) make it unlikely that upstream competition could really give a substantial choice to eligible customers. Nonetheless, this limited upstream and retail competition should be beneficial and Ireland is encouraged to proceed with its reform efforts.

Passage of the country's National Climate Change Strategy (NCCS) in November 2000 was an important step towards addressing the country's climate change challenges. Under the EU burden-sharing arrangement in the Kyoto Protocol (ratified by the Irish Parliament in May 2002), Ireland must limit the net increase of its greenhouse gas (GHG) emissions to 13% above 1990 levels by the target period 2008-2012. As of year-end 2000, GHG emissions had already grown to 24% above 1990 levels and are believed to have grown since that time. Government projections show a 37.3% rise from 1990 levels by 2010 under a business-as-usual scenario.

The NCCS was designed as part of a consultative process with government, the private sector and consumer groups, and covers a wide range of emissions-producing sectors. Despite these important consultations, the lack of a comparative analysis of the cost-effectiveness of the different measures in the various sectors has made it unclear what the total costs of these measures would be or even if the least-cost measures are being pursued. One related problem is that no full projection of the economy and expected emissions reductions has been made that takes into account all the measures proposed in the NCCS. This should be done as soon as possible. The challenge of meeting the emissions target with domestic means alone makes it likely that Kyoto flexible mechanisms [emissions trading, Joint Implementation (JI) and Clean Development Mechanism (CDM)] will be needed to reach the country's target. While such mechanisms are discussed in the NCCS as important tools in reducing emissions, their integration into the overall climate change strategy is unclear. The manner and extent to which such international approaches to climate change will be used should be made more explicit, particularly as experience is gained.

The largest single measure proposed in the NCCS is to either shut down or fuel-switch the coal-fired Moneypoint power generating station. This one measure would account for 22% of the total GHG emissions reductions expected from NCCS proposals. It is not yet clear whether this measure will in fact be enacted, but the government is encouraged to make a decision on this matter as soon as possible. Not only will closure of the plant require the construction of substantial electricity generating capacity to replace Moneypoint, but if this and other fuel-switching measures in the NCCS are enacted, Ireland could use natural gas to generate up to 80% of all its electricity by 2010. Such a potential heavy reliance on gas raises energy security concerns that will require time to address.

A number of recent developments are impacting on Ireland's energy security. Continued uncertainty surrounding the reform of the electricity sector has deterred investment in power generation, and, as mentioned above, a push to eliminate coal-fired generation out of concern for GHG emissions may produce a power sector fuelled 80% by natural gas. In addition, recent economic growth has produced a rapid rise in energy demand which, in turn, has placed strains on the existing infrastructure. These developments, coupled with the country's modest fossil fuel reserves and relative isolation, raise legitimate energy security concerns that the country should continue to address.

The construction and commissioning of a new subsea natural gas pipeline from the UK shows not only the ways in which energy security can be enhanced but also the costs involved with such measures. Faced with an expected increase in gas demand by winter 2002, the government conducted a vigorous examination of the various options and decided to approve construction of a second subsea pipeline linking Irish demand centres with gas supply from the UK. While the added capacity of this second pipeline does in fact guarantee that there will be sufficient gas import capacity from the UK, the timing of the project appears to be premature. Gas demand has not risen as expected and the new pipeline is not likely to be required until 2005. However, the cost of the as yet unneeded second subsea pipeline (approximately €300 million) must be recovered now and is currently being borne by Irish gas consumers. This example shows that while there are in fact a number of ways to address energy security concerns, all the available options and their related costs must be considered carefully before being enacted.

While renewable energy does not currently make a substantial contribution to the country's energy mix, there is large potential, particularly in the form of wind power. Wind power is attractive since it provides emissions-free, domestically-sourced power, thereby addressing the country's climate change and energy security concerns. Ireland has taken steps to encourage renewables use, primarily through an auction process which offers long-term power purchase agreements to buy electricity from renewable sources. The country should facilitate the increased penetration of wind into the electricity system by examining the issues of system frequency stabilisation and back-up power that arise with substantial wind power use. The country should also ensure that all support schemes for renewables are market-based and include proper incentives to reduce costs.

Coal and peat play an important role in the country's energy mix. Together, they account for over 18% of the country's total primary energy supply (TPES), and over 36% of the country's electricity generation. While all coal is imported, its supply is considered very secure and hence, along with domestically-sourced peat, it can contribute to the country's energy security. Both fuels, however, have the disadvantage of high carbon content with correspondingly high CO_2 emissions. The role of these fuels in Ireland's energy mix must strike a proper balance between energy security and GHG emissions mitigation. Although greatly reduced in recent years, peat production is still supported by a subsidy ultimately borne by the consumer. The government should strive to achieve the most efficient level of peat production possible in order to minimise the level of subsidy.

Ireland has improved it energy efficiency dramatically over the last ten years with energy intensity falling by one-third from 1989 to 2000. This improvement was achieved by both government action and a shift in economic activity away from energy-intensive sectors. Efficiency improvements appear poised to continue with a variety of government programmes and initiatives already in place. Historically, Ireland had very low levels of combined heat and power (CHP) usage, but the government is now trying to encourage its use to improve overall efficiency. Transport, however, may provide the best opportunity to improve energy intensity, since an increase in energy use in this sector coincides with the need for a new transportation infrastructure. Thus, the new infrastructure can and should be designed in a way to minimise energy use and resulting emissions.

Ireland is taking a more proactive role in energy R&D than in the past. It has allocated €60 million[4] to this area for the 2001-2006 time period. Despite this commendable increase of resources, national expenditures remain modest by total EU standards. As a result, Ireland would be well served by an active participation in energy R&D activities at the international level, including participation in EU and IEA programmes. In addition, Ireland should try to involve the private sector in its R&D activities in order to leverage limited public sector funds and build capacity for R&D within private companies.

4. On average in 2002, €1 = US$ 0.943.

RECOMMENDATIONS

The government of Ireland should:

Energy Market and Energy Policy

- *Develop a long-term strategy for optimal energy supply mix striking an appropriate balance between energy security and climate change mitigation, noting a rapidly growing share of natural gas in the electricity sector.*
- *Promote international integration in electricity and gas to enhance energy security and competition, and facilitate integration with the single EU market.*
- *Continue to undertake energy supply-demand and CO_2 emissions projections, noting rapid growth in energy consumption and CO_2 emissions.*
- *Pursue social objectives by means other than energy policies, prices and taxation.*

Energy and the Environment

- *Undertake energy and emissions projection and analyses which include the National Climate Change Strategy (NCCS) policies and measures.*
- *Monitor and evaluate the cost-effectiveness of policies and measures in the NCCS and update it as required to achieve the Kyoto targets in the most cost-effective manner.*
- *Ensure that greenhouse gas mitigation measures cover all energy and non-energy sectors and reflect externalities for each source.*
- *Clarify the use and role of CO_2 taxation, emissions trading, Clean Development Mechanism (CDM) and Joint Implementation (JI) in the NCCS.*
- *Develop, with close co-operation among relevant departments, an effective framework for negotiated agreements and appropriate monitoring/reporting mechanisms based on experiences gained from pilot agreements.*
- *For the industrial and power generation sectors, clarify the interrelation amongst negotiated agreements, greenhouse gas taxation and emissions trading, especially in light of the proposed EC directive on emissions trading.*

Energy Efficiency

- *Evaluate existing energy efficiency programmes with the aim of strengthening efforts to improve energy efficiency in a cost-effective manner.*
- *Expand the cost-effective use of pricing and mandatory regulations to promote energy efficiency, for example in the transport sector.*

- *Continue to explore cost-effective mechanisms to promote combined heat and power (CHP).*
- *Enhance the public transport infrastructure in co-ordination with demand management measures to curb energy consumption and CO_2 emissions from the transport sector with close co-operation among the relevant departments.*
- *Explore measures to promote efficient low-CO_2 vehicles, particularly in the public transport sector.*

Natural Gas and Oil

- *Ensure that the regulatory framework facilitates continued monitoring of developments in the natural gas market and, where results do not lead to effective market opening and corresponding competition in the market, work out and adopt the necessary procedures to ameliorate the situation.*
- *Ensure continued adequate transmission capacity and non-discriminatory third-party access to the transmission grid.*
- *Develop a security of supply policy by defining minimum objectives and responsibilities of sector participants while allowing individual players the means to achieve these objectives. The costs of implementing all security of supply measures must be weighed against benefits.*
- *Continue to engage in international co-operation, including through the IEA, the Energy Charter, the EU, and the International Energy Forum (IEF), to support regional security of gas supply.*
- *Undertake efforts to streamline and shorten planning procedures for domestic exploration and production, including ensuring that the affected regions understand the value of production to the country and to their community.*
- *Review taxation of automotive fuels in light of fuel tourism and the consequent impact on GHG emissions.*

Electricity

- *Decide as a matter of urgency how best to ensure the construction of new generating capacity to meet the imminent supply shortfall. Ensure that this next increment of capacity is owned and operated by an independent power producer (IPP) to facilitate market competition.*
- *Continue process of strengthening the transmission grid, including around the north-south interconnection.*
- *Develop as a priority a clear vision for the overall market design and structure, with a firm implementation timetable to provide market certainty and encourage investment in new generating capacity.*

- *Monitor and amend if necessary the current arrangements for separation of the operation and ownership of the grid to ensure that the objectives of an efficient and secure grid continue to be met.*
- *Work towards a clear and coherent set of long-term market rules for trading, including providing for transparent, non-discriminatory market-clearing wholesale prices.*
- *Consider a means of dispersing control of ESB generation among competing companies, particularly for mid-merit (*i.e. *price setting) plant. Alternatives for break-up include privatisation, setting up competing state-owned companies (with independent commercial boards), or leasing or auctioning off management rights to individual plants.*

- *Take an early decision on whether the East-West interconnector will be constructed, taking into account supply security and competition concerns, in order to facilitate decisions on market structure and to provide market certainty, especially for new investors.*

- *Continue efforts to develop an all-island electricity market, including by increasing the usable capacity of the North-South interconnector, in the interests of security of supply and competition.*

- *Develop a clear policy on security of fuel supplies for electricity generation, including through diversity of fuels, generation technologies and dual-fuelling, to avoid over-dependence on imported gas in the long term.*

Renewable Energy

- *Develop a strategy to facilitate the increased penetration of wind power and other renewables into the national electricity market, taking into account back-up requirements.*

- *Ensure that any support schemes for renewables are market-based and incorporate proper incentives for further cost reduction.*

- *Continue to explore the potential for development of offshore wind parks, while taking into account the additional cost factors involved with grid interconnection.*

Coal and Peat

- *Evaluate the role of coal in the energy mix, striking a balance between energy security and greenhouse gas mitigation.*

- *Identify the impact on greenhouse gas emissions of the full cycle of peat production and use.*

- *Ensure that Bord na Mona (BNM - the state-owned peat company) continues to improve peat production efficiency in order to reduce peat subsidies and the distortive effect this has on the market.*

- *Keep under review the role of peat in the energy supply mix taking into account its contribution to energy security, impacts on the electricity market and greenhouse gas emissions.*

Energy R&D

- *Prioritise activities on a limited number of projects and concentrate resources on them with a view to meeting national energy policy objectives.*
- *Engage in active participation in R&D activities on the international level, including participation in EU and IEA programmes.*
- *Stimulate co-operation between the public and private sector in R&D areas such as demonstration projects in the transport sector.*

ITALY

Italy's energy policy is currently driven by market liberalisation, transfer of relevant political and administrative decision-making powers to the regional authorities, diversification of supply sources, energy security, efficiency improvements and environmental protection.

Since the last IEA in-depth review, Italy has made significant progress in implementing electricity and gas market reforms and in restructuring its energy industry. The European Commission directives for electricity and gas market liberalisation have been transposed into legislation. Large state-owned energy companies began to be privatised and the government reduced its shares in both ENEL (electricity) and Eni (oil and gas). New institutions, including an energy sector regulator, are now fully operational, which will ensure a much more market-oriented energy economy, in line with the IEA Shared Goals. Italy ratified the Kyoto Protocol in June 2002 and on 19 December 2002, released the first national action plan for the reduction of greenhouse gas (GHG) emissions, the Revised Guidelines for National Policies and Measures Regarding the Reduction of Greenhouse Gas Emissions.

In Italy, as in other IEA member countries, the simultaneous achievement of energy security, market liberalisation and climate change mitigation is not easy given the sometimes contradictory nature of these objectives. Diversification of energy sources is particularly challenging in this respect. Italy's energy mix is shifting from oil to more use of gas, with little probability of rapidly diversifying much further owing to the limited growth of renewable energy, local resistance to coal and the fact that the nuclear option was abandoned in 1987. Significant reliance on oil and gas, including from external supply sources, raises concerns about security of supply and the risk of high energy costs.

Timely investment in energy production, transportation and interconnection is essential to secure energy supply and more active competition. Italy's high level of local resistance to new infrastructure is becoming increasingly serious in the context of the transfer of power to local authorities. Uncertainties regarding responsibilities for clearing new energy projects and complexity in the authorisation procedures are consequences of the legal changes initiated to enable decentralisation. From April 2002, the government introduced a fast track procedure for new electricity generating plants (Sblocca Centrali), thereby streamlining the decision-making process.

Despite Italy's target to reduce GHG emissions by 6.5% between 1990 and 2008-12, energy related CO_2 emissions have been constantly growing and in 2000 were already 6.5% above the 1990 level. Italy's carbon intensity measured as CO_2 emissions per unit of gross domestic product (GDP) is relatively low, owing to high energy prices, a low energy-intensive industry structure and a mild climate. Lower energy prices resulting from market liberalisation and growing energy demand in the transport sector could erode this advance. Italy faces the challenge to define coal's role in the electricity sector, striking a balance between climate change mitigation, energy security and the urgent need to reduce power generation costs. The domestic measures considered in the scenarios of the Inter-Ministerial Committee for Economic Planning (CIPE) deliberation of 19 December 2002, together with the full utilisation of sinks and the Kyoto flexible mechanisms will allow Italy to achieve its GHG emissions reduction target, provided the corresponding projects and funding are clarified and implemented without delay.

Italy's energy intensity measured as total primary energy supply (TPES) per unit of GDP remains low. This is commendable, but it is imperative to identify to what extent it has been achieved as a result of effective energy efficiency policy efforts or because of structural changes induced by the economic environment and high electricity prices in Italy, and to ensure that all possible measures are implemented to maintain Italy's advance. In 2001, in addition to the existing efficiency standards, the government introduced and defined for each year up to 2006, tradable energy saving obligations to be applied to both electricity and natural gas distributors. Details still need to be finalised before this new scheme becomes fully operational.

Italy is moving away from using fixed feed-in tariffs for renewable energy to a more market-oriented minimum quota obligation scheme with tradable green certificates. This should increase the amount of renewable energy in a country where, despite its significant potential, renewable energy represented only 5.4% of TPES in 2000. While this is a positive step in promoting renewable energy in a compatible manner with market liberalisation, several challenges and uncertainties need to be addressed to secure its effectiveness. The government's intention to monitor this new mechanism is wise.

Italy is highly dependent on external sources for its oil supply. It does have the potential to increase its domestic oil production; however, demand far exceeds potential supply. The complex administrative procedure required to conduct exploration and production investments has led to delays and additional costs for the expansion of domestic production. Italy has an important role as a refining centre, the first in Europe, selling a large part of its products to other countries in Europe. The oil market is free and the government is to be commended for its continued efforts to stimulate competition in the markets. After several years' non-compliance with the International Energy Program (IEP) obligation to hold sufficient strategic oil stocks, the government is correcting the situation. Italy has been satisfying the obligation of 90-day net imports equivalent in stocks during the first half of 2003. It now has to ensure a continuous compliance.

The Italian gas market has developed rapidly, mainly because of the increased use of gas in power generation. Given that this additional gas must be imported, diversification of gas supplies has been an important policy objective. Italy's potential as a growing gas market is huge. The reform of the gas market is moving in the right direction. The 2000 Italian decree implementing the European Commission (EC) directive on the single market for natural gas goes far beyond the minimum requirements established by the EC gas directive. The Energy Authority (Autorità per l'Energia Elettrica e il Gas, AEEG) has compiled rules for market opening and established tariffs for transportation, regasification, storage and distribution. The Energy Authority promotes the development of gas trading hubs. This development would provide Italy with the opportunity to improve security of supply and the option to become a key trading centre for the Mediterranean region. From a legal viewpoint, the Italian market is now fully opened; however, Eni remains in a dominant position and barriers still exist for new entrants. Access to external supply is difficult for small companies unlike large or international companies. Saturation of the existing import pipelines creates an additional entry barrier. Only competitors with capacities to establish their own import facilities, such as liquefied natural gas (LNG) terminals, will be able to compete on an equal basis with Eni. The government needs to encourage investment in LNG terminals and cross-border gas pipelines delivering gas to Italy to secure success of gas market liberalisation and security of supply. Given the potential for domestic gas extraction and the current decline in domestic production, the national strategy for gas exploration and production needs to be intensified. However, local authorities strongly oppose the realisation of this objective.

Since the 1999 in-depth review, Italy has continued to liberalise the electricity market. ENEL was partially privatised and part of its generating capacity was divested to reduce its share in electricity supply to less than 50%, which enabled new participants to enter the market. In May 2003, the retail electricity market was liberalised up to 50%, with full liberalisation planned for 2007. Production and importation activities were fully liberalised from the beginning of the reform process in 1999. Transmission networks were legally unbundled and a transmission system operator (TSO) was established. A market operator was created to facilitate the development of the wholesale electricity market. These arrangements have led to Italy being considered one of the EU countries with the most rigorous conditions for network unbundling. Despite recent progress, current developments in the generating capacity may hinder the achievement of public objectives, such as electricity mix diversification, unit production cost reduction and sufficient electricity supply. This could occur either because the investment plans do not materialise, making it difficult to secure sufficient supply at a lower unit cost, or because they increase the dependency of an even larger portion of the generating capacity on natural gas. While the market is developing with new participants, there are still challenges to avoid abuse of dominant position by the incumbent.

It is commendable that in 2000 the government, largely in line with the conclusions of the 1998 National Conference on Environment and Energy, shaped a new energy R&D policy under the National Research Programme. This resulted in new research priorities and focus on the public R&D budget and prepared the way for a reform of the National Agency for New Technology, Energy and Environment (ENEA).

RECOMMENDATIONS

The government of Italy should:

General Energy Policy

- *Strengthen the national energy strategy on the basis of energy supply and demand scenarios, integrating in a balanced and consistent way the main policy objectives, namely security of supply, reform of the gas and electricity markets and climate change mitigation.*
- *Enhance the visibility of the national energy strategy and the dissemination of energy information on the national energy situation and future challenges to the general public.*
- *Co-ordinate with the Ministry of Productive Activities the actions of relevant ministries in the implementation of energy policy.*
- *Put more emphasis on achieving energy diversification, especially in the electricity sector in order to improve security of supply and reduce electricity generation cost.*
- *Clarify the respective roles and competences of the regional authorities and the government in implementing energy policy. Encourage the regional authorities to develop regional energy plans consistent with the national energy strategy.*
- *Keep the necessary tools to guarantee that investments needed in energy production, transportation and particularly interconnections with European and world markets are achieved in a timely manner and are not subjected to excessive bureaucratic procedural delays.*
- *Continue the liberalisation of the electricity and gas markets. Ensure that newcomers compete on a fair and equal basis with the gas and electricity incumbents. Evaluate the progress of the liberalisation process through benchmarking.*
- *Confirm the independence of the Energy Authority.*

- *Increase transparency of information on the energy market by circulating non-confidential market information to all energy stakeholders.*

Energy and the Environment

- *Implement the national action plan to reduce GHG emissions with least cost measures in order to fill the remaining gap to achieve the Kyoto target. Monitor the progress in reaching this target. Strengthen co-ordinated efforts for CO_2 emissions mitigation.*
- *Reassess the contribution of voluntary agreements (VAs) to emissions reduction, taking into account the forthcoming EU emissions trading system.*
- *Monitor and analyse the effects on emissions of the planned increase in coal use for electricity generation, the changes in carbon tax design/structure and the projected end-use energy price changes.*
- *Strengthen the strategy to disseminate energy efficiency technologies and measures to small and medium-sized enterprises.*

Energy Efficiency

- *Monitor and evaluate the impact and cost-effectiveness of existing and new energy efficiency policies with a view to maintaining low energy intensity in the changing energy market environment.*
- *Promote effective co-ordination between the regional authorities and the government in all areas of energy efficiency. Facilitate sharing of best practices among the regional authorities and the government through information dissemination by ENEA.*
- *Integrate energy efficiency objectives in pursuing the transport policy, in areas such as modal shift and transport infrastructure development, through enhanced co-ordination among relevant ministries (energy, environment, finance and transport).*
- *Accelerate the elimination of old vehicles and promote more efficient low-emission vehicles, in particular trucks, buses and two-wheelers through regulatory (*e.g. *periodic inspection) and economic measures (*e.g. *tax incentives, review of tax exemptions on fuel for commercial transport).*
- *Decrease the share of individual road transport in urban areas through efforts to boost the quantity and quality of collective transport.*
- *Finalise details of, and implement, the energy efficiency certificate as soon as possible, and review it periodically. Publish information on the results and impacts of the scheme as early as possible to keep energy policy*

stakeholders, both inside and outside Italy, informed about the unfolding of this policy experiment.

- *Actively participate in co-operation at EU level in setting efficiency performance requirements for energy labelling and energy performance standards for appliances, equipment and buildings.*

Renewable Energy

- *Increase the share of renewable energy in domestic production to improve energy security and CO_2 mitigation. Increase the renewable energy obligation above the current level.*
- *Facilitate access to the capital market for renewable energy projects and green certificates that will eventually increase the profitability of renewable energy projects.*
- *Streamline authorisation procedures for setting up renewable energy projects.*
- *Ensure an effective and balanced contribution from all the regional authorities to achieve the national renewable energy target, particularly with regard to informing the general public about the possible use of renewables and access to stimulation programmes.*
- *Ensure that ENEA provides sufficient information and expertise to the regional authorities and the general public about funding possibilities and support mechanisms.*

Oil

- *Given the potential for extraction of domestic oil resources and the current decline in domestic production, enhance and improve the national strategy for oil exploration and production.*
- *Given the ongoing devolution process of power and the security of supply constraints, ensure that the granting of upstream licences for exploration and production does not meet unnecessary obstacles.*
- *Continue to engage in international co-operation with producing and transiting countries through different global and regional forums to reinforce security of supply.*
- *Considering the importance of the IEA emergency preparedness mechanism, ensure that the recent improvements to meet the 90-day IEA stock obligation are sufficient to guarantee permanent compliance.*

Natural Gas

- *Continue the unbundling of the transportation and supply businesses to ensure equality of treatment.*
- *Proceed with gas market liberalisation by defining rapidly clear rules, especially for access to storage (Storage Code), LNG terminals (LNG Code) and distribution (Distribution Code).*
- *Encourage the development of the virtual gas hub (National Balancing Point) to facilitate the exchange of gas between shippers and to foster competition.*
- *Enforce a strict regulatory control to prevent abuse of a dominant market position. Preserve the independence of the Energy Authority and streamline the decision process inside the Energy Authority to ensure that it produces the missing codes in the shortest possible time.*
- *Continue to encourage geographical diversification of gas supply.*
- *In the new framework of market liberalisation, update and develop a policy of gas supply security, defining minimum criteria and the responsibilities of individual players.*
- *Given the potential for extraction of domestic gas resources and the current decline in domestic production, enhance and improve the national strategy for gas exploration and production.*
- *As a prerequisite for the success of gas market liberalisation and security of supply, encourage investments in LNG terminals and cross-border gas pipelines delivering gas to Italy. Streamline authorisation procedures for LNG terminals and pipelines. Encourage investments in storage by providing the appropriate tariff incentives.*
- *Assess the costs and benefits of the strategic storage reserve obligation for shippers importing from non-EU countries and consider if the portfolio of flexible tools could be expanded to allow the same level of security of supply at a lower cost.*

Electricity

- *Consider the possibility of reopening a public debate on the nuclear energy option in light of current and future energy policy challenges.*
- *Monitor and publish regularly information on the electricity sector reserve margin and consider additional investment incentives to avoid blackouts in the coming years. Expand the role of the transmission system operator (GRTN) and of the Energy Authority to support the government in this respect.*

- *Analyse options to provide incentives in the transmission and distribution tariff to ensure investment in new transmission capacity.*
- *Further streamline authorisation procedures for building electricity infrastructure.*
- *Expand interconnection for electricity imports.*
- *Encourage dissemination of information to local authorities and communities on electricity projects.*
- *Continue the electricity market liberalisation process, enforcing strict regulatory control to prevent abuse of dominant market position and maintaining the independence of the Energy Authority.*
- *Enable the power exchange to begin its operations as rapidly as possible, facilitate measures that aim to increase its liquidity and create a surveillance structure to avoid abuse of market power.*
- *Ensure independence of the power exchange (GME) and the single buyer (AU) from the transmission system operator (GRTN) and monitor the latter's market power once it has been privatised and GME and AU are fully operational.*
- *Organise the sales of ENEL's transmission assets to GRTN.*
- *Increase international co-operation in the decommissioning of nuclear power plants.*

Research, Development and Demonstration

- *Continue to provide sustainable budgetary support to energy research and development (R&D).*
- *Consider making clear priorities in public R&D. Provide special attention to clean coal technology and the improved efficiency of coal combustion.*
- *Improve the co-ordination of research and development projects and the dissemination of their results to the regional authorities.*
- *Urge ENEA to join the IEA Implementing Agreements on solar concentration.*

JAPAN

Since the last in-depth review in 1999, the major developments in Japan's energy policy have been partial liberalisation of the electricity market, new steps in gas market liberalisation, the ratification of the Kyoto Protocol and development of an enhanced policy package to achieve the Kyoto target. However, balancing the "3 Es" (energy security, economic development and environmental sustainability) remains a challenge.

The most recent *Long-Term Energy Supply and Demand Outlook* up to 2010, which forms the basis for the government's policy package to achieve the "3 Es", was published in 2001. It is important that Japan continues to update it with sensitivity analyses as the first Kyoto commitment period approaches. The timeframe beyond 2010 could also be considered in the next review of the *Outlook*.

ENERGY SECURITY

Japan is making great efforts to ensure security of supply by diversifying its energy mix away from oil. Furthermore, oil stocks exceed the IEA stockholding obligation, many flexibility tools (such as supply diversity and possibilities for fuel-switching) are used for natural gas, and policies to promote nuclear power and renewables help towards diversification. However, growing oil import dependence from a single area is still a concern. Japan is also encountering new issues of energy security. The disruption in gas supply from Arun (Indonesia) shows a potential security threat as the share of gas is increasing in the fuel mix. The outage of TEPCO nuclear plants is another example. In addition, sharpening summer peak demand for electricity may cause a risk in matching demand and supply. Energy security issues are more critical in Japan than in most IEA countries owing to its isolated location and limited domestic energy resources.

ENVIRONMENT

In June 2002, Japan ratified the Kyoto Protocol with a commitment to achieve a 6% greenhouse gas emissions reduction from 1990 levels by 2008-2012. This is a challenging target since in 1999, emissions were 6.8% above the target year levels. The path towards the target has been laid down by the government in the "New Guideline for Measures to Prevent Global Warming" of March 2002.

Japan's CO_2 emissions per capita and per unit of GDP are good compared with the IEA average and the country has developed an impressive range of policies to address its rising CO_2 emissions from the energy sector. These include the innovative Top-Runner Programme to encourage manufacturers to develop more efficient technologies, energy efficiency labelling, new technologies (*e.g.* the Home and Business Energy Management Systems), voluntary energy performance standards for buildings and portfolio standards for renewable energies. However, some of the measures could be strengthened with energy efficiency labelling extended to a wider range of appliances and energy performance standards made mandatory for new buildings and extended to refurbishment of existing buildings. One of the key measures is Keidanren's (Japan Business Federation) Voluntary Action Plan for stabilising industry's emissions by 2010. A major question will be whether the objective will be met if industrial output recovers from the current recession. Nuclear power is important to the country's climate change policy but its increased use depends on several issues which are discussed below. The recently introduced tax on coal, liquefied natural gas (LNG) and liquefied petroleum gas (LPG), albeit not targeted to lower CO_2 emissions and relatively modest, corrects the heavy focus on oil taxes while coal and gas imports have been untaxed up to now. Since the marginal cost of emissions reduction by domestic means is increasing, the participation of industry in international emissions trading and other Kyoto mechanisms would be welcome, as it may give access to the cheapest mitigation options available in Kyoto Protocol Parties.

Nuclear power has a central role in Japanese energy policy both in terms of security of supply and climate change mitigation. Nuclear power is also broadly competitive with other electricity generation forms in Japan. The government's target is to increase nuclear generation by 30% (equivalent to 10-13 new nuclear plants) between 2000 and 2010. This target, however, has become more difficult to reach because of safety-related incidents in recent years, undermining public confidence and jeopardising energy security after significant plant outages. The first challenge is to restore public confidence. Secondly, since the load factor of Japanese nuclear power plants is much lower than the best performers in the world, more attention should be given to shortening the statutory and other outage periods and reducing their frequency. A third challenge is to ensure the role of nuclear power in liberalised electricity markets, a subject that has not been addressed in the recent debate on further market reform in the electricity sector.

ECONOMIC EFFICIENCY

While energy security and environmental issues have been well addressed in Japan, more needs to be done to improve economic efficiency, including efficiency in the energy markets and cost-effectiveness of government policies. Japanese energy policy includes a complex web of financial and fiscal incentives to encourage certain energy supplies and end-use technology choices. It is not clear how well these mechanisms are working individually or collectively. Japan should develop a comprehensive map of all the various incentives and disincentives – financial, tax, regulatory, R&D, etc. – to determine the cost-effectiveness of these measures and rationalise these policy options for maximum impact and leverage.

Despite some recent reductions, energy prices in Japan are still among the highest within IEA member countries. To increase market efficiency, the government has launched market reform. This process is most advanced in the oil sector which has been fully liberalised. However, the implications have not yet been fully ascertained because the industry is still in the middle of restructuring which involves closing excess refining capacities and rationalising retailing.

Natural gas market liberalisation started in 1995 and some 39% of the market is now open. If measured in terms of the market share by new entrants, *i.e.* 2% of the liberalised market segment in March 2002, little competition has emerged. The government has recognised the need for further action to fully capture the potential benefits of market reform and announced new measures such as the introduction of regulated third-party access (TPA) to the pipelines and the promotion of negotiated TPA to the LNG terminals. These appear helpful but their effectiveness needs to be closely monitored and corrective measures need to be introduced promptly if competition does not develop. Expansion of the domestic gas network is also a challenge to further introduction of natural gas, enhancing security of supply and competition.

Electricity market reform was initiated in March 2000. At present, 30% of the market has been opened for competition and regulated TPA has been introduced. Some price reductions have taken place for both liberalised and captive consumers, mainly because of low interest costs, but price positioning due to market liberalisation may also have had an impact. Because new entrants are having difficulties in entering the market and there is little revealed competition between the incumbents, the government has announced further steps. Many of the proposed measures, including clearer criteria for TPA tariffs, removal of pancaking[5], establishment of national power exchange and relaxation of balancing power rules, can help make market access easier, fairer and more transparent. However, the proposal does little to address the fact that the incumbents are very large and powerful companies with significant market powers compared to new entrants. Given the slow entry rate, competition between the incumbents has to be fostered. The effectiveness of the planned unbundling arrangements, the "neutral transmission organisation" and the regulatory institutions should be ensured. If competition does not develop, stronger measures such as establishing an independent national transmission system operator should not be precluded. Furthermore, the weak interconnection between most supply regions should be strengthened to facilitate competition and ensure energy security.

5. Pancaking means that two or more access charges are collected in electricity transactions when two or more transmission systems are used.

In short, the report suggests that there is room for improved economic efficiency in the whole energy field, provided good measures are taken and implemented.

RECOMMENDATIONS

The government of Japan should:

General Energy Policy

- *Develop integrated measures – beyond oil stockpiling – to address the security of supply issues arising from Japan's isolated location, high import dependence, electricity transmission bottlenecks and lack of a trunk network for gas transmission.*
- *While recognising energy security is of the utmost importance for Japan, implement further steps in market reform to ensure a level playing field.*
- *Continue to review 2010 projections in the* Long-Term Energy Supply and Demand Outlook *and carry out sensitivity analyses and consider preparing projections beyond this time frame.*
- *Evaluate the cost-effectiveness of subsidies, fiscal incentives and R&D in support of energy policy goals.*
- *Assess the fuel tax revision with a view to clarifying its objectives and ensuring their cost-effective achievement.*
- *Ensure the timely availability of good quality statistical information to all interested parties, including international organisations.*

Energy and the Environment

- *Address foreseeable and unforeseeable changes in reviewing the* New Guidelines of Measures to Prevent Global Warming *in 2004.*
- *Continue to monitor the GHG emissions, in particular in the transport and electricity sectors, and take further action, if necessary, both domestically and through the Kyoto flexible mechanisms to close the gap with the Kyoto target.*
- *Continue to closely follow progress under the Keidanren's "Voluntary Action Plan on the Environment". Consider encouraging companies to take further actions, including the use of Kyoto mechanisms. Monitor the seemingly rising emissions from businesses outside the Action Plan.*

- *Consider how Japan can take advantage of possible international emissions trading to ensure cost-effective climate change mitigation and lower adverse economic impacts.*
- *Select climate change mitigation measures – including for other GHGs – taking into account their cost-effectiveness and their contribution to energy security.*

Energy Efficiency

- *Assess the efficacy of combining energy efficiency standards/guidelines with subsidies.*
- *Strengthen the standards for appliances and vehicles in the Top-Runner Programme by:*
  - *Considering other approaches to set new standards, such as minimum life-cycle cost or using the international appliance market to identify the top-runner.*
  - *Making labelling mandatory and extending it to a wider range of products.*
  - *Considering different approaches for vehicles to avoid a shift towards increased weight, such as by basing the top-runner on the consumption of the average fleet or by engine size.*
- *Examine the possibility of introducing mandatory efficiency standards for new residential and office buildings, intensify the efforts in certification of new buildings and develop a certification scheme for existing buildings.*

Fossil Fuels

- *Continue addressing security of fossil fuel supply by encouraging the procurement of fuels from diverse sources and creating favourable international relations.*
- *Ensure consistency with the energy security goals in setting up the new entity replacing Japan National Oil Corporation.*
- *Evaluate the cost-effectiveness of Japan National Oil Corporation's operations and take this into account in establishing its successor which should also function consistently with the competitive energy markets.*
- *Ensure real competition in the petroleum market and see to it that consolidation and mergers will not hamper it.*
- *Facilitate further restructuring of refining and retailing sectors to improve efficiency.*
- *Encourage the commercial demonstration and deployment of advanced coal power plants that have higher efficiency and lower GHG emissions.*
- *Stimulate the development of trunk pipelines for natural gas.*

- *Introduce account unbundling between pipeline transmission/distribution of gas and other activities of gas companies.*
- *Reduce regulatory barriers for new entrants to acquire customers in franchised areas.*
- *Follow closely the effectiveness of efforts to promote third-party access to LNG terminals. If the measures are not adequate to ensure effective competition, consider implementing TPA obligation.*

New and Renewable Energy Sources

- *Review in due time the implementation of the renewable portfolio standard to ascertain its effectiveness and what further measures may need to be taken.*
- *Taking account of their potential energy security and GHG benefits, ensure renewables have access to the grid as envisioned for nuclear power.*

Nuclear Power

- *Address safety-related shortcomings, paying particular attention to ensure the effective working of the Nuclear and Industrial Safety Agency and the new organisation, Japan Nuclear Energy Safety Organisation.*
- *Work to restore public confidence in nuclear energy, especially by addressing the political tensions between national and local governments.*
- *Maintain efforts to improve nuclear plant availability, particularly of the boiling water reactor tranche.*
- *Clarify the role of nuclear power in the liberalised market and the respective responsibilities of government and industry in meeting its back-end costs.*
- *Pursue the ultimate disposal of high-level radioactive waste, seeking appropriate sites through enhancing acceptance of its nuclear policy.*

Electricity

- *Promote pricing mechanisms and other demand measures which help moderate peak loads.*
- *Ensure an effective level of unbundling to facilitate fair and effective competition. As a first step, immediately implement the account unbundling and "information firewalls" for separation of transmission from generation and retail activities to level the playing field between incumbents and new entrants. If fair and effective competition does not emerge, the government should not preclude establishing a single independent transmission system operator to manage the national network.*

- *Strengthen the regulatory framework with emphasis on an* ex ante *basis. Ensure the independence of the regulatory authority from industry and the industry development activities of METI, and as a second step, assess the benefits of creating a regulator completely independent from the Ministry of Economy, Trade and Industry (METI).*

- *Foster the strengthening of an inter-regional transmission grid in a cost-effective way, particularly between the two frequency areas, to improve security of supply and facilitate effective competition. Improve the possibilities for access to interconnections by measures such as auctioning the capacities.*

Research and Development

- *Continue to pursue a balanced portfolio of R&D with due attention to adequate support for long-term R&D.*

- *Seek an increasing cost-sharing from industries where possible, especially when they benefit from successful R&D.*

SWITZERLAND

Disclaimer

This report is based on the IEA review team visit to Switzerland that took place in November 2002. It was drafted prior to the results of the 18 May 2003 public vote on popular initiatives on nuclear power and the publication of the government's plans for electricity market reform.

On 18 May 2003, the general public rejected both the Moratorium Plus initiative with a 58.4% majority and the Power without Atoms initiative with a 66.3% majority. Consequently, the nuclear energy law can now be implemented, which implies further operation of existing nuclear plants as long as security allows and submission of new plants to public vote if a referendum is requested.

On 7 March 2003, the government announced plans to introduce a new law to reform the electricity market. In April 2003, it established a commission with representatives from all interest groups to plan the new law. This law should enter into force by mid-2007 at the latest.

In May 2003, the government proposed a plan to reduce the federal budget deficit, which would involve cutting the total budget of SwissEnergy. The government considers that this cut could be compensated by implementing new regulations or by imposing an energy tax, the revenue of which would be earmarked for SwissEnergy.

The Energy 2000 Action Programme (Energy 2000) was the core of Swiss energy policy in the 1990s. It is succeeded by the SwissEnergy Programme (SwissEnergy) for the period 2001 to 2010. Energy 2000 had concrete objectives for electricity and fossil fuel consumption, increasing the use of non-hydro renewables and hydropower as well as upgrading the capacity of nuclear power plants. The totality of the Energy 2000 objectives were not achieved principally owing to inadequate funding, lack of energy efficiency regulation, excessive reliance on voluntary measures that were inadequately taken by industry and the cantons' different degrees of implementation of federal energy efficiency recommendations. Performance and cost-benefit of the Energy 2000 policies and measures were carefully monitored and the experience gained was transferred to SwissEnergy, as demonstrated by the reallocation of certain resources. Additional reallocation may be required between renewables and energy efficiency programmes and measures. Given that the cantons have an important role in implementing SwissEnergy, particularly in the building sector, results of the cost-benefit analysis of different policies and measures as well as "best practices" should be widely shared and, where possible, harmonised between the cantons.

Security of supply is important for Switzerland, which is a landlocked country lacking fossil fuel resources. The government has a robust programme to ensure oil supply security, including its full compliance with the IEA 90-day obligation of net oil imports. Natural gas supply security is enhanced through the large number of interruptible contracts and compulsory stocks of heating oil, which are additional to the international stockholding obligations.

Within the IEA's 3 Es (Energy security, Economic development and Environmental sustainability), environmental issues are the priority of Swiss energy policy. Switzerland principally envisages to use actions implemented in the energy sector to achieve its Kyoto target of a reduction of greenhouse gas (GHG) emissions by 8% below 1990 levels by 2008 to 2012. SwissEnergy calls for a 10% reduction in carbon dioxide (CO_2) emissions below 1990 levels through reductions of consumption of combustibles by 15% and motor fuels by 8%. A variety of measures are proposed to meet these targets, including the development of voluntary commitments (VCs) and voluntary agreements (VAs) with industry and the imposition of a CO_2 "incentive" tax should other measures fail to bring about adequate reductions. Other measures include promotional activities and information dissemination programmes for industry, as well as regulations and standards for buildings, vehicles and electrical appliances.

Despite considerable efforts, the policies and measures still do not seem to be adequate to meet the Kyoto target or the more stringent national target for CO_2 reductions; according to IEA statistics, Swiss energy-related CO_2 emissions increased by 5.6% during 1990 to 2001. This issue may be better addressed if and when the CO_2 "incentive" tax is imposed but work needs to proceed promptly if this instrument is to be available in the near term. The government should further develop emissions trading and other flexible mechanisms given their potential economic benefits, even if these are only intended as supplementary and back-stop alternatives to domestic reductions. In this context, consideration might be given to whether a portion of the tax revenues could be devoted to purchasing GHG emissions permits from the international market.

Energy pricing and taxation needs to be reviewed. Swiss heating oil prices are among the lowest in OECD member countries, partly because of the very low share of taxes by international comparison. This encourages neither energy saving nor the use of alternative energies with lower CO_2 emissions. Gasoline prices in Switzerland are lower than in neighbouring countries, leading to some "fuel tourism". On the other hand, natural gas prices for all consumers are among the highest in IEA member countries owing to rough topography, small market size, low connection density and the fragmented market structure. This discourages market penetration of natural gas. Electricity prices in Switzerland, particularly for small and medium-sized enterprises, are higher than European averages. This is partly explained by the taxes and charges set by the cantons and municipalities. Concerns exist regarding the efficiency of the operation of many publicly-owned small utilities and the profits they secure for their owners. The current price-setting mechanisms lack transparency and enable cross-subsidies from one consumer group to another. Some electricity is supplied free of charge or at low charge to local authorities, therefore jeopardising energy efficiency.

In 2001, nuclear power accounted for 25% of Switzerland's energy supply and 38% of power generation. In March 2003, the Federal Parliament endorsed a new Nuclear Energy Act that updates the current law from 1959. The law will do much to clarify the future role of nuclear energy in Switzerland. For economic, energy security and climate change mitigation reasons, the nuclear option should be kept open. Switzerland has interim storage of nuclear waste from nuclear energy production in Zwilag, with sufficient capacity for the expected lives of the current operating fleet; however disposal options still need to be defined. In 2002, voters in Nidwalden rejected the siting of an underground laboratory for the disposal of low- and intermediate-level nuclear waste. Despite this setback the government needs to continue to develop solutions.

A special feature of the Swiss political system is that citizens can approve legislation through referendums. Given the far-reaching impact of the referendums, it is vital that citizens are adequately informed on policy issues and the consequences of their votes. A public referendum on the Electricity Market Law (EML) was held in September 2002. The law proposal was rejected despite a broad political consensus. The government and market players are currently debating how the electricity market could develop; at the time of the IEA review team visit, no clear path had emerged. While respecting the results of the EML vote, the government should continue to incite competition in the market. An initial step could focus on allowing competition in the wholesale market by permitting the largest consumers and distribution companies to choose their suppliers. An independent regulator and an independent transmission system operator (TSO) should be established. The TSO could enable greater efficiency in the management of the transmission system and in cross-border trade and transit. Effective unbundling is necessary to ensure transparent and non-discriminatory third party access (TPA).

The government also initiated legislation for gas market reform but the project was abandoned following the results of the public referendum on the EML. The gas industry is currently defining how to enable access within the present legislation, which allows negotiated TPA to high-pressure networks. This is commendable, but the government should step up its activities in monitoring the market and settling disputes in order to ensure transparent, fair and fast network access for both incumbents and new entrants. Routes to appeal should be defined and the decisions should come into force immediately in order to avoid incumbents delaying network access, for example by entering into lengthy court processes.

RECOMMENDATIONS

The government of Switzerland should:

General Energy Policy

- *Ensure a better balance in the overall energy policy by emphasising economic efficiency.*
- *Optimise the overall effect of the energy programmes and the use of resources by:*
  - *Developing programmes to assess the costs, benefits and "best practices" of energy policy implementation among and within the cantons;*
  - *Continuing the vigorous monitoring and cost-benefit assessment activities at federal level;*
  - *Reallocating resources to the most cost-effective policies and measures; and*
  - *Continuing to support the harmonisation of the cantons' energy and environmental programmes.*
- *Increase focus on pricing and taxation as energy policy tools in order to internalise the externalities and promote economic and energy efficiency.*
- *Increase public awareness of the consequences of energy-related popular initiatives and law proposals by analysing their potential impacts and communicate these to the general public.*
- *Develop and regularly update energy and CO_2 projections and scenarios for all sectors and fuels.*

Energy and the Environment

- *Take additional action to meet the GHG emissions reduction targets.*
- *Review energy-related climate change mitigation policies with a view to balancing efforts as the current focus on energy efficiency and renewables may not prove to be the most cost-effective solution.*
- *Develop implementation plans for the CO_2 "incentive" tax and emissions trading.*
- *Evaluate the effectiveness of VAs and VCs and envisage the possibility to extend them to all energy-intensive sectors, including oil refineries.*
- *Develop additional support programmes for the cantons to assist them in setting and implementing vehicle taxes that are proportional to CO_2 emissions, and federal programmes to support the innovative use of cleaner fuels in the transport sector.*

Energy Efficiency

- *Ensure clear allocation of responsibilities between the Confederation, the cantons and the various energy agencies. Aim to harmonise policies and measures by strengthening their collaboration.*
- *Continue and increase work on energy efficiency in buildings through:*
  - *Increasing energy efficiency in buildings in co-operation with the cantons;*
  - *Developing and disseminating building sector and space heating statistics; and*
  - *Encouraging individual metering of heating and hot water in existing buildings.*
- *Diversify energies for space heating.*
- *Intensify co-operation with consumer groups and environmental and business associations, including dissemination of information activities and planning and implementing labelling schemes and performance standards for appliances.*
- *Work to further engage financing institutions in the development of incentives for purchases and upgrades that improve energy-efficient infrastructure and equipment.*

Fossil Fuels

- *Use taxation of heating fuels as a tool to improve energy efficiency and address climate change.*
- *Link proposals for tax incentives to promote diesel fuel to further reductions in non-carbon emissions.*
- *Encourage industry to develop a natural gas infrastructure for gas use in the transport sector.*
- *Monitor pricing mechanisms at the natural gas distribution level to ensure transparency, cost-reflectiveness and non-discrimination.*
- *Encourage competition and induce efficiency in the gas market by:*
  - *Urging simple, fast and fair TPA to the networks as well as transparent and non-discriminatory rules for access and tariffs;*
  - *Providing resources to monitor the gas markets and settle disputes;*
  - *Ensuring that captive consumers also benefit from efficiency gains; and*
  - *Promoting the continuing depolitisation of the management of the gas utilities.*

Renewables

- *Continue to assess the cost-benefit of the renewables programmes, including subsidies, R&D and external costs, and ensure that the results are reflected in the allocation of financial resources. In particular, re-examine the cost-effectiveness of the solar energy programme and consider increasing resources for more cost-effective programmes, such as biomass and waste.*

- *Improve the framework of promoting renewables. Explore possibilities to introduce portfolio standards with tradable renewable energy certificates and review the feed-in tariff scheme.*

Nuclear Power

- *Maintain the nuclear option.*

- *Ensure that the general public is fully aware of the potential impacts of the nuclear initiatives and the draft nuclear law.*

- *Continue to take actions to develop safe radioactive waste repositories.*

- *Take actions to maintain sufficient levels of technological competence.*

Electricity and Heat

- *Ensure that adequate resources are devoted to price monitoring and protecting consumers from abusive electricity prices. Raise local authorities' awareness of economic, energy efficiency and environmental benefits of cost-reflective electricity pricing. Encourage them to phase out free electricity supplies to public consumers.*

- *After careful analysis of the vote on Electricity Market Law, continue efforts to introduce competition in electricity markets. Establish a national transmission system operator and a regulator, define the rules for TPA and allow market access for domestic and foreign suppliers, distribution companies and large consumers.*

- *Improve the possibilities for transmission network access by auctioning the capacities. Until a legal framework for market reform is in place, encourage industries to implement improvements.*

- *Study the economic potential for combined heat and power generation both in industry and space heating.*

Research and Development

- *Continue planning to facilitate the integration and alignment of near-term activities and long-term R&D objectives*

PART 2.2

STANDARD REVIEWS

This part contains the 2002/2003 standard reviews for the following seven countries, updating the situation since these countries underwent the in-depth reviews of the 2000/2001 review cycle. The report reflects the situation when they were drafted from July to September 2003.

AUSTRALIA

BELGIUM

CZECH REPUBLIC

NEW ZEALAND

NORWAY

SPAIN

TURKEY

AUSTRALIA

GENERAL ENERGY POLICY

Energy is a shared responsibility among the federal, state and territory governments. On 8 June 2001, the Council of Australian Governments (COAG) agreed to establish a national energy policy framework to guide future energy policy decision-making by jurisdictions and to provide increased policy certainty for energy users and investors. The objectives of the national energy policy are as follows:

- To encourage efficient provision of reliable, competitively-priced energy services, underpinning wealth and job creation and improved quality of life, taking into account the needs of regional, rural and remote areas.
- To encourage responsible development of Australia's energy resources, technology and expertise, their efficient use by industries and households and their exploitation in export markets.
- To mitigate local and global environmental impacts, notably greenhouse impacts, of energy production, transformation, supply and use.

COAG called for the following priority actions to support the energy policy objectives:

- The establishment of the Ministerial Council on Energy (MCE), which is responsible for national leadership and overseeing the continued development of national energy policy. The MCE's first meeting took place on 7 December 2001.
- That the 2001 National Electricity Market (NEM) Ministers' Forum give urgent attention to the technical NEM issues, including impediments to investment in interconnection, transmission pricing and market behaviour.
- The commissioning of a high-level independent strategic review of medium- to longer-term energy market directions, the COAG Energy Market Review (Parer Review). The Parer Review panel delivered its final report, *Towards a Truly National and Efficient Energy Market* in late 2002.

The key findings of the Parer Review are:

- The energy sector governance arrangements are confusing, there is excessive regulation and perceptions of conflicting interests.
- There is insufficient generator competition to allow Australia's gross pool system to work as intended.

- Electricity transmission investment and operation is flawed. The current division by region does not reflect market needs.
- The financial contracts market is extremely illiquid, in part reflecting large regulatory uncertainty.
- There are many impediments to demand side playing its true role in the market.
- There is insufficient competition in the east coast gas market, and too much uncertainty surrounding the new pipeline development.
- Greenhouse responses so far are *ad hoc*, have created uncertainty, and have been poorly targeted.
- The NEM is currently disadvantaging some regions.

In August 2003, the MCE agreed on a comprehensive reform programme that is expected to clear the way for new investment in the national energy market. COAG is considering the reform programme, which includes recommendations in the following areas:

- Governance: improving the national energy policy framework.
- Regulation: reducing the barriers to competitive markets, by possibly establishing a national energy regulator to cover not only electricity but also gas.
- Transmission: facilitating new investment.
- User participation: improving demand-side participation in the market.
- Natural gas: increasing gas penetration in the energy market.
- Greenhouse gas emissions: address greenhouse gas (GHG) emissions from the energy sector on a national basis.

The MCE will implement a comprehensive work plan involving the federal, state and territory governments.

ENERGY SUPPLY AND DEMAND

Australia's total primary energy suppy (TPES) grew by 2.3% per year from 1990 to 2000 and by more than 5% per annum from 2000, to reach 123 Mtoe in 2002. Coal had a leading role in 2002 with almost 48% of TPES, while oil represented 29%, gas 18% and renewables close to 6%.

Australia remains a major energy producer. In 2002, total energy production reached 259 Mtoe, from 158 Mtoe in 1990. Australia's net exports more than doubled from 65 Mtoe in 1990 to 134 Mtoe in 2000, with coal and gas representing 92% and 6% respectively of the energy exports[1].

Since 1990, total final consumption of energy (TFC) grew by 25% to reach 72 Mtoe in 2000. TFC is shared between the industry and transport sectors (approximately 39% each), with the remainder being spread among the other sectors.

ENERGY EFFICIENCY

In 2002, the MCE established the Energy Efficiency and Greenhouse Working Group, with representatives from all jurisdictions, to develop national measures to increase energy efficiency through the development of a National Framework for Energy Efficiency. A final strategy for the National Framework is expected in early 2004.

In January 2002, the Motor Vehicle Environment Council, in consultation with the Federal Department of Transport and Regional Services, released a proposal for an Australian internet-based "green vehicles" guide to be available in 2003. A mandatory, model-specific fuel consumption labelling scheme for new passenger cars commenced in January 2001. The scheme will be expanded to include a wider range of vehicles by 2003. The revised label will also show how much carbon dioxide (CO_2) is emitted by each vehicle. The federal government has undertaken to develop options for challenging but realistic fuel efficiency targets for government car fleets from 2003. A number of states have introduced energy efficiency initiatives, either efficiency and emissions reduction targets or procurement of hybrid fuel vehicles.

In November 2002, the MCE released Australia's ten-year strategy to address standby power. The initiative was supported by a new call for specific measures made at the June 2003 MCE meeting.

A 2003 study of the Australian Bureau of Agricultural and Resource Economics (ABARE) demonstrated that real energy intensity reduced by 6% between 1973 and 1974 and between 2000 and 2001 owing to efficiency gains resulting from fuel mix changes. Other apparent gains in the energy intensity of the economy are linked to changes in GDP structure rather than efficiency gains.

Mandatory energy efficiency measures for houses were introduced in the Building Code of Australia on 1 January 2003.

1. Australia also exports significant quantities of uranium, which are not accounted for in the International Energy Agency's calculation of primary energy exports.

ENERGY AND THE ENVIRONMENT

Australia does not intend to ratify the Kyoto Protocol. However, it aims to meet the Kyoto target to limit emissions to 108% of 1990 levels of its greenhouse gas emissions. In 2000, Australia's total GHG emissions were 553 Mt of CO_2 equivalent, 6.3% above the 1990 level [calculated using the United Nations Framework Convention on Climate Change (UNFCCC) methodology]. The IEA estimates that CO_2 emissions from energy combustion, which account for two-thirds of Australia's total GHG emissions, were 27% above the 1990 level in 2000 and 42% above the 1990 level in 2001, with 369 Mt of CO_2.

In August 2002, the federal government announced it was developing a forward strategy on climate change, focusing on a 20 to 30-year time horizon. In 2002, Australia and the United States established a Climate Action Partnership. In July 2002, 19 projects were announced under the partnership. Australia has implemented a climate change partnership with New Zealand and is looking to strengthen bilateral co-operation on practical responses to climate change with other countries.

The following existing programmes and initiatives adopted by the federal government are projected to contribute to a reduction of 59 Mt of CO_2 equivalent per year until 2010:

- The Mandatory Renewable Energy Target (MRET) – creating a national renewable energy market, including tradable Renewable Energy Certificates.
- The introduction of minimum energy performance standards for domestic appliances and commercial and industrial equipments.
- The introduction of energy efficiency standards for residential and commercial buildings.
- The Greenhouse Gas Abatement Programme (GGAP) – since 1999, the federal government allocates grants on a tender basis to support large emission abatement projects that would not otherwise have been cost-effective.
- The voluntary Greenhouse Challenge Programme – an eight-year-old voluntary agreement with more than 800 member companies and organisations.
- The Greenhouse Friendly Programme – certifies products or services with GHG emissions that have been fully offset by GHG abatement activities.
- The Cities for Climate Protection Programme – over 150 councils involved.
- The Generator Efficiency Standards (GES) – a measure that applies to new, existing and significantly refurbished electricity generating plants with generating capacity superior to 30 MW.

OIL

Australia's oil production grew by 1 Mtoe from 2000 to reach 34 Mtoe in 2002. Australia still exports crude oil (approximately 20 Mtoe in 2001), principally to Japan and the US, while importing a slightly greater quantity, mainly from Brunei, Indonesia, Saudi Arabia and the United Arab Emirates.

The majority of Australia's petroleum potential is thought to exist in offshore basins. In 2002, there was a decline in important exploration activities, such as seismic surveying and well drilling, in these basins compared to 2001. However, there was a small increase in the drilling of development wells. The number of new exploration permits awarded increased during 2002, reflecting a continued interest in frontier exploration areas and in the more mature petroleum exploration areas. The government expects an increase in exploration work in coming years, particularly in the Otway basin off Victoria and Tasmania and the Perth basin off Western Australia.

The 2003 release of offshore petroleum acreage was announced on 25 March 2003 and will remain open to bidding for six to twelve months, depending on the area. The next release is planned for March 2004.

NATURAL GAS

In 2002, Australia's natural gas production reached 31 Mtoe and is expected to continue to grow significantly in the future. One-third of the production is exported, principally to Japan in the form of liquefied natural gas (LNG).

In addition to existing policies, the federal government launched the LNG Action Agenda on 10 October 2000. The Action Agenda identified the following seven key issues, which need to be addressed to make Australia the preferred LNG supplier for new demand (mainly in Asia: Korea, Japan, China, and Chinese Taipei):

- Clarification of greenhouse policy.
- Customs and import arrangements.
- Taxation arrangements.
- Australian industry participation.
- Streamlined project approval processes.
- Effective industry/government marketing.
- Resolution of uncertainties related to the Timor Gap Zone of Co-operation.

The accomplishments of the LNG Action Agenda include clarification of greenhouse policy, new statutory effective life caps for pipeline, clarification of the definition of oil and gas assets that could benefit from tax depreciation and the legal simplification for major LNG projects. The North West Shelf Joint Venture's decision in early 2002 to construct the fourth LNG train is in accordance with the LNG Action Agenda. This A$ 1.6 billion project will, at full capacity of 4.2 Mt per year, increase Australia's LNG exports to nearly 12 Mt per year. Construction of a new pipeline to bring gas onshore at the Burrup Peninsula began in early 2003. The China LNG deal is also expected to underwrite the construction of a fifth LNG train on the North West Shelf.

In June 2003, the Bayu Undan Joint Venture announced the construction of a A$ 1.5 billion LNG plant near Darwin that will supply 3.0 Mt per year of LNG to Japan for 17 years from 2006. The Bayu Undan field, in the Timor Sea, is within the Joint Petroleum Development Area (JPDA). The field contains gas reserves of approximately 100 bcm and liquids (condensate and LPG) reserves of approximately 400 million barrels. Other projects currently under consideration include the Sunrise gas field in the JPDA and the Gorgon gas fields off the coast of Western Australia. Both these projects are currently looking at potential markets and development scenarios.

South-eastern Australia is also experiencing significant new development with projects such as the Patricia Baleen and the Yolla fields in the Bass Strait, the Minerva, Geographe and Thylacine fields in the Otway basin and the Sole gas field in the Gippsland basin. The new 732 km pipeline across the Bass Strait and to Tasmania was completed in early September 2002, and has started to transport natural gas from Victoria's Longford plant to Tasmania.

The Productivity Commission, the federal governments' principal review and advisory body on microeconomic policy and regulation, was asked by the government to review the Gas Access Regime for natural gas pipelines. The review began in June 2003 and will be completed in June 2004. The primary objective of the review is to examine the extent to which current gas access arrangements balance the interests of relevant parties, provide a framework that enables efficient investment in new pipeline and network infrastructures and can assist in facilitating a competitive market for natural gas.

COAL

Coal is an essential component of Australia's energy production. In 2002, it represented nearly 187 Mtoe, more than 70% of Australia's total energy production. Exports account for 75% of production. The principal export markets are Japan, Korea, Chinese Taipei, India and the United Kingdom.

The federal government withdrew from the Joint Coal Board and transferred the responsibility for workers compensation insurance to the New South Wales

(NSW) government in 2002. This brought NSW in line with all other states, which have always had sole responsibility for managing this issue. The NSW government has established a limited liability company, Coal Services, owned by coal industry employers and employees, to manage the former functions of the Joint Coal Board.

The federal government's competition policy reform is improving business competitiveness, in particular through the introduction of regulations on third-party access to coal rail freight. State governments in Queensland and NSW have embraced these changes, which have resulted in significant reductions in rail freight rates (25% in Queensland and over 50% in NSW since 1995/1996). These reductions have been achieved through increased efficiency and volume benefits in rail operations and the removal of the hidden royalty component in the rail freight rate. Further reductions in coal rail freight rates are anticipated once real third-party competition commences.

ELECTRICITY

Between 2000 and 2002, following sustained economic growth, Australia's gross electricity generation grew at a strong 5% rate. Seventy-eight per cent of the electricity was produced using coal. This share is expected to decline gradually, leaving more room for gas. The federal government envisages that gas will represent 21% of gross electricity generation by 2010, from 12% in 2001. This will only occur if the gas market reform engenders lower natural gas prices, thereby enabling gas to compete with cheap coal, especially brown coal from Victoria.

In 1998, the National Electricity Market (NEM) was launched between Queensland, NSW, Victoria, South Australia and the Australian Capital Territory (ACT). In 2002, full retail contestability was introduced in NSW and Victoria, and in 2003 it was introduced in South Australia and the ACT. A fully contestable market at retail level has been implemented in the NEM jurisdictions, excepting Queensland, where the government postponed indefinitely contestability to consumers below 200 MWh per year.

If implemented, the measures to be adopted following the recommendations in the Parer Review are likely to facilitate competition by increasing investment in electricity transmission, expanding the states' interconnections and interstate trade, controlling and reducing possible market power from generating companies and reducing regulatory uncertainty. These measures will also alleviate the threat of possible tensions on energy supply that can arise for a variety of reasons, including weather and generating capacity failure.

RENEWABLES

In 2001, the bulk of renewable energy (77%) came from combustible renewables and wastes, with a further 22% from hydro. The share of renewable energy in TPES remained stable until then, at around 6%.

The Mandatory Renewable Energy Target (MRET) began operations on 1 April 2001 and established a requirement that wholesale purchasers of electricity source an additional 9.5 TWh of energy from renewable sources by 2010. The MRET is based on a system of tradable Renewable Energy Certificates (RECs), which allows renewable energy power plants and solar hot water systems owners to earn extra funds for each megawatt-hour of energy they create or replace.

In 2001, 600 000 RECs were created, exceeding the targeted 300 000 RECs and providing a head start for the 2002 target of 1.1 million RECs. In 2002, RECs traded at prices ranging from A$ 36 to A$ 40 per MWh, the higher figure being equal to the penalty for not complying with the obligation. As of March 2003, 178 power stations were accredited to generate RECs.

The federal government has allocated over A$ 300 million to support renewable energy development as part of its greenhouse policy.

RESEARCH AND DEVELOPMENT

Companies involved in the energy sector can benefit from research and development (R&D) support programmes offered by the federal government under the Backing Australia's Ability policy. Although not energy-specific, the programmes involve the R&D Tax Concession, which is a federal government initiative to increase the amount of R&D conducted in Australia by allowing companies to deduct up to 125% of eligible expenditure on R&D activities from assessable income. In June 2001, a 175% Premium Tax Concession was added for companies that increase their level of R&D. The R&D Start Programme is another R&D support programme. It is intended for non-tax-exempt Australian companies and is a merit-based programme designed to assist Australian industry to undertake R&D and its commercialisation through a range of grants and loans. In the 2000 to 2001 financial year, the R&D Start Programme approved 252 grants and loans to industry totalling A$ 230 million.

The Cooperative Research Centre (CRC) for Coal in Sustainable Development, established on 1 July 2001, will continue to build on research carried out by its predecessor CRC for Black Coal Utilisation. On 1 July 2003, the Australian Petroleum CRC was renamed the CRC for Greenhouse Gas Technologies (CO_2CRC), to reflect its new focus to develop cost-effective technologies to reduce CO_2 emissions in the atmosphere. Other energy CRCs include mining technology and equipment, renewable energy and clean power from lignite.

The federal government has allocated A$ 1 million between 2002 and 2004 to study the potential for a hydrogen industry in Australia.

COAL 21, a national initiative aimed at significantly reducing and eliminating GHG emissions from coal-based electricity, was launched in early 2003. The initiative is a partnership between Australian governments and the coal, electricity and research communities. A major focus of this initiative will be the development of near-zero emissions and carbon sequestration technologies. COAL 21 links in with international initiatives in which Australia is taking a leading role, such as the Carbon Sequestration Leadership Forum and bilateral climate action partnerships.

Australia participates in sixteen IEA Implementing Agreements.

BELGIUM

GENERAL ENERGY POLICY

From the early 1970s, Belgium's overall energy policy objectives have concentrated on security of supply based on the diversification of geographical sources and fuels, energy efficiency, transparent and competitive energy pricing and environmental protection.

Since the 2001 in-depth review, the main developments in Belgian energy policy have been the major steps taken towards the National Climate Plan, advances in market liberalisation and a progressive phasing-out of nuclear.

The regional governments of Flanders, Wallonia and Brussels-Capital are principally responsible for designing and implementing policies for energy efficiency, renewables, non-nuclear energy research and development (R&D) and market regulation for the distribution and supply of electricity and gas through distribution networks. The federal government is responsible for issues that need to be dealt with at the national level, including electricity and gas tariffs, market regulation for large infrastructures for storage, transport and distribution of energy, the nuclear fuel cycle, and R&D in both nuclear fusion and fission.

The following websites contain additional information on the topics addressed in this review:

FEDERAL LEVEL

Federal Public Service – Economy – Division Energy:
http://www.energie.mineco.fgov.be

CREG (Commission for Electricity and Gas Regulation):
http://www.creg.be

ONDRAF/NIRAS (Belgian Agency for Radioactive Waste
and Enriched Fissile Materials Management): http://www.ondraf.be

Federal Planning Bureau: http://www.plan.be

BRUSSELS-CAPITAL REGION

Brussels Institute for Management of the Environment, IBGEBIM,
http://www.ibgebim.be

FLEMISH REGION

Natural Resources and Energy Department:
http://www.energiesparen.be

VREG (Flemish Electricity and Gas Regulatory Commission):
http://www.vreg.be

Sustainable Energy Agency, ODE-Vlaanderen: http://www.ode.be

Energy and Environment Information System: http://www.emis.vito.be

WALLOON REGION

Administration for Energy: http://energie.wallonie.be
and http://mrw.wallonie.be/dgtre

CWAPE (Walloon Electricity and Gas Regulatory Commission):
http://www.cwape.be

Information site on renewables: http://www.erel.org

Energy desks: http://energie.wallonie.be (click on "particulier")

Renewable Energy Agency: http://www.apere.org

ENERGY SUPPLY AND DEMAND

In 2002, total primary energy supply (TPES) was 59 Mtoe, 21% over the 1990 levels compared to a 26% increase in GDP over the same period. The share of oil in TPES has been quite steady over the past decade and amounted to 38% in 2002. Coal use has been replaced by natural gas as the share of coal in TPES declined from 21% to 16%, whereas the share of natural gas increased from 17% to 22%. The latest forecasts date back to 1996 and do not take into account recent developments such as energy market liberalisation, the nuclear phase-out decision and new policies for renewables. However, modelling work has been conducted, for example in the context of developing climate change mitigation measures.

Total final consumption (TFC) increased by 30% between 1990 and 2001 reaching 43 Mtoe. Industry had the largest share (44%), followed by the residential, services and other sectors (33%) and the transport sector (23%). Between 1990 and 2001, industrial energy demand grew by 40% (partly driven by non-energy use of fuels), while 23% growth could be observed both in the transport sector and the residential, services and other sectors.

The government appointed an International Peer Review Group to assess the 2000 report on future energy supply by the Commission for the Analysis of Methods for the Generation of Electricity and Re-evaluation of Energy Vectors (AMPERE Commission). It made the following recommendations:

- Implement an active demand-side management (DSM) policy.
- Study the electricity saving potential in detail.
- Assess the status and cost of different electricity production technologies.
- Study the near-term potential for electricity generation from renewables.
- Carefully manage decentralised electricity production.
- Study all implications of nuclear energy phase-out and its replacement by other sources.
- Study in detail the possible impacts of international electricity trade, including the problems in managing international electricity flows through Belgium.
- Continuous monitoring of the development of technologies both on the demand and supply side.

ENERGY AND THE ENVIRONMENT

Belgium agreed to reduce its greenhouse gas (GHG) emissions by 7.5% from the 1990 levels by 2008-2012 under the Kyoto Protocol and the EU "burden-sharing" agreement. In 2001, energy-related CO_2 emissions were 12% higher than those in 1990. Despite TPES declining by 0.3 Mtoe from 2000 to 2001, energy-related CO_2 emissions increased by 1.1 Mt. Belgium's third national communication to the United Nations Framework Convention on Climate Change (UNFCCC)[2] indicated that total GHG emissions are estimated to increase by 16%, excluding bunker fuels, between 1990 and 2010 with the current measures. According to a medium-term scenario assuming the introduction of a carbon tax of €1.3 at 1990 prices per tonne of CO_2 in 2002 that would gradually be increased to €11.5 at 1990 prices per tonne of CO_2 by 2010 and the use of non-fiscal measures (mainly standards), the increase would be 6.4% over the same period, which would imply a 13.9% gap to the Kyoto target. The gap can be closed by promptly adopting new domestic measures or by relying on the Kyoto flexible mechanisms. According to a long-term scenario, further measures and a tax of €20.4 per tCO_2 would be needed to close the gap. The Federal Planning Bureau and consultants have issued studies on the economic impact of scenarios combining fiscal and non-fiscal

2. See http://www.environment.fgov.be/Root/tasks/atmosphere/klim/pub/bel/set_fr.htm

measures. The scenarios constitute both a sensitivity analysis of the models and a tool for the implementation of the National Climate Plan.

The federal government, in consultation with the regional governments, prepared the National Climate Plan for 2002-2012, which has not yet been enforced. The regions were consulted because they have formulated their own climate change mitigation policies and measures, including energy efficiency measures (*e.g.* voluntary agreements) and portfolio standards for renewables and CHP. The objective of the plan is to meet the Kyoto target through the implementation of a coherent national policy that has sufficient sectoral and cross-sectoral measures and specific measures for individual industries. For the energy sector, the plan addresses energy efficiency and standards, the use of renewables and the application of flexible mechanisms. Although the plan does not propose a national carbon tax, it does refer to it in its scenarios. Furthermore, the Federal Plan for Sustainable Development for 2000-2004 stipulates that if no agreement at the European Union level is reached, Belgium will unilaterally take steps to introduce CO_2 and/or energy taxation.

A Climate Commission will be created to assess on an annual basis national co-operation and the implementation of the measures taken in the framework of the National Climate Plan. The commission will consist of representatives from the federal and regional governments and be supported by a permanent secretariat.

ENERGY EFFICIENCY

Belgium's TPES per capita increased from 4.88 toe in 1990 to 5.73 toe in 2002 compared to the 3.41 toe average in OECD Europe in 2002. The government expects TPES per capita to level off. Belgian energy intensity (measured as TPES per GDP) is higher than the average in OECD Europe because the latter has been improving faster. In 2002, Belgium's energy intensity was 0.183 toe per US$ 1 000 at 1995 prices and exchange rates, compared to 0.161 toe in OECD Europe. In 1990, the level was 0.190 toe in Belgium and 0.184 toe in OECD Europe.

In 2003, an international consortium led by the Fraunhofer Institute finalised a study for the federal government on demand-side management (see http://mineco.fgov.be/energy/home_fr.htm). In the "benchmarking scenario", where savings are derived from a comparison with other countries, CO_2 reduction would be sufficient to meet Belgium's Kyoto target by lowering energy-related CO_2 emissions to 100 $MtCO_2$. The "economic potential scenario" assumes extensive use of demand reduction potentials, going beyond the current international best practices, and implementing investments with zero net costs (so-called "win-win" measures). Under this scenario, CO_2 emissions would be cut down considerably further, opening the potential for a possible second commitment period in the

Kyoto process, and partly compensating the impact of nuclear phase-out after 2015. The study makes concrete proposals for demand-side management that could be included through co-ordinated federal and regional policies according to their administrative feasibility and national or European constraints and priorities.

At the federal level, the first step to implement the proposals was taken as part of the personal income tax reform by the law of August 2001, which enabled tax reductions on investment in energy efficiency and the use of renewables in residential buildings. The tax reductions include 15% of the expenditure on the replacement of old boilers, the installation of sanitary water-heating systems using solar energy and the installation of photovoltaic panels, and 40% of the cost of double-glazing windows, roof insulation, energy audits and the regulation of central heating. With a total budget of €37.5 million, the maximum reduction of €500 per household in 2002 and €600 per household in 2003 could be increased to €1 000 per household in 2004.

All regions have introduced policies and measures to promote energy efficiency. The 2002 Flemish decree for the promotion of energy efficiency sets the grid manager energy saving targets to be realised at customer level. Certificate markets to support combined heat and power (CHP) have been introduced in Flanders and also in Wallonia where they are imbedded into its green certificates system. Brussels-Capital is in the process of preparing its own certificate scheme to promote CHP. Flanders is establishing a quota-based certificate system for the promotion of CHP with a target to install an additional 1 198 MW by 2005. Flanders and Wallonia have introduced voluntary agreements for energy-intensive industries. The Flemish agreements are based on "world top benchmarking" of energy efficiency, whereas the Walloon government subsidises energy auditing and monitoring in industry, as well as technical certification of products contributing to a better control of energy consumption. Projects are under way in all regions to improve energy efficiency in buildings in line with the EU Directive on the Energy Performance in Buildings. The Flemish region is also preparing a law to establish a legal framework on which specific implementing measures will be based related to energy efficiency, renewables and the implementation of flexible mechanisms and emissions trading.

OIL

Total oil supply increased from 18.7 Mtoe in 1990 to 24.3 Mtoe in 2001. Transport and industry are the largest oil consumers. Fuel consumption continues to rise, especially in road transportation. The largest industrial oil consumer is the chemical industry.

Belgium imports all the oil it needs. In 2001, crude oil imports amounted to 32 Mt and the main sources were Norway (25%), the United Kingdom (19%), Saudi Arabia (18%), the former Soviet Union (16%), Iran (9%) and Venezuela (4%). Oil product imports amounted to 15.5 Mt and came predominantly from the Netherlands (60%), the United Kingdom (10%), the former Soviet Union (9%) and France (8%). In 2001, Belgium exported different oil products totalling 19.3 Mt, principally to OECD countries.

In 2002, the energy administration proposed a new law on a public stockholding body and on stricter regulations on security stocks. In March 2003, a report was finalised to meet the restricted Council of Ministers' (vice prime ministers) request for more information on the additional costs of centralised stockholding. The newly appointed government is expected to take a decision on this issue. In September 2002, the energy administration began updating its crisis policy in co-operation with the oil industry. The objective is to make a "gentleman's agreement" with the oil sector on the allocation of oil products and the use of the security stocks in times of crisis.

Heating oil "extra", which is a new type of heating oil that was introduced in 2002, is coloured diesel oil with a sulphur content of 50 parts per million (ppm). It is still more expensive than traditional heating oil, but enables better combustion and is therefore more environment-friendly.

By the end of 2003, funds for soil pollution in public service stations (Bofas) and for pollution at the end-user level (Premaz) are expected to be fully operational.

The Fund for Analysis of Oil Products (FAPETRO) carries out systematic quality checks of oil products on the Belgian market. In 2001, it took about 12 000 motor fuel samples at Belgian filling stations and in 2002 about 10 000 samples. The operation of the fund has been extended to private pumps, *i.e.* pumps owned by haulage, bus and taxi companies, and in 2003, the fund will start to control the quality of heating fuel.

NATURAL GAS

In 2001, natural gas demand in Belgium totalled 13.2 Mtoe, 61% over the 1990 level. Fourty per cent was used in the residential and services sectors, 38% in industry and 22% for electricity generation. The government expects moderate growth of 7% in gas demand for the period 2001 to 2010. In 2001, the import sources were the Netherlands (54%), Norway (39%) and the United Kingdom (6%). Whereas the majority of supplies are on long-term contracts, the share of spot markets reached 16% in 2000. The Zeebrugge hub has made Belgium an important natural gas transit country. By 2005, gas transport capacity between Zeebrugge and Bacton (United Kingdom) will increase from 8.5 bcm to 16.5 bcm because of the construction of two gas compressors at Zeebrugge. Two additional gas compressors, currently under consideration, would increase the capacity to 25 bcm.

Despite a slow start, Belgium's market opening reached 65% at the beginning of January 2003 and 83% in July 2003. A federal law passed in July 2001 lowered the eligibility threshold for market access to 5 mcm per year and in 2002 important steps were taken at the regional level. In Flanders, customers with annual consumption of at least 1 mcm per year have been able to choose their supplier since the beginning of 2003 and on 1 July 2003 eligibility was extended to all gas consumers. The network operators in the region were nominated on a provisional basis in October 2002 and technical regulation covering access to the networks was published in November 2002. Wallonia adopted its decree for the organisation of the gas market in December 2002. The decree enables access to customers consuming at least 1 mcm per year and to customers operating a good quality co-generation facility. Brussels-Capital has not opened its gas market. Despite progress in legislation, the share of new entrants at the national level is still small at about 5%. In 2001, the dominant gas company, Distrigas, separated its operations into two different companies, namely Distrigas NV and Fluxys. The latter is in charge of the operation and development of the transport network, storage facilities and LNG terminal.

RENEWABLES

In 2002, the use of renewables amounted to 1.7 Mtoe and their share of TPES was 2.9%. Electricity generation from renewables (including pumped storage and waste) totalled 2 TWh in 2001 (2.6% of total generation) with major contributions coming from combustible renewables and wastes.

A federal decree of July 2002 (enforced in July 2003), defines the conditions for issuing green certificates by the Commission for Electricity and Gas Regulation (CREG) for offshore wind energy production. The decree also stipulates that, upon request from any producer located in Belgium, the national transmission operator must buy green certificates for the minimum price of €90 per MWh for offshore wind energy, €50 per MWh for onshore wind energy, €50 per MWh for hydro, €150 per MWh for solar energy and €20 per MWh for biomass.

Both Flanders and Wallonia have introduced laws for portfolio standards and tradable renewable energy certificates. Electricity suppliers in Flanders are obliged to buy a certain amount of green certificates from green electricity producers or invest in the necessary production capacity. The obligation is set at 0.8% of its total electricity supply in 2003, 1.2% in 2004, 2% in 2005 and 6% in 2011. The Walloon government's mandatory targets for the share of renewables in electricity generation are 3% for July 2003, 7% for 2007 and 12% for 2012 encompassing electricity both from renewables and efficient CHP installations on the basis of avoided CO_2 emissions (see http://www.cwape.be). The Flemish region has created CHP certificates by a separate decree. The certificates cannot be exchanged between the two regions until they sign an agreement of mutual recognition of the certificates.

To implement EU Directive 2001/77/EC, the regional governments are preparing a guarantee of origin system for electricity generated from renewables. The system is also intended to further develop the green electricity market.

A recent measure taken by Brussels-Capital is the introduction of grants of 35% towards the purchase and installation of solar water-heating systems (subject to a maximum limit of €992 per household) to encourage the use of renewables in residential buildings. Brussels is planning a law that would establish green electricity consumption quotas: 2% in 2004, 2.25% in 2005 and 2.5% in 2006. To meet these quotas, suppliers will be obliged to buy the necessary amount of green certificates from green electricity producers. These quotas include efficient CHP.

Wallonia's Soltherm Programme aims at increasing the use of solar water-heating. The programme was introduced in 2000 with the target of installing 200 000 m^2 of solar panels over a ten-year period. At present, 4 400 m^2 have been installed. The region provides a €625 subsidy for each installation. In addition to the subsidy, other promotional measures include efforts to increase the quality of the systems, training activities and awareness campaigns. The local public authorities participate, for example by giving additional subsidies and distribution information to the potential users.

NUCLEAR

Belgium's seven nuclear reactors generated 59% of its electricity in 2001. The Belgian nuclear generating capacity increased from 5 713 MW in 2000 to 5 761 MW at the beginning of 2003 owing to the replacement of the steam generators in Tihange 2.

On 31 January 2003, the law on the gradual phase-out of nuclear energy was promulgated stipulating the following:

- Nuclear power plants used for industrial electricity production must be closed 40 years after their commissioning.
- It is not permitted to build nuclear power plants for industrial electricity production.
- The CREG must supervise electricity supply security, inform the government about possible problems and formulate recommendations in this respect.
- On the basis of government and CREG recommendations, the King can take measures when there is a risk of an electricity supply crisis, but without prejudice to the gradual nuclear phase-out. In the case of a *force majeure* (unforeseeable circumstances), the decision has to be elaborated according to the circumstances.

The report by the International Peer Review Group of the AMPERE Commission made some recommendations with respect to nuclear. These recommendations include maintaining the necessary expertise on nuclear energy to ensure high performance and safety, government participation in private R&D on future reactor types, moving radioactive waste management forward more expeditiously, using participatory processes and speeding up the modernisation of nuclear safety organisations and testing the efficiency of emergency plans.

To address the challenges created by the liberalisation of the electricity market, the Parliament approved a new law for the dismantling of nuclear power plants and for spent fuel management. Synatom will become a full subsidiary of Electrabel and will be responsible for all aspects of decommissioning and spent fuel management, including funds for decommissioning. An advisory committee will be created to supervise the implementation.

A number of royal decrees addressing nuclear safety, such as the protection against ionising radiation, were enforced on 20 July 2001. The Federal Nuclear Inspection Authority became fully operational on 24 August 2001. The law on civil liability of nuclear energy operators was amended in July 2000 to increase the maximum liability from €99 million to €297 million.

By the end of 2002, vitrified high-level waste from the reprocessing of spent fuel had been shipped five times from The Hague to Belgoprocess (a subsidiary of the Belgian waste management organisation ONDRAF) in Dessel.

The 1998 programme for the disposal of low-level waste continues. At the beginning of 2002, ONDRAF published SAFIR 2, a report that summarises the results from the second phase (1990 to 2000) of its methodological R&D programme for the geological disposal of medium-, high-level and long-lived waste. The report describes the progress with respect to feasibility and safety of deep geological disposal in Belgium. It concludes that there are currently no insurmountable problems regarding geological disposal in Boom Clay (the host formation most examined in Belgium), which increases confidence in the possibility of disposal in clay, but recognises the need for further studies. SAFIR 2 was submitted to an international peer review organised by the Nuclear Energy Agency. The peer review group recognised the high quality of ONDRAF's work. It acknowledged that Boom Clay shows good properties in terms of safety and feasibility for a disposal facility and that the report was a good basis for concertation with the safety authorities and decision-makers. However, it also confirmed that further research efforts are necessary and recommended that the programme should develop in the direction of stakeholder dialogue in choosing the disposal option and site and that a strategy must be developed for a structured approach to uncertainties and for the definition of priorities. SAFIR 2 and the peer review results have been submitted to the government for its approval of the continuation of the programme and its elements, such as the elaboration of a decision framework and a dialogue process for each step of the geological proposal.

One-fifth of the core of the Tihange 2 and Doel 3 reactors is loaded with mixed oxide fuel (MOX). Use of MOX will continue until 2006 when stocks and supplies of separated civilian plutonium and reprocessed uranium are exhausted.

ELECTRICITY

In 2001, electricity consumption was 78 TWh, up by 35% from the 1990 level. This corresponds to an average growth rate of 2.7% per year. Nuclear power accounted for 59% of total gross electricity generation in 2001 followed by natural gas (20.1%), coal (16.2%), oil (2.1%), combustible renewables and wastes (2%) and hydro (0.6%). The major change in generation structure has been the increase of the share of natural gas from 7.7% in 1990 and the decrease of the share of coal from 28.2%.

Market liberalisation is changing the industry structure in Belgium. Electrabel accounts for almost 90% of total generation. If needed, part of the Belgian generation and the cross-border transmission capacity will be auctioned. The system operation activities of Electrabel and the Company for the Co-ordination of the Production and Transport of Electricity (CPTE) have been merged into a single organisation, Elia, which became a legal entity in June 2001. Elia comprises two companies, Elia System Operator (ESO), which was appointed as the transmission system operator on 13 September 2002 and Elia Assets, which owns the networks. Both companies are 70% owned by CPTE and 30% by Publi-T, which is a co-operative company representing the Belgian municipalities (*i.e.* local authorities); however, the energy administration and the incumbents have agreed that CPTE should limit its share to 30%, municipalities to 30% and that 40% should be sold through the stock exchange. ESO's principal tasks are to give third-party access to the high-voltage networks, define rules for it, draw an investment programme for the networks, allocate cross-border capacity and settle disputes.

The Electricity and Gas Control Committee (CCEG) was dismantled in July 2003 and all regulatory duties at the federal level have been concentrated in the CREG.

At the national level, 59% of the electricity market was opened for competition when the threshold for eligibility was lowered from 20 GWh to 10 GWh per year at the beginning of 2003. The national average increased to 80% on 1 July 2003 because of full opening in Flanders and will climb to 87% at the beginning of 2005 owing to the steps to be taken in other regions.

The Flemish electricity market was completely liberalised on 1 July 2003. Seven of the 20 suppliers active on the market supply electricity to household customers. The grid manager appointed each household consumer a "default supplier" to guarantee public service. The Flemish Energy Minister has demanded that the Flemish Electricity and Gas Regulatory Commission (VREG) assist Flemish customers in choosing an energy supplier. VREG will publish energy prices and supply conditions on its website. The Flemish region is preparing a decree to make energy invoices more transparent. Household electricity prices have been temporarily capped as from 1 July 2003 until 31 December 2003, and the "default suppliers" are not allowed to increase their prices. Furthermore, lower social tariffs for poor households will be continued.

At the beginning of 2003, electricity markets in Wallonia and Brussels-Capital were opened to all consumers with over 10 GWh annual demand at one site. In Wallonia, all high-voltage customers, connected to a voltage of 1 kV or higher, will become eligible at the beginning of 2005. According to current legislation in Brussels-Capital, the next step will be taken at the beginning of 2005 when the market will be opened for all high-tension consumers and full market opening will take place at the beginning of 2007. However, in accordance with the latest EU directives, the region plans to revise its legislation to open the market to all enterprises on 1 July 2004 and to residential consumers in 2007.

The CREG has elaborated the Indicative Programme for Electricity Generation 2002 to 2011 (see http://www.creg.be) that addresses electricity demand management, use of renewables, CHP and clean coal technologies as well as the international interconnection lines. The programme provides recommendations within the framework of different scenarios taking into account the latest energy and environmental policies, including the Kyoto target. Together with other plans and basic studies, the programme's recommendations will be taken into account in energy policies.

RESEARCH AND DEVELOPMENT

The administration of non-nuclear-related R&D programmes is the exclusive responsibility of the three regions, while nuclear-related R&D programmes are pursued at the national level mainly by the National Nuclear Research Centre (CEN/SCK).

Wallonia's energy R&D budget, €8 to €10 million per year, contributes 38% to the total governmental expenditures for energy R&D in Belgium. Until recently, the emphasis of Wallonian R&D included power generation and electricity transmission, but it has now shifted more towards renewable energy technologies (49%) and energy conservation (35%). The results of the PROMETHEE Programme[3] are used to define topics for possible R&D proposals

3. The objective of the PROMETHEE Programme is to design a research and innovation strategy for the region.

for public financing. The current priorities are energy use of biomass and waste, small hydro, solar energy and climate-sensitive architecture. Because Belgian coal resources are located in Wallonia, coal technologies receive sustained support. Wallonia supports the PIMENT Programme, which promotes energy efficiency and the application of renewable resources in buildings and in the services sector. Wallonia's future energy R&D policy is reflected in the *Contrat d'Avenir pour la Wallonie* (CAWA), presented in April 2000 and updated in February 2002. CAWA emphasises participation in the European research programmes and initiatives, collaboration between universities, research centres and enterprises, and sustaining the creation of innovative enterprises.

The Flemish government has ordered the Flemish Institute for Technological Research (VITO) to study how to create a framework for the implementation of the industrial benchmarking voluntary agreements. In addition, special attention is given to CO_2 emissions reduction projects, in particular to the possibility to assist methane extraction combined with CO_2 storage in exhausted coal mines.

The CEN/SCK continues to work on the nuclear R&D topics mentioned in the 2001 in-depth review, namely reactor safety, nuclear waste management, radiation protection, radioecology, radiobiology, radioisotope production, medical applications, nuclear fusion natural radioactivity and safeguards. The key activities in reactor safety are reactor pressure vessel steel, integrity of internal reactor structural materials, fuels, reactor physics and instrumentation. The CEN/SCK also works on the pre-design of ADS (accelerator driven system) called Myrrha. Generally, an ADS system allows the transmutation of long-lived radionuclides in shorter-lived ones, which would ease the geological disposal, but the scope of Myrrha is broader because it could be used for testing materials and fuels for any new reactor type. A final decision on the implementation of Myrrha is expected after June 2004. Furthermore, the SCK/CEN, in collaboration with Belgian universities, has set up an inter-university programme of the third cycle in nuclear engineering in the form of the consortium Belgian Nuclear Higher Education Network (BNEN).

CZECH REPUBLIC

GENERAL ENERGY POLICY

The Czech Republic's energy policy objectives are set out in the National Energy Policy that was adopted by the government in 2000. In 2001, the government approved the Energy Act to enforce the policy objectives, including legislative compliance with the "*acquis communautaire*" and appointed an independent regulator, the Energy Regulatory Office (ERO), to implement the Energy Act, specifically by setting tariffs, licensing operators and monitoring the market opening.

In December 2001, the Czech Republic provisionally closed the "Energy Chapter" of the negotiations on European Union accession and will officially join the EU on 1 May 2004.

In 2002, in compliance with the new Energy Management Act that was enforced in 2001, the government decided to update the National Energy Policy in order to improve energy efficiency and environmental performance, enhance the energy sector restructuring and comply with new EU and other international commitments.

The updating of the energy strategy to 2030 is expected to be approved in the second half of 2003. The preliminary version, made available in the summer of 2003, includes six policy scenarios, ranging from expanding nuclear capacities to easing environmental restrictions on brown coal mining.

ENERGY SUPPLY AND DEMAND

In 2002, total primary energy supply (TPES) was 41.3 Mtoe, almost the same level as in 2001, which was still 12.5% lower than the 1990 level. Between 1990 and 2002, energy production, mainly coal, decreased by 20% while energy imports increased by 25%. Currently, coal and nuclear account for 79% and 16% respectively of domestic energy production. Crude oil and petroleum products represent almost half of total imports, followed by natural gas with 41% and coal with 6%. The country's import dependence remains stable at 47%.

Coal was still the predominant fuel in 2002, accounting for 50% of TPES, followed by oil (21%), natural gas (19%), nuclear (12%), hydropower (0.5%) and other renewables (1.7%).

Between 1990 and 2001, total final consumption of energy (TFC) decreased by 27%. Although final coal consumption during this period decreased by a factor of 4.5, it still currently accounts for 15% of TFC. Petroleum products and natural gas have become the dominant fuels with market shares of 31% and

25% respectively, followed by electricity with 17% and heat with 11%. Industrial consumption halved during the period 1990 to 2001 and currently accounts for 38% of TFC. While the share of residential consumption has remained stable at 22%, the share of transport consumption has rapidly increased from 8% to 20%. The share of services in TFC is 12%.

The latest available forecast issued in 2002 projected for 2010 a slight increase of TPES by 1.5% to 42 Mtoe and an increase of TFC by 10.5% to 28.3 Mtoe. While coal's share in TPES and TFC is expected to decrease by one-third, coal will still account for one-third of TPES. Driven by the transport sector, the oil share will increase to 21% of TPES and 30% of TFC. Natural gas is expected to become the second fuel in TPES with 26% and the first in TFC with 32%. The share of nuclear in TPES should grow by 76% and reach 16% of TPES in 2010. In 2010, the government aims to increase the share of renewables in TPES from 1.6% to 6%, which corresponds to an 8% increase in the use of renewables in gross power production.

ENERGY AND THE ENVIRONMENT

A major objective of the energy and environment policies is to continue and even accelerate the reduction of pollutant emissions, which, despite impressive progress, remain much higher than the OECD Europe average.

Even if greenhouse gas emissions are 20% below the 1990 baseline, they are constantly growing. GHG emissions in the Czech Republic stand at 11.56 tCO_2 per capita (2000) and 0.89 $kgCO_2$ per thousand US$ (at 1995 prices and purchasing power parities) compared with the OECD Europe average of 7.57 tCO_2 and 0.41 $kgCO_2$, respectively. Other pollutant emissions such as sulphur have decreased but also remain much higher than the OECD average. Higher energy intensity and the dominance of coal largely explain this gap.

In October 2001, the Czech Republic ratified the Kyoto Protocol and adopted a new climate change strategy. In 2002, a new Clean Air Act was enforced, which harmonises and transposes into Czech legislation the relevant "*acquis communautaire*" prior to EU accession. The government has set up the necessary conditions for the implementation of the flexible mechanisms of the Kyoto Protocol. It has approved several projects, including a Joint Implementation (JI) project with the Netherlands on district heating systems using biomass and four projects with the Prototype Carbon Fund (PCF).

ENERGY EFFICIENCY AND RENEWABLES

The energy consumption per capita has slightly decreased in the Czech Republic from 4.5 toe in 1990 to 4 toe in 2001. Between 1990 and 2001, energy intensity per unit of GDP decreased by 17% at 0.29 toe per thousand US$ of GDP (purchasing power parities). However, it is still 1.6 times higher than the OECD Europe average.

The Czech Energy Agency (CEA) is the state agency responsible for the implementation of the national energy efficiency programme. CEA selects and co-finances projects but has insufficient financial and human resources (20 staff) to implement the programme objectives. Funding for energy efficiency projects is also provided by the State Environmental Fund.

Substantial additional efforts from governmental organisations appear to be required to make full use of the large energy savings potential, which has been estimated at minimum 20%. Improving energy efficiency at low or no cost will increase competitiveness and household welfare.

In an effort to converge with EU policies on renewable energy, the government aims to increase the share of renewable energy sources to at least 6% of TPES and 8% of the gross power production by 2010. In 2002, this share represented 2.2%, with biomass accounting for 77% of the total amount. One of the important tools to achieve this objective is the State Programme for the Promotion of Energy Savings and for the Use of Renewables.

The main potential for development includes biomass, biogas, small hydropower and solar water-heaters. In 2003, ERO enacted a regulation providing higher minimum purchase tariffs for electricity generated from renewable sources. This regulation is to be modified at the end of the first year of its implementation. The West Bohemia distribution company became the first electricity distributor to offer renewable electricity to its customers. The Ministry of Agriculture supports energy crops used to produce biofuels.

COAL

Coal, mainly brown coal, continues to be the dominant fuel produced in the Czech Republic and is the largest contributor to TPES, primarily for power generation. Its share has continued to decrease in the consuming sectors (mainly coking coal in iron and steel industries).

In 2002, 48.9 Mt of brown coal including lignite (2001, 51.0 Mt) and 14.5 Mt of hard coal (2001, 15.1 Mt) were mined.

The restructuring process that was initiated in the 1990s to rationalise production and reduce subsidies and losses is still ongoing. In the summer of 2003, the government initiated the procedure to privatise the two remaining large state-owned brown coal mines, Severoceske Doly (Northern Bohemia) and Sokolovska ubelna (Western Bohemia). The sales are restricted to mining companies not operating in neighbouring countries and without assets in other energy sources. The other major brown coal mine, Mostecka ubelna spolecnost (Northern Bohemia), was acquired in 1999 by Investenergy (Appian Group).

In 2002, the second largest hard coal producer CMD stopped its operation in the Kladno basin, but continues its mining activities in the Ostrava-Karviná basin. With the objective of phasing out the activity of OKD, the biggest hard coal producer in the Czech Republic, part of the company was sold in 2002 to the state enterprise Diamo, which specialises in the liquidation of reduced mining capacities and rehabilitation of mining sites.

OIL

Crude oil imports currently account for 98% of oil supply. The modernisation of the Kralupy refinery has increased demand for lighter international crude. In 2001, these supplies, which transit through the IKL pipeline that is connected to Germany, accounted for 36% of total imports. Russian imports, delivered by the Druzhba pipeline, continue to provide the bulk of imports (64%). Net oil imports in 2002 reached 8 Mtoe.

The Česká rafinérská, which comprises the Litvínov and Kralupy refineries, is jointly owned by the Czech oil and chemical company Unipetrol (51% shareholder), and the international oil companies Shell, Conoco and Agip (49%). The shareholders of the Česká rafinérská have agreed that from August 2003 the company will be limited to processing crude oil.

At the end of 2001, the government launched the privatisation of Unipetrol, which has the highest revenue among Czech-owned industrial companies. In February 2002, the government's 62.99% share in Unipetrol was sold to Agrofert Holding. However, Agrofert did not meet the financial obligations associated with the purchase and consequently in September 2002 the purchase contract was cancelled. The government decided that the Ministry of Finance would prepare a public tender for the privatisation of Unipetrol, which is expected to be promulgated by the National Property Fund before 31 October 2003 latest.

The second largest retail network in the Czech Republic was the state-owned Benzina. Benzina was sold to the state-owned Čepro, which operates the retail network under its new trade name EuroOil.

The Czech Republic has continued to consolidate its oil supply security system, with state-owned emergency oil stocks representing over 80 days equivalent of consumption. An additional 20 to 30 days of commercial stocks were reported by oil companies and, according to the IEA, the Czech Republic has over 100 days of oil stocks. Emergency oil stocks were used to a limited extent during the 2002 flooding. New storage capacities for crude oil (125 000 m^3) and petroleum products (40 000 m^3) will be operational at the end of 2003.

NATURAL GAS

Imports (9.7 bcm in 2002) account for almost all gas supply and come mainly from Russia (73%) and Norway (27%). The country is an important transit route from Russia to Western Europe, which receives 25% of its supply through this route.

In 2002, the natural gas sector (Transgas and eight distribution companies) including transit, was sold to a single investor, RWE GAS for €4.2 billion. In 2003, RWE acquired the remaining 3% of the Transgas shares owned by the State and is required to divest its upstream interest (MND) to Ruhrgas in compliance with anti-monopoly regulation.

A partial opening of the gas market has been initially planned for 2005. The Czech Republic will organise the gas market in compliance with the EU Accession Treaty and with the mandatory EU directives.

NUCLEAR

Despite protests from neighbouring countries, notably Austria, and the fact that both the construction costs and commissioning date were exceeded, the Temelin nuclear power plant has been fully operational since April 2003. The two hybrid Soviet-Western design reactors (1.8 GW) supply about 15% of the total electricity generation and have increased the share of nuclear in the power mix from 18% in 2000 to 40% in 2002. The second nuclear power plant, Dukovany, has been progressively upgraded and should operate until 2025.

According to CEZ, the operator of the country's two nuclear plants, the total cost of the construction of the Temelin plant amounted to Kcs 98.6 billion and Kcs 26.7 billion for the upgrading of Dukovany.

In May 2002, the government authorised the last operating uranium mine at Dolní Rožínka to continue activities up to the year 2005. It also approved a strategy on radioactive waste.

ELECTRICITY

Between 2001 and 2002, total domestic electricity consumption dropped slightly by 0.2% from 53.8 TWh to 53.7 TWh. Industry remains the largest consuming sector (35%), followed by households (22%).

In 2002, the net exports balance accounted for 22% of gross generation (11.4 TWh, of which exports are 16.6 TWh and imports 5.2 TWh). The Czech Republic exports electricity principally to Germany and imports mainly from

Poland. Exports have remained constrained by transmission capacity and the saturation of European markets, which depressed the prices. Several distribution companies import electricity directly (1.1 TWh) via 110 kV lines.

The Czech electricity market has entered into a new phase of transformation with its gradual opening to competition and its future integration in the EU internal electricity market. This process is accompanied by the establishment of a new institutional structure.

In 2001, the Electricity Market Operator (EMO) was established as a state-owned stock share company and began its activities in 2002. EMO is responsible for organising the short-term electricity market, including processing of demand and offer balances on the short-term electricity market.

The Czech transmission system operator (CEPS) was originally a 100% subsidiary of CEZ. In March 2002, the government decided to transfer the majority ownership (66%) from CEZ to the National Property Fund and the Ministry of Labour and Social Affairs. These shares were later partly transferred into the newly established Social Insurance Company. CEPS provides electricity transmission services for users of the Czech transmission system within European interconnected power systems and dispatching for the Czech power system.

The Energy Regulatory Office (ERO) exercises regulation in the energy sector and is responsible for designing the relevant secondary legislation determined by the Energy Act. The Office for the Protection of Competition (UOHS) has also played a role in the restructuring of the sector in order to develop a competitive market.

In January 2002, the first stage of the electricity market opening was implemented and consumers above 40 GWh per year, equivalent to 30% of total sales, were given the opportunity to choose their own suppliers. In January 2003, the next stage of the market was opened for consumers above 9 GWh per year, equivalent to 40% of the market. The proportion of clients who switched to new suppliers during the first year has been estimated at 5% of the market.

In 2002, the power mix was dominated by coal (67%) and nuclear (25%). The commissioning of the Temelin plant has increased nuclear's share in the power mix and the baseload overcapacity from 50% in 2000 to 70% in 2003. Gross generation rose from 64.2 TWh in 1999 to 76.0 TWh in 2002.

The electricity industry structure is characterised by the dominance of CEZ in the domestic market. In 2002, CEZ's share in the domestic market dropped to 56.6%. The independent power producers (IPPs) have increased their share to 33.7% and imports account for the remaining 9.7%.

In early 2003, the government decided to integrate the shares of the eight power distribution companies to CEZ, which acquired majority stakes in five of the companies and minority shares in the remaining three. However, the

Office for the Protection of Competition has conditioned its approval of the merger pending the sale of the three minority and one majority stakes as well as its remaining shares (34%) in CEPS.

Thirty-two per cent of CEZ's capital is floated on the stock exchange. The government intended to sell its majority stake in CEZ (67%) but did not conclude the international privatisation tender process during 2001 and 2002. No privatisation plans for CEZ are foreseen before 2006.

DISTRICT HEATING

Heat is an important energy for households and major industries, accounting for 17% and 21% of their final consumption, respectively. Coal remains the main fuel (63%) to generate heat, followed by gas (26%). Wastes and renewables (mainly biomass) share has increased to 5%. The principal heat generators are also independent power producers, which are mainly privately-owned.

RESEARCH AND DEVELOPMENT

The National Research & Development Programme provides funding for projects selected from all sectors of the national economy. Although there is no special budget for energy projects, the programme's priorities include nuclear safety, the use of coal for energy purposes, energy efficiency and the use of renewables.

The Ministry of Industry and Trade has initiated the procedure for the Czech Republic to participate in the IEA Implementing Agreement on Energy Conservation in Buildings and Community Systems. The country became a Contract Party by signing the agreement in March 2003 in Paris.

NEW ZEALAND

GENERAL ENERGY POLICY

The government's general energy policy objectives and framework are set out in the "Energy Policy Framework" released in October 2000. The government is committed to seeking a sustainable and efficient energy future by ensuring that energy services are delivered to consumers in an efficient, fair, reliable and sustainable manner. Current and future policies will aim to achieve the following objectives:

- Environmental sustainability, including continuing to improve energy efficiency and a progressive transition to renewable sources of energy.
- Consumer costs and prices should be as low as possible, while ensuring that prices reflect the full costs of supply, including environmental costs.
- Reliable and secure supply of essential energy services.
- Fair pricing in order that the least advantaged in the community have access to energy services at reasonable prices.
- Continued public ownership of publicly-owned assets.

ENERGY SUPPLY AND DEMAND

In 2002, New Zealand's total primary energy supply (TPES) was 18.38 Mtoe, a 0.4% rise from the previous year. Oil and gas dominated the energy supply, with 36% and 28% of TPES respectively, followed by geothermal with 11% and hydroelectricity with 11%.

Total final consumption of energy (TFC) was 13.7 Mtoe, a drop of 1.1% from the previous year. Oil was the predominant fuel used directly by the consumer, representing 42% of total demand, followed by electricity at 21% and natural gas at 20%. In 2001, industry accounted for 44% of TFC, transportation for 36% and other sectors (primarily residences) for 20%.

ENERGY AND THE ENVIRONMENT

In December 2002, New Zealand ratified the Kyoto Protocol and committed to keep its greenhouse gas emissions at 1990 levels during the initial 2008–2112 period.

In October 2002, the government confirmed New Zealand's climate change policy framework. The National Energy Efficiency and Conservation Strategy (NEECS) is one of the framework's "foundation policies" together with the Growth and Innovation Framework, the New Zealand Transport Strategy (under development), the New Zealand Waste Strategy, climate change research and a partnership with local government to address climate change at a local level.

Key measures and actions in the climate change policy include the following:

- A charge will be applied to emissions from fossil fuels and industrial processes during the Kyoto Protocol's initial commitment period. The charge will approximate the international emissions price, but be capped at NZ$ 25[4] per tonne of carbon dioxide (CO_2) equivalent. Revenue from this tax will be recycled into programmes such as funding climate change projects. The government retains the option of introducing emissions trading as an alternative to an emissions charge if the international carbon market is functional and the price is consistently and reliably below the NZ$ 25 cap.
- Provision of government incentives for climate change projects that will deliver defined reductions in GHG emissions, in any sector of the economy. Incentives might include money or the pre-allocation of emission units. The government will invite bids from firms or groups via a contestable process. To qualify, projects must go beyond business-as-usual plans.
- Negotiated Greenhouse Agreements (NGAs) for firms and industries where there is significant risk to their international competitiveness. NGAs would comprise a contractual commitment by the firm or industry to achieve international best practice in managing emissions, in return for exemption from all or part of the emissions charge.
- Exemption for the agricultural sector's non-CO_2 emissions from any price measure (emissions charge or trading regime) in the first commitment period, provided the sector invests in research to identify options for reducing agricultural emissions. The government retains the option of imposing a levy if the research effort falls short of its targets.
- Government retention of the sink credits and associated liabilities allocated to New Zealand under the Protocol in recognition of the carbon sink value of post-1990 forest plantings. These credits will be retained and managed by the government, at least during the first commitment period.
- An amendment to the Resource Management Act (RMA) to remove the regional councils' ability to directly control GHG emissions through resource

4. In 2002, NZ$ 1.0 equalled US$ 0.462.

consents and regional plans, given that emissions will be dealt with through national policies. Further RMA measures are being considered relating to prioritising renewable energy and adaptation to the effects of climate change.

ENERGY EFFICIENCY

The National Energy Efficiency and Conservation Strategy (NEECS) was approved in September 2001. The NEECS aims to continue to improve national energy efficiency with a target of at least a 20% improvement in economy-wide energy efficiency by 2012. It also addresses goals for renewable energy supply described in the renewable energy section below.

The NEECS consists of five Action Plans in the following areas: buildings and appliances (residential/commercial), industry, transport, central and local government, and energy supply. The Ministry for the Environment and the Energy Efficiency and Conservation Authority (EECA), in particular, are working on the policy and implementation aspects of the government's commitment to energy efficiency and energy conservation.

RESIDENTIAL/COMMERCIAL SECTOR

The NEECS's energy efficiency and conservation policies in the residential/commercial sector include revision of the Building Code, minimum energy performance standards, the Energy Saver Fund, socially focused residential retrofits, and research.

The government approved mandatory energy performance standards and energy performance labelling for selected electrical products as specified in the NEECS. From 1 April 2002, mandatory energy performance labelling was required for a range of domestic appliances.

The Energy Saver Fund has been renamed the EnergyWise Residential Grants Fund. In 2000-2001 the government allocated NZ$ 1.1 million to EECA to administer a Maori Healthy Housing and Employment Pilot as part of its Maori Housing Strategy. The project successfully delivered house retrofits to 788 households resulting in an estimated 20 million kWh of energy savings over the lifetime of the measures, equating to 12 600 tonnes of CO_2 reductions.

INDUSTRY SECTOR

The government is redeveloping and relaunching the successful EnergyWise Companies Campaign. This programme has established effective partnerships between the government and the industrial and commercial sectors, thereby directing management attention to the identification and implementation of cost-effective energy-efficient practices and technologies.

Over 600 of New Zealand's largest companies are actively committed to the campaign. These companies are implementing energy management practices and drawing support from the EECA's best-practice advisers and technical literature. Additional tools are being developed and a number of partnerships are being explored to help small businesses reduce energy costs.

A further component of the EECA's commitment programme is the provision of Crown Energy Efficiency Loans (13 loans were issued between July 2001 and June 2002 totalling over NZ$ 980 000).

TRANSPORT SECTOR

The EECA's energy efficiency and other transport-related policies as set out in the NEECS focus on fleet management, policy and pricing, behaviour change and research. The EECA has successfully established fleet management fuel monitoring trials and benchmarking web-based software.

Transport behaviour change initiatives included launching the Walking School Buses Campaign, co-ordinating the first National Walk a Child to School Day, public transport seminars and establishing relationships with key transport organisations.

Research activities included demand management initiatives such as the Green Travel Plans involving a partnership with the New Zealand Police. An investigation was undertaken on transport energy issues from economic and other perspectives to help prioritise the EECA's transport-related energy efficiency initiatives.

The EECA's work on eco-efficient vehicles will include efficiency standards for vehicles, subject to detailed proposals reported to the government as part of its climate change work programme. This work is directed by the NEECS's major short-term proposal to investigate measures to improve vehicle fuel efficiency.

CENTRAL AND LOCAL GOVERNMENT

The Government Leadership Programme encourages energy efficiency improvements within public sector agencies and institutions. At present the voluntary scheme involves 34 government agencies. An energy saving goal of 15% by 2005 over 2000 levels has been set, equivalent to energy savings of NZ$ 14 million and CO_2 emissions savings of about 75 000 to 100 000 tonnes per year. The scheme will be expanded to include the wider state sector, for example hospitals, schools and defence, with emphasis on agencies spending over NZ$ 100 000 per year on energy. The proposal would require investment of NZ$ 30-40 million. The programme is considered to be the basis for seeking similar commitments from the private sector.

Local government has been targeted through the EnergyWise Councils Programme. A similar 15% energy efficiency target for local government has been set in the NEECS. Priority has been given to information dissemination through newsletters, seminars and forums, and improved monitoring, reporting, benchmarking and ranking among member councils. Priority has also been given to special efficiency projects in street lighting, water and sewage pumping.

MONITORING PROGRESS TOWARDS THE NEECS TARGETS

The methodology to measure progress towards the NEECS targets has included establishing the base year for the targets and indices to measure progress. The EECA is measuring and communicating progress through use of a national energy efficiency index. This index is being built up from a comprehensive programme of sectoral and sub-sectoral monitoring that includes the development of a number of key indicators for each sector. Some of the necessary monitoring information already exists, but further expansion is required. The EECA is identifying data gaps, determining key monitoring indicators, and undertaking sector studies to fill data gaps. Sector studies undertaken during the past 12 months include local government and the dairy, timber processing and meat industry sectors.

RENEWABLES AND NON-CONVENTIONAL FUELS

Nearly 30% of New Zealand’s TPES comes from renewable energy sources, including 13% from geothermal, 10% from hydroelectricity, 6% from biomass and 0.4% from solar and wind technologies.

In October 2002, the government released New Zealand’s renewable energy target to have an additional 30 petajoules (PJ) per year from renewable sources in 2012 compared to 133.5 PJ in 2000. Some of the measures to achieve the target are being implemented as part of the government’s Climate Change Policy Package, while the other measures will be part of the Renewable Energy Programme administered by the EECA.

Three important climate change measures are the “Projects” mechanism, Negotiated Greenhouse Agreements (NGAs) and an emissions charge. The “Projects” mechanism is being established as an incentive for actions that provide cost-effective GHG emissions reductions before and during the Kyoto Protocol's first commitment period. It will be a competitive bid-in fund designed to support a range of GHG reduction projects, including renewable energy projects. The NGAs will encourage the use of renewables because firms entering into these agreements can meet their commitments in some cases by reducing the GHG intensity of their operations through the use of renewable energy. The carbon emissions charge will increase the price of fossil fuels relative to most renewable energy sources, thus increasing their competitiveness.

The Renewable Energy Programme is another effort within the NEECS to support renewable energy by engaging stakeholders and minimising barriers that inhibit the full potential of renewable energy. The programme aims to cover information and communication, education and training in renewable energy, identifying and prioritising research needs, supporting pilot projects/demonstrations, standards setting, market development, capacity enhancement and business development and government leadership. Responsibility for implementing these measures rests largely with the EECA and the Ministry for the Environment.

COAL

In 2002, New Zealand had 1.3 Mtoe of coal primary energy supply. Coal production in 2002 was 2.73 Mtoe, an increase of 0.36 Mtoe on the previous year. About 55% of coal mined in New Zealand is exported and there are no imports. Solid Energy is the dominant coal producer in New Zealand, accounting for over 75% of all coal produced in 2001.

OIL

In 2002, New Zealand produced 1.7 Mtoe of crude oil, condensate and naphtha, a 7% decrease from 2000. About 85% of this production was exported, mostly to Australia, Japan and the US, and the remaining 15% was used for feedstocks at the Marsden Point Refinery. New Zealand also has substantial imports and, when considered on a net basis, New Zealand imports 70% of its oil supply.

In 2001, 18 wells were drilled in three petroleum basins. All of the wells were drilled onshore. The 2001-2002 onshore and nearshore Taranaki Bidding Round attracted 41 bids for 26 blocks on offer and resulted in 21 new permits being granted in August 2002. In September 2002, the government opened the Deepwater Taranaki Bidding Round. Five blocks were placed on offer totalling 42 000 km^2 of unexplored acreage adjacent to the highly productive Taranaki basin. Planning is also under way for an onshore/offshore Canterbury Bidding Round and a new Taranaki Bidding Round. As of November 2002, there were 69 onshore and offshore exploration permits in New Zealand.

There have been two new oil discoveries since 2000. The Goldie discovery within the Ngatoro mining permit has been flowing at up to 700 barrels of oil per day (currently shut in) and in south Taranaki the Kauri discovery appears to have the potential to produce oil and gas over multiple zones.

The government sets minimum quality standards for petrol and diesel in the Petroleum Products Specifications Regulations. The regulations affect the performance of fuel and the limits for components that could be harmful to the environment or to public health. In 2001, the government undertook the first comprehensive assessment of these regulations since their inception. Prior amendments to the regulations eliminated the use of lead and reduced the amount of permissible total aromatics in petrol.

The review considered consumers, industry, health, safety, environmental and quality issues when developing recommendations for petrol and diesel within the New Zealand context. New regulations came into force in September 2002 and will be introduced in phases until January 2006. Major changes to the petrol regulations include lowering the allowable levels of benzene and total aromatics, prohibiting the use of methyl tertiary butyl ether (MTBE), restricting the acceptable manganese content and permitting the use of up to 10% volume ethanol as a blending agent. For diesel, major changes include the lowering of allowable levels of sulphur, decreasing the maximum acceptable density, increasing the minimum permissible cetane number and introducing standards for filterability and polycyclic aromatic hydrocarbon content.

NATURAL GAS

Natural gas is critical to the New Zealand economy, providing 30% of TPES. All gas is produced domestically with no imports or exports. About 48% of gas is used for electricity generation and in the winter of 2001, additional gas was used to meet electricity demand given low hydro output that winter. Thirty-seven per cent of gas is used for petrochemical production, mainly Methanex producing methanol, and 15% is used directly in the industrial, commercial and residential sectors.

New Zealand's gas sector is in transition owing to the expected depletion of supply from its largest gas field, the Maui field (currently 80% of supply). Depletion was anticipated around 2009 but is now expected to occur two years earlier or possibly even sooner. The government's direct commercial involvement in gas ends in 2009 with the termination of the Maui contract.

In order to improve the efficiency of the sector, the government initiated a wide-ranging review of the gas sector in February 2001, which resulted in the release in November 2002 of a draft government policy statement ("Development of New Zealand's Gas Industry"), which will be subject to comment in the next few months before a final statement is released.

The government's objective for gas is to "ensure that gas is delivered to existing and new customers in an efficient, fair, reliable, and environmentally sustainable manner". To meet this objective, the government has announced that it favours industry-led solutions where possible, but is prepared to use regulatory solutions where necessary.

To enable the development of industry-led solutions, the government has invited the gas industry to establish a governing entity and decision-making process to manage the further development of gas market arrangements. The governing entity must develop a work programme that allows for efficient gas market arrangements. It must be representative of all stakeholders, including consumers, and have an independent chair. The government intends the governing entity to:

- Improve arrangements for the wholesale trading of gas.
- Develop an open access regime for all transmission pipelines.
- Develop standard terms and conditions for accessing distribution pipelines.
- Develop model contracts for consumers.
- Develop standardised arrangements for customer switching.
- Establish an independent system for handling consumer complaints.

The government considers open access to the Maui pipeline as being critical to promoting the efficient delivery of gas. The government intends to facilitate the process of amending the Maui contracts (in which the government has a significant commercial interest) so that non-Maui gas can be transported through the Maui pipeline. The government has invited the companies involved to present it with a proposal that provides open access to the Maui pipeline.

The debate in New Zealand on whether pipeline prices are excessive has led the government to request the Commerce Commission, under section 56 of the Commerce Act, to report on whether increased regulatory control should be introduced for gas pipelines.

In the meantime, the government has decided to further develop the Gas (Information Disclosure) Regulations 1997. As part of these changes, Optimised Deprival Value (ODV) will be formalised in the information disclosure regime as an interim measure because of the following:

- While ODV is currently used by gas pipeline companies, there is no assurance of consistent application of valuation rules (this can impact on profit measures).
- Regulated ODVs provide a firm basis for making any commercial gain transparent.

ELECTRICITY

The New Zealand electricity industry has experienced a major structural reform moving from a centrally controlled system to a market-based competitive model. In 2000, a Ministerial Inquiry into the electricity industry led to further reform, a central tenet of which is the government's desire for industry solutions where possible, with regulation only where necessary.

In December 2000, this inquiry resulted in a government policy statement (GPS), designed to improve market functioning. It sets out expectations for policy delivery through industry self-governance and details the specific market improvements sought by the government, including:

- Disclosure of information on hydro spill, spot market bids by generators and hedge and contract prices.
- Real-time pricing and improved demand-side management.
- Low fixed charges for low-use consumers.
- Participation by all network and retail companies in a consumer complaints resolution scheme.
- Model consumer contracts and prepayment meters.
- Improved arrangements for distributed generation.
- Forecasts of security of supply.
- Arrangements for making grid investments and agreeing on transmission pricing.

New Zealand's dependence on hydro electricity, coupled with low lake levels and unusually high demand resulted in an electricity shortage in the winter of 2001. Following the shortage, the government conducted a review of the way the country's electricity system functioned over the winter.

The review concluded that the electricity price spot market worked much as expected, with very high prices signalling an increasingly tight supply situation and record demand, and that the market would have worked better if the reforms specified in the GPS had been fully implemented, for example:

- Projections of system adequacy.
- Disclosure of forward hedge prices.
- Disclosure of generator offer prices into the market.
- Development of real-time spot market pricing and promotion of demand-side participation.

- Arrangements for new transmission investments to relieve constraints.
- Development of financial instruments to manage transmission risk.

In light of concerns about high spot prices and the findings of the electricity sector inquiry, the government amended the GPS with the Electricity Amendment Act 2002. This amendment requires public disclosure of generator offers on the wholesale market after two weeks rather than three months. This will give consumers and other interested parties an early opportunity to seek explanations from generators if questions arise about offer behaviour and prices.

The government also advised the electricity industry that it will consider taking further measures if effective retail competition does not transpire. The government considers that there are sufficient electricity retailers in the market for effective competition to occur, but only if regional monopolies do not develop.

ELECTRICITY GOVERNANCE ESTABLISHMENT COMMITTEE AND THE ELECTRICITY COMMISSION

The industry established the Electricity Governance Establishment Committee (EGEC) to develop a draft rulebook combining existing industry rules and enhancements required by the GPS. In December 2001, an application was made to the Commerce Commission to authorise the proposed self-governance arrangements, as it was likely that, without authorisation, the arrangements would have been in breach of the Commerce Act. Authorisation, with conditions, was granted in September 2002, but this was appealed by some parties, including the state-owned transmission company, Transpower. The EGEC continued to develop the necessary self-governing arrangements for the industry.

In the first half of 2003, decreased rainfall again produced a shortfall in available electricity with prices beginning to rise in April 2003. A successful energy conservation campaign and higher rainfall during the latter part of 2003 helped to avert any customer shortages. However, this near-crisis renewed calls for a more reliable electricity industry able to avert the types of shortages the country had experienced in two of the previous three years. Members of the EGEC continued their negotiations to determine suitable arrangements, but no solution suitable to all parties was found and the EGEC became defunct.

The government responded by creating the Electricity Commission, which is responsible for contracting with generators to provide reserve thermal power to be used during dry years. This reserve power will be withheld from the market during normal years to avoid market distortion. Consumers will pay for this reserve capacity through a special charge on their bills that is not expected to exceed 0.5% per unit of electricity purchased. Sufficient reserve capacity will be built up over a three-year period to meet any electricity shortfall in a one-in-60 dry year.

MARKET DEVELOPMENTS

Since the last in-depth review, some specific improvements to market arrangements have occurred, particularly with regard to opportunities for large consumers to participate in the wholesale electricity market.

- **Hydro spill:** Since April 2002, each hydro generator publicly reports hydro spill information, including the amount of water spilled and reasons for the spill, within four weeks of the end of each quarter.
- **Hedge index:** In July 2002, a public index for fixed electricity contracts was established. The index is designed to provide some means of establishing a forward price curve for electricity.
- **Bids and offers:** All generator offers and demand bids from 29 May 2002 are made publicly available four weeks after the day on which they are submitted.
- **RTP trial:** Real-time pricing offers electricity purchasers the opportunity to participate more effectively in the wholesale price discovery process. In October 2002, a three-month trial began in which every half-hour, six five-minute indicative prices will be calculated and published.
- **Financial transmission rights:** The government is developing a policy on the introduction of FTRs, which the industry will be expected to implement.

REGULATION OF DISTRIBUTION BUSINESSES

An amendment to the Commerce Act in 2001 establishes a regulatory regime for electricity distribution businesses by providing the Commerce Commission with the regulatory power to declare price control. As part of the overall regime, the Commerce Commission is required to publish performance thresholds. The thresholds, which are still under development, will act as a screening mechanism. If a distribution business breaches a threshold, the Commission can investigate the performance of that business to determine whether it should be placed under price control. The first assessment of distribution businesses against the thresholds is expected by mid-2003.

ELECTRICITY COMPLAINTS

In January 2002, in response to a government request, an Electricity Complaints Commission Scheme and an associated code of practice was set up to create a one-stop-shop where consumers can get independent help with complaints about their electricity company. The scheme covers distribution companies and retail companies. Under the scheme, every member company agrees to maintain the minimum standards set out in the code of practice. The scheme is funded by its members, but is fully independent of the industry.

COMPETITION

The electricity shortages in the winter of 2001, which caused significant increases in spot prices and the subsequent demise of a major retailer, have increased incentives for generators to balance their generation-retail portfolio. A trend towards increased "regionalisation" has emerged, with generators preferring to retail in areas close to their source of generation. Nevertheless, partly owing to government directives, the level of retail competition has improved, with the proportion of domestic consumers with only one retailer down to 3% and around 80% of the population now having a choice of three or more retailers.

RESEARCH AND DEVELOPMENT

The Foundation for Research, Science and Technology (FRST) is responsible for investing the majority of public money in research and development. At any one time FRST has approximately NZ$ 11 million per year allocated to energy projects. This money is spread among renewables, energy efficiency, oil and gas and other projects. Each year, FRST focuses on and funds different areas of research. In 2001-2002, it focused on two energy portfolios, namely Traditional Energy Resources and Energy Systems and Management.

In 2002-2003, NZ$ 5.94 million of new funding was made available across these two portfolios. In the Traditional Energy Resources portfolio, NZ$ 4.25 million was made available annually to fund two projects; NZ$ 3.8 million per year for six years was allocated to the Institute of Geological and Nuclear Sciences (IGNS) to fund work on "Basin Evolution and Petroleum Potential", and NZ$ 450 000 per year for six years was allocated to the University of Waikato to fund work on "Improving the Discovery of Oil and Gas". In the Energy Systems and Management portfolio, NZ$ 1.69 million of new funding was allocated annually to projects such as a Building Research Association Project on Household Energy Efficiency (NZ$ 700 000 for four years) and a National Institute of Water and Atmospheric Research project on Energy and the Climate Risk (NZ$ 210 000 for six years).

GENERAL ENERGY POLICY

Norway is a major energy producer and exporter of oil and gas. Its energy policy is oriented towards meeting the following objectives:

- Added value based on sustainable development.
- Liberalised energy markets.
- Limited energy use through measures stimulating increased energy efficiency.
- Increased production from renewable energy.
- Opening of new petroleum provinces.
- Accommodating the growing influence of international structures such as the World Trade Organization (WTO), the Organisation for Economic Co-operation and Development (OECD) and the European Union (EU).
- Stability in the oil market.
- Responding effectively to changes in the international energy market, including ongoing mergers among major players and new information and communication technology.

The Parliament (Storting) determines the political framework for the petroleum and energy sectors and resource management. The Ministry of Petroleum and Energy has overall administrative responsibility for these sectors and ensures that activities follow the guidelines drawn up by Parliament. The Norwegian Petroleum Directorate and the Norwegian Water Resources and Energy Directorate are subordinate agencies of the ministry and are responsible for the administration of Norway's petroleum, water and energy resources. The Ministry of Environment has administrative responsibility for the climate change policy. Enova, the new state-owned agency for promoting energy savings, renewable energy and environment-friendly natural gas solutions, was established on 1 July 2001, and has been operational since 1 January 2002. The Research Council of Norway is responsible for publicly funded energy research and development (R&D).

In 1991, a carbon dioxide (CO_2) tax was imposed on fossil fuels used for energy purposes. In 2005, where technically possible, a scheme will be introduced for early trade in greenhouse gas emissions from sources that are currently exempted from the CO_2 tax. (Further details on the scheme for trade are described in the Energy and the Environment section below.) Fossil fuels are also charged a SO_2 tax. In 2002, a general value-added tax was applied at a level of 24%. Table 1 shows CO_2 and SO_2 taxation on different fossil fuels in 2002[5].

Table 1

CO_2 and SO_2 Taxation on Fossil Fuels, 2002

Product	*Carbon Dioxide*	*Sulphur Dioxide*
Coal and coke	0.49 NKr/kg	
Fuel oil	0.49 NKr/litre	0.07 NKr/litre
Gasoline, leaded	0.73 NKr/litre	
Gasoline, unleaded	0.73 NKr/litre	
Oil, offshore	0.73 NKr/litre	
Gas, offshore	0.73 NKr/Sm^3	

In 2001, the tax on electricity consumption was NKr 0.113 per kWh. On 1 January 2002, the tax was reduced to NKr 0.093 per kWh. In 2000, a basic tax on fuel oil was introduced to avoid increased use of heating oil after an increase in the electricity tax from NKr 0.0594 per kWh in 1999 to NKr 0.0856 in 2000. In 2002, the basic tax on fuel oil was NKr 0.389 per litre.

Manufacturing industries, mining and quarrying, greenhouse nurseries and households in northern Norway are exempted from the electricity tax. On 20 March 2003, the Finance Minister, Per-Kristian Foss, announced that the exemptions would be extended to all commercial entities. This action was prompted in part by the involvement of the EU surveillance committee (ESA) which claimed the exemptions amounted to state aid to the exempted industries and thus violated Norway's European single market obligations. While ESA cannot influence overall taxation levels in Norway, it can comment on preferred tax treatment of selected industries. The tax cuts will be introduced in 2004 and phased in over a two-year period, costing the government up to NKr 500 million annually in lost revenue.

ENERGY SUPPLY AND DEMAND

In 2002, Norway's total primary energy supply (TPES) was 27.7 Mtoe, a 4.1% rise from the previous year; 40% of the TPES came from hydroelectricity, 21%

5. In 2002, one Norwegian krone (NKr) was equal to US$ 0.125.

from oil and 35% from natural gas. Norway has no nuclear facilities. In 2001, total final consumption of energy (TFC) was 21.2 Mtoe, a rise of 4.3% from the previous year. Electricity was the predominant fuel used directly by the consumer, representing 46% of total demand, followed by oil at 40% and biomass at 6%. Natural gas accounted for only 3% of the country's TFC. In 2001, industry accounted for 44% of TFC, transportation for 22%, and other sectors (primarily residences) for 34%.

Norway is a substantial producer and exporter of petroleum and natural gas. In 2002, Norway produced 145.8 Mtoe of crude oil and 14.7 Mtoe of NGL/condensates, of which about 95% was exported. The country produced 54.9 Mtoe of natural gas, exporting 99%. In 2002, Norway was the world's seventh-largest oil producer (including NGL), and the third-largest oil exporter. It is the largest supplier of gas to north-west Europe, supplying about 13% of Europe's gas market. Based on the proven recoverable gas resources, Norwegian gas supply is likely to increase in the future.

ENERGY AND THE ENVIRONMENT

Norway signed the Kyoto Protocol in April 1998 and ratified it in May 2002. The Norwegian commitment under the Kyoto Protocol is to limit the increase in greenhouse gas emissions to 1% above 1990 levels in the first commitment period 2008-2012. CO_2 emissions account for about 75% of total GHG emissions and have risen 33%[6] from 1990 to 2001.

The energy sector accounts for about two-thirds of Norwegian GHG emissions. Road traffic and oil and gas production are the largest sources in this sector. Process-related industrial emissions from the production of metals, minerals and chemicals are the second-largest source. In 2001, the oil and gas industry accounted for 24% of CO_2 emissions, road traffic for 22%, stationary combustion for 20% and industrial processes for 17%. Since electricity is generated almost exclusively from hydropower, emissions from stationary combustion are dominated by industrial sources.

In 2002, Parliament approved the former government's June 2001 White Paper and the present government's March 2002 supplementary White Paper on Climate Change Policy. On the basis of these papers, the government has implemented a framework to pursue the necessary climate change mitigation strategy.

Up to 2008, the government will pursue a number of climate-related measures. These measures include continuing to levy the CO_2 tax at the current level and

6. Owing to differences in methodology and definitions estimating energy-related CO_2 emissions, the IEA statistics and the official Norwegian figures differ from one another. Norway's statistics show that in 1990 energy-related CO_2 emissions were 28.4 Mt and in 2001 they were 34.4 Mt, for an increase over that time of 21%.

introducing a quota-based domestic emissions trading system for the period 2005 to 2007 for industries not currently charged the CO_2 tax. Consequently, almost all sectors will be regulated by climate policy instruments, which will facilitate meeting the Kyoto Protocol requirement to make "demonstrable progress" by 2005.

A broad domestic emissions trading system covering about 80% of the emissions will be introduced for the first commitment period 2008-2012. The system will be compatible with the international emissions trading system under the Kyoto Protocol and will be based on the recommendations of the commission of experts appointed to devise an emissions trading system.

A target has been introduced to reduce the use of mineral oils for heating by 25%.

The government's White Paper on Domestic Use of Natural Gas proposes that Norway participate in an international mandatory certificate market for green electricity. Parliament has approved the government's proposal that Norway contribute to developing an international market for such certificates. In doing so, the government will keep in mind environmental concerns, security of supply and an acceptable management of natural resources in Norway.

ENERGY EFFICIENCY AND RENEWABLES

Norway's per capita energy use is higher than the OECD average but comparable with its neighbours. In 2001, per capita energy use in Norway was 6.1 toe, while in 1997 it was 5.6 toe and in 1973 it was 5.3 toe. In 2001, per capita energy use in the OECD was 4.7 toe and in OECD Europe 3.4 toe. Norway's energy mix differs from the OECD average and its neighbours in its above-average per capita electricity consumption, which stems from the country's rich supplies of relatively cheap hydropower. Consequently, a large energy-intensive industrial sector has developed and electricity is widely used to heat buildings and water.

Enova, the new agency for promoting energy savings, renewable energy and environment-friendly natural gas solutions, has been operational since 1 January 2002. Enova is a public enterprise owned by the Ministry of Petroleum and Energy.

Enova's principal mission is to contribute to energy savings, including the environmentally sound and rational use of energy, and the production of renewable energy, relying on financial instruments and incentives to stimulate market actors and mechanisms to achieve national energy policy goals. In addition, Enova is promoting environment-friendly natural gas solutions. The establishment of Enova signals a shift in Norway's organisation and implementation of its energy efficiency and renewable energy policy. By gathering strategic policy responsibilities in a small, flexible and market-oriented organisation, Norway intends to have a proactive agency with the capacity to stimulate energy efficiency by motivating cost-effective and environmentally sound investment decisions. Enova enjoys considerable freedom in choosing its strategy and policy measures. It advises the Ministry of Petroleum and Energy on energy efficiency and renewable energy issues.

Enova aims to achieve the following objectives adopted by Parliament in spring 2000:

- To limit energy use considerably below the business-as-usual scenario.
- To increase the annual use of central heating based on renewable energy sources, heat pumps and waste heat by 4 TWh by 2010.
- To install wind power plants with an annual production capacity of 3 TWh by 2010.
- To increase the land-based use of natural gas.

To achieve these objectives, the Parliament will allocate a total of up to NKr 5 billion of grants over a ten-year period. The funding comes from a levy on the electricity distribution tariffs and from ordinary grants over the state budget. Enova is responsible for establishing incentives and financial funding schemes for cost-effective and environmentally sound investments.

Enova has organised its activities into main programme areas. Currently, organisations can apply for funding in the following programme areas:

- **Heat distribution (infrastructure) and heat generation.** Based on renewable energy sources, such as bioenergy and waste. Enova can contribute up to 15% of the total project cost.
- **Energy end use/energy efficiency**
  - Industry: Energy savings and efficiency improvements in industry are targeted by benchmarking and analysis of industrial companies' energy use.
  - Energy management in large commercial buildings: The goal is to reduce energy use by 100 GWh per year. Project activities that qualify for funding are energy management, training, dissemination of information, energy monitoring and energy and environmental analyses.
  - Energy management in small commercial buildings: The goal of the programme is to reduce the need for energy by approximately 70 GWh per year.
  - Retrofitting of street lighting: The programme targets owners of large facilities and outdoor lighting infrastructure who are considering changing existing light fixtures.

- Residential buildings: The programme is aimed at both new homes and the rehabilitation of the existing building stock in the residential sector.

- **Wind energy**. Investment subsidies are granted to cost-effective projects that would not otherwise have been realised. The maximum level of subsidy is 10% of the total investment. A second programme aims to demonstrate and assist the commercialisation of wind technology suitable for Norwegian conditions by providing a maximum of 60% of approved project costs.

- **Renewable energy** (other than wind). The aim is to facilitate deployment of new renewable energy technologies, particularly solar space and solar water heating. Hydropower projects, including production from small, micro and mini generation plants are not covered by Enova's grant schemes.

- **Information, advice and campaigns**. National television advertising campaigns, energy information and advice on technologies and solutions for household and commercial end-users.

OIL

The government aims to promote stability and predictability in the oil market. Together with a reasonably high oil price, this will strengthen the basis for investments on the Norwegian Continental Shelf (NCS) and improve the energy security of oil-consuming countries. Experience in recent years has demonstrated that a low oil price, even for a short period of time, has negative consequences for new activity on the NCS. Oil production peaked in 2000 and is expected to remain at its current level through 2004, at which time it will start to decline. As of 2001, Norway had estimated oil reserves of 9.4 billion barrels.

In November 2001, Norway announced that it would reduce its oil production to help stabilise the crude oil market. In the first half of 2002, the government cut oil production by 150 000 barrels per day to reach a production target of approximately 3 million barrels per day. During this period, oil prices started to increase, and in late June 2002, the government stated that it would not extend the restriction on oil production into the second half of 2002.

The Norwegian oil sector has undergone significant restructuring in the past several years. Statoil is the country's largest oil company and had at one time been 100% state-owned. Statoil managed, but did not own, the State Direct Financial Interest (SDFI), which represented the government's holdings in 150 production licences representing about 40% of total production. In May 2001, Statoil was allowed to purchase 15% of SDFI for US$ 4.2 billion[7], and

7. Or NKr 38.6 billion.

on 18 June 2001 the government sold 18.2% of its share in Statoil in an initial public offering for NKr 14 233 million or approximately US$ 1.9 billion[8]. In addition, the government sold 6.5% of SDFI to nine other companies for NKr 8.4 billion or US$ 1.1 billion. A new state-owned company, Petoro, was set up to manage the remaining SDFI portfolio, which is still owned by the State. The SDFI portfolio has a production capacity of about 1 million barrels per day of crude oil.

NATURAL GAS

Prior to 1 June 2001, all Norwegian gas was sold through the Gas Negotiating Committee (GFU), which consisted of Statoil and Norsk Hydro. The government-imposed GFU sold gas on behalf of the gas producers on the Norwegian Continental Shelf (NCS). In January 2002, the government terminated the GFU and replaced it with individual company-based sales.

On 14 May 2001, the Ministry of Petroleum and Energy established the state-owned Gassco. Since 1 January 2002, Gassco has operated most of the upstream pipeline network. It has no ownership in gas resources or infrastructure. The company ensures neutrality and efficiency in the operation and development of the upstream pipeline network.

Gassled was created on 1 January 2003 as a unified ownership structure for the major parts of the upstream pipeline network on the NCS. The organisation of the gas transportation activities under one ownership system allows for more efficient operation and development of the system. Gassco is the operator of Gassled.

By January 2003, new regulations had been implemented on principles for access to the upstream pipeline network. The new access regime is neutral for all users of the transport system and reduces the transaction costs related to transport. Gassco, as a neutral operator, organises the capacity management and tariffs are listed in the regulations.

In the recent White Paper on Domestic Use of Natural Gas, the government presents a policy to increase natural gas use. Norway has tended to export almost all of its natural gas, thereby improving the trade balances. Natural gas is one option to meet Norway's growing energy demand. Availability of gas is an important factor in increasing its domestic use and the government has suggested establishing a support scheme for building new gas infrastructure. The proposed support scheme includes plants and transmission pipelines for LNG

8. Assuming NKr/US$ exchange rate of 7.50.
9. Assuming NKr/US$ exchange rate of 7.50.

transport. It will not cover distribution grids. The support scheme is proposed to be managed by Enova.

The White Paper also concentrates on the main political element of advancing gas-fired power plants with CO_2 capture and storage, with the government proposing to do the following:

- Strengthen R&D activities to promote gas-fired power plants with CO_2 capture.
- Establish a support scheme for investment in full-scale gas-fired power plants with CO_2 capture from 2006.
- Establish a public company to manage the support scheme for investment in power plants with CO_2 capture.
- Establish a national centre for practical uses of natural gas, targeted at end-users.
- Consider governmental participation in development and management of CO_2 infrastructure, and prepare for enhanced oil recovery and CO_2 storage.

Companies on the NCS plan to construct a pipeline from the Ormen Lange field in the Norwegian Sea to the existing upstream pipeline network (Gassled) at Sleipner in the North Sea and from there a pipeline to Easington in the United Kingdom. The southern part of the pipeline system from Sleipner to the UK is expected to have a capacity of 70 mcm (2.4 bcf) per day and will further increase the flexibility of the Norwegian upstream pipeline network. The development of this transportation system depends on further agreements by the Norwegian and UK governments. The 1 200 km pipeline system is expected to cost NKr 15-20 billion.

In August 2002, Norway and the UK jointly released a report, "Unlocking Value through Closer Relationships", which called for greater co-operation between the two countries to ensure that resources are fully exploited without interference from real or perceived barriers. Both countries are now discussing a framework treaty that will facilitate cross-border opportunities.

In May 2002, Parliament approved the development of the Snohvit LNG project in the Barents region and allowed the State Direct Financial Interest to participate with investments of US$ 1.57 billion in the project. Total investments in the project are expected to reach US$ 5 billion. The project includes subsea field development and an LNG plant onshore on Melkøya, close to Hammerfest. The Snohvit scheme is one of the biggest industrial developments in Norway and is expected to produce 5.7 bcm of liquefied natural gas for 25 years following the planned 2006 production start-up. Gas from the field will be transported by pipeline to the onshore facility, liquefied and transported by ship to customers, for instance in Spain and the United States. Construction on the project began in June 2002.

ELECTRICITY

More than 99% of Norwegian power generation is based on hydropower. In 2001, total production was 121 TWh.

In 2001, the Norwegian Water Resources and Energy Directorate reviewed the data on water inflow to hydropower plants and revised the estimate for hydropower production in a normal year. The earlier estimate was based on the time series for water inflow for the period 1931 to 1990, whereas the new estimate is based on the period 1970 to 1999. Production in a normal year is calculated to be about 118 TWh. However, production is highly dependent on yearly precipitation levels. In 2000, the production amounted to 143 TWh.

In December 2001, the state-owned power company Statkraft purchased the independent electricity company Trondheim Energiverk for US$ 483 million, making Statkraft the second-largest power company in Scandinavia with over 50% of the Norwegian market. In January 2001, Prime Minister Stoltenberg declared that the era of large-scale new hydropower was finished and several such projects being developed, including Beiarn, Bjollaga and Melfjord, were abandoned. The present government, which took office after general elections in the autumn of 2001 and is headed by Prime Minister Bondevik, continues this policy.

Norway's heavy reliance on hydropower caused problems during winter 2002/2003. Below-average precipitation lowered reservoir levels, which reduced the amount of electricity generation available. At the same time, unusually cold temperatures increased electricity demand. Power prices rose to record highs with household bills two to three times higher than in 2001. Electricity imports from Russia, Poland and Germany into the Nordpool electricity exchange area increased. Civil servants called for energy conservation in offices and streets, with people being told to turn down heaters and otherwise reduce electricity use. In addition, many industrial facilities curtailed their electricity use, with some shutting down operations entirely during the period of high prices. With these responses to the unusual weather situation, the Norwegian electricity market was able to perform without any serious disruptions.

Norway is considering increased international electricity interconnections as a means of dealing with the variability of hydropower production, which is dependent on meteorological conditions. The interconnections could be used to export power in wet years (or seasons) and import power in dry years (or seasons). Imports and exports could also flow on a daily basis, reducing prices and increasing the security of both regions. Statnett, the Norwegian grid operator, has applied to the Ministry of Petroleum and Energy for a licence to build a 750 km subsea electricity cable between Suldal in Norway and the Easington terminal in the UK. Statnett would build the 1 200 MW cable in conjunction with the UK's National Grid Transco, sharing the project's expected US$ 1.3 billion cost. The cable is planned to come on line in 2007.

In 1999, Naturkraft (owned one-third each by Statkraft, Statoil and Norsk Hydro) was granted discharge permits, allowing it to proceed with plans to develop two gas-fired power plants. In autumn 2000, the conditions of the discharge permits were amended in accordance with a parliamentary decision and were confirmed by Royal Decree in summer 2001. In October 2002, Naturkraft was granted an extension of the current licences.

In 2001, Industrikraft Midt-Norge was granted a construction and operating licence and discharge permit for a co-generation gas-fired power plant. In 2002, Industrikraft Midt-Norge postponed the decision on this investment.

RESEARCH AND DEVELOPMENT

The government has decided to reorganise the Research Council of Norway by replacing its current six sectors with the following three divisions:

- Development of Professions and Disciplines.
- Innovation and User-initiated Research.
- Strategic Commitments.

The Board of the Research Council will be smaller and stronger and the management of the divisions will be closely linked to it.

The Research Council of Norway recently signed an agreement with Enova, the new agency for promoting energy savings, new renewable energy and environment-friendly natural gas solutions, thereby ensuring closer co-ordination of the activities of the two parties.

SPAIN

GENERAL ENERGY POLICY

Prior to the 2001 in-depth review, the government abandoned the periodical ten-year National Energy Plan (*Plan Energético Nacional*, PEN), which focused on meeting the country's future energy requirements. In September 2002, the government launched a new plan, the Electricity and Gas Sector Plan – Development of the Transmission Networks 2001-2011 (*Planificación de los Sectores de Electricidad y Gas – Desarrollo de las Redes de Transporte 2001-2011*). This plan focuses on the development of Spain's basic energy infrastructure and contains information on demand evolution, energy mix, environmental issues, investments, etc. The plan estimates that a minimum investment of €26.5 billion is needed for electricity generation and gas and electricity distribution, and foresees that natural gas and renewables will become more important while the use of nuclear, coal and oil in electricity generation will decline.

ENERGY SUPPLY AND DEMAND

Spain depends on imports for most of its supply. In 2002, it imported 76% of the energy it consumed. In 2002, total primary energy supply (TPES) was 131 Mtoe, representing a rapid growth of 44% over the 1990 figure. The share of oil in TPES was 51.2%, followed by coal (16.2%), natural gas (14.3%), nuclear (12.5%) and renewable energy sources (5.8%).

In 2001, the government released new energy forecasts for the period up to 2010 indicating that TPES will continue to grow rapidly by 30% between 2002 and 2010, driven by economic growth of 2.9% per year. The share of oil is expected to decline to 48%, nuclear to 9.7% and coal to 8.7%, whereas the share of natural gas is expected to increase to 21.7%, combustible renewables and wastes to 8% and hydro and other renewables to 3.6%.

Between 1990 and 2001, total final energy consumption (TFC) grew by 49%, with a 54% increase in the transport sector, 54% in the residential, services and agricultural sectors, and 43% in the industry sector. Between 2001 and 2010, the government expects TFC to increase by 37%. Growth will be strongest in the residential, services and agricultural sectors (46%), but a significant demand increase is also expected in the transport (40%) and industry (29%) sectors.

ENERGY AND THE ENVIRONMENT

Spain ratified the Kyoto Protocol in April 2002. The government agreed to limit the net increase in greenhouse gas emissions to 15% above 1990 levels by 2008-2012 under the Kyoto Protocol and the European Union (EU) "burden-sharing" agreement. However, energy-related CO_2 emissions, which constitute a large share of total emissions, were 38% higher in 2001 than in 1990. Although Spain began preparing a Strategy for Sustainable Development in June 2001 in an effort to meet its Kyoto commitment, no clear time frame has been set for the completion of this work. An Inter-ministerial Commission has been established to co-ordinate the strategy.

The Spanish Bureau for Climate Change, under the Ministry of the Environment's General Directorate for Environment Quality and Assessment, was created by Royal Decree 376/2001 in April 2001 to act as the National Climate Council's secretariat. Although the National Climate Council is responsible for developing and supervising the Spanish strategy against climate change, the regional governments are allowed to adapt policies in their specific geographic areas provided that these do not conflict with national policies. The Spanish Bureau for Climate Change has established three working groups, with representatives from administration and industry, to work on domestic climate change mitigation measures, emissions trading and application of the clean development mechanism (CDM) and Joint Implementation.

The EU Directive on Environmental Impact Assessment (85/377/EC) was transposed to Spanish legislation by Law 6/2001 of 8 May 2001. Royal Decree 287/2001 of 26 April 2001 adopted the EU Directive 1999/32/EC, which establishes limits for the sulphur content of oil products. Royal Decree 785/2001 of 6 July 2001 prohibited the use of leaded fuel from 1 August 2001.

ENERGY EFFICIENCY

Owing to the strong growth in energy demand, TPES per capita increased from 2.35 toe in 1990 to 3.24 toe in 2002; the gap to the OECD Europe average (3.41 toe in 2002) has been narrowing fast. By 2010, the government expects TPES per capita to reach 4.02 toe. Energy intensity (measured as TPES per GDP) in Spain has surpassed that in OECD Europe owing to growth of the former and improvement in the latter. In 2002, Spain's energy intensity reached 0.178 toe per US$ 1000 at 1995 prices and exchange rates compared to 0.161 toe in OECD Europe.

The Institute for the Diversification and Saving of Energy (IDAE) works together with the government and the regional and local agencies to co-ordinate and implement policies and actions promoting the rational use of energy and the diversification of energy sources, including the use of renewables. The Ministry of Economy is preparing a Spanish Energy

Efficiency Strategy, scheduled to be completed in 2003 that covers all sectors, except industry, with a prioritised list of measures and plans for monitoring and control.

Spain is in the process of establishing new mandatory building standards (updating those from 1979) and preparing a building certification and labelling scheme to implement the EU's "SAVE Directive" 93/76/EC. Once the legislation is in place, the regions will enforce it. Energy efficiency in the public sector is promoted through voluntary agreements, which are also used in industry together with information dissemination, third-party financing and promotion of co-generation. In the transport sector, measures include financial incentives to eliminate old cars; the development of city transport plans; the promotion of reduced VAT on tickets for public transport and the use of annual vehicle taxes, which are proportionate to vehicle weight and engine size.

OIL

Total oil supply increased from 46.5 Mtoe in 1990 to 67.3 Mtoe in 2002 but its share in TPES remained stable at 51% to 52% throughout the decade. Demand for diesel is rapidly increasing whereas demand for gasoline is levelling off, mainly driven by lower taxes on diesel.

Spain has some indigenous oil resources but they cover less than 1% of demand. Proven domestic oil reserves were 157 million barrels as of January 2003. Domestic production takes place in five oilfields. In 2002, the government gave Repsol-YPF permission to explore potential oil deposits near the Canary Islands. Crude oil and oil products are imported from diverse sources. In 2001, the volume of crude oil imports was 56.8 Mt and the most significant sources were Nigeria (15%), Mexico (14%), Libya (13%), Saudi Arabia (11%) and Russia (9%). Oil product imports were 21.2 Mt in 2001 and came mainly from Italy (22%), Algeria (17%), the US (15%) and Russia (8%). In 2001, Spain exported a total of 6.2 Mt of different oil products, mainly to the US and Western Europe.

Gasoline and diesel prices in Spain are among the lowest in IEA Europe, largely thanks to relatively low taxes. Price ceilings are imposed on 8 kg LPG cylinder and pipeline supplies of LPG, while prices for all other petroleum products can be set freely.

The oil market has been liberalised but remains rather concentrated with Repsol-YPF and Cepsa being the major players both in refining and distribution. The *Compañia Logística de Hidrocarburos* (CLH) transports about 95% of the oil products in Spain and owns most of the logistics. Repsol has reduced its shareholding in CLH from over 60% in 2000 to about 25% (as at end April 2003) to comply with the legislation that caps the shareholding of any single owner of CLH at 25% of shares and voting rights.

NATURAL GAS

Spain's natural gas demand continues to grow. It reached 18.7 Mtoe in 2002 which is almost four times higher than in 1990. In 2002, Spain's first combined cycle gas turbines were commissioned, further increasing natural gas demand. The government estimates gas demand to more than double by 2010.

Spain currently has five entry points for natural gas; two pipelines (the Lacq-Calahorra in the north and the Maghreb-Europe in the south) and three regasification plants for LNG (Barcelona, Cartagena and Huelva). In 2001, 44% of natural gas was imported via pipelines and 56% as LNG. Algeria accounted for 55% of supplies, which is under the indicative limit of 60% set by legislation for supplies from any single country.

The forecasted high demand growth requires significant investments in gas infrastructure. In 2002, Spain's Gas Natural and Portugal's Trangas announced an increase of 50% in the capacity of the Maghreb-Spain pipeline by the end of 2004. The National Energy Commission (CNE) has warned that "a delay in the expansion of regasification [capacity], in the construction of the Huelva-Cordoba-Madrid gas pipeline, in the Sagunto [regasification] plant or in the capacity extension of the Maghreb gas pipeline in its international section, could seriously compromise supply". In 2003, only 0.55 mcm of regasification capacity will come into operation instead of the 1 mcm forecasted and recommended by the CNE in 2001.

The Gas Natural Group remains the dominant player in the Spanish gas market. The group is vertically integrated and covers all areas of business from import to retail. The transmission system operator (TSO) Enagas owns the majority of the transmission networks. It has been held by Gas Natural Group but legislation limits the shareholding of any single owner of the TSO to 35%. After the June 2002 public offer, the shareholding of Gas Natural Group was reduced to 41% and 46% of the shares were free floating.

The structure of third-party access tariffs was established by Ministerial Order 949/2001 in August 2001 and the latest order defining tariff levels was issued in January 2003. Although market liberalisation was extended to all consumers at the beginning of 2003, small consumers can still choose regulated tariffs. In the first quarter of 2003, about 60% of natural gas was purchased from the free market, compared to 55% in 2002, 38% in 2001 and 9% in 2000. There is no reliable information on the number of consumers changing suppliers.

A 70% cap on the market share of any single supplier was enforced at the beginning of 2003. Another regulatory measure, which is aimed at increasing competition, is that a minimum of 25% of the gas supplied through the pipeline from Algeria, the cheapest gas source for Spain, must be supplied to the liberalised markets.

To support the development of competition in the gas and electricity sectors, the CNE has launched campaigns to inform consumers about the possibility to change suppliers. The Ministry of Economy has also established an information telephone line for consumers.

COAL

Coal demand was 21.2 Mtoe in 2002, slightly more than in 1990. Domestic production accounted for 33% of total coal demand. The most important import sources for hard coal were South Africa (38%), Australia (18%) and Indonesia (14%), and for steam coal were South Africa (46%), Indonesia (18%) and Russia (11%).

Coal is Spain's most important domestic energy source. However, its price is higher compared to coal available on the international market and the government is subsidising domestic coal-mining. While coal subsidies have been decreasing, Spain gives more subsidies to the coal industry than any other IEA coal-mining country except Germany. According to the EU regulations that took effect in July 2002, Spain's coal production is estimated to be reduced by 65% over the next ten years and production subsidies will no longer be provided for coal mines that are unable to improve their competitiveness. In 2002, subsidies of €606.9 million were given for the operation of coal mines and €173.5 million were paid directly to the workers for early retirement; there were no subsidies for production reductions or closures.

RENEWABLES

The 1999 Plan for the Promotion of Renewable Energy in Spain sets a target of 12% of Spain's energy demand being met from renewable sources by 2010, in line with the EU target defined in the European Commission's White Paper for Renewable Energy Sources. In 2002, the use of renewables amounted to 7.6 Mtoe and their share of TPES was 5.8%. Electricity generation from renewables totalled 51.3 TWh in 2001 (22% of total generation) with a major contribution coming from hydropower (17%) and 5% from the rest of the renewable energy plants.

Although the 1999 plan defines interim targets for 2006 for energy (a 4.8 Mtoe increase over 1999 levels), investment (€10 billion) and state aid (€1.3 billion), no strategy to meet the final target in 2010 has yet been announced. During the three-year period between 1999 and 2001, 14.8% of the 2006 interim targets for energy, 25.2% for investment and 4.1% for state aid had been achieved. Progress has principally been made in wind power development, which achieved half of its 2006 electricity generation target by the end of 2001; its total capacity reached 3 244 MW. In addition to direct subsidies for investment and operation costs, renewables have guaranteed market access with regulated feed-in tariffs. However, problems with grid connections and slow permit procedures slow down wind power capacity increases.

NUCLEAR

Spain has nine nuclear reactors, operating at seven sites, with a total gross generating capacity of about 7 800 MW. In 2001, Confrentes and the two Ascó units were granted authorisation for an additional ten years of operation. In 2001, nuclear plants produced 63.7 TWh, supplying 27% of the country's electricity requirements. Spanish nuclear reactors continue to perform very efficiently; the load factor was 91.7% in 2002 and 93.1% in 2001, among the highest in OECD countries.

ELECTRICITY

In 2001, electricity consumption was 201 TWh, compared to 126 TWh in 1990. This corresponds to an average growth rate of 4.4% per year. In 2001, coal stations accounted for 30.6% of total gross electricity production, followed by nuclear (27.1%), hydro (17.5%), oil (10.5%), natural gas (10%), wind and solar power (3%) and combustible renewables and wastes (1.4%).

The government estimates electricity demand to grow by 46% between 2001 and 2010, representing a 3.5% annual growth rate. Industry is investing heavily to meet the increasing demand. The three largest utilities, Endesa, Iberdrola and Unión Fenósa, plan to invest €8 billion for new generating plants in Spain between August 2001 and 2005. In 2001, the TSO for electricity, Red Eléctrica de España (REE), invested €78.4 million in expanding the networks and announced plans to invest €60.2 million to €72.2 million to improve interconnections with France. Feasibility studies are under way on a subsea electrical cable between Algeria and Spain.

In 2001, the Portuguese and Spanish governments decided to create the Iberian Electricity Market (IBELM) by 1 January 2003 latest. However, its implementation and establishment is not likely to occur before 2006 owing to many unresolved issues, mainly related to different market designs in the two countries. According to the governments' agreement, the 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. Its main functions will be to facilitate trading and to administer access to the Spain-Portugal interconnections.

Two decrees were issued in 2002 to facilitate market access for small consumers, either through load profiling or by installing hourly metering. Since the beginning of 2003, small consumers have the option of either choosing their supplier or regulated tariffs. In 2007, regulated tariffs for high-voltage electricity consumers will be abolished and electricity will have to be purchased from liberalised markets.

In terms of volume, eligible consumers purchased 57% of their electricity supply from liberalised markets in 2002 compared to 28% in 2000. However, 67% of eligible consumers chose regulated tariffs in 2002.

The industry structure is changing. In 1998, power production was divided between the Endesa Group (48%), Iberdrola (26%), Unión Fenósa (11%), Hidrocantábrico (4%) and independent power producers (11%). In 2002, ENEL acquired Viesco from the Endesa Group; Viesco currently has a 5% share of the market. There have been several acquisition attempts among the Spanish power utilities, by foreign power utilities and by the gas industry, but only the ownership structure of Hidrocantábrico has changed. In 2001, it was acquired by Energie Baden-Wurttemberg (EnBW), Electricidade de Portugal (EdP) and the Spanish bank, Caja de Ahorros de Asturias (Cajastur). In April 2003, REE increased its majority ownership of the Spanish mainland electricity transmission network to 84% by acquiring transmission assets from Endesa and Unión Fenósa. It is currently negotiating with Hidrocantábrico and Viesco on the purchase of their electricity transmission networks.

RESEARCH AND DEVELOPMENT

In 2001, the public energy research and development (R&D) budget for energy was €50 million, of which 48% was used for R&D on nuclear power, 35% on renewable energy, 7% on energy conservation, 5% on fossil fuels, 3% on power and storage technologies and 2% on other areas.

The main recipient of public funding is the public CIEMAT (Research Centre for Energy, Environment and Technology). Other bodies carrying out publicly funded energy R&D include CSIC (Centre for Scientific Research), ENUSA (National Uranium Company), CSN (Nuclear Safety Board), ENRESA (National Company for Radioactive Wastes) and universities. Financing is also given to private companies and technology centres.

The National Plan for Scientific Research, Development and Technological Innovation for the period 2000 to 2003 defines the priority areas for energy R&D. These included more efficient and less polluting energy systems (with special focus on renewables and fuel cells), alternative systems for propulsion, and new fuels for the transport sector with special attention to the reduction of CO_2 emissions.

TURKEY

GENERAL ENERGY POLICY

Since the early 1980s, Turkish energy policy has concentrated on market liberalisation in an effort to stimulate investment in response to increasing internal energy demand. Turkey's new government, which was elected in November 2002, has continued this policy despite lower energy demand induced by the 2001 economic crisis.

The need for fiscal discipline has increased pressure on the government to lower energy supply costs. The government is in the process of renegotiating the price of energy imports and is also working towards diversifying its external supply sources. Turkey is currently negotiating with Algeria and Nigeria to extend its gas purchases from these two countries and is examining alternative ways to save energy and to reduce its energy import bill. The government intends to establish Turkey as a strategic energy transit route. Several major pipeline projects are planned or under construction, in particular the expansion of the existing pipelines from the Caspian region to Europe via Georgia, Azerbaijan and the Middle East.

Turkey's energy imports increased prior to the 2001 economic crisis, owing to total final energy consumption (TFC) growing much faster than domestic production. In an effort to mobilise large volumes of foreign investment to boost supply, the government removed constitutional restrictions on private-sector involvement in public-service contracts. In January 2000, the International Arbitration Law was applied for the first time to settle disputes between the State and the private sector on public-service contracts. The law has facilitated the financing of energy sector projects.

During the 1990s, Turkey attracted significant private investments using three models for project financing and ownership, namely Build-Operate-Transfer (BOT), Build-Own-Operate (BOO) and Transfer of Operating Rights (TOR). TOR is still used for privatisation policies, for example in the electricity distribution sector.

In 2001, the Parliament voted two energy liberalisation laws, the Electricity Market Law and the Natural Gas Market Law, which aimed to end public monopoly in the energy sector and to implement cost-reflecting pricing structures. The laws made it possible to launch a new organisation, the Energy Market Regulation Authority (EMRA), to regulate the electricity and natural gas markets. In November 2001, the government commissioned the Energy Market Regulatory Board, which manages the EMRA.

ENERGY SUPPLY AND DEMAND

Between 2000 and 2001, total primary energy supply (TPES) considerably declined by 6.5%, from 77 Mtoe to 72 Mtoe. Despite this decline, the government foresees a significant recovery in energy demand and a doubling of the supply to 152 Mtoe by 2010. In 2002, oil maintained its lead with a 40% share of TPES, followed by coal (27%), natural gas (20%) and renewables (14%). Between 2000 and 2001, energy production (54% of it being coal in 2001) marginally decreased by 2% to 26 Mtoe owing to Turkey's preference to reduce its energy imports. Net imports reduced significantly by 10%, and the external energy dependence measured as a ratio of net imports to TPES declined from 65% in 2000 to 62% in 2001.

Between 2000 and 2001, TFC significantly decreased by 9% to almost 52 Mtoe. Industrial consumption declined by 19% during the same period, while TFC in the transport and residential/commercial sectors decreased by 4% and 3% respectively.

ENERGY AND THE ENVIRONMENT

Turkey is an Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC), which includes OECD countries and countries with economies in transition. As such, Turkey has an obligation to implement policies and measures for emissions reductions, but does not have an emissions target. As an OECD country, Turkey was also an Annex II Party to the UNFCCC. During the Seventh Conference of the Parties to the UNFCCC (COP-7), held in Marrakech in 2001, it was decided to remove Turkey from the Annex II list, recognising its special circumstances as an Annex I Party. Turkey is in the process of ratifying the UNFCCC.

CO_2 emissions from the energy sector increased by 58% between 1990 and 2000 and then decreased by 8% between 2000 and 2001. CO_2 emissions from the energy sector are expected to increase again in the future together with economic recovery.

ENERGY EFFICIENCY

In 2002, the Ministry of Industry and Trade issued regulations on the energy labelling for household refrigerators, deep freezers, washing machines, dryers, dishwashers and light bulbs. Since the beginning of 2003, the regulations are mandatory and were implemented to harmonise Turkish legislation with the European Union. The Industrial Energy Manager Programme has been pursued, and most of the energy managers of big industrial entities have been trained and are now certified energy managers.

OIL

Turkey is not a major oil producer. Its oil production, which amounted to 2.4 Mtoe in 2002, 9% down from 2.7 Mtoe in 2000, is expected to continue to gradually decline. In 2002, 91% of the oil demand was imported, mainly from Iran, Libya and Saudi Arabia. The 2001 economic crisis affected total oil demand, which shrank by 7% in TPES to 30 Mtoe in 2002.

Most of Turkey's future oil supply is expected to come from countries in Central Asia, such as Azerbaijan and Kazakhstan. In September 2002, construction began on the Baku-Tbilisi-Ceyhan oil pipeline by a consortium of international oil companies led by British Petroleum (BP), following the 1998 decision between Georgia, Azerbaijan, Kazakhstan and Turkmenistan to build the pipeline. The pipeline will connect the Caspian Sea to the Turkish Mediterranean via Georgia and will provide oil and gas for the European and US markets. Construction is expected to be completed in 2005[10].

In March 2003, an Oil Market Reform Law was presented by the government to the Parliament. If enacted, this law will liberalise oil and oil products pricing.

Downstream oil policy is guided by the need to liberalise the oil sector, through privatisation and modernisation efforts. The Turkish Petroleum Refineries Corporation (TUPRAS) carries out most of Turkey's oil refining and owns four of the six oil refineries located in Turkey. TUPRAS is currently modernising its refineries and shifting the product mix towards lighter products such as gasoline in order to meet EU standards for gasoline and diesel fuel by 2004. The government envisages selling its remaining share of TUPRAS capital (65%); however, the privatisation calendar has not yet been approved. Petrol Ofisi (POAS), the formerly state-owned petroleum distribution company, is now mostly privatised; 51% of POAS was sold to investors in 2000. In July 2002, the government announced its intention to sell its remaining 25.8% share in POAS to Dogan Petrol Yatirimlari, the majority shareholder. Privatisation is a prerequisite for the International Monetary Fund's assistance to Turkey through the economic crisis.

NATURAL GAS

Turkish gas production is very limited and represented only 2% of the 14 Mtoe of total gas supplied to Turkey in 2002. Natural gas domestic production

10. In 2003, using the OECD Guidelines for Multinational Enterprises Framework, a code of business conduct was backed by 38 governments (30 OECD members and eight non-members) and revised in 2000; several non-governmental organisations challenged the project.

significantly decreased in 2001 from 2000. Unlike other primary energies, natural gas supply did not decline during and after the economic crisis, but grew by 6% from 2000 to 2001. Contractual take-or-pay obligations have resulted in a relative increase in natural gas use. To regulate the seasonal, daily and hourly fluctuations in natural gas consumption, studies are being carried out to assess underground storage facilities. A project has been initiated to use the North Marmara and Degirmenkoy depleted gas fields in the Thrace region, which could be commissioned in 2005. Salt caverns in the Salt Lake in Central Anatolia are also planned to be used as underground storage facilities.

Up to 2001, Turkey imported 69% of its total imported gas from Russia, 23% from Algeria and 8% from Nigeria. Gas deliveries from Iran began in December 2001, after repeated delays. BOTAS signed the Natural Gas Sale and Purchase Agreement with SOCAR for the delivery of 6.6 bcm per year of natural gas from the Azeri "Shah Deniz" gas field from 2006. In February 2003, the seller party was changed to AGSC (Azerbaijan Gas Supply Company). The pipeline will deliver gas at the Georgian/Turkish border and is expected to cost €3.2 billion.

The government still expects gas demand to grow almost fourfold by 2010; however, questions remain on whether domestic demand will grow rapidly enough to absorb the additional volumes contracted from Iran and Azerbaijan, in addition to the gas that will be supplied by Russia, Algeria and Nigeria. For instance, in June 2002, Turkey stopped gas imports from Iran, citing gas quality problems. In November 2002, Turkey announced that it had resumed gas imports from Iran after obtaining a lower price and a reduction in the take-or-pay percentage. The €3 billion Blue Stream Pipeline was put into operation in February 2003. It is planned to transport 16 bcm per year of natural gas along a distance of 1 200 km from Russia to Turkey. In March 2003, Turkey halted gas imports from Blue Stream.

In late February 2003, the government signed a binding agreement with Greece to facilitate the expansion of Turkey's role as an important transit centre for natural gas exports to Greece and beyond. The agreement calls for the extension of the natural gas pipeline from Turkey to Greece, a project with a maximum capacity of 3.6 bcm per year for an investment of approximately €270 million. Other routes, notably from Turkey to Austria, are also being considered.

The Natural Gas Market Law, enacted in May 2001, will gradually force BOTAS to reduce its share of gas imports to 20%, requiring the company to sell part of its existing gas import contracts by 2009. By then, BOTAS should be split into separate units that will eventually be privatised for gas imports, transport and storage.

COAL

Between 2000 and 2001, domestic coal production increased by 6% to 14 Mtoe. Turkey has both hard coal and lignite deposits. Two lignite mines are the property of the state-owned company EÜAŞ. The Kangal mine is operated by a private company under contract. Most of the other mines are operated by the state-owned company Turkish Coal Enterprises (TKI). Although Turkey still imports approximately one-third of its coal consumption, coal supply decreased by 12% to 20 Mtoe between 2000 and 2001.

ELECTRICITY

Between 1990 and 2000, Turkey more than doubled its gross electricity output to reach 124 TWh in 2000, the second-largest growth in IEA countries. The 2001 economic crisis stalled this growth. Between 2000 and 2001, total electricity output and electricity demand decreased by 2% and 1% respectively. The share of gas in electricity production continued to grow, representing 40% of the electricity produced in 2001, followed by coal with 31% and hydro with 19%. Turkey has a relatively high number of co-generation plants.

Before the economic crisis, the rapid growth in electricity demand led Turkey to increase its installed generating capacity and to import electricity from Bulgaria. The imports stopped in April 2003 because Turkish domestic production had become cheaper. Turkey's economic difficulties also compromised several electricity generating projects. Regulatory changes added to the temporary uncertainties, despite the approval in 2001 of the new Electricity Market Law, which will eventually facilitate competition and investment. The new law called for the state-owned electricity utility, TEAS, to be broken up into separate generation, transmission and trade companies. Following the unbundling, which was carried out in 2001, a new state-owned company, Electricity Generation Company (EÜAŞ) is responsible for electricity generation; the Turkish Electricity Transmission Company (TEIAŞ) was created to construct, operate and maintain Turkey's high-voltage electricity transmission grid and the newly created Turkish Electricity Trading and Contracting Company (TETAŞ) is responsible for wholesale electricity trade. Plants in the EÜAŞ portfolio and the distribution assets of TEDAS are expected to be privatised, while transmission will remain a state responsibility given its monopolistic character. TETAŞ will be the dominant player in the wholesale trading activities until private wholesale companies are introduced in the market.

In May 2002, the EMRA issued drafts of the Energy Market Licensing Regulation and the Electricity Market Tariffs Regulation, which were enforced in August 2002. The EMRA announced a four-stage approach to developing a competitive electricity market: 1) licensing firms in the electricity and natural gas markets; 2) allowing large industrial users the right to choose their initial electricity provider in March 2003, which represents around 20% of the market; 3) setting up the Market Financial Reconciliation Centre for balancing and settlements; and 4) initiating the operations of this centre. The Parliament is examining the possibility to expand the EMRA's mandate to include petroleum upstream activities.

In May 2002, the Ministry of Energy and Natural Resources informed the Turkish Privatisation Agency (OIB) on the power plants and distribution assets to be included in the privatisation process. Progress on the implementation of the new Electricity Market Law has been slower than expected. OIB has included 19 distribution regions in the portfolio of energy assets to be privatised through tenders in 2004.

The EMRA is aiming for energy prices that reflect costs. In this respect, a regional power tariff could be implemented in 2003 to reduce discrepancies between provinces.

RENEWABLES

Turkey has a relatively good potential for renewable energy. The country represents approximately 1% of the total world hydroelectric potential. Turkey has significant potential for geothermal and wind energies, which largely remain to be developed. Studies are in progress to promote the use of renewable energy sources in competitive electricity market conditions. A separate legislation is being prepared to define incentives for this purpose.

In 2002, renewable energy accounted for almost 14% of TPES. Although hydro represented a significant 3% share of TPES in 2001, combustible renewables and wastes – largely fuel wood consumed by households – represented the bulk of TPES with an 8% share. This share is expected to decrease in the future. Hydroelectricity production reduced by one-third in 2001 compared to 2000, mainly to compensate for lower electricity demand and a rather inelastic supply of natural gas in the framework of take-or-pay contracts.

RESEARCH AND DEVELOPMENT

During 2002 and 2003, Turkey's research, development and demonstration (RD&D) activities can be placed in two categories. The first category covers a number of small-scale (up to €100 000) clean energy R&D projects, which are principally financed by national funds. The total figure allocated to this category is less than €1 million. The first category also covers university projects, such as photovoltaics, solar-heating devices and biogas, and joint ventures between public R&D organisations and small to medium-sized private companies, such as the hybrid-electric car and energy conservation.

The second category covers medium or larger-sized international projects (from €100 000 to several million euros), which are generally funded by international organisations and include projects such as NATO-SfP projects, the EU Sixth Framework projects and WEAG projects. The main areas of research for these projects are photovoltaic technologies, fuel cells, fuel reformers for fuel cells, the all-electric vehicle and biomass gasification.

PART 2.3

ENERGY BALANCES AND KEY STATISTICAL DATA OF IEA COUNTRIES

AUSTRALIA

AUSTRIA

BELGIUM

CANADA

CZECH REPUBLIC

DENMARK

FINLAND

FRANCE

GERMANY

GREECE

HUNGARY

IRELAND

ITALY

JAPAN

KOREA

LUXEMBOURG

NETHERLANDS

NEW ZEALAND

NORWAY

PORTUGAL

SPAIN

SWEDEN

SWITZERLAND

TURKEY

UNITED KINGDOM

UNITED STATES

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**68.0**	**157.7**	**232.3**	**250.4**	**314.6**	**363.2**	**..**
Coal[1]		40.3	106.3	163.2	179.6	207.8	229.7	..
Oil		19.8	29.0	33.9	35.0	32.0	34.2	..
Gas		3.4	17.1	28.5	29.1	65.0	87.8	..
Comb. Renewables & Wastes[2]		3.5	4.0	5.0	5.2	7.7	9.2	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.0	1.2	1.4	1.4	1.7	1.7	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	0.1	0.1	0.1	0.4	0.5	..
TOTAL NET IMPORTS[4]		**–10.3**	**–65.7**	**–121.3**	**–134.9**	**–169.5**	**–181.8**	**..**
Coal[1]	Exports	17.6	67.7	114.6	125.2	158.3	168.2	..
	Imports	–	–	–	–	–	–	..
	Net Imports	–17.6	–67.7	–114.6	–125.2	–158.3	–168.2	..
Oil	Exports	3.4	9.3	22.8	27.4	26.1	27.7	..
	Imports	12.5	14.2	26.3	27.3	44.4	56.5	..
	Bunkers	1.8	0.6	0.9	0.8	1.0	1.2	..
	Net Imports	7.4	4.3	2.6	–0.8	17.4	27.6	..
Gas	Exports	–	2.3	9.3	8.8	28.6	41.2	..
	Imports	–	–	–	–	–	–	..
	Net Imports	–	–2.3	–9.3	–8.8	–28.6	–41.2	..
Electricity	Exports	–	–	–	–	–	–	..
	Imports	–	–	–	–	–	–	..
	Net Imports	–	–	–	–	–	–	..
TOTAL STOCK CHANGES		**–0.1**	**–4.5**	**–1.1**	**0.1**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**57.6**	**87.5**	**109.8**	**115.6**	**145.1**	**181.4**	**..**
Coal[1]		22.6	35.0	47.4	55.4	49.5	61.5	..
Oil		27.1	32.5	36.5	33.2	49.4	61.8	..
Gas		3.4	14.8	19.3	20.3	36.4	46.7	..
Comb. Renewables & Wastes[2]		3.5	4.0	5.0	5.2	7.7	9.2	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.0	1.2	1.4	1.4	1.7	1.7	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	0.1	0.1	0.1	0.4	0.5	..
Electricity Trade[5]		–	–	–	–	–	–	..
Shares (%)								
Coal		*39.2*	*39.9*	*43.2*	*47.9*	*34.1*	*33.9*	..
Oil		*47.1*	*37.2*	*33.2*	*28.7*	*34.0*	*34.1*	..
Gas		*5.9*	*16.9*	*17.6*	*17.6*	*25.1*	*25.7*	..
Comb. Renewables & Wastes		*6.1*	*4.5*	*4.6*	*4.5*	*5.3*	*5.1*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*1.7*	*1.4*	*1.3*	*1.2*	*1.2*	*1.0*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	*0.1*	*0.1*	*0.1*	*0.3*	*0.3*	..
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	2000	2001	2010	2020	2030
TFC	**40.0**	**58.1**	**72.0**	**73.0**	**91.6**	**115.4**	**..**
Coal[1]	4.9	4.3	4.0	3.8	2.5	2.7	..
Oil	24.7	30.5	37.2	37.1	46.0	57.8	..
Gas	2.4	8.8	11.5	12.1	18.7	24.1	..
Comb. Renewables & Wastes[2]	3.5	3.3	4.3	4.4	4.8	5.5	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.1	0.1	0.1	0.1	0.2	..
Electricity	4.5	11.1	14.9	15.5	19.5	25.1	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*12.3*	*7.4*	*5.6*	*5.2*	*2.7*	*2.4*	..
Oil	*61.7*	*52.6*	*51.7*	*50.9*	*50.2*	*50.1*	..
Gas	*5.9*	*15.2*	*15.9*	*16.6*	*20.4*	*20.9*	..
Comb. Renewables & Wastes	*8.7*	*5.6*	*6.0*	*6.0*	*5.3*	*4.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	..
Electricity	*11.3*	*19.1*	*20.6*	*21.3*	*21.3*	*21.7*	..
Heat	–	–	–	–	–	–	..
TOTAL INDUSTRY[6]	**17.6**	**23.1**	**28.0**	**28.8**	**36.4**	**44.6**	**..**
Coal[1]	4.6	4.1	3.9	3.6	2.3	2.6	..
Oil	7.7	6.3	7.5	7.5	9.2	10.8	..
Gas	1.8	6.1	7.5	8.0	12.8	16.5	..
Comb. Renewables & Wastes[2]	1.5	1.5	2.5	2.5	2.8	3.2	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	2.0	5.1	6.6	7.3	9.3	11.5	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*26.4*	*17.6*	*13.9*	*12.5*	*6.4*	*5.7*	..
Oil	*43.8*	*27.4*	*26.9*	*25.9*	*25.3*	*24.3*	..
Gas	*10.0*	*26.5*	*26.8*	*27.8*	*35.1*	*37.1*	..
Comb. Renewables & Wastes	*8.5*	*6.4*	*8.8*	*8.5*	*7.6*	*7.3*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*11.3*	*22.0*	*23.6*	*25.2*	*25.6*	*25.7*	..
Heat	–	–	–	–	–	–	..
TRANSPORT[7]	**13.5**	**22.7**	**28.2**	**28.3**	**37.1**	**47.5**	**..**
TOTAL OTHER SECTORS[8]	**8.9**	**12.3**	**15.7**	**15.9**	**18.2**	**23.3**	**..**
Coal[1]	0.3	0.1	0.0	0.1	0.0	0.0	..
Oil	3.5	1.8	2.0	2.0	0.8	0.9	..
Gas	0.6	2.7	3.6	3.7	5.2	6.7	..
Comb. Renewables & Wastes[2]	2.0	1.8	1.9	1.9	2.1	2.3	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.1	0.1	0.1	0.1	0.2	..
Electricity	2.5	5.9	8.0	8.0	10.0	13.4	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*3.2*	*1.1*	*0.3*	*0.4*	–	–	..
Oil	*39.7*	*14.2*	*13.0*	*12.8*	*4.3*	*3.7*	..
Gas	*7.0*	*21.8*	*23.2*	*23.5*	*28.7*	*28.5*	..
Comb. Renewables & Wastes	*22.5*	*14.4*	*11.9*	*12.0*	*11.4*	*9.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.7*	*0.6*	*0.7*	*0.7*	*0.8*	..
Electricity	*27.7*	*47.7*	*51.0*	*50.6*	*54.9*	*57.4*	..
Heat	–	–	–	–	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**16.0**	**35.1**	**46.3**	**57.3**	**59.5**	**74.2**	**..**
OUTPUT (Mtoe)	**5.5**	**13.3**	**17.8**	**18.7**	**22.5**	**28.9**	**..**
(TWh gross)	64.4	154.3	207.4	216.9	261.6	335.6	..
Output Shares (%)							
Coal	*74.9*	*77.1*	*77.4*	*78.3*	*66.9*	*67.8*	..
Oil	*2.6*	*2.7*	*1.3*	*1.3*	*1.1*	*0.9*	..
Gas	*4.3*	*10.6*	*12.6*	*12.1*	*21.3*	*22.3*	..
Comb. Renewables & Wastes	*0.5*	*0.4*	*0.5*	*0.6*	*1.7*	*1.8*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*17.7*	*9.2*	*8.1*	*7.6*	*7.7*	*6.0*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.0*	*0.1*	*1.3*	*1.1*	..
TOTAL LOSSES	**17.8**	**29.3**	**38.6**	**48.7**	**53.5**	**66.0**	**..**
of which:							
Electricity and Heat Generation[10]	10.5	21.7	28.5	38.6	37.0	45.4	..
Other Transformation	5.5	0.6	0.8	0.7	4.7	5.3	..
Own Use and Losses[11]	1.7	7.0	9.2	9.3	11.8	15.3	..
Statistical Differences	**-0.1**	**0.2**	**-0.8**	**-6.1**	**–**	**–**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	197.13	317.76	450.31	468.04	642.44	906.22	..
Population (millions)	13.61	17.18	19.27	19.47	21.49	23.62	..
TPES/GDP[12]	0.29	0.28	0.24	0.25	0.23	0.20	..
Energy Production/TPES	1.18	1.80	2.12	2.17	2.17	2.00	..
Per Capita TPES[13]	4.23	5.10	5.70	5.94	6.75	7.68	..
Oil Supply/GDP[12]	0.14	0.10	0.08	0.07	0.08	0.07	..
TFC/GDP[12]	0.20	0.18	0.16	0.16	0.14	0.13	..
Per Capita TFC[13]	2.94	3.38	3.74	3.75	4.27	4.89	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	157.9	259.7	329.2	369.6	389.8	492.9	..
CO_2 Emissions from Bunkers (Mt CO_2)	7.3	6.3	10.0	10.4	11.1	11.8	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	3.0	2.2	2.3	5.3	2.6	2.3	..
Coal	1.5	3.2	3.1	16.8	-1.3	2.2	..
Oil	2.9	0.1	1.2	-9.0	4.5	2.3	..
Gas	12.7	7.1	2.7	5.4	6.7	2.5	..
Comb. Renewables & Wastes	0.1	1.0	2.4	2.4	4.5	1.8	..
Nuclear	–	–	–	–	–	–	..
Hydro	5.1	-0.7	1.7	-2.1	2.2	0.1	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	17.3	2.3	23.5	14.6	1.3	..
TFC	2.5	2.1	2.2	1.4	2.6	2.3	..
Electricity Consumption	6.3	5.0	2.9	4.4	2.6	2.5	..
Energy Production	3.9	5.7	3.9	7.8	2.6	1.4	..
Net Oil Imports	4.2	-6.9	-5.0	–	–	4.8	..
GDP	2.5	3.0	3.5	3.9	3.6	3.5	..
Growth in the TPES/GDP Ratio	0.5	-0.8	-1.2	1.3	-1.0	-1.2	..
Growth in the TFC/GDP Ratio	-0.0	-0.9	-1.3	-2.5	-1.0	-1.1	..

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	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**7.9**	**8.1**	**9.6**	**9.7**	**10.4**	**11.6**	**..**
Coal[1]		1.0	0.6	0.3	0.3	0.0	0.0	..
Oil		2.7	1.2	1.1	1.0	1.0	1.1	..
Gas		2.0	1.1	1.5	1.5	1.8	2.1	..
Comb. Renewables & Wastes[2]		0.7	2.4	3.0	3.2	3.8	4.2	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.6	3.6	3.5	3.7	..
Geothermal		–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.3	0.4	..
TOTAL NET IMPORTS[4]		**14.0**	**17.2**	**19.1**	**20.0**	**22.0**	**23.9**	**..**
Coal[1]	Exports	0.1	0.0	0.0	0.0	0.0	0.0	..
	Imports	3.1	3.2	3.0	3.3	3.0	2.1	..
	Net Imports	3.0	3.2	3.0	3.3	3.0	2.1	..
Oil	Exports	0.1	0.6	1.5	1.7	1.6	1.8	..
	Imports	9.9	10.2	12.5	13.4	13.4	15.1	..
	Bunkers	–	–	–	–	–	–	..
	Net Imports	9.7	9.6	11.0	11.7	11.8	13.2	..
Gas	Exports	–	–	0.0	0.3	0.0	0.0	..
	Imports	1.3	4.4	5.3	5.4	7.1	8.4	..
	Net Imports	1.3	4.4	5.3	5.0	7.1	8.4	..
Electricity	Exports	0.4	0.6	1.3	1.2	1.3	1.3	..
	Imports	0.3	0.6	1.2	1.2	1.4	1.5	..
	Net Imports	–0.1	–0.0	–0.1	0.0	0.1	0.1	..
TOTAL STOCK CHANGES		**–0.3**	**–0.3**	**0.1**	**1.0**	**–0.2**	**–0.6**	**..**
TOTAL SUPPLY (TPES)		**21.7**	**25.0**	**28.8**	**30.7**	**32.3**	**34.9**	**..**
Coal[1]		3.9	4.1	3.6	3.7	3.0	2.1	..
Oil		12.3	10.6	12.2	13.1	12.5	14.1	..
Gas		3.3	5.2	6.5	6.9	9.0	10.3	..
Comb. Renewables & Wastes[2]		0.7	2.4	2.9	3.2	3.8	4.2	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.6	3.6	3.5	3.7	..
Geothermal		–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.3	0.4	..
Electricity Trade[5]		–0.1	–0.0	–0.1	0.0	0.1	0.1	..
Shares (%)								
Coal		*17.9*	*16.4*	*12.4*	*12.2*	*9.2*	*6.0*	..
Oil		*56.7*	*42.4*	*42.3*	*42.8*	*38.9*	*40.3*	..
Gas		*15.3*	*20.7*	*22.7*	*22.6*	*28.0*	*29.5*	..
Comb. Renewables & Wastes		*3.3*	*9.8*	*10.1*	*10.4*	*11.8*	*12.1*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*7.5*	*10.8*	*12.5*	*11.7*	*10.8*	*10.6*	..
Geothermal		–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
Solar/Wind/Other		–	*0.1*	*0.2*	*0.3*	*0.8*	*1.1*	..
Electricity Trade		*–0.6*	*–0.2*	*–0.4*	*0.1*	*0.4*	*0.4*	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**16.8**	**20.6**	**24.5**	**25.8**	**26.9**	**29.0**	**..**
Coal[1]	2.0	1.5	1.2	1.2	0.9	0.7	..
Oil	10.2	9.5	11.1	11.8	11.2	12.1	..
Gas	1.8	3.1	4.4	4.3	5.6	5.8	..
Comb. Renewables & Wastes[2]	0.7	2.1	2.2	2.5	2.6	2.8	..
Geothermal	–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other	–	0.0	0.1	0.1	0.1	0.1	..
Electricity	2.2	3.7	4.5	4.9	5.2	5.9	..
Heat	–	0.6	1.0	1.1	1.2	1.5	..
Shares (%)							
Coal	*11.8*	*7.4*	*4.8*	*4.6*	*3.4*	*2.5*	..
Oil	*60.4*	*46.2*	*45.2*	*45.9*	*41.7*	*41.8*	..
Gas	*10.7*	*14.9*	*18.0*	*16.7*	*21.0*	*20.1*	..
Comb. Renewables & Wastes	*4.1*	*10.4*	*9.2*	*9.5*	*9.8*	*9.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.1*	*0.3*	*0.3*	*0.5*	*0.5*	..
Electricity	*12.9*	*18.1*	*18.5*	*18.8*	*19.2*	*20.4*	..
Heat	–	*3.0*	*4.0*	*4.1*	*4.5*	*5.1*	..
TOTAL INDUSTRY[6]	**6.5**	**7.0**	**8.2**	**8.0**	**8.7**	**8.9**	**..**
Coal[1]	0.7	0.8	0.9	0.9	0.7	0.6	..
Oil	3.3	2.1	2.3	2.3	2.0	2.3	..
Gas	1.3	2.0	2.3	2.1	3.0	2.8	..
Comb. Renewables & Wastes[2]	0.0	0.6	0.7	0.7	0.8	0.8	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	1.0	1.5	1.9	2.0	2.1	2.3	..
Heat	–	–	–	–	–	0.0	..
Shares (%)							
Coal	*11.5*	*11.0*	*11.2*	*11.6*	*8.4*	*7.0*	..
Oil	*51.7*	*29.8*	*28.1*	*29.0*	*23.0*	*25.5*	..
Gas	*20.2*	*28.6*	*28.6*	*26.1*	*34.9*	*32.0*	..
Comb. Renewables & Wastes	*0.5*	*8.7*	*8.2*	*8.4*	*9.2*	*9.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.1*	*21.8*	*23.9*	*24.9*	*24.5*	*25.8*	..
Heat	–	–	–	–	–	–	..
TRANSPORT[7]	**4.0**	**5.2**	**6.9**	**7.4**	**7.3**	**8.1**	**..**
TOTAL OTHER SECTORS[8]	**6.3**	**8.4**	**9.4**	**10.4**	**10.9**	**12.0**	**..**
Coal[1]	1.1	0.8	0.3	0.3	0.2	0.1	..
Oil	3.1	2.6	2.4	2.8	2.6	2.5	..
Gas	0.5	1.0	1.9	2.0	2.4	2.7	..
Comb. Renewables & Wastes[2]	0.7	1.5	1.6	1.8	1.8	1.9	..
Geothermal	–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other	–	0.0	0.1	0.1	0.1	0.1	..
Electricity	1.0	1.9	2.3	2.5	2.6	3.2	..
Heat	–	0.6	1.0	1.1	1.2	1.5	..
Shares (%)							
Coal	*17.9*	*8.9*	*2.7*	*2.5*	*1.7*	*0.9*	..
Oil	*48.6*	*31.2*	*25.5*	*26.5*	*23.5*	*20.7*	..
Gas	*7.6*	*11.8*	*19.7*	*18.7*	*21.7*	*22.6*	..
Comb. Renewables & Wastes	*10.3*	*18.3*	*16.7*	*17.1*	*16.6*	*16.0*	..
Geothermal	–	–	*0.1*	–	*0.1*	–	..
Solar/Wind/Other	–	*0.2*	*0.7*	*0.6*	*1.1*	*1.1*	..
Electricity	*15.6*	*22.4*	*24.3*	*24.3*	*24.2*	*26.4*	..
Heat	–	*7.3*	*10.3*	*10.1*	*11.1*	*12.2*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.9**	**6.9**	**8.2**	**8.5**	**9.3**	**10.7**	**..**
OUTPUT (Mtoe)	**2.7**	**4.2**	**5.2**	**5.4**	**5.7**	**6.6**	**..**
(TWh gross)	30.9	49.3	60.2	62.4	66.7	76.5	..
Output Shares (%)							
Coal	*10.3*	*14.2*	*11.2*	*12.7*	*8.0*	*3.7*	..
Oil	*14.1*	*3.8*	*2.7*	*3.2*	*5.2*	*8.7*	..
Gas	*14.3*	*15.7*	*13.4*	*13.6*	*18.4*	*22.4*	..
Comb. Renewables & Wastes	*0.7*	*2.4*	*3.0*	*3.2*	*4.7*	*5.0*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*60.6*	*63.9*	*69.5*	*67.0*	*61.0*	*56.5*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.3*	*2.5*	*3.6*	..
TOTAL LOSSES	**4.7**	**4.5**	**4.3**	**4.7**	**5.4**	**6.0**	**..**
of which:							
Electricity and Heat Generation[10]	2.2	2.0	2.0	2.0	2.2	2.5	..
Other Transformation	1.3	0.9	0.8	0.9	0.8	0.7	..
Own Use and Losses[11]	1.2	1.5	1.5	1.8	2.4	2.8	..
Statistical Differences	**0.1**	**0.0**	**0.0**	**0.3**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	137.92	212.47	269.37	271.17	324.07	395.05	..
Population (millions)	7.59	7.73	8.11	8.13	8.20	8.28	..
TPES/GDP[12]	0.16	0.12	0.11	0.11	0.10	0.09	..
Energy Production/TPES	0.37	0.32	0.33	0.32	0.32	0.33	..
Per Capita TPES[13]	2.85	3.24	3.55	3.78	3.94	4.22	..
Oil Supply/GDP[12]	0.09	0.05	0.05	0.05	0.04	0.04	..
TFC/GDP[12]	0.12	0.10	0.09	0.10	0.08	0.07	..
Per Capita TFC[13]	2.22	2.66	3.02	3.17	3.28	3.50	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	54.3	56.6	62.7	66.6	65.5	69.7	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	0.9	1.7	1.7	1.7	1.7	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.7	0.4	1.4	6.8	0.6	0.8	..
Coal	–1.1	1.1	–1.3	4.4	–2.5	–3.4	..
Oil	0.8	–1.7	1.4	7.8	–0.5	1.2	..
Gas	4.6	1.7	2.3	6.6	3.0	1.3	..
Comb. Renewables & Wastes	6.3	8.1	1.8	9.0	2.1	1.0	..
Nuclear	–	–	–	–	–	–	..
Hydro	6.7	1.2	2.9	–	–0.3	0.6	..
Geothermal	–	–	36.8	–	3.7	–	..
Solar/Wind/Other	–	–	16.7	17.1	14.0	3.5	..
TFC	2.2	0.7	1.7	5.4	0.5	0.7	..
Electricity Consumption	3.9	2.8	2.0	7.2	0.7	1.4	..
Energy Production	0.2	0.1	1.7	1.5	0.8	1.1	..
Net Oil Imports	2.7	–1.6	1.4	6.4	0.1	1.2	..
GDP	3.0	2.4	2.4	0.7	2.0	2.0	..
Growth in the TPES/GDP Ratio	–1.2	–1.9	–1.0	6.1	–1.4	–1.2	..
Growth in the TFC/GDP Ratio	–0.8	–1.7	–0.6	4.7	–1.5	–1.2	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**6.5**	**13.1**	**13.5**	**13.1**	**12.9**	**..**	**..**
Coal[1]		6.4	1.2	0.2	0.1	–	..	..
Oil		–	–	–	–	–	..	..
Gas		0.0	0.0	0.0	–	–	..	..
Comb. Renewables & Wastes[2]		0.0	0.7	0.7	0.8	0.6	..	..
Nuclear		0.0	11.1	12.6	12.1	12.3	..	..
Hydro		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	..	..
TOTAL NET IMPORTS[4]		**39.8**	**35.5**	**45.2**	**46.8**	**44.4**	**..**	**..**
Coal[1]	Exports	0.8	1.1	1.2	1.4	0.9	..	..
	Imports	5.3	10.3	8.8	9.7	8.6	..	..
	Net Imports	4.6	9.2	7.6	8.3	7.7	..	..
Oil	Exports	15.1	19.2	23.7	22.2	16.4	..	..
	Imports	46.4	41.7	52.9	52.0	42.9	..	..
	Bunkers	3.1	4.1	5.4	5.3	4.0	..	..
	Net Imports	28.2	18.4	23.8	24.5	22.5	..	..
Gas	Exports	–	–	–	–	–	..	..
	Imports	7.1	8.2	13.3	13.1	14.2	..	..
	Net Imports	7.1	8.2	13.3	13.1	14.2	..	..
Electricity	Exports	0.2	0.7	0.6	0.6	..	..	..
	Imports	0.1	0.4	1.0	1.4	..	..	..
	Net Imports	–0.1	–0.3	0.4	0.8	..	..	..
TOTAL STOCK CHANGES		**–0.0**	**0.1**	**0.6**	**–0.9**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**46.3**	**48.7**	**59.3**	**59.0**	**57.3**	**..**	**..**
Coal[1]		11.2	10.2	8.4	7.7	7.7	..	..
Oil		28.0	18.7	23.8	24.3	22.5	..	..
Gas		7.1	8.2	13.4	13.2	14.2	..	..
Comb. Renewables & Wastes[2]		0.0	0.7	0.8	0.9	0.6	..	..
Nuclear		0.0	11.1	12.6	12.1	12.3	..	..
Hydro		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	..	..
Electricity Trade[5]		–0.1	–0.3	0.4	0.8	–	..	..
Shares (%)								
Coal		*24.1*	*21.0*	*14.1*	*13.1*	*13.4*	..	..
Oil		*60.5*	*38.5*	*40.1*	*41.1*	*39.3*	..	..
Gas		*15.4*	*16.8*	*22.5*	*22.3*	*24.7*	..	..
Comb. Renewables & Wastes		–	*1.4*	*1.4*	*1.6*	*1.0*	..	..
Nuclear		–	*22.9*	*21.2*	*20.5*	*21.4*	..	..
Hydro		–	–	*0.1*	*0.1*	*0.1*	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other		–	–	–	–	–	..	..
Electricity Trade		*–0.1*	*–0.7*	*0.6*	*1.3*	–	..	..

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	2000	2001	2010	2020	2030
TFC	**34.6**	**33.0**	**42.3**	**43.1**	**41.0**	**..**	**..**
Coal[1]	5.7	3.4	2.6	2.9	3.7	..	..
Oil	21.0	17.3	22.0	22.4	20.8	..	..
Gas	4.6	6.8	10.2	10.2	9.0	..	..
Comb. Renewables & Wastes[2]	–	0.3	0.3	0.4	..	..	..
Geothermal	–	0.0	0.0	0.0	–	..	..
Solar/Wind/Other	–	0.0	0.0	0.0	–	..	..
Electricity	2.9	5.0	6.7	6.7	6.4	..	..
Heat	0.3	0.2	0.5	0.5	1.1	..	..
Shares (%)							
Coal	*16.5*	*10.2*	*6.2*	*6.7*	*9.0*	..	..
Oil	*60.7*	*52.4*	*52.0*	*51.9*	*50.7*	..	..
Gas	*13.3*	*20.6*	*24.0*	*23.8*	*22.0*	..	..
Comb. Renewables & Wastes	–	*1.0*	*0.8*	*0.8*	..	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*8.5*	*15.1*	*15.8*	*15.6*	*15.7*	..	..
Heat	*0.9*	*0.7*	*1.2*	*1.1*	*2.6*	..	..
TOTAL INDUSTRY[6]	**16.8**	**13.5**	**18.7**	**19.0**	**16.1**	**..**	**..**
Coal[1]	3.5	2.9	2.4	2.7	3.4	..	..
Oil	7.9	4.3	6.9	7.3	4.1	..	..
Gas	3.2	3.3	5.3	5.0	3.9	..	..
Comb. Renewables & Wastes[2]	–	0.1	0.2	0.2	..	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	1.9	2.6	3.4	3.4	3.7	..	..
Heat	0.3	0.2	0.4	0.4	0.9	..	..
Shares (%)	..	..					
Coal	*21.1*	*21.5*	*13.0*	*14.1*	*21.3*	..	..
Oil	*46.8*	*32.1*	*36.9*	*38.7*	*25.6*	..	..
Gas	*18.7*	*24.5*	*28.5*	*26.3*	*24.5*	..	..
Comb. Renewables & Wastes	–	*1.0*	*1.0*	*1.0*	..	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*11.5*	*19.5*	*18.4*	*17.8*	*23.0*	..	..
Heat	*1.9*	*1.4*	*2.3*	*2.2*	*5.5*	..	..
TRANSPORT[7]	**5.0**	**7.9**	**9.9**	**9.7**	**9.7**	**..**	**..**
TOTAL OTHER SECTORS[8]	**12.7**	**11.7**	**13.7**	**14.4**	**15.2**	**..**	**..**
Coal[1]	2.2	0.5	0.2	0.2	0.3	..	..
Oil	8.1	5.2	5.4	5.4	7.2	..	..
Gas	1.5	3.5	4.8	5.3	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	3.2	2.6	..	..
Heat	–	0.0	0.1	0.1	0.2	..	..
Shares (%)							
Coal	*17.0*	*4.1*	*1.6*	*1.7*	*1.6*	..	..
Oil	*64.2*	*44.7*	*39.0*	*37.6*	*47.0*	..	..
Gas	*11.4*	*30.1*	*35.2*	*36.6*	*33.2*	..	..
Comb. Renewables & Wastes	–	*1.6*	*1.1*	*1.2*	..	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*7.4*	*19.3*	*22.7*	*22.4*	*16.9*	..	..
Heat	–	*0.3*	*0.5*	*0.4*	*1.2*	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**10.0**	**17.7**	**19.7**	**18.7**	**22.0**	**..**	**..**
OUTPUT (Mtoe)	**3.5**	**6.0**	**7.1**	**6.8**	**7.3**	**..**	**..**
(TWh gross)	40.6	70.3	82.8	78.6	84.9	..	..
Output Shares (%)							
Coal	*21.7*	*28.2*	*19.4*	*16.2*	*8.7*	..	..
Oil	*53.7*	*1.9*	*1.0*	*2.1*	*2.3*	..	..
Gas	*23.7*	*7.7*	*19.3*	*20.1*	*29.6*	..	..
Comb. Renewables & Wastes	*0.3*	*1.0*	*1.6*	*2.0*	*3.5*	..	..
Nuclear	*0.2*	*60.8*	*58.2*	*59.0*	*55.5*	..	..
Hydro	*0.4*	*0.4*	*0.6*	*0.6*	*0.4*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.0*	*0.0*	*0.0*	*0.0*	..	..
TOTAL LOSSES	**11.8**	**16.1**	**16.3**	**15.6**	**16.3**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	6.2	11.4	12.0	11.4	13.6	..	..
Other Transformation	4.2	2.1	1.6	1.5	1.3	..	..
Own Use and Losses[11]	1.4	2.7	2.7	2.7	1.5	..	..
Statistical Differences	**–0.1**	**–0.5**	**0.7**	**0.3**	**–**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	174.37	255.75	316.69	319.13	391.60	..	..
Population (millions)	9.73	9.97	10.25	10.28	10.00	..	..
TPES/GDP[12]	0.27	0.19	0.19	0.18	0.15	..	..
Energy Production/TPES	0.14	0.27	0.23	0.22	0.23	..	..
Per Capita TPES[13]	4.76	4.88	5.79	5.74	5.73	..	..
Oil Supply/GDP[12]	0.16	0.07	0.08	0.08	0.06	..	..
TFC/GDP[12]	0.20	0.13	0.13	0.13	0.10	..	..
Per Capita TFC[13]	3.55	3.32	4.13	4.19	4.10	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	133.6	106.9	118.5	119.6	116.4	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	11.3	16.0	21.7	20.2	16.0	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	0.7	0.1	2.0	–0.5	–0.3	..	..
Coal	–1.0	–0.3	–2.0	–7.9	–0.0	..	..
Oil	–1.5	–2.8	2.4	2.1	–0.8	..	..
Gas	4.5	–1.2	5.0	–1.4	0.8	..	..
Comb. Renewables & Wastes	41.7	22.8	1.8	13.2	–5.1	..	..
Nuclear	130.2	12.8	1.2	–3.8	0.2	..	..
Hydro	4.9	1.3	5.4	–2.6	–2.6	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	7.2	150.0	–16.4	..	..
TFC	0.3	–0.6	2.5	1.9	–0.6	..	..
Electricity Consumption	4.2	2.6	2.9	0.8	–0.5	..	..
Energy Production	2.4	5.2	0.4	–3.3	–0.2	..	..
Net Oil Imports	–0.8	–3.4	2.6	2.9	–0.9	..	..
GDP	2.4	2.2	2.2	0.8	2.3	..	..
Growth in the TPES/GDP Ratio	–1.6	–2.1	–0.2	–1.3	–2.6	..	..
Growth in the TFC/GDP Ratio	–2.0	–2.7	0.3	1.1	–2.8	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**198.0**	**273.7**	**374.8**	**379.2**	**461.3**	**505.3**	**..**
Coal[1]		11.7	37.9	37.1	37.6	39.9	38.7	..
Oil		96.3	94.1	128.4	130.2	170.9	193.5	..
Gas		61.4	88.6	148.3	152.3	179.5	199.9	..
Comb. Renewables & Wastes[2]		7.8	8.1	11.2	10.5	17.0	19.0	..
Nuclear		4.1	19.4	19.0	20.0	20.3	19.0	..
Hydro		16.7	25.5	30.8	28.6	33.2	34.6	..
Geothermal		–	–	–	–	0.4	0.4	..
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.1	0.1	..
TOTAL NET IMPORTS[4]		**–35.4**	**–60.6**	**–132.2**	**–132.6**	**–175.1**	**–189.6**	**..**
Coal[1]	Exports	7.6	21.4	22.3	20.9	20.3	23.1	..
	Imports	10.5	9.5	14.6	15.7	8.7	6.5	..
	Net Imports	2.8	–11.9	–7.6	–5.2	–11.6	–16.6	..
Oil	Exports	63.1	49.7	93.4	96.0	128.2	143.9	..
	Imports	48.8	34.5	54.3	57.0	54.3	60.0	..
	Bunkers	–	0.9	1.1	1.0	0.7	0.8	..
	Net Imports	–14.3	–16.1	–40.2	–40.0	–74.6	–84.7	..
Gas	Exports	23.1	33.0	82.7	88.5	88.0	88.0	..
	Imports	0.3	0.5	1.3	3.2	1.0	1.0	..
	Net Imports	–22.8	–32.5	–81.3	–85.3	–86.9	–86.9	..
Electricity	Exports	1.4	1.6	4.4	3.4	5.4	4.7	..
	Imports	0.2	1.5	1.3	1.4	3.4	3.3	..
	Net Imports	–1.2	–0.0	–3.1	–2.0	–2.0	–1.4	..
TOTAL STOCK CHANGES		**–1.6**	**–4.0**	**8.3**	**1.6**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**161.0**	**209.1**	**250.9**	**248.2**	**286.1**	**315.7**	**..**
Coal[1]		15.3	24.3	31.0	30.7	28.3	22.1	..
Oil		81.0	77.1	87.8	88.8	96.3	108.9	..
Gas		37.3	54.7	74.2	71.5	92.6	113.0	..
Comb. Renewables & Wastes[2]		7.8	8.1	11.2	10.5	17.0	19.0	..
Nuclear		4.1	19.4	19.0	20.0	20.3	19.0	..
Hydro		16.7	25.5	30.8	28.6	33.2	34.6	..
Geothermal		–	–	–	–	0.4	0.4	..
Solar/Wind/Other[3]		–	0.0	0.0	0.0	0.1	0.1	..
Electricity Trade[5]		–1.2	–0.0	–3.1	–2.0	–2.0	–1.4	..
Shares (%)								
Coal		*9.5*	*11.6*	*12.3*	*12.4*	*9.9*	*7.0*	..
Oil		*50.3*	*36.9*	*35.0*	*35.8*	*33.7*	*34.5*	..
Gas		*23.2*	*26.2*	*29.6*	*28.8*	*32.3*	*35.8*	..
Comb. Renewables & Wastes		*4.9*	*3.9*	*4.5*	*4.2*	*5.9*	*6.0*	..
Nuclear		*2.5*	*9.3*	*7.6*	*8.1*	*7.1*	*6.0*	..
Hydro		*10.4*	*12.2*	*12.3*	*11.5*	*11.6*	*10.9*	..
Geothermal		–	–	–	–	*0.2*	*0.1*	..
Solar/Wind/Other		–	–	–	–	–	–	..
Electricity Trade		*–0.7*	–	*–1.2*	*–0.8*	*–0.7*	*–0.4*	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**133.2**	**161.3**	**191.4**	**185.0**	**220.3**	**248.8**	**..**
Coal[1]	5.2	3.1	3.6	3.2	4.7	5.4	..
Oil	77.6	70.6	82.0	81.5	86.8	98.2	..
Gas	23.7	43.3	53.1	48.5	62.2	69.8	..
Comb. Renewables & Wastes[2]	7.6	7.8	10.5	9.8	15.6	17.5	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	18.9	36.0	41.4	41.1	50.2	57.0	..
Heat	0.1	0.6	0.8	0.8	0.7	0.9	..
Shares (%)							
Coal	*3.9*	*1.9*	*1.9*	*1.7*	*2.1*	*2.2*	..
Oil	*58.3*	*43.7*	*42.9*	*44.1*	*39.4*	*39.5*	..
Gas	*17.8*	*26.8*	*27.7*	*26.2*	*28.2*	*28.1*	..
Comb. Renewables & Wastes	*5.7*	*4.8*	*5.5*	*5.3*	*7.1*	*7.0*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*14.2*	*22.3*	*21.6*	*22.2*	*22.8*	*22.9*	..
Heat	*0.1*	*0.4*	*0.4*	*0.5*	*0.3*	*0.3*	..
TOTAL INDUSTRY[6]	**52.8**	**63.2**	**75.3**	**71.3**	**97.5**	**111.1**	**..**
Coal[1]	4.7	3.0	3.5	3.2	4.6	5.3	..
Oil	21.4	18.7	21.7	21.7	24.9	27.6	..
Gas	11.9	20.2	23.1	20.3	31.2	36.2	..
Comb. Renewables & Wastes[2]	5.7	6.2	8.7	8.0	13.6	15.4	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	9.1	14.4	17.5	17.2	22.4	25.8	..
Heat	0.1	0.6	0.8	0.8	0.7	0.9	..
Shares (%)							
Coal	*8.9*	*4.8*	*4.7*	*4.5*	*4.8*	*4.8*	..
Oil	*40.4*	*29.5*	*28.9*	*30.5*	*25.5*	*24.8*	..
Gas	*22.5*	*32.0*	*30.7*	*28.5*	*32.0*	*32.6*	..
Comb. Renewables & Wastes	*10.8*	*9.8*	*11.5*	*11.2*	*14.0*	*13.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*17.2*	*22.9*	*23.2*	*24.2*	*23.0*	*23.2*	..
Heat	*0.2*	*1.0*	*1.1*	*1.2*	*0.8*	*0.8*	..
TRANSPORT[7]	**35.3**	**44.2**	**53.5**	**52.7**	**63.1**	**72.8**	**..**
TOTAL OTHER SECTORS[8]	**45.1**	**54.0**	**62.7**	**61.0**	**59.7**	**64.8**	**..**
Coal[1]	0.4	0.1	0.0	0.0	0.1	0.1	..
Oil	21.3	10.9	12.0	11.9	6.5	6.9	..
Gas	11.9	20.2	25.3	23.8	24.5	25.7	..
Comb. Renewables & Wastes[2]	1.9	1.6	1.8	1.8	2.0	2.2	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	9.5	21.2	23.5	23.5	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*	..
Oil	*47.4*	*20.2*	*19.1*	*19.4*	*10.8*	*10.7*	..
Gas	*26.3*	*37.4*	*40.3*	*38.9*	*41.0*	*39.6*	..
Comb. Renewables & Wastes	*4.2*	*3.0*	*2.9*	*3.0*	*3.3*	*3.3*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*21.2*	*39.3*	*37.6*	*38.5*	*44.7*	*46.2*	..
Heat	–	–	–	–	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**36.1**	**70.7**	**87.4**	**86.9**	**91.9**	**97.2**	**..**
OUTPUT (Mtoe)	**23.2**	**41.4**	**52.0**	**50.6**	**59.5**	**66.4**	**..**
(TWh gross)	270.1	481.9	605.2	587.9	691.4	771.5	..
Output Shares (%)							
Coal	*12.9*	*17.1*	*19.4*	*20.1*	*13.8*	*8.5*	..
Oil	*3.4*	*3.4*	*2.4*	*2.9*	*0.7*	*0.6*	..
Gas	*6.0*	*2.0*	*5.7*	*6.1*	*16.1*	*27.2*	..
Comb. Renewables & Wastes	–	*0.8*	*1.2*	*1.2*	*2.0*	*2.1*	..
Nuclear	*5.6*	*15.1*	*12.0*	*13.0*	*11.3*	*9.5*	..
Hydro	*72.1*	*61.6*	*59.2*	*56.7*	*55.9*	*52.1*	..
Geothermal	–	–	–	–	*0.1*	*0.1*	..
Solar/Wind/Other	–	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	..
TOTAL LOSSES	**31.2**	**48.7**	**59.2**	**60.8**	**65.9**	**67.0**	**..**
of which:							
Electricity and Heat Generation[10]	12.8	28.6	34.5	35.5	31.7	30.0	..
Other Transformation	1.9	–1.3	–3.1	–3.4	11.7	12.9	..
Own Use and Losses[11]	16.5	21.4	27.7	28.7	22.5	24.1	..
Statistical Differences	**–3.5**	**–0.9**	**0.3**	**2.4**	**–**	**–**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	319.20	534.39	707.13	717.39	933.58	1154.87	..
Population (millions)	22.49	27.70	30.77	31.08	33.20	35.30	..
TPES/GDP[12]	0.50	0.39	0.35	0.35	0.31	0.27	..
Energy Production/TPES	1.23	1.31	1.49	1.53	1.61	1.60	..
Per Capita TPES[13]	7.16	7.55	8.16	7.98	8.62	8.94	..
Oil Supply/GDP[12]	0.25	0.14	0.12	0.12	0.10	0.09	..
TFC/GDP[12]	0.42	0.30	0.27	0.26	0.24	0.22	..
Per Capita TFC[13]	5.92	5.82	6.22	5.95	6.64	7.05	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	375.1	430.2	528.5	519.5	541.5	595.0	..
CO_2 Emissions from Bunkers (Mt CO_2)	6.3	5.6	6.4	6.5	5.6	5.7	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	2.9	0.8	1.8	–1.1	1.6	1.0	..
Coal	4.4	1.9	2.5	–0.8	–0.9	–2.4	..
Oil	2.1	–1.6	1.3	1.1	0.9	1.2	..
Gas	2.7	2.1	3.1	–3.6	2.9	2.0	..
Comb. Renewables & Wastes	–1.6	1.2	3.2	–6.3	5.5	1.2	..
Nuclear	15.7	6.4	–0.2	5.3	0.2	–0.7	..
Hydro	3.8	1.8	1.9	–7.0	1.7	0.4	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	29.2	26.9	6.9	–	..
TFC	2.4	0.4	1.7	–3.4	2.0	1.2	..
Electricity Consumption	4.7	3.4	1.4	–0.7	2.2	1.3	..
Energy Production	1.0	2.4	3.2	1.2	2.2	0.9	..
Net Oil Imports	–	–	9.6	–0.4	7.2	1.3	..
GDP	3.9	2.6	2.8	1.5	3.0	2.2	..
Growth in the TPES/GDP Ratio	–1.0	–1.8	–1.0	–2.5	–1.3	–1.1	..
Growth in the TFC/GDP Ratio	–1.4	–2.2	–1.1	–4.7	–1.0	–0.9	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**38.51**	**38.52**	**29.86**	**30.49**	**25.66**	**21.47**	**19.37**
Coal[1]		38.01	34.71	25.00	25.29	17.00	12.00	9.60
Oil		0.04	0.21	0.38	0.36	0.40	0.40	0.40
Gas		0.36	0.20	0.17	0.12	0.10	0.30	0.30
Comb. Renewables & Wastes[2]		–	–	0.62	0.69	1.30	1.90	2.20
Nuclear		–	3.28	3.54	3.84	6.70	6.70	6.70
Hydro		0.09	0.12	0.15	0.18	0.16	0.17	0.17
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	–	–	–
TOTAL NET IMPORTS[4]		**6.99**	**7.63**	**9.42**	**10.67**	**16.40**	**22.50**	**24.40**
Coal[1]	Exports	2.56	7.26	5.78	5.56	4.10	1.10	0.90
	Imports	0.15	1.57	1.04	1.11	1.20	1.40	1.60
	Net Imports	–2.41	–5.69	–4.74	–4.45	–2.90	0.30	0.70
Oil	Exports	0.04	6.56	1.09	1.31	1.60	1.60	1.70
	Imports	8.91	15.16	8.63	9.51	10.20	10.60	11.00
	Bunkers	–	–	–	–	–	–	–
	Net Imports	8.87	8.60	7.54	8.20	8.60	9.00	9.30
Gas	Exports	0.01	–	0.00	–	–	–	–
	Imports	0.73	4.78	7.48	7.73	11.00	13.00	14.00
	Net Imports	0.72	4.78	7.48	7.73	11.00	13.00	14.00
Electricity	Exports	0.44	0.76	1.61	1.63	0.70	0.40	0.30
	Imports	0.25	0.70	0.75	0.81	0.40	0.60	0.70
	Net Imports	–0.19	–0.06	–0.86	–0.82	–0.30	0.20	0.40
TOTAL STOCK CHANGES		**–0.08**	**1.25**	**1.10**	**0.24**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**45.42**	**47.40**	**40.38**	**41.40**	**42.06**	**43.97**	**43.77**
Coal[1]		35.59	29.84	21.53	21.09	14.10	12.30	10.30
Oil		8.91	8.96	7.89	8.39	9.00	9.40	9.70
Gas		1.01	5.26	7.50	8.03	11.10	13.30	14.30
Comb. Renewables & Wastes[2]		–	–	0.62	0.69	1.30	1.90	2.20
Nuclear		–	3.28	3.54	3.84	6.70	6.70	6.70
Hydro		0.09	0.12	0.15	0.18	0.16	0.17	0.17
Geothermal		–	–	–	–	–	–	–
Solar/Wind/Other[3]		–	–	–	–	–	–	–
Electricity Trade[5]		–0.19	–0.06	–0.86	–0.82	–0.30	0.20	0.40
Shares (%)								
Coal		*78.4*	*63.0*	*53.3*	*50.9*	*33.5*	*28.0*	*23.5*
Oil		*19.6*	*18.9*	*19.6*	*20.3*	*21.4*	*21.4*	*22.2*
Gas		*2.2*	*11.1*	*18.6*	*19.4*	*26.4*	*30.3*	*32.7*
Comb. Renewables & Wastes		–	–	*1.5*	*1.7*	*3.1*	*4.3*	*5.0*
Nuclear		–	*6.9*	*8.8*	*9.3*	*15.9*	*15.2*	*15.3*
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*	*–2.1*	*–2.0*	*–0.7*	*0.5*	*0.9*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**33.07**	**35.30**	**25.14**	**25.57**	**28.20**	**30.40**	**30.80**
Coal[1]	20.66	17.43	4.59	3.81	2.70	2.30	1.60
Oil	8.06	8.09	7.55	7.89	8.30	8.40	8.70
Gas	1.81	4.19	5.91	6.42	9.00	10.50	10.70
Comb. Renewables & Wastes[2]	–	–	0.21	0.28	0.70	1.00	1.20
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	2.54	4.14	4.25	4.38	4.45	5.10	5.40
Heat	–	1.45	2.62	2.79	3.05	3.10	3.20
Shares (%)							
Coal	*62.5*	*49.4*	*18.3*	*14.9*	*9.6*	*7.6*	*5.2*
Oil	*24.4*	*22.9*	*30.0*	*30.9*	*29.4*	*27.6*	*28.2*
Gas	*5.5*	*11.9*	*23.5*	*25.1*	*31.9*	*34.5*	*34.7*
Comb. Renewables & Wastes	–	–	*0.8*	*1.1*	*2.5*	*3.3*	*3.9*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.7*	*11.7*	*16.9*	*17.1*	*15.8*	*16.8*	*17.5*
Heat	–	*4.1*	*10.4*	*10.9*	*10.8*	*10.2*	*10.4*
TOTAL INDUSTRY[6]	**19.42**	**18.63**	**11.17**	**10.91**	**12.15**	**13.25**	**12.80**
Coal[1]	12.06	10.06	3.27	2.81	1.80	1.60	1.10
Oil	5.30	4.23	2.75	2.82	3.40	3.30	3.40
Gas	0.46	2.02	2.60	2.59	4.10	5.10	5.10
Comb. Renewables & Wastes[2]	–	–	0.14	0.19	0.10	0.20	0.30
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.61	2.32	1.63	1.72	1.70	1.95	1.70
Heat	–	–	0.78	0.79	1.05	1.10	1.20
Shares (%)							
Coal	*62.1*	*54.0*	*29.3*	*25.7*	*14.8*	*12.1*	*8.6*
Oil	*27.3*	*22.7*	*24.6*	*25.9*	*28.0*	*24.9*	*26.6*
Gas	*2.4*	*10.9*	*23.3*	*23.7*	*33.7*	*38.5*	*39.8*
Comb. Renewables & Wastes	–	–	*1.3*	*1.8*	*0.8*	*1.5*	*2.3*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.3*	*12.4*	*14.6*	*15.7*	*14.0*	*14.7*	*13.3*
Heat	–	–	*7.0*	*7.2*	*8.6*	*8.3*	*9.4*
TRANSPORT[7]	**2.46**	**2.86**	**4.88**	**5.15**	**4.80**	**5.20**	**5.70**
TOTAL OTHER SECTORS[8]	**11.18**	**13.81**	**9.10**	**9.52**	**11.25**	**11.95**	**12.30**
Coal[1]	8.47	7.37	1.33	1.00	0.90	0.70	0.50
Oil	0.60	1.27	0.19	0.16	0.60	0.70	0.70
Gas	1.35	2.17	3.28	3.81	4.70	5.00	5.20
Comb. Renewables & Wastes[2]	–	–	0.04	0.07	0.60	0.80	0.90
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.76	1.56	2.42	2.48	2.45	2.75	3.00
Heat	–	1.45	1.84	2.00	2.00	2.00	2.00
Shares (%)							
Coal	*75.7*	*53.3*	*14.6*	*10.5*	*8.0*	*5.9*	*4.1*
Oil	*5.4*	*9.2*	*2.0*	*1.7*	*5.3*	*5.9*	*5.7*
Gas	*12.1*	*15.7*	*36.1*	*40.0*	*41.8*	*41.8*	*42.3*
Comb. Renewables & Wastes	–	–	*0.5*	*0.7*	*5.3*	*6.7*	*7.3*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*6.8*	*11.3*	*26.6*	*26.1*	*21.8*	*23.0*	*24.4*
Heat	–	*10.5*	*20.3*	*21.1*	*17.8*	*16.7*	*16.3*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**9.70**	**16.54**	**20.43**	**21.17**	**20.66**	**20.57**	**20.47**
OUTPUT (Mtoe)	**3.54**	**5.38**	**6.27**	**6.38**	**5.75**	**5.90**	**6.00**
(TWh gross)	41.17	62.56	72.91	74.23	66.85	68.60	69.75
Output Shares (%)							
Coal	*85.1*	*71.8*	*73.1*	*71.7*	*50.2*	*44.7*	*41.4*
Oil	*11.3*	*4.8*	*0.5*	*0.5*	*0.7*	*1.2*	*1.4*
Gas	*0.9*	*1.0*	*4.3*	*4.2*	*6.5*	*11.4*	*14.6*
Comb. Renewables & Wastes	–	–	*1.0*	*1.0*	*1.4*	*2.6*	*3.0*
Nuclear	–	*20.1*	*18.6*	*19.9*	*38.4*	*37.5*	*36.8*
Hydro	*2.6*	*2.3*	*2.4*	*2.8*	*2.8*	*2.8*	*2.7*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
TOTAL LOSSES	**13.62**	**13.54**	**14.86**	**15.29**	**13.86**	**13.57**	**12.97**
of which:							
Electricity and Heat Generation[10]	6.16	9.34	10.84	11.23	11.11	10.82	10.52
Other Transformation	5.90	1.73	1.19	1.21	0.40	0.30	0.10
Own Use and Losses[11]	1.57	2.48	2.83	2.85	2.35	2.45	2.35
Statistical Differences	**–1.27**	**–1.45**	**0.38**	**0.54**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	40.52	54.61	55.28	57.09	88.56	144.25	234.97
Population (millions)	9.92	10.36	10.27	10.26	10.10	10.10	10.10
TPES/GDP[12]	1.12	0.87	0.73	0.73	0.47	0.30	0.19
Energy Production/TPES	0.85	0.81	0.74	0.74	0.61	0.49	0.44
Per Capita TPES[13]	4.58	4.57	3.93	4.03	4.16	4.35	4.33
Oil Supply/GDP[12]	0.22	0.16	0.14	0.15	0.10	0.07	0.04
TFC/GDP[12]	0.82	0.65	0.45	0.45	0.32	0.21	0.13
Per Capita TFC[13]	3.33	3.41	2.45	2.49	2.79	3.01	3.05
Energy-related CO_2 Emissions (Mt CO_2)[14]	153.0	153.8	118.4	118.7	103.1	102.6	98.4
CO_2 Emissions from Bunkers (Mt CO_2)	0.7	0.7	0.5	0.4	0.4	0.4	0.4

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.2	–0.2	–1.6	2.5	0.2	0.4	–0.0
Coal	–0.3	–1.4	–3.2	–2.1	–4.4	–1.4	–1.8
Oil	4.2	–2.2	–1.3	6.3	0.8	0.4	0.3
Gas	14.3	8.0	3.6	7.1	3.7	1.8	0.7
Comb. Renewables & Wastes	–	–	–	11.1	7.3	3.9	1.5
Nuclear	–	–	0.8	8.5	6.4	–	–
Hydro	13.3	–4.1	2.0	17.2	–1.1	0.3	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
TFC	2.8	–0.9	–3.3	1.7	1.1	0.8	0.1
Electricity Consumption	3.4	2.6	0.2	3.0	0.2	1.4	0.6
Energy Production	2.0	–1.0	–2.5	2.1	–1.9	–1.8	–1.0
Net Oil Imports	3.9	–2.4	–1.3	8.7	0.5	0.5	0.3
GDP	2.5	1.4	0.1	3.3	5.0	5.0	5.0
Growth in the TPES/GDP Ratio	–1.3	–1.6	–1.7	–0.7	–4.6	–4.3	–4.8
Growth in the TFC/GDP Ratio	0.3	–2.2	–3.5	–1.5	–3.7	–4.0	–4.6

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**0.43**	**9.84**	**27.78**	**27.17**	**26.53**	**8.83**	**..**
Coal[1]		–	–	–	–	–	–	..
Oil		0.07	5.85	18.26	17.34	13.96	4.42	..
Gas		–	2.77	7.41	7.59	9.40	1.44	..
Comb. Renewables & Wastes[2]		0.35	1.16	1.65	1.77	2.44	2.24	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.00	0.00	0.00	0.00	0.00	0.00	..
Geothermal		–	0.00	0.00	0.00	0.01	0.01	..
Solar/Wind/Other[3]		–	0.06	0.46	0.46	0.72	0.72	..
TOTAL NET IMPORTS[4]		**19.85**	**7.60**	**–8.84**	**–7.23**	**–2.96**	**14.88**	**..**
Coal[1]	Exports	0.04	0.03	0.07	0.10	–	–	..
	Imports	1.91	6.25	3.86	4.16	5.47	4.32	..
	Net Imports	1.87	6.22	3.79	4.06	5.47	4.32	..
Oil	Exports	2.89	5.56	18.47	16.26	2.77	–	..
	Imports	21.58	8.22	9.97	9.14	–	6.84	..
	Bunkers	0.69	0.96	1.34	1.12	1.13	1.13	..
	Net Imports	18.00	1.70	–9.84	–8.23	–3.90	5.71	..
Gas	Exports	–	0.93	2.88	3.05	3.36	–	..
	Imports	–	–	–	–	–	6.15	..
	Net Imports	–	–0.93	–2.88	–3.05	–3.36	6.15	..
Electricity	Exports	0.11	0.42	0.67	0.76	1.17	1.30	..
	Imports	0.09	1.03	0.72	0.71	–	–	..
	Net Imports	–0.02	0.61	0.06	–0.05	–1.17	–1.30	..
TOTAL STOCK CHANGES		**–0.44**	**0.18**	**0.46**	**–0.16**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**19.83**	**17.61**	**19.40**	**19.78**	**23.57**	**23.71**	**..**
Coal[1]		1.93	6.10	4.02	4.20	5.47	4.32	..
Oil		17.57	7.86	8.73	8.72	10.05	10.13	..
Gas		–	1.82	4.45	4.63	6.04	7.58	..
Comb. Renewables & Wastes[2]		0.35	1.16	1.68	1.82	2.44	2.24	..
Nuclear		–	–	–	–	–	–	..
Hydro		0.00	0.00	0.00	0.00	0.00	0.00	..
Geothermal		–	0.00	0.00	0.00	0.01	0.01	..
Solar/Wind/Other[3]		–	0.06	0.47	0.47	0.72	0.72	..
Electricity Trade[5]		–0.02	0.61	0.06	–0.05	–1.17	–1.30	..
Shares (%)								
Coal		*9.7*	*34.7*	*20.7*	*21.2*	*23.2*	*18.2*	..
Oil		*88.6*	*44.7*	*45.0*	*44.1*	*42.6*	*42.7*	..
Gas		–	*10.3*	*22.9*	*23.4*	*25.6*	*32.0*	..
Comb. Renewables & Wastes		*1.8*	*6.6*	*8.7*	*9.2*	*10.4*	*9.5*	..
Nuclear		–	–	–	–	–	–	..
Hydro		–	–	–	–	–	–	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	*0.3*	*2.4*	*2.4*	*3.1*	*3.0*	..
Electricity Trade		*–0.1*	*3.4*	*0.3*	*–0.2*	*–5.0*	*–5.5*	..

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	2000	2001	2010	2020	2030
TFC	**16.26**	**13.88**	**15.04**	**15.16**	**17.11**	**18.14**	**..**
Coal[1]	0.34	0.41	0.31	0.25	0.31	0.35	..
Oil	14.26	7.55	7.43	7.24	8.22	8.69	..
Gas	0.12	1.16	1.68	1.77	2.00	2.12	..
Comb. Renewables & Wastes[2]	0.16	0.56	0.58	0.62	0.66	0.68	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.00	0.01	0.01	0.01	0.01	..
Electricity	1.39	2.44	2.79	2.84	3.13	3.44	..
Heat	–	1.76	2.25	2.44	2.78	2.85	..
Shares (%)							
Coal	*2.1*	*2.9*	*2.1*	*1.6*	*1.8*	*1.9*	..
Oil	*87.7*	*54.4*	*49.4*	*47.8*	*48.1*	*47.9*	..
Gas	*0.7*	*8.3*	*11.1*	*11.7*	*11.7*	*11.7*	..
Comb. Renewables & Wastes	*1.0*	*4.1*	*3.9*	*4.1*	*3.9*	*3.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	*0.1*	–	–	..
Electricity	*8.5*	*17.6*	*18.6*	*18.7*	*18.3*	*19.0*	..
Heat	–	*12.7*	*14.9*	*16.1*	*16.2*	*15.7*	..
TOTAL INDUSTRY[6]	**4.10**	**3.01**	**3.22**	**3.24**	**3.79**	**4.19**	**..**
Coal[1]	0.21	0.33	0.28	0.22	0.28	0.32	..
Oil	3.41	1.23	1.05	1.06	1.19	1.30	..
Gas	0.02	0.54	0.79	0.83	0.99	1.09	..
Comb. Renewables & Wastes[2]	0.06	0.11	0.09	0.11	0.13	0.14	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.40	0.73	0.86	0.88	0.99	1.12	..
Heat	–	0.07	0.15	0.16	0.22	0.23	..
Shares (%)							
Coal	*5.2*	*10.9*	*8.8*	*6.7*	*7.3*	*7.5*	..
Oil	*83.3*	*40.8*	*32.5*	*32.6*	*31.4*	*31.1*	..
Gas	*0.4*	*17.9*	*24.5*	*25.5*	*26.2*	*25.9*	..
Comb. Renewables & Wastes	*1.4*	*3.8*	*2.8*	*3.3*	*3.4*	*3.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.7*	*24.1*	*26.7*	*27.2*	*26.1*	*26.6*	..
Heat	–	*2.5*	*4.7*	*4.8*	*5.7*	*5.5*	..
TRANSPORT[7]	**3.52**	**4.11**	**4.87**	**4.66**	**5.60**	**6.01**	**..**
TOTAL OTHER SECTORS[8]	**8.65**	**6.77**	**6.95**	**7.26**	**7.72**	**7.94**	**..**
Coal[1]	0.13	0.08	0.03	0.03	0.04	0.04	..
Oil	7.34	2.24	1.55	1.56	1.45	1.40	..
Gas	0.10	0.62	0.88	0.95	1.01	1.03	..
Comb. Renewables & Wastes[2]	0.10	0.45	0.49	0.51	0.53	0.54	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.00	0.01	0.01	0.01	0.01	..
Electricity	0.98	1.70	1.90	1.93	2.12	2.30	..
Heat	–	1.68	2.09	2.28	2.56	2.62	..
Shares (%)							
Coal	*1.4*	*1.2*	*0.4*	*0.4*	*0.5*	*0.5*	..
Oil	*84.9*	*33.1*	*22.2*	*21.4*	*18.8*	*17.6*	..
Gas	*1.2*	*9.2*	*12.7*	*13.0*	*13.1*	*13.0*	..
Comb. Renewables & Wastes	*1.2*	*6.7*	*7.1*	*7.1*	*6.9*	*6.8*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
Electricity	*11.3*	*25.1*	*27.4*	*26.6*	*27.5*	*29.0*	..
Heat	–	*24.9*	*30.1*	*31.4*	*33.2*	*33.0*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.60**	**7.10**	**8.44**	**8.88**	**12.07**	**11.90**	**..**
OUTPUT (Mtoe)	**1.64**	**2.23**	**3.10**	**3.24**	**4.53**	**5.00**	**..**
(TWh gross)	19.12	25.98	36.04	37.71	52.71	58.12	..
Output Shares (%)							
Coal	*35.8*	*90.3*	*46.3*	*47.3*	*43.7*	*34.7*	..
Oil	*64.1*	*3.7*	*12.3*	*11.1*	*9.6*	*6.9*	..
Gas	–	*2.7*	*24.4*	*24.6*	*23.5*	*38.2*	..
Comb. Renewables & Wastes	–	*0.8*	*5.1*	*5.6*	*9.5*	*7.9*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.0*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*2.3*	*11.8*	*11.4*	*13.6*	*12.3*	..
TOTAL LOSSES	**3.66**	**3.67**	**4.36**	**4.48**	**6.47**	**5.58**	**..**
of which:							
Electricity and Heat Generation[10]	2.96	2.66	2.48	2.55	4.03	3.30	..
Other Transformation	0.44	–0.40	–0.04	0.11	–	–	..
Own Use and Losses[11]	0.26	1.41	1.91	1.82	2.44	2.27	..
Statistical Differences	**–0.08**	**0.06**	**0.00**	**0.15**	**–**	**–**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	128.44	163.49	205.49	207.45	244.29	273.00	..
Population (millions)	5.02	5.14	5.34	5.36	5.45	5.50	..
TPES/GDP[12]	0.15	0.11	0.09	0.10	0.10	0.09	..
Energy Production/TPES	0.02	0.56	1.43	1.37	1.13	0.37	..
Per Capita TPES[13]	3.95	3.43	3.63	3.69	4.32	4.31	..
Oil Supply/GDP[12]	0.14	0.05	0.04	0.04	0.04	0.04	..
TFC/GDP[12]	0.13	0.08	0.07	0.07	0.07	0.07	..
Per Capita TFC[13]	3.24	2.70	2.82	2.83	3.14	3.30	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	56.6	50.6	50.1	50.5	63.8	63.2	..
CO_2 Emissions from Bunkers (Mt CO_2)	4.5	4.8	6.6	5.9	6.0	6.0	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.2	–1.7	1.0	2.0	2.0	0.1	..
Coal	14.4	3.2	–4.1	4.7	3.0	–3.3	..
Oil	–1.4	–6.3	1.0	–0.1	1.6	0.1	..
Gas	–	–	9.4	4.1	3.0	3.3	..
Comb. Renewables & Wastes	6.9	7.4	3.8	7.8	3.3	–1.2	..
Nuclear	–	–	–	–	–	–	..
Hydro	–	–	–	–	–	–	..
Geothermal	–	–	4.1	–	15.5	–1.4	..
Solar/Wind/Other	–	44.0	23.7	–	5.1	–	..
TFC	0.7	–1.8	0.8	0.8	1.4	0.8	..
Electricity Consumption	4.9	2.5	1.4	1.7	1.1	1.4	..
Energy Production	14.7	23.4	10.9	–2.2	–0.3	–14.5	..
Net Oil Imports	–2.6	–18.1	–	–16.4	–8.0	–	..
GDP	1.5	1.4	2.3	1.0	1.8	1.6	..
Growth in the TPES/GDP Ratio	–0.3	–3.0	–1.3	1.0	0.1	–1.5	..
Growth in the TFC/GDP Ratio	–0.9	–3.1	–1.5	–0.2	–0.5	–0.7	..

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	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**4.9**	**12.1**	**15.1**	**15.2**	**19.2**	**19.8**	**..**
Coal[1]		–	–	–	–	–	–	..
Peat		0.1	1.8	1.2	1.4	1.9	2.0	..
Oil		–	–	0.1	0.1	–	–	..
Gas		–	–	–	–	–	–	..
Comb. Renewables & Wastes[2]		3.9	4.3	6.7	6.6	7.8	8.4	..
Nuclear		–	5.0	5.9	5.9	8.4	8.2	..
Hydro		0.9	0.9	1.3	1.1	1.1	1.1	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.1	..
TOTAL NET IMPORTS[4]		**16.6**	**17.7**	**18.1**	**18.6**	**18.4**	**20.4**	**..**
Coal[1]	Exports	0.0	0.0	–	–	–	–	..
	Imports	2.4	4.4	3.6	4.2	4.3	5.7	..
	Net Imports	2.4	4.4	3.6	4.2	4.3	5.7	..
Peat	Exports	–	–	0.0	0.0	–	–	..
	Imports	–	–	–	–	–	–	..
	Net Imports	–	–	–0.0	–0.0	–	–	..
Oil	Exports	0.2	1.7	5.2	5.0	..	..	..
	Imports	14.0	12.5	16.0	15.4	9.2	9.4	..
	Bunkers	0.1	0.6	0.7	0.6	–	–	..
	Net Imports	13.8	10.2	10.1	9.8	9.2	9.4	..
Gas	Exports	–	–	–	–	–	–	..
	Imports	–	2.2	3.4	3.7	4.4	4.9	..
	Net Imports	–	2.2	3.4	3.7	4.4	4.9	..
Electricity	Exports	0.0	0.0	0.0	0.2	0.0	0.0	..
	Imports	0.4	0.9	1.1	1.0	0.5	0.5	..
	Net Imports	0.4	0.9	1.0	0.9	0.5	0.5	..
TOTAL STOCK CHANGES		**–0.1**	**–0.6**	**–0.2**	**0.1**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**21.3**	**29.2**	**33.0**	**33.8**	**37.6**	**40.2**	**..**
Coal[1]		2.5	4.1	3.6	4.2	4.3	5.7	..
Peat		0.0	1.2	1.4	1.9	1.9	2.0	..
Oil		13.6	10.3	9.6	9.4	9.2	9.4	..
Gas		–	2.2	3.4	3.7	4.4	4.9	..
Comb. Renewables & Wastes[2]		3.9	4.6	6.7	6.6	7.8	8.4	..
Nuclear		–	5.0	5.9	5.9	8.4	8.2	..
Hydro		0.9	0.9	1.3	1.1	1.1	1.1	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	–	0.0	0.0	0.0	0.1	..
Electricity Trade[5]		0.4	0.9	1.0	0.9	0.5	0.5	..
Shares (%)								
Coal		*11.8*	*14.1*	*11.0*	*12.4*	*11.5*	*14.1*	..
Peat		*0.2*	*4.2*	*4.4*	*5.7*	*5.1*	*5.0*	..
Oil		*63.6*	*35.1*	*29.2*	*27.9*	*24.5*	*23.4*	..
Gas		–	*7.5*	*10.4*	*11.0*	*11.8*	*12.1*	..
Comb. Renewables & Wastes		*18.5*	*15.6*	*20.4*	*19.7*	*20.7*	*20.9*	..
Nuclear		–	*17.2*	*17.8*	*17.6*	*22.3*	*20.4*	..
Hydro		*4.2*	*3.2*	*3.8*	*3.4*	*3.0*	*2.8*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	–	–	*0.1*	*0.1*	..
Electricity Trade		*1.7*	*3.1*	*3.1*	*2.5*	*1.2*	*1.2*	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**19.4**	**22.7**	**24.8**	**25.2**	**29.2**	**31.3**	**..**
Coal[1]	1.0	1.2	0.8	0.8	2.0	2.3	..
Peat	0.0	0.4	0.3	0.3	0.4	0.4	..
Oil	11.5	9.7	8.3	8.5	8.7	8.9	..
Gas	0.0	1.0	1.0	1.1	1.9	2.0	..
Comb. Renewables & Wastes[2]	3.9	3.5	5.0	4.8	5.8	6.2	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	2.3	5.1	6.5	6.6	7.7	8.5	..
Heat	0.6	1.9	2.8	3.0	2.7	2.9	..
Shares (%)							
Coal	*5.3*	*5.1*	*3.4*	*3.3*	*6.8*	*7.4*	..
Peat	*0.1*	*1.8*	*1.3*	*1.3*	*1.4*	*1.4*	..
Oil	*59.2*	*42.5*	*33.7*	*33.7*	*29.7*	*28.4*	..
Gas	*0.1*	*4.3*	*4.0*	*4.2*	*6.6*	*6.4*	..
Comb. Renewables & Wastes	*20.3*	*15.5*	*20.2*	*19.2*	*19.8*	*19.9*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*11.9*	*22.3*	*26.2*	*26.3*	*26.4*	*27.3*	..
Heat	*3.1*	*8.4*	*11.2*	*12.0*	*9.3*	*9.2*	..
TOTAL INDUSTRY[6]	**7.6**	**10.5**	**12.2**	**11.9**	**15.1**	**16.5**	**..**
Coal[1]	0.9	1.2	0.8	0.8	2.0	2.3	..
Peat	0.0	0.4	0.3	0.3	0.4	0.4	..
Oil	5.0	2.6	1.8	1.7	1.7	1.8	..
Gas	0.0	0.9	0.9	1.0	1.9	1.9	..
Comb. Renewables & Wastes[2]	–	2.5	3.9	3.7	4.6	5.0	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	1.6	2.8	3.7	3.6	4.4	4.9	..
Heat	0.1	0.2	0.7	0.8	0.2	0.2	..
Shares (%)							
Coal	*12.1*	*11.0*	*6.8*	*6.9*	*13.1*	*13.9*	..
Peat	*0.2*	*3.6*	*2.4*	*2.5*	*2.6*	*2.4*	..
Oil	*66.2*	*24.7*	*15.0*	*14.5*	*11.2*	*11.0*	..
Gas	*0.1*	*9.0*	*7.6*	*8.1*	*12.3*	*11.6*	..
Comb. Renewables & Wastes	–	*23.4*	*32.1*	*30.8*	*30.3*	*30.0*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*20.4*	*26.6*	*30.1*	*30.6*	*29.1*	*29.7*	..
Heat	*1.0*	*1.7*	*6.0*	*6.5*	*1.5*	*1.4*	..
TRANSPORT[7]	**2.6**	**4.4**	**4.5**	**4.6**	**4.4**	**4.7**	**..**
TOTAL OTHER SECTORS[8]	**9.3**	**7.9**	**8.1**	**8.7**	**9.7**	**10.1**	**..**
Coal[1]	0.1	0.0	0.0	0.0	0.0	0.0	..
Peat	0.0	0.0	0.0	0.0	0.0	0.0	..
Oil	3.9	2.7	2.1	2.2	2.6	2.5	..
Gas	0.0	0.0	0.1	0.1	0.1	0.1	..
Comb. Renewables & Wastes[2]	3.9	1.1	1.1	1.2	1.2	1.3	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	0.8	2.2	2.8	3.0	3.3	3.6	..
Heat	0.5	1.7	2.0	2.3	2.5	2.7	..
Shares (%)							
Coal	*1.1*	*0.1*	–	–	–	–	..
Peat	*0.1*	*0.2*	*0.3*	*0.3*	*0.2*	*0.3*	..
Oil	*42.3*	*35.0*	*25.6*	*25.7*	*27.3*	*24.5*	..
Gas	–	*0.5*	*0.8*	*0.8*	*0.6*	*0.7*	..
Comb. Renewables & Wastes	*42.6*	*13.6*	*13.5*	*13.4*	*12.3*	*12.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*8.2*	*28.5*	*34.4*	*34.0*	*33.9*	*35.5*	..
Heat	*5.7*	*22.1*	*25.4*	*26.0*	*25.6*	*26.4*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.5**	**11.9**	**14.8**	**16.1**	**17.6**	**19.0**	**..**
OUTPUT (Mtoe)	**2.2**	**4.7**	**6.0**	**6.4**	**7.5**	**8.4**	**..**
(TWh gross)	26.1	54.4	70.0	74.5	87.6	97.2	..
Output Shares (%)							
Coal	*18.7*	*18.5*	*13.2*	*15.2*	*13.5*	*17.9*	..
Peat	*9.4*	*14.6*	*5.7*	*8.3*	*6.0*	*5.6*	..
Oil	*31.6*	*3.1*	*0.9*	*0.9*	*1.6*	*1.7*	..
Gas	–	*8.6*	*14.4*	*15.5*	*11.8*	*12.4*	..
Comb. Renewables & Wastes	–	–	*12.7*	*11.7*	*15.2*	*15.9*	..
Nuclear	–	*35.3*	*32.1*	*30.6*	*36.7*	*32.4*	..
Hydro	*40.3*	*20.0*	*20.9*	*17.7*	*14.8*	*13.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.4*	*0.7*	..
TOTAL LOSSES							
of which:	2.0	7.1	8.3	9.1	8.4	8.9	..
Electricity and Heat Generation[10]	0.6	5.1	5.8	6.5	7.1	7.5	..
Other Transformation	0.5	0.6	0.8	1.0	0.7	0.9	..
Own Use and Losses[11]	0.9	1.4	1.6	1.7	0.6	0.6	..
Statistical Differences	**–0.1**	**–0.7**	**–0.0**	**–0.5**	**–**	**–**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	81.40	133.73	166.23	167.39	209.41	260.32	..
Population (millions)	4.67	4.99	5.18	5.19	5.26	5.29	..
TPES/GDP[12]	0.26	0.22	0.20	0.20	0.18	0.15	..
Energy Production/TPES	0.23	0.41	0.46	0.45	0.51	0.49	..
Per Capita TPES[13]	4.57	5.85	6.37	6.52	7.15	7.59	..
Oil Supply/GDP[12]	0.17	0.08	0.06	0.06	0.04	0.04	..
TFC/GDP[12]	0.24	0.17	0.15	0.15	0.14	0.12	..
Per Capita TFC[13]	4.16	4.56	4.78	4.86	5.56	5.91	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	48.4	55.0	54.8	60.2	59.0	65.9	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.5	2.8	3.2	2.9	1.1	1.1	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	2.3	1.6	1.2	2.5	1.2	0.7	..
Coal	7.4	0.6	–1.3	15.7	0.3	2.8	..
Peat	48.1	10.6	1.7	33.4	–0.1	0.4	..
Oil	–0.5	–2.3	–0.6	–2.1	–0.3	0.2	..
Gas	–	9.4	4.6	8.3	2.0	0.9	..
Comb. Renewables & Wastes	–2.4	2.7	4.0	–1.4	1.7	0.8	..
Nuclear	–	10.0	1.6	1.3	3.9	–0.2	..
Hydro	0.6	–0.0	3.0	–9.9	–0.2	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–14.3	19.6	6.6	..
TFC	0.4	1.2	0.9	1.9	1.6	0.7	..
Electricity Consumption	4.7	4.7	2.5	2.4	1.7	1.0	..
Energy Production	4.7	5.9	2.3	0.1	2.7	0.3	..
Net Oil Imports	1.1	–3.3	–0.1	–2.8	–0.7	0.2	..
GDP	2.4	3.3	2.2	0.7	2.5	2.2	..
Growth in the TPES/GDP Ratio	–0.1	–1.6	–0.9	1.8	–1.3	–1.5	..
Growth in the TFC/GDP Ratio	–1.9	–2.0	–1.3	1.2	–0.9	–1.5	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**36.1**	**111.7**	**131.5**	**133.2**	**129.3**	**118.6**	**..**
Coal[1]		18.0	8.2	2.5	1.6	–	–	..
Oil		2.1	3.5	1.8	1.8	–	–	..
Gas		6.3	2.5	1.5	1.5	–	–	..
Comb. Renewables & Wastes[2]		1.7	10.9	11.5	11.9	11.4	12.5	..
Nuclear		3.8	81.9	108.2	109.7	111.4	99.5	..
Hydro		4.1	4.6	5.8	6.4	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**	**129.5**	**130.8**	**178.5**	**215.7**	**..**
Coal[1]	Exports	1.3	0.6	0.5	0.5	–	–	..
	Imports	10.8	13.7	13.5	11.6	10.8	11.5	..
	Net Imports	9.5	13.0	13.0	11.2	10.8	11.5	..
Oil	Exports	13.7	14.8	23.0	21.1	6.3	5.6	..
	Imports	145.1	100.9	112.9	115.2	121.3	135.1	..
	Bunkers	5.3	2.5	3.0	2.7	2.7	3.4	..
	Net Imports	126.0	83.6	87.0	91.4	112.3	126.1	..
Gas	Exports	0.1	0.3	0.7	0.8	–	–	..
	Imports	7.6	24.7	36.1	34.9	59.7	82.4	..
	Net Imports	7.6	24.4	35.4	34.1	59.7	82.4	..
Electricity	Exports	0.6	4.5	6.3	6.3	4.3	4.3	..
	Imports	0.4	0.6	0.3	0.4	–	–	..
	Net Imports	–0.2	–3.9	–6.0	–5.9	–4.3	–4.3	..
TOTAL STOCK CHANGES		**–2.4**	**–1.7**	**–3.5**	**1.6**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**176.6**	**227.1**	**257.4**	**265.6**	**307.8**	**334.2**	**..**
Coal[1]		29.2	20.2	15.0	12.7	10.8	11.5	..
Oil		124.3	87.3	87.2	93.8	112.3	126.1	..
Gas		13.6	26.0	35.4	36.7	59.7	82.4	..
Comb. Renewables & Wastes[2]		1.7	10.9	11.5	12.0	11.4	12.5	..
Nuclear		3.8	81.9	108.2	109.7	111.4	99.5	..
Hydro		4.1	4.6	5.8	6.4	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	–6.0	–5.9	–4.3	–4.3	..
Shares (%)								
Coal		*16.6*	*8.9*	*5.8*	*4.8*	*3.5*	*3.4*	..
Oil		*70.4*	*38.4*	*33.9*	*35.3*	*36.5*	*37.7*	..
Gas		*7.7*	*11.5*	*13.8*	*13.8*	*19.4*	*24.7*	..
Comb. Renewables & Wastes		*1.0*	*4.8*	*4.5*	*4.5*	*3.7*	*3.7*	..
Nuclear		*2.2*	*36.0*	*42.0*	*41.3*	*36.2*	*29.8*	..
Hydro		*2.3*	*2.0*	*2.2*	*2.4*	*2.1*	*2.0*	..
Geothermal		–	–	–	*0.1*	..	..	..
Solar/Wind/Other		–	–	–	–	..	..	..
Electricity Trade		*–0.1*	*–1.7*	*–2.3*	*–2.2*	*–1.4*	*–1.3*	..

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

Please note: Forecast data for combustible renewables and wastes include final consumption of solar. Forecasts do not include inputs and outputs from geothermal, solar, wind and combustible renewables and wastes to electricity and heat generation. All forecast data are based on the 1999 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**138.1**	**147.4**	**168.6**	**173.8**	**204.5**	**231.2**	**..**
Coal[1]	13.1	7.5	4.2	3.5	7.9	7.9	..
Oil	99.4	79.5	88.1	91.1	105.2	118.8	..
Gas	11.2	23.9	32.7	34.4	40.5	45.8	..
Comb. Renewables & Wastes[2]	1.7	9.6	9.6	10.0	11.4	12.5	..
Geothermal	–	0.1	0.1	0.1	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	..	..	..
Electricity	12.8	26.0	33.1	34.0	39.5	46.1	..
Heat	–	0.7	0.7	0.6	..	..	..
Shares (%)							
Coal	*9.5*	*5.1*	*2.5*	*2.0*	*3.9*	*3.4*	..
Oil	*72.0*	*53.9*	*52.2*	*52.4*	*51.5*	*51.4*	..
Gas	*8.1*	*16.2*	*19.4*	*19.8*	*19.8*	*19.8*	..
Comb. Renewables & Wastes	*1.2*	*6.5*	*5.7*	*5.8*	*5.6*	*5.4*	..
Geothermal	–	*0.1*	*0.1*	*0.1*	–	–	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*9.3*	*17.6*	*19.6*	*19.6*	*19.3*	*20.0*	..
Heat	–	*0.5*	*0.4*	*0.4*	..	..	..
TOTAL INDUSTRY[6]	**55.7**	**46.3**	**50.8**	**50.4**	**63.6**	**70.5**	**..**
Coal[1]	7.2	5.9	3.6	3.0	6.3	5.6	..
Oil	35.3	18.0	19.5	19.9	26.3	28.9	..
Gas	5.8	11.1	14.4	14.1	15.1	16.5	..
Comb. Renewables & Wastes[2]	0.2	1.5	1.7	1.7	2.0	2.6	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	7.2	9.9	11.6	11.6	13.8	16.9	..
Heat	–	–	–	–	..	..	..
Shares (%)							
Coal	*12.9*	*12.7*	*7.1*	*5.9*	*10.0*	*8.0*	..
Oil	*63.4*	*38.8*	*38.4*	*39.6*	*41.4*	*41.0*	..
Gas	*10.4*	*24.0*	*28.3*	*28.1*	*23.8*	*23.4*	..
Comb. Renewables & Wastes	*0.4*	*3.3*	*3.3*	*3.5*	*3.1*	*3.7*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*13.0*	*21.3*	*22.9*	*23.0*	*21.7*	*24.0*	..
Heat	–	–	–	–	..	..	..
TRANSPORT[7]	**27.1**	**42.8**	**52.7**	**53.3**	**62.4**	**75.4**	**..**
TOTAL OTHER SECTORS[8]	**55.4**	**58.2**	**65.0**	**70.2**	**78.5**	**85.2**	**..**
Coal[1]	5.8	1.7	0.6	0.6	1.6	2.3	..
Oil	37.6	19.5	17.1	19.1	17.9	16.1	..
Gas	5.4	12.8	18.3	20.2	25.4	29.3	..
Comb. Renewables & Wastes[2]	1.5	8.1	7.7	8.0	9.1	9.6	..
Geothermal	–	0.1	0.1	0.1	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	..	..	..
Electricity	5.0	15.3	20.5	21.4	24.6	27.9	..
Heat	–	0.7	0.7	0.6	..	..	..
Shares (%)							
Coal	*10.5*	*2.9*	*1.0*	*0.8*	*2.0*	*2.7*	..
Oil	*68.0*	*33.4*	*26.3*	*27.3*	*22.7*	*18.9*	..
Gas	*9.7*	*22.0*	*28.1*	*28.8*	*32.3*	*34.4*	..
Comb. Renewables & Wastes	*2.7*	*13.9*	*11.8*	*11.4*	*11.6*	*11.3*	..
Geothermal	–	*0.2*	*0.2*	*0.2*	–	–	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*9.0*	*26.3*	*31.5*	*30.5*	*31.3*	*32.8*	..
Heat	–	*1.2*	*1.0*	*0.9*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**35.9**	**98.3**	**126.8**	**127.5**	**137.6**	**142.9**	**..**
OUTPUT (Mtoe)	**15.7**	**35.8**	**46.1**	**47.0**	**52.7**	**57.8**	**..**
(TWh gross)	182.5	416.8	535.8	546.0	612.7	672.1	..
Output Shares (%)							
Coal	*19.4*	*8.5*	*5.8*	*4.5*	*1.5*	*1.9*	..
Oil	*40.2*	*2.1*	*1.4*	*1.0*	*0.2*	*0.1*	..
Gas	*5.5*	*0.7*	*2.1*	*3.1*	*16.3*	*29.8*	..
Comb. Renewables & Wastes	*0.4*	*0.4*	*0.6*	*0.6*	..	..	..
Nuclear	*8.1*	*75.4*	*77.5*	*77.1*	*69.8*	*56.8*	..
Hydro	*26.1*	*12.8*	*12.5*	*13.6*	*12.3*	*11.3*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	*0.3*	*0.1*	*0.1*	*0.1*	..	..	..
TOTAL LOSSES	**37.6**	**75.2**	**94.2**	**95.6**	**103.2**	**103.1**	**..**
of which:							
Electricity and Heat Generation[10]	20.2	61.8	80.1	79.9	86.4	85.7	..
Other Transformation	5.4	1.6	0.4	2.1	..	..	..
Own Use and Losses[11]	12.0	11.8	13.7	13.6	16.9	17.4	..
Statistical Differences	**0.9**	**4.5**	**–5.3**	**–3.8**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	961.43	1473.22	1772.34	1804.85	2214.74	2780.22	..
Population (millions)	53.30	58.17	60.59	60.91	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	0.51	0.50	0.42	0.35	..
Per Capita TPES[13]	3.31	3.90	4.25	4.36	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]	2.59	2.53	2.78	2.85	3.31	3.64	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	489.0	352.7	375.8	384.9	470.7	563.7	..
CO_2 Emissions from Bunkers (Mt CO_2)	22.7	17.7	25.3	22.7	22.7	24.9	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.0	1.8	1.3	3.2	1.7	0.8	..
Coal	1.7	–4.2	–2.9	–15.6	–1.7	0.6	..
Oil	–1.4	–2.4	–0.0	7.5	2.0	1.2	..
Gas	7.4	2.0	3.1	3.5	5.6	3.3	..
Comb. Renewables & Wastes	7.6	13.8	0.6	3.8	–0.5	0.9	..
Nuclear	18.1	20.6	2.8	1.4	0.2	–1.1	..
Hydro	5.7	–2.0	2.3	11.2	0.1	0.1	..
Geothermal	–	–	1.2	12.1	–	–	..
Solar/Wind/Other	–1.8	3.2	2.9	2.5	–	–	..
TFC	0.7	0.2	1.4	3.1	1.8	1.2	..
Electricity Consumption	5.4	3.7	2.5	2.7	1.7	1.6	..
Energy Production	2.1	9.5	1.6	1.3	–0.3	–0.9	..
Net Oil Imports	–1.4	–2.9	0.4	5.1	2.3	1.2	..
GDP	2.8	2.4	1.9	1.8	2.3	2.3	..
Growth in the TPES/GDP Ratio	–1.8	–0.6	–0.6	1.3	–0.6	–1.4	..
Growth in the TFC/GDP Ratio	–2.1	–2.1	–0.5	1.2	–0.5	–1.0	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**171.7**	**186.2**	**135.2**	**133.7**	**116.9**	**..**	**..**
Coal[1]		141.4	121.8	60.6	58.2	51.0	..	..
Oil		6.8	4.7	3.9	4.0	1.6	..	..
Gas		16.4	13.5	15.8	15.9	13.1	..	..
Comb. Renewables & Wastes[2]		2.5	4.8	7.8	8.2	8.3	..	..
Nuclear		3.2	39.8	44.2	44.6	39.1	..	..
Hydro		1.3	1.5	1.9	1.8	1.9	..	..
Geothermal		–	0.0	0.0	0.0	–	..	..
Solar/Wind/Other[3]		–	0.0	0.9	1.1	2.0	..	..
TOTAL NET IMPORTS[4]		**167.3**	**165.4**	**203.9**	**215.0**	**233.5**	**..**	**..**
Coal[1]	Exports	18.3	8.2	0.6	0.5	0.1	..	..
	Imports	15.2	11.5	22.2	26.3	23.1	..	..
	Net Imports	–3.1	3.3	21.7	25.8	23.0	..	..
Oil	Exports	9.9	10.2	22.2	19.8	14.6	..	..
	Imports	171.1	132.9	149.6	152.8	154.7	..	..
	Bunkers	4.1	2.5	2.2	2.2	1.8	..	..
	Net Imports	157.1	120.2	125.2	130.7	138.4	..	..
Gas	Exports	0.1	0.9	4.2	5.2	2.9	..	..
	Imports	12.4	42.7	61.1	63.4	74.1	..	..
	Net Imports	12.3	41.7	56.8	58.2	71.2	..	..
Electricity	Exports	0.7	2.6	3.6	3.6	1.7	..	..
	Imports	1.7	2.7	3.9	3.9	2.6	..	..
	Net Imports	1.0	0.1	0.3	0.3	0.9	..	..
TOTAL STOCK CHANGES		**–1.1**	**4.7**	**4.3**	**2.4**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**337.9**	**356.2**	**343.4**	**351.1**	**350.4**	**..**	**..**
Coal[1]		139.4	128.5	84.8	85.0	74.0	..	..
Oil		161.9	126.5	131.7	134.5	140.0	..	..
Gas		28.7	55.0	71.8	75.6	84.2	..	..
Comb. Renewables & Wastes[2]		2.5	4.8	7.8	8.2	8.3	..	..
Nuclear		3.2	39.8	44.2	44.6	39.1	..	..
Hydro		1.3	1.5	1.9	1.8	1.9	..	..
Geothermal		–	0.0	0.0	0.0	–	..	..
Solar/Wind/Other[3]		–	0.0	0.9	1.1	2.0	..	..
Electricity Trade[5]		1.0	0.1	0.3	0.3	0.9	..	..
Shares (%)								
Coal		*41.2*	*36.1*	*24.7*	*24.2*	*21.1*	..	..
Oil		*47.9*	*35.5*	*38.4*	*38.3*	*39.9*	..	..
Gas		*8.5*	*15.4*	*20.9*	*21.5*	*24.0*	..	..
Comb. Renewables & Wastes		*0.7*	*1.3*	*2.3*	*2.3*	*2.4*	..	..
Nuclear		*0.9*	*11.2*	*12.9*	*12.7*	*11.2*	..	..
Hydro		*0.4*	*0.4*	*0.5*	*0.5*	*0.5*	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other		–	–	*0.3*	*0.3*	*0.6*	..	..
Electricity Trade		*0.3*	–	*0.1*	*0.1*	*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	2000	2001	2010	2020	2030
TFC	**246.6**	**247.3**	**242.3**	**246.0**	**261.7**	**..**	**..**
Coal[1]	53.1	37.3	10.5	9.7	11.6	..	..
Oil	138.2	117.7	123.0	125.1	130.3	..	..
Gas	21.1	41.0	55.1	56.0	61.7	..	..
Comb. Renewables & Wastes[2]	1.7	3.0	4.6	4.9	4.3	..	..
Geothermal	–	0.0	0.0	0.0	–	..	..
Solar/Wind/Other	–	0.0	0.1	0.1	0.5	..	..
Electricity	26.9	39.1	42.2	43.1	44.6	..	..
Heat	5.5	9.1	6.8	7.1	8.6	..	..
Shares (%)							
Coal	*21.5*	*15.1*	*4.3*	*3.9*	*4.4*	..	..
Oil	*56.0*	*47.6*	*50.8*	*50.8*	*49.8*	..	..
Gas	*8.6*	*16.6*	*22.7*	*22.8*	*23.6*	..	..
Comb. Renewables & Wastes	*0.7*	*1.2*	*1.9*	*2.0*	*1.6*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	*0.1*	*0.2*	..	..
Electricity	*10.9*	*15.8*	*17.4*	*17.5*	*17.1*	..	..
Heat	*2.2*	*3.7*	*2.8*	*2.9*	*3.3*	..	..
TOTAL INDUSTRY[6]	**105.9**	**89.5**	**79.9**	**78.1**	**88.8**	**..**	**..**
Coal[1]	28.7	20.7	9.2	8.4	11.0	..	..
Oil	46.9	27.3	28.2	27.7	31.8	..	..
Gas	13.3	19.7	21.4	20.8	25.1	..	..
Comb. Renewables & Wastes[2]	0.0	0.8	0.5	0.5	0.3	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	15.3	18.6	19.7	19.8	18.9	..	..
Heat	1.6	2.4	0.9	0.9	1.7	..	..
Shares (%)							
Coal	*27.1*	*23.1*	*11.5*	*10.8*	*12.3*	..	..
Oil	*44.3*	*30.5*	*35.3*	*35.5*	*35.9*	..	..
Gas	*12.6*	*22.0*	*26.8*	*26.6*	*28.3*	..	..
Comb. Renewables & Wastes	–	*0.9*	*0.6*	*0.6*	*0.3*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*14.5*	*20.8*	*24.7*	*25.4*	*21.3*	..	..
Heat	*1.5*	*2.7*	*1.1*	*1.2*	*1.9*	..	..
TRANSPORT[7]	**39.7**	**60.0**	**67.4**	**66.0**	**67.4**	**..**	**..**
TOTAL OTHER SECTORS[8]	**101.0**	**97.8**	**95.0**	**101.9**	**105.5**	**..**	**..**
Coal[1]	22.7	16.6	1.3	1.3	0.7	..	..
Oil	54.2	31.6	28.9	33.0	33.0	..	..
Gas	7.8	21.3	33.7	35.3	36.6	..	..
Comb. Renewables & Wastes[2]	1.7	2.2	4.0	4.1	3.9	..	..
Geothermal	–	0.0	0.0	0.0	–	..	..
Solar/Wind/Other	–	0.0	0.1	0.1	0.5	..	..
Electricity	10.7	19.3	21.1	22.0	24.0	..	..
Heat	3.9	6.7	5.9	6.2	6.9	..	..
Shares (%)							
Coal	*22.5*	*16.9*	*1.4*	*1.2*	*0.6*	..	..
Oil	*53.6*	*32.3*	*30.4*	*32.4*	*31.3*	..	..
Gas	*7.7*	*21.8*	*35.5*	*34.6*	*34.6*	..	..
Comb. Renewables & Wastes	*1.7*	*2.2*	*4.2*	*4.0*	*3.7*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.5*	..	..
Electricity	*10.6*	*19.8*	*22.2*	*21.6*	*22.8*	..	..
Heat	*3.9*	*6.9*	*6.2*	*6.0*	*6.5*	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**98.6**	**141.2**	**133.4**	**136.8**	**128.8**	**..**	**..**
OUTPUT (Mtoe)	**32.2**	**47.1**	**48.8**	**49.9**	**51.4**	**..**	**..**
(TWh gross)	374.4	547.6	567.1	579.8	598.0	..	..
Output Shares (%)							
Coal	*69.0*	*58.8*	*52.7*	*51.9*	*50.5*	..	..
Oil	*12.0*	*1.9*	*0.8*	*1.1*	*0.8*	..	..
Gas	*10.9*	*7.4*	*9.3*	*9.9*	*14.5*	..	..
Comb. Renewables & Wastes	*0.8*	*0.9*	*1.8*	*2.2*	*2.7*	..	..
Nuclear	*3.2*	*27.8*	*29.9*	*29.5*	*25.1*	..	..
Hydro	*4.1*	*3.2*	*3.8*	*3.5*	*3.6*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.0*	*1.7*	*1.9*	*2.9*	..	..
TOTAL LOSSES	**90.7**	**112.0**	**100.8**	**102.2**	**86.5**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	60.0	83.4	77.1	79.1	69.3	..	..
Other Transformation	7.0	8.0	5.9	5.9	0.9	..	..
Own Use and Losses[11]	23.7	20.5	17.7	17.2	16.3	..	..
Statistical Differences	**0.5**	**–3.0**	**0.3**	**2.8**	**2.2**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	1514.68	2221.56	2687.83	2703.25	3230.63	..	..
Population (millions)	78.96	79.36	82.19	82.34	78.60	..	..
TPES/GDP[12]	0.22	0.16	0.13	0.13	0.11	..	..
Energy Production/TPES	0.51	0.52	0.39	0.38	0.33	..	..
Per Capita TPES[13]	4.28	4.49	4.18	4.26	4.46	..	..
Oil Supply/GDP[12]	0.11	0.06	0.05	0.05	0.04	..	..
TFC/GDP[12]	0.16	0.11	0.09	0.09	0.08	..	..
Per Capita TFC[13]	3.12	3.12	2.95	2.99	3.33	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	1058.7	964.1	834.8	850.2	844.7	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	21.8	22.1	28.6	28.2	26.9	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.5	–0.3	–0.4	2.2	–0.0	..	..
Coal	–0.2	–0.6	–4.1	0.3	–1.5	..	..
Oil	–0.1	–2.2	0.4	2.1	0.4	..	..
Gas	10.2	0.6	2.7	5.2	1.2	..	..
Comb. Renewables & Wastes	6.2	2.7	5.0	4.9	0.2	..	..
Nuclear	27.5	10.3	1.0	1.0	–1.5	..	..
Hydro	3.2	–0.5	2.2	–5.9	0.6	..	..
Geothermal	–	–	3.6	–	–	..	..
Solar/Wind/Other	–	–	50.6	18.0	7.2	..	..
TFC	1.2	–0.6	–0.2	1.5	0.7	..	..
Electricity Consumption	3.8	1.4	0.7	2.3	0.4	..	..
Energy Production	1.0	0.2	–3.2	–1.0	–1.5	..	..
Net Oil Imports	0.2	–2.5	0.4	4.4	0.6	..	..
GDP	2.4	2.2	1.9	0.6	2.0	..	..
Growth in the TPES/GDP Ratio	–0.9	–2.5	–2.2	1.6	–2.0	..	..
Growth in the TFC/GDP Ratio	–1.1	–2.8	–2.1	0.9	–1.3	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

	1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION	**2.33**	**9.20**	**9.99**	**9.97**	**11.14**	**..**	**..**
Coal[1]	1.69	7.12	8.22	8.39	8.82	..	..
Oil	–	0.84	0.26	0.18	0.30	..	..
Gas	–	0.14	0.04	0.04	0.04	..	..
Comb. Renewables & Wastes[2]	0.45	0.89	1.01	1.01	1.14	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	0.19	0.15	0.32	0.18	0.33	..	..
Geothermal	–	0.00	0.00	0.00	0.11	..	..
Solar/Wind/Other[3]	–	0.06	0.14	0.17	0.40	..	..
TOTAL NET IMPORTS[4]	**11.12**	**12.74**	**18.13**	**18.60**	**29.40**	**..**	**..**
Coal[1] Exports	0.02	–	0.04	0.03	–	..	..
Imports	0.47	0.92	0.81	0.89	0.76	..	..
Net Imports	0.45	0.92	0.77	0.86	0.76	..	..
Oil Exports	4.95	7.56	4.17	3.98	6.00	..	..
Imports	16.51	21.87	23.44	23.32	31.22	..	..
Bunkers	0.89	2.55	3.60	3.49	3.60	..	..
Net Imports	10.67	11.76	15.67	15.85	21.62	..	..
Gas Exports	–	–	–	–	–	..	..
Imports	–	–	1.69	1.67	7.02	..	..
Net Imports	–	–	1.69	1.67	7.02	..	..
Electricity Exports	0.00	0.05	0.15	0.09	–	..	..
Imports	0.01	0.11	0.15	0.31	–	..	..
Net Imports	0.00	0.06	–0.00	0.22	–	..	..
TOTAL STOCK CHANGES	**–1.10**	**0.24**	**–0.29**	**0.14**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)	**12.36**	**22.18**	**27.82**	**28.70**	**40.54**	**..**	**..**
Coal[1]	2.10	8.07	9.04	9.31	9.58	..	..
Oil	9.61	12.81	15.61	16.14	21.92	..	..
Gas	–	0.14	1.70	1.68	7.06	..	..
Comb. Renewables & Wastes[2]	0.45	0.89	1.01	1.01	1.14	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	0.19	0.15	0.32	0.18	0.33	..	..
Geothermal	–	0.00	0.00	0.00	0.11	..	..
Solar/Wind/Other[3]	–	0.06	0.14	0.17	0.40	..	..
Electricity Trade[5]	0.00	0.06	–0.00	0.22	–	..	..
Shares (%)							
Coal	*17.0*	*36.4*	*32.5*	*32.4*	*23.6*	..	..
Oil	*77.7*	*57.8*	*56.1*	*56.2*	*54.1*	..	..
Gas	–	*0.6*	*6.1*	*5.9*	*17.4*	..	..
Comb. Renewables & Wastes	*3.6*	*4.0*	*3.6*	*3.5*	*2.8*	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	*1.5*	*0.7*	*1.1*	*0.6*	*0.8*	..	..
Geothermal	–	–	–	–	*0.3*	..	..
Solar/Wind/Other	–	*0.3*	*0.5*	*0.6*	*1.0*	..	..
Electricity Trade	–	*0.3*	–	*0.7*	–	..	..

0 is negligible, – is nil, .. is not available.
Please note: All forecasts are based on the 2001 submisson.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	9.21	15.47	19.51	20.09	29.53	..	..
Coal[1]	0.52	1.20	0.88	0.89	0.76	..	..
Oil	7.15	10.75	13.46	13.92	19.87	..	..
Gas	0.00	0.11	0.38	0.38	1.88	..	..
Comb. Renewables & Wastes[2]	0.45	0.89	0.95	0.94	1.08	..	..
Geothermal	–	0.00	0.00	0.00	–	..	..
Solar/Wind/Other	–	0.06	0.10	0.10	0.14	..	..
Electricity	1.09	2.45	3.71	3.83	5.79	..	..
Heat	–	–	0.03	0.03	0.03	..	..
Shares (%)							
Coal	*5.6*	*7.8*	*4.5*	*4.4*	*2.6*	..	..
Oil	*77.6*	*69.5*	*69.0*	*69.3*	*67.3*	..	..
Gas	–	*0.7*	*1.9*	*1.9*	*6.4*	..	..
Comb. Renewables & Wastes	*4.9*	*5.8*	*4.9*	*4.7*	*3.7*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.4*	*0.5*	*0.5*	*0.5*	..	..
Electricity	*11.9*	*15.8*	*19.0*	*19.1*	*19.6*	..	..
Heat	–	–	*0.1*	*0.1*	*0.1*	..	..
TOTAL INDUSTRY[6]	**3.49**	**4.70**	**5.19**	**5.23**	**7.32**	**..**	**..**
Coal[1]	0.46	1.18	0.85	0.87	0.72	..	..
Oil	2.39	2.18	2.57	2.58	3.54	..	..
Gas	–	0.10	0.37	0.35	0.99	..	..
Comb. Renewables & Wastes[2]	–	0.19	0.24	0.24	0.25	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.63	1.04	1.17	1.18	1.82	..	..
Heat	–	–	–	–	–	..	..
Shares (%)							
Coal	*13.1*	*25.0*	*16.4*	*16.6*	*9.8*	..	..
Oil	*68.7*	*46.5*	*49.4*	*49.4*	*48.4*	..	..
Gas	–	*2.2*	*7.0*	*6.8*	*13.5*	..	..
Comb. Renewables & Wastes	–	*4.1*	*4.6*	*4.5*	*3.4*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*18.2*	*22.2*	*22.5*	*22.7*	*24.8*	..	..
Heat	–	–	–	–	–	..	..
TRANSPORT[7]	**2.70**	**5.95**	**7.36**	**7.53**	**11.44**	**..**	**..**
TOTAL OTHER SECTORS[8]	**3.03**	**4.82**	**6.95**	**7.33**	**10.78**	**..**	**..**
Coal[1]	0.04	0.03	0.03	0.02	0.04	..	..
Oil	2.08	2.63	3.56	3.83	4.98	..	..
Gas	0.00	0.01	0.01	0.02	0.86	..	..
Comb. Renewables & Wastes[2]	0.45	0.70	0.71	0.70	0.83	..	..
Geothermal	–	0.00	0.00	0.00	–	..	..
Solar/Wind/Other	–	0.06	0.10	0.10	0.14	..	..
Electricity	0.46	1.40	2.53	2.63	3.91	..	..
Heat	–	–	0.03	0.03	0.03	..	..
Shares (%)							
Coal	*1.4*	*0.5*	*0.4*	*0.3*	*0.3*	..	..
Oil	*68.6*	*54.5*	*51.1*	*52.2*	*46.2*	..	..
Gas	*0.1*	*0.1*	*0.2*	*0.2*	*8.0*	..	..
Comb. Renewables & Wastes	*14.9*	*14.6*	*10.1*	*9.6*	*7.7*	..	..
Geothermal	–	*0.1*	–	–	–	..	..
Solar/Wind/Other	–	*1.2*	*1.4*	*1.4*	*1.3*	..	..
Electricity	*15.0*	*29.0*	*36.3*	*35.8*	*36.3*	..	..
Heat	–	–	*0.4*	*0.4*	*0.3*	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.34**	**8.90**	**11.93**	**12.00**	**16.77**	**..**	**..**
OUTPUT (Mtoe)	**1.27**	**2.99**	**4.59**	**4.56**	**6.72**	**..**	**..**
(TWh gross)	14.82	34.78	53.43	53.08	78.12	..	..
Output Shares (%)							
Coal	*35.5*	*72.4*	*64.2*	*66.8*	*43.7*	*..*	*..*
Oil	*49.5*	*22.3*	*16.6*	*16.0*	*12.6*	*..*	*..*
Gas	*–*	*0.3*	*11.1*	*11.6*	*34.4*	*..*	*..*
Comb. Renewables & Wastes	*–*	*–*	*0.3*	*0.3*	*0.3*	*..*	*..*
Nuclear	*–*	*–*	*–*	*–*	*–*	*..*	*..*
Hydro	*15.0*	*5.1*	*6.9*	*4.0*	*4.9*	*..*	*..*
Geothermal	*–*	*–*	*–*	*–*	*0.2*	*..*	*..*
Solar/Wind/Other	*–*	*0.0*	*0.8*	*1.4*	*4.0*	*..*	*..*
TOTAL LOSSES	**3.14**	**7.00**	**8.53**	**8.77**	**11.00**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	2.07	5.91	7.31	7.41	10.00	..	..
Other Transformation	0.44	–0.23	–0.70	–0.64	–	..	..
Own Use and Losses[11]	0.64	1.31	1.92	2.00	1.00	..	..
Statistical Differences	**0.00**	**–0.28**	**–0.21**	**–0.15**	**–**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	84.54	110.50	139.16	144.84	206.16	..	..
Population (millions)	8.93	10.16	10.92	10.96	11.00	..	..
TPES/GDP[12]	0.15	0.20	0.20	0.20	0.20	..	..
Energy Production/TPES	0.19	0.41	0.36	0.35	0.27	..	..
Per Capita TPES[13]	1.38	2.18	2.55	2.62	3.69	..	..
Oil Supply/GDP[12]	0.11	0.12	0.11	0.11	0.11	..	..
TFC/GDP[12]	0.11	0.14	0.14	0.14	0.14	..	..
Per Capita TFC[13]	1.03	1.52	1.79	1.83	2.68	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	34.4	70.6	87.8	90.2	118.3	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	4.5	10.5	13.9	13.4	13.7	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	4.4	3.0	2.3	3.2	3.9	..	..
Coal	8.7	8.0	1.1	3.0	0.3	..	..
Oil	3.5	0.7	2.0	3.4	3.5	..	..
Gas	–	–	28.6	–1.2	17.3	..	..
Comb. Renewables & Wastes	–	6.4	1.2	–	1.3	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	8.2	–6.2	7.7	–43.4	6.9	..	..
Geothermal	–	–	–4.0	–	55.8	..	..
Solar/Wind/Other	–	–	9.2	19.6	10.4	..	..
TFC	4.0	2.6	2.3	3.0	4.4	..	..
Electricity Consumption	7.0	3.7	4.2	3.2	4.7	..	..
Energy Production	8.3	8.5	0.8	–0.2	1.2	..	..
Net Oil Imports	2.5	–0.4	2.9	1.2	3.5	..	..
GDP	3.3	0.7	2.3	4.1	4.0	..	..
Growth in the TPES/GDP Ratio	1.1	2.3	–0.0	–0.9	–0.1	..	..
Growth in the TFC/GDP Ratio	0.7	1.9	0.0	–1.1	0.4	..	..

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	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**12.70**	**14.24**	**11.19**	**10.82**	**9.74**	**8.95**	**8.56**
Coal[1]		6.05	4.14	2.89	2.66	2.20	2.00	1.80
Oil		2.02	2.27	1.68	1.57	1.00	0.80	0.70
Gas		4.03	3.81	2.47	2.48	2.00	1.60	1.50
Comb. Renewables & Wastes[2]		0.59	0.42	0.42	0.40	0.84	0.84	0.84
Nuclear		–	3.58	3.71	3.70	3.60	3.60	3.60
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	–	0.01	0.01	0.08	0.10	0.10
Solar/Wind/Other[3]		–	–	–	0.00	0.00	0.01	0.01
TOTAL NET IMPORTS[4]		**8.66**	**14.17**	**13.87**	**13.78**	**17.11**	**18.77**	**19.37**
Coal[1]	Exports	0.11	–	0.13	0.10	–	–	–
	Imports	1.74	1.63	1.21	1.09	1.33	1.35	1.27
	Net Imports	1.63	1.63	1.08	1.00	1.33	1.35	1.27
Oil	Exports	0.92	1.52	1.80	2.31	1.50	1.50	1.50
	Imports	7.39	7.96	7.01	7.05	7.65	8.15	8.45
	Bunkers	–	–	–	–	–	–	–
	Net Imports	6.48	6.44	5.21	4.73	6.15	6.65	6.95
Gas	Exports	0.01	0.02	0.07	0.00	–	–	–
	Imports	0.17	5.19	7.35	7.78	9.48	10.46	10.95
	Net Imports	0.15	5.17	7.28	7.78	9.48	10.46	10.95
Electricity	Exports	0.09	0.19	0.52	0.62	0.16	0.16	0.15
	Imports	0.49	1.14	0.82	0.90	0.31	0.47	0.35
	Net Imports	0.40	0.96	0.30	0.27	0.16	0.31	0.20
TOTAL STOCK CHANGES		**–0.02**	**0.06**	**–0.13**	**0.73**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**21.33**	**28.47**	**24.93**	**25.34**	**26.85**	**27.73**	**27.93**
Coal[1]		7.91	6.12	3.97	3.62	3.53	3.35	3.07
Oil		8.21	8.51	6.87	6.62	7.15	7.45	7.65
Gas		4.17	8.91	9.65	10.71	11.48	12.06	12.45
Comb. Renewables & Wastes[2]		0.64	0.38	0.42	0.40	0.84	0.84	0.84
Nuclear		–	3.58	3.71	3.70	3.60	3.60	3.60
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	–	0.01	0.01	0.08	0.10	0.10
Solar/Wind/Other[3]		–	–	–	0.00	0.00	0.01	0.01
Electricity Trade[5]		0.40	0.96	0.30	0.27	0.16	0.31	0.20
Shares (%)								
Coal		*37.1*	*21.5*	*15.9*	*14.3*	*13.1*	*12.1*	*11.0*
Oil		*38.5*	*29.9*	*27.5*	*26.1*	*26.6*	*26.9*	*27.4*
Gas		*19.6*	*31.3*	*38.7*	*42.3*	*42.7*	*43.5*	*44.6*
Comb. Renewables & Wastes		*3.0*	*1.3*	*1.7*	*1.6*	*3.1*	*3.0*	*3.0*
Nuclear		–	*12.6*	*14.9*	*14.6*	*13.4*	*13.0*	*12.9*
Hydro		–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Geothermal		–	–	–	–	*0.3*	*0.3*	*0.3*
Solar/Wind/Other		–	–	–	–	–	–	–
Electricity Trade		*1.9*	*3.4*	*1.2*	*1.1*	*0.6*	*1.1*	*0.7*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**17.14**	**20.93**	**17.26**	**17.78**	**19.67**	**19.77**	**19.69**
Coal[1]	4.17	2.68	0.71	0.65	0.82	0.74	0.66
Oil	6.71	7.41	5.54	5.31	5.90	6.20	6.40
Gas	3.08	6.20	6.69	7.34	7.73	8.11	8.30
Comb. Renewables & Wastes[2]	0.62	0.34	0.35	0.33	0.89	0.89	0.89
Geothermal	–	–	0.01	0.01	–	–	–
Solar/Wind/Other	–	–	–	0.00	–	–	–
Electricity	1.51	2.72	2.53	2.63	2.78	2.20	1.80
Heat	1.06	1.59	1.44	1.52	1.55	1.64	1.64
Shares (%)							
Coal	*24.3*	*12.8*	*4.1*	*3.6*	*4.2*	*3.7*	*3.4*
Oil	*39.1*	*35.4*	*32.1*	*29.9*	*30.0*	*31.4*	*32.5*
Gas	*17.9*	*29.6*	*38.8*	*41.3*	*39.3*	*41.0*	*42.2*
Comb. Renewables & Wastes	*3.6*	*1.6*	*2.0*	*1.9*	*4.5*	*4.5*	*4.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.8*	*13.0*	*14.7*	*14.8*	*14.2*	*11.1*	*9.1*
Heat	*6.2*	*7.6*	*8.3*	*8.5*	*7.9*	*8.3*	*8.3*
TOTAL INDUSTRY[6]	**7.90**	**8.06**	**4.97**	**4.88**	**5.54**	**5.62**	**5.51**
Coal[1]	1.87	0.80	0.46	0.41	0.53	0.48	0.43
Oil	2.34	2.11	1.55	1.28	1.68	1.77	1.81
Gas	2.29	3.76	1.70	1.89	2.01	2.11	2.11
Comb. Renewables & Wastes[2]	0.02	0.00	–	0.01	0.11	0.11	0.11
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.92	1.18	0.76	0.81	0.82	0.74	0.63
Heat	0.46	0.21	0.51	0.48	0.40	0.43	0.43
Shares (%)							
Coal	*23.6*	*9.9*	*9.2*	*8.4*	*9.5*	*8.5*	*7.8*
Oil	*29.6*	*26.2*	*31.2*	*26.2*	*30.4*	*31.5*	*32.8*
Gas	*29.0*	*46.6*	*34.1*	*38.8*	*36.2*	*37.4*	*38.3*
Comb. Renewables & Wastes	*0.2*	–	–	*0.2*	*1.9*	*1.9*	*1.9*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.7*	*14.7*	*15.2*	*16.6*	*14.8*	*13.1*	*11.4*
Heat	*5.9*	*2.6*	*10.3*	*9.8*	*7.2*	*7.6*	*7.7*
TRANSPORT[7]	**2.37**	**3.15**	**3.33**	**3.48**	**3.55**	**3.71**	**3.84**
TOTAL OTHER SECTORS[8]	**6.88**	**9.72**	**8.96**	**9.42**	**10.57**	**10.44**	**10.33**
Coal[1]	1.93	1.88	0.25	0.23	0.29	0.26	0.23
Oil	2.45	2.25	0.74	0.66	0.75	0.79	0.80
Gas	0.78	2.44	4.99	5.45	5.72	6.01	6.19
Comb. Renewables & Wastes[2]	0.60	0.34	0.35	0.32	0.78	0.78	0.78
Geothermal	–	–	0.01	0.01	–	–	–
Solar/Wind/Other	–	–	–	0.00	–	–	–
Electricity	0.52	1.43	1.69	1.73	1.88	1.40	1.11
Heat	0.60	1.38	0.93	1.04	1.15	1.21	1.21
Shares (%)							
Coal	*28.1*	*19.4*	*2.7*	*2.4*	*2.7*	*2.5*	*2.3*
Oil	*35.7*	*23.1*	*8.3*	*7.0*	*7.1*	*7.5*	*7.8*
Gas	*11.4*	*25.1*	*55.7*	*57.8*	*54.1*	*57.5*	*59.9*
Comb. Renewables & Wastes	*8.7*	*3.5*	*3.9*	*3.4*	*7.4*	*7.5*	*7.6*
Geothermal	–	–	*0.1*	*0.1*	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.5*	*14.7*	*18.8*	*18.3*	*17.8*	*13.4*	*10.8*
Heat	*8.7*	*14.2*	*10.4*	*11.0*	*10.9*	*11.6*	*11.7*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**6.37**	**10.23**	**10.33**	**10.44**	**10.95**	**11.06**	**11.07**
OUTPUT (Mtoe)	**1.52**	**2.45**	**3.03**	**3.13**	**3.28**	**3.36**	**3.47**
(TWh gross)	17.64	28.44	35.19	36.42	38.11	39.06	40.38
Output Shares (%)							
Coal	*66.0*	*30.5*	*27.6*	*24.5*	*21.5*	*20.5*	*19.8*
Oil	*17.2*	*4.8*	*12.5*	*11.5*	*10.5*	*10.0*	*9.7*
Gas	*16.2*	*15.7*	*18.8*	*24.3*	*28.9*	*31.2*	*33.4*
Comb. Renewables & Wastes	–	*0.1*	*0.3*	*0.3*	*0.5*	*0.5*	*0.5*
Nuclear	–	*48.3*	*40.3*	*38.8*	*38.0*	*37.1*	*35.9*
Hydro	*0.6*	*0.6*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	*0.0*	*0.1*	*0.2*	*0.2*
TOTAL LOSSES	**4.87**	**7.99**	**7.69**	**7.66**	**7.19**	**7.95**	**8.24**
of which:							
Electricity and Heat Generation[10]	3.67	6.03	5.66	5.61	5.80	5.78	5.61
Other Transformation	0.21	–0.05	0.15	0.16	–0.20	–0.20	–0.20
Own Use and Losses[11]	0.99	2.02	1.89	1.88	1.58	2.37	2.83
Statistical Differences	**–0.68**	**–0.45**	**–0.02**	**–0.09**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	34.03	50.35	54.39	56.47	83.92	132.84	216.38
Population (millions)	10.43	10.37	10.21	10.19	10.06	9.86	9.54
TPES/GDP[12]	0.63	0.57	0.46	0.45	0.32	0.21	0.13
Energy Production/TPES	0.60	0.50	0.45	0.43	0.36	0.32	0.31
Per Capita TPES[13]	2.05	2.75	2.44	2.49	2.67	2.81	2.93
Oil Supply/GDP[12]	0.24	0.17	0.13	0.12	0.09	0.06	0.04
TFC/GDP[12]	0.50	0.42	0.32	0.31	0.23	0.15	0.09
Per Capita TFC[13]	1.64	2.02	1.69	1.74	1.95	2.01	2.06
Energy-related CO_2 Emissions (Mt CO_2)[14]	68.5	70.5	55.4	56.3	58.3	59.7	60.0
CO_2 Emissions from Bunkers (Mt CO_2)	0.2	0.5	0.7	0.7	0.7	0.7	0.7

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	4.9	0.0	–1.3	1.6	0.6	0.3	0.1
Coal	1.2	–3.0	–4.2	–8.9	–0.3	–0.5	–0.8
Oil	5.6	–2.6	–2.1	–3.5	0.9	0.4	0.3
Gas	10.0	1.7	0.8	10.9	0.8	0.5	0.3
Comb. Renewables & Wastes	–2.6	–3.3	0.9	–4.1	8.6	–	–
Nuclear	–	–	0.4	–0.4	–0.3	–	–
Hydro	6.3	1.3	–	6.7	–	–	–
Geothermal	–	–	–	20.0	34.1	1.3	–
Solar/Wind/Other	–	–	–	–	–	11.6	2.9
TFC	4.5	–0.6	–1.9	3.0	1.1	0.1	–0.0
Electricity Consumption	6.0	2.2	–0.7	3.8	0.6	–2.3	–2.0
Energy Production	2.4	–0.3	–2.4	–3.3	–1.2	–0.8	–0.5
Net Oil Imports	7.1	–3.8	–2.1	–9.1	3.0	0.8	0.4
GDP	4.3	1.3	0.8	3.8	4.5	4.7	5.0
Growth in the TPES/GDP Ratio	0.6	–1.2	–2.1	–2.1	–3.7	–4.2	–4.7
Growth in the TFC/GDP Ratio	0.2	–1.8	–2.7	–0.8	–3.2	–4.4	–4.8

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**1.120**	**3.467**	**2.110**	**1.729**	**2.899**	**..**	**..**
Coal[1]		0.045	0.016	–	–	–	..	..
Peat		1.020	1.411	0.894	0.810	0.881	..	..
Oil		–	–	–	–	–	..	..
Gas		–	1.872	0.958	0.658	1.590	..	..
Comb. Renewables & Wastes[2]		–	0.108	0.164	0.180	0.168	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		0.055	0.060	0.073	0.051	0.069	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	–	0.021	0.029	0.191	..	..
TOTAL NET IMPORTS[4]		**5.901**	**7.357**	**12.153**	**13.607**	**14.346**	**..**	**..**
Coal[1]	Exports	0.073	0.023	0.014	0.014	0.008	..	..
	Imports	0.578	2.290	1.727	1.874	0.907	..	..
	Net Imports	0.505	2.267	1.713	1.860	0.899	..	..
Peat	Exports	–	–	–	–	0.010	..	..
	Imports	–	–	–	–	–	..	..
	Net Imports	–	–	–	–	–0.010	..	..
Oil	Exports	0.472	0.680	1.326	1.288	1.423	..	..
	Imports	5.956	5.788	9.435	10.296	10.409	..	..
	Bunkers	0.092	0.018	0.154	0.164	0.089	..	..
	Net Imports	5.392	5.090	7.955	8.844	8.897	..	..
Gas	Exports	–	–	–	–	–	..	..
	Imports	–	–	2.477	2.924	4.470	..	..
	Net Imports	–	–	2.477	2.924	4.470	..	..
Electricity	Exports	0.002	–	0.006	0.025	–	..	..
	Imports	0.006	–	0.015	0.003	0.090	..	..
	Net Imports	0.004	–	0.009	–0.022	0.090	..	..
TOTAL STOCK CHANGES		**0.168**	**–0.250**	**0.070**	**–0.356**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**7.189**	**10.575**	**14.333**	**14.981**	**17.245**	**..**	**..**
Coal[1]		0.565	2.375	1.853	1.830	0.899	..	..
Peat		1.020	1.288	0.726	0.797	0.871	..	..
Oil		5.545	4.871	8.053	8.533	8.897	..	..
Gas		–	1.872	3.435	3.583	6.060	..	..
Comb. Renewables & Wastes[2]		–	0.108	0.164	0.180	0.168	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		0.055	0.060	0.073	0.051	0.069	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	–	0.021	0.029	0.191	..	..
Electricity Trade[5]		0.004	–	0.008	–0.021	0.090	..	..
Shares (%)								
Coal		*7.9*	*22.5*	*12.9*	*12.2*	*5.2*	..	..
Peat		*14.2*	*12.2*	*5.1*	*5.3*	*5.1*	..	..
Oil		*77.1*	*46.1*	*56.2*	*57.0*	*51.6*	..	..
Gas		–	*17.7*	*24.0*	*23.9*	*35.1*	..	..
Comb. Renewables & Wastes		–	*1.0*	*1.1*	*1.2*	*1.0*	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		*0.8*	*0.6*	*0.5*	*0.3*	*0.4*	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other		–	–	*0.1*	*0.2*	*1.1*	..	..
Electricity Trade		*0.1*	–	*0.1*	*-0.1*	*0.5*	..	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**5.416**	**7.840**	**11.225**	**11.744**	**14.037**	**..**	**..**
Coal[1]	0.520	1.138	0.451	0.408	0.262	..	..
Peat	0.408	0.427	0.106	0.106	0.127	..	..
Oil	3.856	4.149	7.207	7.589	8.691	..	..
Gas	0.103	0.998	1.583	1.685	2.384	..	..
Comb. Renewables & Wastes[2]	–	0.108	0.140	0.156	0.128	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.529	1.021	1.737	1.800	2.445	..	..
Heat	–	–	–	–	–	..	..
Shares (%)							
Coal	*9.6*	*14.5*	*4.0*	*3.5*	*1.9*	..	..
Peat	*7.5*	*5.4*	*0.9*	*0.9*	*0.9*	..	..
Oil	*71.2*	*52.9*	*64.2*	*64.6*	*61.9*	..	..
Gas	*1.9*	*12.7*	*14.1*	*14.3*	*17.0*	..	..
Comb. Renewables & Wastes	–	*1.4*	*1.2*	*1.3*	*0.9*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*9.8*	*13.0*	*15.5*	*15.3*	*17.4*	..	..
Heat	–	–	–	–	–	..	..
TOTAL INDUSTRY[6]	**1.920**	**2.385**	**2.834**	**2.901**	**2.967**	**..**	**..**
Coal[1]	0.044	0.272	0.051	0.048	0.004	..	..
Peat	–	–	–	–	–	..	..
Oil	1.662	0.879	1.170	1.185	0.734	..	..
Gas	0.025	0.787	0.853	0.892	1.154	..	..
Comb. Renewables & Wastes[2]	–	0.061	0.096	0.109	0.088	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.189	0.386	0.665	0.667	0.987	..	..
Heat	–	–	–	–	–	..	..
Shares (%)							
Coal	*2.3*	*11.4*	*1.8*	*1.7*	*0.1*	..	..
Peat	–	–	–	–	–	..	..
Oil	*86.6*	*36.9*	*41.3*	*40.8*	*24.7*	..	..
Gas	*1.3*	*33.0*	*30.1*	*30.7*	*38.9*	..	..
Comb. Renewables & Wastes	–	*2.6*	*3.4*	*3.8*	*3.0*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*9.8*	*16.2*	*23.5*	*23.0*	*33.3*	..	..
Heat	–	–	–	–	–	..	..
TRANSPORT[7]	**1.406**	**2.031**	**4.100**	**4.377**	**5.590**	**..**	**..**
TOTAL OTHER SECTORS[8]	**2.090**	**3.425**	**4.291**	**4.466**	**5.480**	**..**	**..**
Coal[1]	0.476	0.866	0.400	0.361	0.258	..	..
Peat	0.408	0.427	0.106	0.106	0.127	..	..
Oil	0.788	1.240	1.939	2.028	2.370	..	..
Gas	0.078	0.211	0.730	0.794	1.230	..	..
Comb. Renewables & Wastes[2]	–	0.047	0.044	0.047	0.040	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.340	0.634	1.071	1.130	1.455	..	..
Heat	–	–	–	–	–	..	..
Shares (%)							
Coal	*22.8*	*25.3*	*9.3*	*8.1*	*4.7*	..	..
Peat	*19.5*	*12.5*	*2.5*	*2.4*	*2.3*	..	..
Oil	*37.7*	*36.2*	*45.2*	*45.4*	*43.2*	..	..
Gas	*3.7*	*6.2*	*17.0*	*17.8*	*22.4*	..	..
Comb. Renewables & Wastes	–	*1.4*	*1.0*	*1.1*	*0.7*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*16.3*	*18.5*	*25.0*	*25.3*	*26.6*	..	..
Heat	–	–	–	–	–	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**1.766**	**3.135**	**4.976**	**5.262**	**5.369**	..	..
OUTPUT (Mtoe)	**0.632**	**1.224**	**2.036**	**2.118**	**2.740**	..	..
(TWh gross)	7.348	14.229	23.673	24.632	31.859	..	..
Output Shares (%)							
Coal	*1.0*	*41.6*	*28.8*	*28.7*	*13.6*	..	..
Peat	*23.9*	*15.8*	*7.5*	*8.9*	*6.0*	..	..
Oil	*66.3*	*10.0*	*19.6*	*21.1*	*1.4*	..	..
Gas	–	*27.7*	*39.1*	*37.1*	*69.0*	..	..
Comb. Renewables & Wastes	–	–	*0.4*	*0.4*	*0.5*	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	*8.8*	*4.9*	*3.6*	*2.4*	*2.5*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	*1.0*	*1.4*	*7.0*	..	..
TOTAL LOSSES							
of which:	1.649	2.259	3.423	3.686	3.208	..	..
Electricity and Heat Generation[10]	1.134	1.911	2.940	3.144	2.629	..	..
Other Transformation	0.329	0.041	0.029	0.063	–	..	..
Own Use and Losses[11]	0.186	0.307	0.454	0.479	0.579	..	..
Statistical Differences	**0.124**	**0.476**	**–0.314**	**–0.449**	**–**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	26.92	52.88	105.98	112.01	172.28	..	..
Population (millions)	3.07	3.51	3.80	3.85	4.18	..	..
TPES/GDP[12]	0.27	0.20	0.14	0.13	0.10	..	..
Energy Production/TPES	0.16	0.33	0.15	0.12	0.17	..	..
Per Capita TPES[13]	2.34	3.02	3.77	3.89	4.13	..	..
Oil Supply/GDP[12]	0.21	0.09	0.08	0.08	0.05	..	..
TFC/GDP[12]	0.20	0.15	0.11	0.10	0.08	..	..
Per Capita TFC[13]	1.76	2.24	2.95	3.05	3.36	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	21.0	30.3	41.3	43.1	45.7	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	1.1	1.1	2.3	2.7	2.4	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	3.6	1.6	3.1	4.5	1.6	..	..
Coal	6.9	9.9	–2.5	–1.2	–7.6	..	..
Peat	2.1	1.0	–5.6	9.8	1.0	..	..
Oil	2.3	–2.4	5.2	6.0	0.5	..	..
Gas	–	13.6	6.3	4.3	6.0	..	..
Comb. Renewables & Wastes	–	–	4.3	9.8	–0.8	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	4.3	–1.5	2.0	–30.1	3.4	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	38.1	23.3	..	..
TFC	4.3	1.0	3.7	4.6	2.0	..	..
Electricity Consumption	5.8	2.9	5.5	3.6	3.5	..	..
Energy Production	4.6	8.1	–4.8	–18.1	5.9	..	..
Net Oil Imports	2.9	–2.0	4.6	11.2	0.1	..	..
GDP	4.9	3.6	7.2	5.7	4.9	..	..
Growth in the TPES/GDP Ratio	–1.3	–1.9	–3.8	–1.1	–3.2	..	..
Growth in the TFC/GDP Ratio	–0.6	–2.4	–3.3	–1.0	–2.8	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**20.5**	**25.5**	**27.1**	**26.3**	**36.7**	**41.2**	**49.6**
Coal[1]		0.3	0.3	0.0	–	–	–	–
Oil		1.1	4.7	4.7	4.2	10.0	10.0	10.0
Gas		12.6	14.0	13.6	12.5	13.0	8.0	8.0
Comb. Renewables & Wastes[2]		0.2	0.8	1.7	2.2	5.0	12.0	18.0
Nuclear		0.8	–	–	–	–	–	–
Hydro		3.2	2.7	3.8	4.0	4.0	4.3	4.3
Geothermal		2.1	3.0	3.1	3.2	3.6	4.5	5.7
Solar/Wind/Other[3]		–	0.0	0.1	0.2	1.1	2.4	3.6
TOTAL NET IMPORTS[4]		**109.3**	**128.9**	**149.6**	**143.9**	**146.0**	**156.5**	**162.4**
Coal[1]	Exports	0.4	0.1	0.1	0.1	–	–	–
	Imports	8.2	13.9	13.2	13.7	20.0	21.0	23.0
	Net Imports	7.7	13.7	13.1	13.6	20.0	21.0	23.0
Oil	Exports	29.4	20.1	22.1	23.0	22.0	18.0	18.0
	Imports	136.4	109.5	110.0	106.9	76.5	70.0	70.0
	Bunkers	7.1	2.7	2.7	2.8	2.5	2.0	1.6
	Net Imports	99.9	86.7	85.2	81.1	52.0	50.0	50.4
Gas	Exports	–	0.0	0.0	0.1	–	–	–
	Imports	1.6	25.3	47.0	44.8	67.0	82.0	87.0
	Net Imports	1.6	25.3	47.0	44.8	67.0	82.0	87.0
Electricity	Exports	0.2	0.1	0.0	0.0	–	–	–
	Imports	0.3	3.1	3.9	4.2	6.0	3.0	1.0
	Net Imports	0.1	3.0	3.8	4.2	6.0	3.0	1.0
TOTAL STOCK CHANGES		**–0.9**	**–1.8**	**–5.0**	**1.8**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**128.9**	**152.6**	**171.7**	**172.0**	**182.7**	**197.7**	**212.0**
Coal[1]		8.1	14.6	12.6	13.4	20.0	21.0	23.0
Oil		100.1	89.3	88.2	86.5	62.0	60.0	60.4
Gas		14.2	39.0	57.9	58.1	80.0	90.0	95.0
Comb. Renewables & Wastes[2]		0.2	0.9	2.2	2.5	6.0	12.5	19.0
Nuclear		0.8	–	–	–	–	–	–
Hydro		3.2	2.7	3.8	4.0	4.0	4.3	4.3
Geothermal		2.1	3.0	3.1	3.2	3.6	4.5	5.7
Solar/Wind/Other[3]		–	0.0	0.1	0.2	1.1	2.4	3.6
Electricity Trade[5]		0.1	3.0	3.8	4.2	6.0	3.0	1.0
Shares (%)								
Coal		*6.3*	*9.6*	*7.3*	*7.8*	*10.9*	*10.6*	*10.8*
Oil		*77.6*	*58.5*	*51.3*	*50.3*	*33.9*	*30.3*	*28.5*
Gas		*11.0*	*25.6*	*33.7*	*33.8*	*43.8*	*45.5*	*44.8*
Comb. Renewables & Wastes		*0.2*	*0.6*	*1.3*	*1.4*	*3.3*	*6.3*	*9.0*
Nuclear		*0.6*	–	–	–	–	–	–
Hydro		*2.5*	*1.8*	*2.2*	*2.3*	*2.2*	*2.2*	*2.0*
Geothermal		*1.7*	*1.9*	*1.8*	*1.9*	*2.0*	*2.3*	*2.7*
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.6*	*1.2*	*1.7*
Electricity Trade		*0.1*	*2.0*	*2.2*	*2.4*	*3.3*	*1.5*	*0.5*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**98.7**	**117.6**	**131.2**	**134.1**	**145.8**	**155.1**	**161.5**
Coal[1]	3.3	3.4	2.1	2.2	3.0	3.0	3.0
Oil	72.1	64.2	65.1	66.2	55.0	53.1	53.9
Gas	12.8	30.6	38.6	39.7	54.0	58.0	60.0
Comb. Renewables & Wastes[2]	–	0.9	1.7	1.8	1.5	4.5	5.1
Geothermal	–	0.2	0.2	0.2	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.6	1.3	1.5
Electricity	10.6	18.5	23.5	23.9	31.4	34.8	37.6
Heat	–	–	–	–	0.3	0.4	0.5
Shares (%)							
Coal	*3.3*	*2.9*	*1.6*	*1.6*	*2.1*	*1.9*	*1.9*
Oil	*73.0*	*54.5*	*49.6*	*49.4*	*37.7*	*34.2*	*33.4*
Gas	*12.9*	*26.0*	*29.4*	*29.6*	*37.0*	*37.4*	*37.1*
Comb. Renewables & Wastes	–	*0.7*	*1.3*	*1.4*	*1.0*	*2.9*	*3.2*
Geothermal	–	*0.2*	*0.2*	*0.2*	–	–	–
Solar/Wind/Other	–	–	–	–	*0.4*	*0.8*	*0.9*
Electricity	*10.7*	*15.7*	*17.9*	*17.8*	*21.5*	*22.5*	*23.3*
Heat	–	–	–	–	*0.2*	*0.3*	*0.3*
TOTAL INDUSTRY[6]	**47.6**	**44.6**	**46.2**	**45.9**	**52.6**	**57.8**	**61.6**
Coal[1]	2.6	3.3	2.0	2.1	3.0	3.0	3.0
Oil	29.7	16.9	14.1	13.5	10.0	10.0	12.0
Gas	8.7	14.6	17.6	17.6	23.0	26.0	26.5
Comb. Renewables & Wastes[2]	–	0.2	0.3	0.3	0.5	1.5	1.5
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	0.5	0.5	0.6
Electricity	6.6	9.5	12.2	12.3	15.6	16.8	18.0
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*5.6*	*7.3*	*4.3*	*4.6*	*5.7*	*5.2*	*4.9*
Oil	*62.3*	*37.9*	*30.5*	*29.4*	*19.0*	*17.3*	*19.5*
Gas	*18.2*	*32.9*	*38.1*	*38.4*	*43.7*	*45.0*	*43.1*
Comb. Renewables & Wastes	–	*0.5*	*0.6*	*0.7*	*1.0*	*2.6*	*2.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	*1.0*	*0.9*	*0.9*
Electricity	*13.9*	*21.4*	*26.4*	*26.8*	*29.7*	*29.1*	*29.2*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**20.5**	**35.3**	**42.4**	**42.9**	**41.0**	**41.2**	**42.0**
TOTAL OTHER SECTORS[8]	**30.6**	**37.8**	**42.7**	**45.3**	**52.2**	**56.1**	**58.0**
Coal[1]	0.5	0.1	0.1	0.1	–	–	–
Oil	22.5	12.8	9.7	10.9	7.0	5.5	5.0
Gas	4.0	15.7	20.7	21.7	29.0	30.0	31.0
Comb. Renewables & Wastes[2]	–	0.6	1.4	1.5	1.0	3.0	3.6
Geothermal	–	0.2	0.2	0.2	–	–	–
Solar/Wind/Other	–	0.0	0.0	0.0	0.1	0.8	0.9
Electricity	3.6	8.3	10.5	10.8	14.8	16.4	17.0
Heat	–	–	–	–	0.3	0.4	0.5
Shares (%)							
Coal	*1.5*	*0.3*	*0.2*	*0.2*	–	–	–
Oil	*73.5*	*33.8*	*22.8*	*24.0*	*13.4*	*9.8*	*8.6*
Gas	*13.1*	*41.6*	*48.4*	*48.0*	*55.6*	*53.5*	*53.4*
Comb. Renewables & Wastes	–	*1.7*	*3.4*	*3.4*	*1.9*	*5.3*	*6.2*
Geothermal	–	*0.5*	*0.5*	*0.5*	–	–	–
Solar/Wind/Other	–	–	–	–	*0.2*	*1.4*	*1.6*
Electricity	*11.8*	*22.1*	*24.7*	*23.9*	*28.3*	*29.2*	*29.3*
Heat	–	–	–	–	*0.6*	*0.7*	*0.9*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**28.0**	**43.1**	**52.1**	**50.4**	**55.3**	**67.8**	**81.1**
OUTPUT (Mtoe)	**12.4**	**18.3**	**23.2**	**23.4**	**28.4**	**34.8**	**39.6**
(TWh gross)	143.9	213.2	269.9	271.9	330.0	405.0	460.0
Output Shares (%)							
Coal	*3.6*	*16.8*	*11.3*	*13.5*	*21.8*	*19.8*	*18.5*
Oil	*62.4*	*48.2*	*31.8*	*27.6*	*6.7*	*5.4*	*4.8*
Gas	*3.1*	*18.6*	*37.5*	*38.3*	*48.5*	*48.9*	*43.5*
Comb. Renewables & Wastes	*0.9*	*0.1*	*0.7*	*1.0*	*5.4*	*8.6*	*15.2*
Nuclear	*2.2*	–	–	–	–	–	–
Hydro	*26.1*	*14.8*	*16.4*	*17.2*	*14.2*	*12.3*	*10.9*
Geothermal	*1.7*	*1.5*	*1.7*	*1.7*	*1.8*	*1.7*	*1.7*
Solar/Wind/Other	–	*0.0*	*0.5*	*0.7*	*1.6*	*3.2*	*5.4*
TOTAL LOSSES	**29.9**	**35.0**	**40.4**	**37.6**	**36.9**	**42.6**	**50.5**
of which:							
Electricity and Heat Generation[10]	15.6	24.8	28.8	27.1	26.6	32.6	41.0
Other Transformation	6.0	1.0	2.2	1.1	1.5	1.0	0.5
Own Use and Losses[11]	8.3	9.2	9.4	9.4	8.8	9.0	9.0
Statistical Differences	**0.3**	**–0.0**	**0.0**	**0.3**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	647.03	1030.05	1203.89	1225.27	1490.35	1816.73	2214.58
Population (millions)	54.75	56.72	57.76	57.93	58.49	58.04	56.98
TPES/GDP[12]	0.20	0.15	0.14	0.14	0.12	0.11	0.10
Energy Production/TPES	0.16	0.17	0.16	0.15	0.20	0.21	0.23
Per Capita TPES[13]	2.35	2.69	2.97	2.97	3.12	3.41	3.72
Oil Supply/GDP[12]	0.15	0.09	0.07	0.07	0.04	0.03	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	2.27	2.32	2.49	2.67	2.83
Energy-related CO_2 Emissions (Mt CO_2)[14]	334.4	400.1	425.1	425.3	428.6	451.4	473.9
CO_2 Emissions from Bunkers (Mt CO_2)	26.3	15.0	19.3	19.3	18.3	16.7	15.5

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.5	0.7	1.2	0.2	0.7	0.8	0.7
Coal	4.3	3.1	–1.5	6.4	4.6	0.5	0.9
Oil	–0.0	–1.0	–0.1	–1.8	–3.6	–0.3	0.1
Gas	8.1	5.1	4.0	0.3	3.6	1.2	0.5
Comb. Renewables & Wastes	23.4	0.8	9.0	10.6	10.4	7.6	4.3
Nuclear	–2.9	–	–	–	–	–	–
Hydro	3.4	–3.3	3.4	5.9	0.0	0.6	–
Geothermal	0.1	3.0	0.4	2.8	1.4	2.3	2.4
Solar/Wind/Other	–	–	38.3	43.8	21.4	8.6	4.1
TFC	1.3	0.9	1.1	2.2	0.9	0.6	0.4
Electricity Consumption	4.0	3.0	2.4	1.7	3.1	1.0	0.8
Energy Production	0.2	1.9	0.6	–2.9	3.8	1.2	1.9
Net Oil Imports	–0.4	–1.1	–0.2	–4.8	–4.8	–0.4	0.1
GDP	3.5	2.4	1.6	1.8	2.2	2.0	2.0
Growth in the TPES/GDP Ratio	–1.9	–1.6	–0.4	–1.6	–1.5	–1.2	–1.3
Growth in the TFC/GDP Ratio	–2.1	–1.5	–0.5	0.4	–1.2	–1.3	–1.6

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**29.5**	**73.3**	**105.5**	**104.1**	**..**	**..**	**..**
Coal[1]		17.9	4.6	1.6	1.6	..	..	..
Oil		0.8	0.7	0.8	0.7	..	..	..
Gas		2.3	1.8	2.2	2.2	..	..	..
Comb. Renewables & Wastes[2]		–	4.4	5.8	5.2	..	..	..
Nuclear		2.5	52.7	83.9	83.4	..	..	..
Hydro		5.7	7.7	7.5	7.2	..	..	..
Geothermal		0.2	1.5	2.9	3.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.9	0.9	..	..	..
TOTAL NET IMPORTS[4]		**300.7**	**364.2**	**422.6**	**413.0**	**..**	**..**	**..**
Coal[1]	Exports	0.4	1.1	1.8	1.2	..	..	..
	Imports	41.3	70.0	96.1	99.5	..	..	..
	Net Imports	40.9	68.9	94.3	98.4	..	..	..
Oil	Exports	2.9	3.8	4.4	4.8	..	..	..
	Imports	276.7	262.6	273.7	261.5	..	..	..
	Bunkers	16.8	5.1	4.8	4.1	..	..	..
	Net Imports	257.0	253.6	264.5	252.6	..	..	..
Gas	Exports	–	–	–	–	..	..	..
	Imports	2.8	41.7	63.8	62.0	..	..	..
	Net Imports	2.8	41.7	63.8	62.0	..	..	..
Electricity	Exports	–	–	–	–	..	..	..
	Imports	–	–	–	–	..	..	..
	Net Imports	–	–	–	–	..	..	..
TOTAL STOCK CHANGES		**–6.6**	**–1.0**	**–3.9**	**3.6**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**323.6**	**436.5**	**524.2**	**520.7**	**..**	**..**	**..**
Coal[1]		57.9	74.0	95.7	100.2	..	..	..
Oil		252.2	253.0	261.6	256.1	..	..	..
Gas		5.1	43.3	65.9	64.8	..	..	..
Comb. Renewables & Wastes[2]		–	4.4	5.8	5.2	..	..	..
Nuclear		2.5	52.7	83.9	83.4	..	..	..
Hydro		5.7	7.7	7.5	7.2	..	..	..
Geothermal		0.2	1.5	2.9	3.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.9	0.9	..	..	..
Electricity Trade[5]		–	–	–	–	..	..	..
Shares (%)								
Coal		*17.9*	*16.9*	*18.3*	*19.2*	..	..	..
Oil		*77.9*	*58.0*	*49.9*	*49.2*	..	..	..
Gas		*1.6*	*9.9*	*12.6*	*12.4*	..	..	..
Comb. Renewables & Wastes		–	*1.0*	*1.1*	*1.0*	..	..	..
Nuclear		*0.8*	*12.1*	*16.0*	*16.0*	..	..	..
Hydro		*1.8*	*1.8*	*1.4*	*1.4*	..	..	..
Geothermal		*0.1*	*0.3*	*0.5*	*0.6*	..	..	..
Solar/Wind/Other		–	–	*0.2*	*0.2*	..	..	..
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	2000	2001	2010	2020	2030
TFC	**234.4**	**293.4**	**347.5**	**342.1**	**..**	**..**	**..**
Coal[1]	20.2	22.5	21.6	20.8	..	..	..
Oil	171.5	188.3	221.0	218.5	..	..	..
Gas	7.0	14.7	20.2	20.4	..	..	..
Comb. Renewables & Wastes[2]	–	2.6	2.7	2.2	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	0.8	0.7	..	..	..
Electricity	35.7	65.1	80.8	79.1	..	..	..
Heat	0.0	0.2	0.4	0.4	..	..	..
Shares (%)							
Coal	*8.6*	*7.7*	*6.2*	*6.1*	..	..	..
Oil	*73.2*	*64.2*	*63.6*	*63.9*	..	..	..
Gas	*3.0*	*5.0*	*5.8*	*6.0*	..	..	..
Comb. Renewables & Wastes	–	*0.9*	*0.8*	*0.7*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.2*	*0.2*	..	..	..
Electricity	*15.2*	*22.2*	*23.3*	*23.1*	..	..	..
Heat	–	*0.1*	*0.1*	*0.1*	..	..	..
TOTAL INDUSTRY[6]	**140.2**	**134.5**	**139.4**	**131.6**	**..**	**..**	**..**
Coal[1]	18.2	21.7	21.3	20.8	..	..	..
Oil	94.9	73.3	73.4	68.1	..	..	..
Gas	2.1	4.6	8.1	8.4	..	..	..
Comb. Renewables & Wastes[2]	–	2.5	2.7	2.2	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	25.1	32.4	33.9	32.1	..	..	..
Heat	–	–	–	–	..	..	..
Shares (%)							
Coal	*13.0*	*16.2*	*15.3*	*15.8*	..	..	..
Oil	*67.7*	*54.4*	*52.7*	*51.8*	..	..	..
Gas	*1.5*	*3.4*	*5.8*	*6.4*	..	..	..
Comb. Renewables & Wastes	–	*1.8*	*1.9*	*1.7*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*17.9*	*24.1*	*24.3*	*24.4*	..	..	..
Heat	–	–	–	–	..	..	..
TRANSPORT[7]	**42.6**	**74.3**	**95.0**	**96.1**	**..**	**..**	**..**
TOTAL OTHER SECTORS[8]	**51.6**	**84.5**	**113.1**	**114.4**	**..**	**..**	**..**
Coal[1]	1.8	0.8	0.2	–	..	..	..
Oil	35.3	42.5	54.1	55.9	..	..	..
Gas	5.0	10.1	12.1	12.0	..	..	..
Comb. Renewables & Wastes[2]	–	0.1	0.0	0.0	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	0.8	0.7	..	..	..
Electricity	9.5	30.9	45.3	45.3	..	..	..
Heat	0.0	0.2	0.4	0.4	..	..	..
Shares (%)							
Coal	*3.4*	*0.9*	*0.2*	–	..	..	..
Oil	*68.5*	*50.2*	*47.9*	*48.8*	..	..	..
Gas	*9.6*	*11.9*	*10.7*	*10.5*	..	..	..
Comb. Renewables & Wastes	–	*0.1*	–	–	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.7*	*0.7*	..	..	..
Electricity	*18.4*	*36.6*	*40.1*	*39.6*	..	..	..
Heat	*0.1*	*0.2*	*0.4*	*0.4*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**90.6**	**169.4**	**221.6**	**217.2**	..	..	..
OUTPUT (Mtoe)	**40.0**	**73.2**	**90.9**	**88.9**	..	..	..
(TWh gross)	465.4	850.8	1056.9	1033.2	..	..	..
Output Shares (%)							
Coal	*8.0*	*14.5*	*21.3*	*23.1*	..	..	..
Oil	*73.2*	*29.7*	*13.9*	*11.3*	..	..	..
Gas	*2.3*	*19.4*	*24.5*	*24.9*	..	..	..
Comb. Renewables & Wastes	–	*2.0*	*1.2*	*0.7*	..	..	..
Nuclear	*2.1*	*23.8*	*30.5*	*31.0*	..	..	..
Hydro	*14.3*	*10.5*	*8.3*	*8.1*	..	..	..
Geothermal	*0.1*	*0.2*	*0.3*	*0.3*	..	..	..
Solar/Wind/Other	–	*0.0*	*0.0*	*0.0*	..	..	..
TOTAL LOSSES	**94.6**	**142.0**	**176.5**	**171.9**	..	..	..
of which:							
Electricity and Heat Generation[10]	50.5	96.1	130.3	128.0	..	..	..
Other Transformation	25.1	23.3	24.4	23.3	..	..	..
Own Use and Losses[11]	19.0	22.6	21.8	20.6	..	..	..
Statistical Differences	**–5.4**	**1.1**	**0.2**	**6.8**	..	..	..

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	2618.63	4935.97	5680.57	5647.68	..	..	..
Population (millions)	108.66	123.54	126.93	127.21	..	..	..
TPES/GDP[12]	0.12	0.09	0.09	0.09	..	..	..
Energy Production/TPES	0.09	0.17	0.20	0.20	..	..	..
Per Capita TPES[13]	2.98	3.53	4.13	4.09	..	..	..
Oil Supply/GDP[12]	0.10	0.05	0.05	0.05	..	..	..
TFC/GDP[12]	0.09	0.06	0.06	0.06	..	..	..
Per Capita TFC[13]	2.16	2.37	2.74	2.69	..	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	891.2	1018.7	1149.9	1132.3	..	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	58.6	29.6	35.0	31.7	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.5	1.9	1.8	–0.7	..	..	..
Coal	–2.0	3.4	2.6	4.6	..	..	..
Oil	0.4	–0.2	0.3	–2.1	..	..	..
Gas	24.2	8.0	4.3	–1.6	..	..	..
Comb. Renewables & Wastes	–	–	2.8	–9.6	..	..	..
Nuclear	39.1	10.1	4.8	–0.7	..	..	..
Hydro	3.2	0.9	–0.2	–3.5	..	..	..
Geothermal	22.3	6.2	6.8	2.5	..	..	..
Solar/Wind/Other	–	4.8	46.5	–5.4	..	..	..
TFC	1.0	1.5	1.7	–1.5	..	..	..
Electricity Consumption	3.9	3.4	2.2	–2.2	..	..	..
Energy Production	4.9	5.8	3.7	–1.4	..	..	..
Net Oil Imports	0.5	–0.4	0.4	–4.5	..	..	..
GDP	3.5	4.0	1.4	–0.6	..	..	..
Growth in the TPES/GDP Ratio	–1.9	–2.0	0.4	–0.1	..	..	..
Growth in the TFC/GDP Ratio	–2.4	–2.4	0.3	–1.0	..	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**6.76**	**21.91**	**33.37**	**34.21**	**..**	**..**	**..**
Coal[1]		6.65	7.58	1.79	1.65	..	..	..
Oil		–	–	0.67	0.57	..	..	..
Gas		–	–	–	–	..	..	..
Comb. Renewables & Wastes[2]		–	–	2.12	2.36	..	..	..
Nuclear		–	13.78	28.40	29.22	..	..	..
Hydro		0.11	0.55	0.35	0.36	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.05	0.05	..	..	..
TOTAL NET IMPORTS[4]		**13.03**	**68.51**	**159.40**	**158.51**	**..**	**..**	**..**
Coal[1]	Exports	0.12	–	–	–	..	..	..
	Imports	0.45	15.73	38.45	39.15	..	..	..
	Net Imports	0.34	15.73	38.45	39.15	..	..	..
Oil	Exports	1.04	3.73	40.85	40.14	..	..	..
	Imports	14.28	55.41	150.78	146.53	..	..	..
	Bunkers	0.56	1.58	6.05	5.94	..	..	..
	Net Imports	12.69	50.10	103.88	100.46	..	..	..
Gas	Exports	–	–	–	–	..	..	..
	Imports	–	2.68	17.07	18.90	..	..	..
	Net Imports	–	2.68	17.07	18.90	..	..	..
Electricity	Exports	–	–	–	–	..	..	..
	Imports	–	–	–	–	..	..	..
	Net Imports	–	–	–	–	..	..	..
TOTAL STOCK CHANGES		**1.86**	**2.17**	**–1.61**	**2.07**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**21.64**	**92.58**	**191.16**	**194.78**	**..**	**..**	**..**
Coal[1]		8.13	25.49	39.45	43.00	..	..	..
Oil		13.40	50.04	103.79	101.08	..	..	..
Gas		–	2.72	17.01	18.73	..	..	..
Comb. Renewables & Wastes[2]		–	–	2.12	2.36	..	..	..
Nuclear		–	13.78	28.40	29.22	..	..	..
Hydro		0.11	0.55	0.35	0.36	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.05	0.05	..	..	..
Electricity Trade[5]		–	–	–	–	..	..	..
Shares (%)								
Coal		*37.6*	*27.5*	*20.6*	*22.1*	..	..	..
Oil		*61.9*	*54.0*	*54.3*	*51.9*	..	..	..
Gas		–	*2.9*	*8.9*	*9.6*	..	..	..
Comb. Renewables & Wastes		–	–	*1.1*	*1.2*	..	..	..
Nuclear		–	*14.9*	*14.9*	*15.0*	..	..	..
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	2000	2001	2010	2020	2030
TFC	**17.40**	**63.99**	**126.18**	**130.25**	**..**	**..**	**..**
Coal[1]	6.49	11.37	6.69	7.23	..	..	..
Oil	9.81	43.82	86.11	85.25	..	..	..
Gas	–	0.67	10.92	11.81	..	..	..
Comb. Renewables & Wastes[2]	–	–	0.11	0.11	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	0.00	0.04	0.04	..	..	..
Electricity	1.10	8.12	20.08	21.53	..	..	..
Heat	–	–	2.22	4.28	..	..	..
Shares (%)							
Coal	*37.3*	*17.8*	*5.3*	*5.6*	..	..	..
Oil	*56.4*	*68.5*	*68.2*	*65.5*	..	..	..
Gas	–	*1.1*	*8.7*	*9.1*	..	..	..
Comb. Renewables & Wastes	–	–	*0.1*	*0.1*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*6.3*	*12.7*	*15.9*	*16.5*	..	..	..
Heat	–	–	*1.8*	*3.3*	..	..	..
TOTAL INDUSTRY[6]	**7.37**	**25.17**	**58.21**	**60.66**	**..**	**..**	**..**
Coal[1]	0.39	2.71	6.12	6.65	..	..	..
Oil	6.22	17.42	38.29	37.63	..	..	..
Gas	–	0.07	2.88	3.21	..	..	..
Comb. Renewables & Wastes[2]	–	–	–	–	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	0.76	4.97	10.92	11.37	..	..	..
Heat	–	–	–	1.81	..	..	..
Shares (%)							
Coal	*5.3*	*10.8*	*10.5*	*11.0*	..	..	..
Oil	*84.4*	*69.2*	*65.8*	*62.0*	..	..	..
Gas	–	*0.3*	*4.9*	*5.3*	..	..	..
Comb. Renewables & Wastes	–	–	–	–	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*10.3*	*19.7*	*18.8*	*18.7*	..	..	..
Heat	–	–	–	*3.0*	..	..	..
TRANSPORT[7]	**2.60**	**14.93**	**30.03**	**31.08**	**..**	**..**	**..**
TOTAL OTHER SECTORS[8]	**7.43**	**23.89**	**37.94**	**38.52**	**..**	**..**	**..**
Coal[1]	6.08	8.67	0.57	0.58	..	..	..
Oil	1.02	11.56	17.97	16.74	..	..	..
Gas	–	0.60	8.04	8.61	..	..	..
Comb. Renewables & Wastes[2]	–	–	0.11	0.11	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	0.00	0.04	0.04	..	..	..
Electricity	0.33	3.06	8.99	9.97	..	..	..
Heat	–	–	2.22	2.47	..	..	..
Shares (%)							
Coal	*81.9*	*36.3*	*1.5*	*1.5*	..	..	..
Oil	*13.7*	*48.4*	*47.4*	*43.5*	..	..	..
Gas	–	*2.5*	*21.2*	*22.4*	..	..	..
Comb. Renewables & Wastes	–	–	*0.3*	*0.3*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	..	..	..
Electricity	*4.5*	*12.8*	*23.7*	*25.9*	..	..	..
Heat	–	–	*5.9*	*6.4*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.30**	**26.60**	**66.03**	**71.07**	**..**	**..**	**..**
OUTPUT (Mtoe)	**1.27**	**9.06**	**22.68**	**24.21**	**..**	**..**	**..**
(TWh gross)	14.83	105.37	263.73	281.51	..	..	..
Output Shares (%)							
Coal	*9.0*	*16.8*	*37.0*	*39.2*	..	..	..
Oil	*82.3*	*17.9*	*9.3*	*8.5*	..	..	..
Gas	–	*9.1*	*10.7*	*10.8*	..	..	..
Comb. Renewables & Wastes	–	–	*0.2*	*0.1*	..	..	..
Nuclear	–	*50.2*	*41.3*	*39.8*	..	..	..
Hydro	*8.7*	*6.0*	*1.5*	*1.5*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.0*	*0.0*	..	..	..
TOTAL LOSSES	**4.10**	**28.58**	**61.33**	**62.69**	**..**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	2.03	17.53	40.52	41.37	..	..	..
Other Transformation	1.06	6.64	8.68	8.57	..	..	..
Own Use and Losses[11]	1.01	4.41	12.14	12.76	..	..	..
Statistical Differences	**0.14**	**0.02**	**3.65**	**1.84**	**..**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	93.22	341.55	620.45	639.24	..	..	..
Population (millions)	34.10	42.87	47.01	47.34	..	..	..
TPES/GDP[12]	0.23	0.27	0.31	0.30	..	..	..
Energy Production/TPES	0.31	0.24	0.17	0.18	..	..	..
Per Capita TPES[13]	0.63	2.16	4.07	4.11	..	..	..
Oil Supply/GDP[12]	0.14	0.15	0.17	0.16	..	..	..
TFC/GDP[12]	0.19	0.19	0.20	0.20	..	..	..
Per Capita TFC[13]	0.51	1.49	2.68	2.75	..	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	65.8	226.2	421.7	435.8	..	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	2.1	5.9	21.0	20.9	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	10.8	7.9	7.5	1.9	..	..	..
Coal	6.9	7.0	4.5	9.0	..	..	..
Oil	12.3	5.8	7.6	–2.6	..	..	..
Gas	–	–	20.1	10.1	..	..	..
Comb. Renewables & Wastes	–	–	–	11.1	..	..	..
Nuclear	–	29.2	7.5	2.9	..	..	..
Hydro	10.5	9.6	–4.5	3.5	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	32.0	–6.3	..	..	..
TFC	9.8	7.0	7.0	3.2	..	..	..
Electricity Consumption	15.9	10.6	9.5	7.2	..	..	..
Energy Production	4.9	8.4	4.3	2.5	..	..	..
Net Oil Imports	13.3	5.8	7.6	–3.3	..	..	..
GDP	8.5	7.6	6.2	3.0	..	..	..
Growth in the TPES/GDP Ratio	2.1	0.3	1.3	–1.1	..	..	..
Growth in the TFC/GDP Ratio	1.2	–0.6	0.8	0.2	..	..	..

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	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**0.00**	**0.03**	**0.06**	**0.06**	**0.05**	**..**	**..**
Coal[1]		–	–	–	–	–	..	..
Oil		–	–	–	–	–	..	..
Gas		–	–	–	–	–	..	..
Comb. Renewables & Wastes[2]		–	0.03	0.04	0.05	0.04	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		0.00	0.01	0.01	0.01	0.01	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	–	0.00	0.00	0.00	..	..
TOTAL NET IMPORTS[4]		**4.51**	**3.55**	**3.68**	**3.75**	**3.67**	**..**	**..**
Coal[1]	Exports	–	–	–	–	–	..	..
	Imports	2.44	1.13	0.13	0.11	0.10	..	..
	Net Imports	2.44	1.13	0.13	0.11	0.10	..	..
Oil	Exports	0.01	0.01	0.02	0.03	–	..	..
	Imports	1.69	1.67	2.41	2.49	1.80	..	..
	Bunkers	–	–	–	–	–	..	..
	Net Imports	1.67	1.65	2.39	2.46	1.80	..	..
Gas	Exports	–	–	–	–	–	..	..
	Imports	0.22	0.43	0.67	0.69	1.47	..	..
	Net Imports	0.22	0.43	0.67	0.69	1.47	..	..
Electricity	Exports	0.07	0.06	0.06	0.06	0.18	..	..
	Imports	0.24	0.40	0.56	0.55	0.48	..	..
	Net Imports	0.18	0.34	0.49	0.49	0.30	..	..
TOTAL STOCK CHANGES		**–0.01**	**–0.01**	**–0.05**	**0.03**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**4.51**	**3.57**	**3.68**	**3.83**	**3.72**	**..**	**..**
Coal[1]		2.44	1.13	0.13	0.11	0.10	..	..
Oil		1.67	1.64	2.34	2.48	1.80	..	..
Gas		0.22	0.43	0.67	0.69	1.47	..	..
Comb. Renewables & Wastes[2]		–	0.03	0.04	0.05	0.04	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		0.00	0.01	0.01	0.01	0.01	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	–	0.00	0.00	0.00	..	..
Electricity Trade[5]		0.18	0.34	0.49	0.49	0.30	..	..
Shares (%)								
Coal		*54.1*	*31.7*	*3.4*	*2.9*	*2.7*	..	..
Oil		*37.1*	*46.0*	*63.5*	*64.8*	*48.4*	..	..
Gas		*4.9*	*12.0*	*18.2*	*18.1*	*39.5*	..	..
Comb. Renewables & Wastes		–	*0.7*	*1.2*	*1.2*	*1.1*	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		*0.1*	*0.2*	*0.3*	*0.3*	*0.2*	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.1*	..	..
Electricity Trade		*3.9*	*9.5*	*13.4*	*12.7*	*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	2000	2001	2010	2020	2030
TFC	**2.94**	**2.96**	**3.62**	**3.76**	**3.24**	**..**	**..**
Blast Furnace Gas	0.74	0.20	–	–	–	..	..
Other Coal[1]	0.24	0.35	0.13	0.11	0.10	..	..
Oil	1.54	1.64	2.34	2.48	1.80	..	..
Gas	0.18	0.42	0.62	0.64	0.72	..	..
Comb. Renewables & Wastes[2]	–	–	0.02	0.02	0.01	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.26	0.36	0.49	0.48	0.55	..	..
Heat	–	–	0.03	0.03	0.06	..	..
Shares (%)							
Blast Furnace Gas	*25.1*	*6.8*	–	–	–	..	..
Other Coal	*8.1*	*11.7*	*3.5*	*2.9*	*3.1*	..	..
Oil	*52.1*	*55.3*	*64.6*	*65.9*	*55.6*	..	..
Gas	*6.0*	*14.2*	*17.2*	*16.9*	*22.2*	..	..
Comb. Renewables & Wastes	–	–	*0.4*	*0.4*	*0.4*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*8.7*	*12.0*	*13.6*	*12.9*	*16.9*	..	..
Heat	–	–	*0.7*	*0.9*	*1.8*	..	..
TOTAL INDUSTRY[6]	**2.09**	**1.34**	**0.97**	**0.94**	**1.04**	**..**	**..**
Blast Furnace Gas	0.74	0.20	–	–	–	..	..
Other Coal[1]	0.20	0.34	0.13	0.11	0.10	..	..
Oil	0.81	0.30	0.09	0.08	0.09	..	..
Gas	0.14	0.28	0.41	0.41	0.45	..	..
Comb. Renewables & Wastes[2]	–	–	–	–	–	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.20	0.23	0.33	0.32	0.37	..	..
Heat	–	–	0.02	0.02	0.04	..	..
Shares (%)							
Blast Furnace Gas	*35.4*	*15.1*	–	–	–	..	..
Other Coal	*9.7*	*25.3*	*12.9*	*11.7*	*9.2*	..	..
Oil	*38.6*	*22.0*	*9.0*	*8.7*	*8.7*	..	..
Gas	*6.6*	*20.8*	*42.4*	*43.4*	*42.8*	..	..
Comb. Renewables & Wastes	–	–	–	–	–	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*9.7*	*16.8*	*34.1*	*34.0*	*35.1*	..	..
Heat	–	–	*1.7*	*2.2*	*4.2*	..	..
TRANSPORT[7]	**0.29**	**1.03**	**1.92**	**2.03**	**1.41**	**..**	**..**
TOTAL OTHER SECTORS[8]	**0.56**	**0.59**	**0.72**	**0.80**	**0.79**	**..**	**..**
Coal[1]	0.03	0.01	0.00	0.00	0.00	..	..
Oil	0.44	0.31	0.33	0.38	0.31	..	..
Gas	0.04	0.14	0.21	0.23	0.27	..	..
Comb. Renewables & Wastes[2]	–	–	0.02	0.02	0.01	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.05	0.13	0.15	0.16	0.17	..	..
Heat	–	–	0.01	0.01	0.02	..	..
Shares (%)							
Coal	*6.1*	*1.0*	*0.1*	*0.1*	*0.5*	..	..
Oil	*78.4*	*53.6*	*46.1*	*47.3*	*39.3*	..	..
Gas	*6.8*	*24.1*	*29.1*	*29.1*	*34.6*	..	..
Comb. Renewables & Wastes	–	–	*2.2*	*2.0*	*1.8*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*8.8*	*21.3*	*21.1*	*19.9*	*21.9*	..	..
Heat	–	–	*1.2*	*1.6*	*1.9*	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**0.44**	**0.20**	**0.09**	**0.10**	**0.58**	**..**	**..**
OUTPUT (Mtoe)	**0.12**	**0.05**	**0.04**	**0.04**	**0.30**	**..**	**..**
(TWh gross)	1.39	0.62	0.43	0.50	3.48	..	..
Output Shares (%)							
Blast Furnace Gas	*58.8*	*76.4*	–	–	–	..	..
Other Coal	–	–	–	–	–	..	..
Oil	*27.6*	*1.4*	–	–	–	..	..
Gas	*10.2*	*5.4*	*53.1*	*56.0*	*94.8*	..	..
Comb. Renewables & Wastes	–	*5.4*	*12.9*	*11.8*	*1.4*	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	*3.4*	*11.2*	*27.7*	*26.7*	*2.6*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	*6.2*	*5.4*	*1.1*	..	..
TOTAL LOSSES	1.54	0.61	0.06	0.07	0.48	..	..
of which:							
Electricity and Heat Generation[10]	0.32	0.14	0.02	0.02	0.23	..	..
Other Transformation	1.08	0.41	–	–	–	..	..
Own Use and Losses[11]	0.14	0.06	0.04	0.04	0.25	..	..
Statistical Differences	**0.02**	**0.00**	**0.00**	**0.00**	**–**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1990 US$)	8.44	14.91	25.08	25.34	31.10	..	..
Population (millions)	0.35	0.38	0.44	0.44	0.49	..	–
TPES/GDP[12]	0.53	0.24	0.15	0.15	0.12	..	..
Energy Production/TPES	0.00	0.01	0.02	0.02	0.01	..	..
Per Capita TPES[13]	12.83	9.37	8.39	8.65	7.65	..	..
Oil Supply/GDP[12]	0.20	0.11	0.09	0.10	0.06	..	..
TFC/GDP[12]	0.35	0.20	0.14	0.15	0.10	..	..
Per Capita TFC[13]	8.39	7.76	8.24	8.50	6.66	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	16.5	10.5	8.0	8.4	8.1	–	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.2	0.4	1.0	1.1	1.1	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	–2.5	–0.8	0.3	4.1	–0.3	..	..
Coal	–4.6	–4.3	–19.8	–12.0	–1.1	..	–
Oil	–4.0	2.1	3.6	6.2	–3.5	..	..
Gas	13.6	–0.8	4.6	3.6	8.7	..	..
Comb. Renewables & Wastes	–	3.0	5.8	4.5	–1.0	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	12.2	–2.6	5.2	10.0	–3.5	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	8.0	..	..
TFC	–0.1	0.1	2.0	4.0	–1.7	..	..
Electricity Consumption	2.7	1.6	3.3	–1.6	1.4	..	..
Energy Production	36.6	1.6	6.3	5.3	–1.2	..	..
Net Oil Imports	–3.5	1.8	3.8	2.8	–3.4	..	..
GDP	1.3	4.6	5.3	1.0	2.3	..	..
Growth in the TPES/GDP Ratio	–3.7	–5.1	–4.8	3.0	–2.6	..	..
Growth in the TFC/GDP Ratio	–1.3	–4.3	–3.1	3.0	–3.9	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**56.8**	**60.3**	**56.9**	**60.4**	**59.3**	**64.8**	**..**
Coal[1]		1.1	–	–	–	–	–	..
Oil		1.6	4.1	2.4	2.3	0.8	0.8	..
Gas		53.7	54.6	51.9	55.7	54.7	60.9	..
Comb. Renewables & Wastes[2]		–	0.7	1.5	1.3	2.5	2.5	..
Nuclear		0.3	0.9	1.0	1.0	0.9	–	..
Hydro		–	0.0	0.0	0.0	0.0	0.0	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.3	0.6	..
TOTAL NET IMPORTS[4]		**6.0**	**6.4**	**21.1**	**16.9**	**20.1**	**21.9**	**..**
Coal[1]	Exports	1.4	2.2	6.1	10.6	7.4	7.4	..
	Imports	2.9	11.6	14.2	19.0	15.5	16.7	..
	Net Imports	1.5	9.4	8.2	8.4	8.1	9.3	..
Oil	Exports	42.4	60.2	65.9	68.3	43.9	43.9	..
	Imports	83.8	91.1	107.8	110.1	93.3	93.5	..
	Bunkers	11.6	10.9	13.4	14.7	21.1	21.1	..
	Net Imports	29.8	19.9	28.5	27.1	28.3	28.5	..
Gas	Exports	25.3	25.8	29.7	35.5	33.9	33.9	..
	Imports	–	2.0	12.5	15.3	16.0	16.1	..
	Net Imports	–25.3	–23.8	–17.2	–20.2	–17.9	–17.8	..
Electricity	Exports	0.1	0.0	0.3	0.4	–	–	..
	Imports	0.0	0.8	2.0	1.8	1.6	1.8	..
	Net Imports	–0.1	0.8	1.6	1.5	1.6	1.8	..
TOTAL STOCK CHANGES		**–0.3**	**–0.2**	**–2.5**	**–0.1**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**62.4**	**66.5**	**75.5**	**77.2**	**79.4**	**86.7**	**..**
Coal[1]		2.9	8.9	8.0	8.3	8.1	9.3	..
Oil		30.9	24.3	28.6	29.5	29.0	29.3	..
Gas		28.5	30.8	34.7	35.5	36.8	43.1	..
Comb. Renewables & Wastes[2]		–	0.7	1.5	1.3	2.5	2.5	..
Nuclear		0.3	0.9	1.0	1.0	0.9	–	..
Hydro		–	0.0	0.0	0.0	0.0	0.0	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other[3]		–	0.0	0.1	0.1	0.3	0.6	..
Electricity Trade[5]		–0.1	0.8	1.6	1.5	1.6	1.8	..
Shares (%)								
Coal		*4.6*	*13.4*	*10.6*	*10.8*	*10.2*	*10.8*	..
Oil		*49.5*	*36.6*	*37.8*	*38.1*	*36.6*	*33.8*	..
Gas		*45.6*	*46.3*	*46.0*	*46.0*	*46.4*	*49.7*	..
Comb. Renewables & Wastes		–	*1.1*	*2.0*	*1.6*	*3.1*	*2.9*	..
Nuclear		*0.5*	*1.4*	*1.4*	*1.3*	*1.2*	–	..
Hydro		–	–	–	–	–	–	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.4*	*0.7*	..
Electricity Trade		*–0.2*	*1.2*	*2.2*	*1.9*	*2.1*	*2.1*	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**48.8**	**51.2**	**59.5**	**60.3**	**65.7**	**69.4**	**..**
Coal[1]	1.1	1.2	0.7	0.7	2.4	2.5	..
Oil	24.7	19.9	24.5	25.0	24.5	24.7	..
Gas	19.3	23.0	23.1	23.3	27.3	28.6	..
Comb. Renewables & Wastes[2]	–	0.3	0.3	0.2	0.4	0.4	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.1	..
Electricity	3.8	6.3	8.4	8.6	10.0	12.1	..
Heat	–	0.4	2.6	2.5	1.0	1.1	..
Shares (%)							
Coal	*2.2*	*2.4*	*1.1*	*1.1*	*3.7*	*3.6*	..
Oil	*50.5*	*38.9*	*41.1*	*41.4*	*37.3*	*35.6*	..
Gas	*39.5*	*44.9*	*38.8*	*38.7*	*41.5*	*41.3*	..
Comb. Renewables & Wastes	–	*0.6*	*0.5*	*0.4*	*0.6*	*0.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	*0.1*	..
Electricity	*7.8*	*12.4*	*14.2*	*14.2*	*15.2*	*17.4*	..
Heat	–	*0.9*	*4.3*	*4.2*	*1.6*	*1.5*	..
TOTAL INDUSTRY[6]	**21.2**	**21.1**	**22.8**	**22.9**	**28.7**	**31.7**	**..**
Coal[1]	0.8	1.2	0.6	0.6	2.4	2.4	..
Oil	10.4	8.2	9.2	9.7	10.4	10.9	..
Gas	8.1	8.8	8.2	7.6	11.7	13.4	..
Comb. Renewables & Wastes[2]	–	0.1	0.1	0.1	0.0	0.0	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	0.0	0.0	..
Electricity	2.0	2.9	3.5	3.5	3.8	4.5	..
Heat	–	–	1.2	1.4	0.4	0.4	..
Shares (%)							
Coal	*3.6*	*5.6*	*2.8*	*2.7*	*8.3*	*7.7*	..
Oil	*48.8*	*39.0*	*40.4*	*42.3*	*36.3*	*34.5*	..
Gas	*38.4*	*41.6*	*36.1*	*33.1*	*40.7*	*42.2*	..
Comb. Renewables & Wastes	–	*0.2*	*0.3*	*0.3*	–	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*9.2*	*13.5*	*15.3*	*15.3*	*13.1*	*14.3*	..
Heat	–	–	*5.1*	*6.3*	*1.5*	*1.4*	..
TRANSPORT[7]	**7.5**	**10.6**	**14.5**	**14.6**	**13.1**	**12.7**	**..**
TOTAL OTHER SECTORS[8]	**20.2**	**19.5**	**22.1**	**22.8**	**23.9**	**24.9**	**..**
Coal[1]	0.3	0.1	0.0	0.0	0.0	0.0	..
Oil	6.9	1.2	0.8	0.8	1.2	1.2	..
Gas	11.1	14.2	14.9	15.8	15.6	15.3	..
Comb. Renewables & Wastes[2]	–	0.2	0.2	0.2	0.4	0.4	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	0.1	..
Electricity	1.8	3.4	4.8	4.9	6.0	7.4	..
Heat	–	0.4	1.4	1.1	0.6	0.6	..
Shares (%)							
Coal	*1.6*	*0.3*	*0.1*	*0.1*	*0.2*	*0.1*	..
Oil	*34.2*	*6.2*	*3.8*	*3.6*	*5.0*	*4.7*	..
Gas	*55.3*	*72.9*	*67.1*	*69.1*	*65.2*	*61.3*	..
Comb. Renewables & Wastes	–	*1.3*	*1.0*	*0.8*	*1.7*	*1.5*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	*0.1*	*0.2*	..
Electricity	*8.8*	*17.2*	*21.7*	*21.6*	*25.2*	*29.6*	..
Heat	–	*2.3*	*6.3*	*4.8*	*2.6*	*2.5*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**12.0**	**15.3**	**19.2**	**20.1**	**17.7**	**22.5**	**..**
OUTPUT (Mtoe)	**4.5**	**6.2**	**7.7**	**8.1**	**9.0**	**11.1**	**..**
(TWh gross)	52.6	71.9	89.6	93.7	105.2	129.0	..
Output Shares (%)							
Coal	*6.0*	*38.3*	*28.4*	*28.5*	*24.4*	*24.5*	..
Oil	*12.3*	*4.3*	*3.5*	*3.3*	*4.2*	*3.8*	..
Gas	*79.5*	*50.9*	*57.7*	*58.9*	*57.7*	*60.5*	..
Comb. Renewables & Wastes	–	*1.4*	*4.7*	*3.7*	*6.7*	*5.9*	..
Nuclear	*2.1*	*4.9*	*4.4*	*4.2*	*3.4*	–	..
Hydro	–	*0.1*	*0.2*	*0.1*	*0.2*	*0.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.1*	*1.2*	*1.2*	*3.4*	*5.1*	..
TOTAL LOSSES	**14.3**	**15.5**	**16.2**	**17.3**	**13.7**	**17.3**	**..**
of which:							
Electricity and Heat Generation[10]	7.5	8.6	8.4	9.1	6.9	9.6	..
Other Transformation	1.6	0.9	1.4	1.7	4.7	4.9	..
Own Use and Losses[11]	5.2	6.0	6.3	6.5	2.1	2.8	..
Statistical Differences	**–0.7**	**–0.2**	**–0.2**	**–0.4**	**–**	**–**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	252.64	373.34	497.58	503.86	629.26	805.50	..
Population (millions)	13.44	14.95	15.92	16.04	16.09	17.00	..
TPES/GDP[12]	0.25	0.18	0.15	0.15	0.13	0.11	..
Energy Production/TPES	0.91	0.91	0.75	0.78	0.75	0.75	..
Per Capita TPES[13]	4.65	4.45	4.74	4.81	4.93	5.10	..
Oil Supply/GDP[12]	0.12	0.07	0.06	0.06	0.05	0.04	..
TFC/GDP[12]	0.19	0.14	0.12	0.12	0.10	0.09	..
Per Capita TFC[13]	3.64	3.42	3.74	3.76	4.08	4.08	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	153.8	157.1	173.3	177.5	169.4	188.1	..
CO_2 Emissions from Bunkers (Mt CO_2)	39.3	39.0	52.4	56.4	76.7	76.7	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.7	–0.3	1.3	2.3	0.3	0.9	..
Coal	2.4	9.4	–1.1	4.2	–0.3	1.4	..
Oil	0.4	–2.4	1.6	3.2	–0.2	0.1	..
Gas	2.4	–0.6	1.2	2.4	0.4	1.6	..
Comb. Renewables & Wastes	–	10.3	7.4	–14.8	7.9	0.2	..
Nuclear	21.0	0.0	1.1	1.3	–1.1	–	..
Hydro	–	–	4.1	–16.7	8.0	0.5	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	32.8	–	14.2	6.1	..
TFC	2.0	–0.7	1.5	1.3	1.0	0.5	..
Electricity Consumption	4.4	2.3	2.9	1.5	1.7	1.9	..
Energy Production	4.4	–1.8	–0.6	6.2	–0.2	0.9	..
Net Oil Imports	1.0	–4.1	3.6	–4.7	0.5	0.1	..
GDP	2.6	2.2	2.9	1.3	2.5	2.5	..
Growth in the TPES/GDP Ratio	–0.9	–2.4	–1.6	1.0	–2.1	–1.6	..
Growth in the TFC/GDP Ratio	–0.6	–2.7	–1.4	0.0	–1.5	–1.9	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**4.05**	**12.26**	**14.75**	**14.93**	**17.72**	**20.92**	**26.37**
Coal[1]		1.29	1.39	2.20	2.37	4.00	6.00	9.00
Oil		0.18	1.96	1.92	1.81	2.15	2.15	2.79
Gas		0.28	3.90	5.06	5.32	2.97	3.28	2.95
Comb. Renewables & Wastes[2]		–	0.68	1.23	1.18	1.56	2.03	2.63
Nuclear		–	–	–	–	–	–	–
Hydro		1.23	2.01	2.12	1.85	2.23	2.33	2.35
Geothermal		1.07	2.32	2.16	2.34	4.75	4.96	6.45
Solar/Wind/Other[3]		–	0.01	0.07	0.07	0.07	0.18	0.20
TOTAL NET IMPORTS[4]		**4.27**	**1.79**	**3.16**	**3.06**	**3.40**	**3.71**	**4.09**
Coal[1]	Exports	0.02	0.23	1.11	1.30	2.50	3.67	5.51
	Imports	–	0.01	–	–	–	–	–
	Net Imports	–0.02	–0.22	–1.11	–1.30	–2.50	–3.67	–5.51
Oil	Exports	–	1.47	1.42	1.39	–	–	–
	Imports	4.60	3.80	5.93	6.01	6.29	7.82	10.16
	Bunkers	0.31	0.32	0.23	0.24	0.39	0.43	0.56
	Net Imports	4.29	2.01	4.28	4.37	5.90	7.39	9.60
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
Electricity	Exports	–	–	–	–	–	–	–
	Imports	–	–	–	–	–	–	–
	Net Imports	–	–	–	–	–	–	–
TOTAL STOCK CHANGES		**–0.05**	**–0.03**	**0.14**	**0.30**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**8.27**	**14.02**	**18.05**	**18.29**	**21.12**	**24.64**	**30.47**
Coal[1]		1.26	1.13	1.10	1.27	1.50	2.33	3.49
Oil		4.42	3.98	6.32	6.27	8.05	9.54	12.40
Gas		0.28	3.90	5.06	5.32	2.97	3.28	2.95
Comb. Renewables & Wastes[2]		–	0.68	1.23	1.18	1.56	2.03	2.63
Nuclear		–	–	–	–	–	–	–
Hydro		1.23	2.01	2.12	1.85	2.23	2.33	2.35
Geothermal		1.07	2.32	2.16	2.34	4.75	4.96	6.45
Solar/Wind/Other[3]		–	0.01	0.07	0.07	0.07	0.18	0.20
Electricity Trade[5]		–	–	–	–	–	–	–
Shares (%)								
Coal		*15.3*	*8.0*	*6.1*	*7.0*	*7.1*	*9.4*	*11.5*
Oil		*53.5*	*28.4*	*35.0*	*34.3*	*38.1*	*38.7*	*40.7*
Gas		*3.4*	*27.8*	*28.0*	*29.1*	*14.0*	*13.3*	*9.7*
Comb. Renewables & Wastes		–	*4.9*	*6.8*	*6.4*	*7.4*	*8.2*	*8.6*
Nuclear		–	–	–	–	–	–	–
Hydro		*14.9*	*14.3*	*11.7*	*10.1*	*10.5*	*9.5*	*7.7*
Geothermal		*12.9*	*16.5*	*12.0*	*12.8*	*22.5*	*20.1*	*21.2*
Solar/Wind/Other		–	*0.1*	*0.4*	*0.4*	*0.3*	*0.7*	*0.7*
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	2000	2001	2010	2020	2030
TFC	**6.05**	**9.98**	**13.88**	**13.73**	**14.55**	**18.22**	**23.15**
Coal[1]	0.87	1.01	0.81	0.92	1.15	1.88	2.97
Oil	3.67	4.43	5.84	5.80	7.48	8.94	11.62
Gas	0.14	1.30	2.95	2.71	1.58	2.16	2.42
Comb. Renewables & Wastes[2]	–	0.58	1.06	1.05	0.69	0.70	1.17
Geothermal	–	0.27	0.33	0.31	0.49	0.99	1.47
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	1.37	2.39	2.89	2.93	3.17	3.56	3.51
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*14.4*	*10.1*	*5.8*	*6.7*	*7.9*	*10.3*	*12.8*
Oil	*60.6*	*44.4*	*42.1*	*42.3*	*51.4*	*49.1*	*50.2*
Gas	*2.4*	*13.0*	*21.2*	*19.7*	*10.9*	*11.8*	*10.4*
Comb. Renewables & Wastes	–	*5.8*	*7.6*	*7.6*	*4.8*	*3.8*	*5.1*
Geothermal	–	*2.7*	*2.4*	*2.3*	*3.4*	*5.4*	*6.3*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*22.6*	*23.9*	*20.9*	*21.4*	*21.8*	*19.5*	*15.2*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**2.18**	**4.15**	**6.30**	**6.01**	**5.11**	**6.69**	**8.70**
Coal[1]	0.69	0.86	0.70	0.78	0.91	1.50	2.37
Oil	0.96	0.59	0.60	0.51	0.66	0.72	0.94
Gas	0.05	1.06	2.62	2.36	1.16	1.56	1.75
Comb. Renewables & Wastes[2]	–	0.46	0.91	0.89	0.56	0.56	0.94
Geothermal	–	0.22	0.27	0.25	0.39	0.79	1.17
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.48	0.96	1.21	1.22	1.43	1.55	1.53
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*31.5*	*20.7*	*11.1*	*13.0*	*17.9*	*22.4*	*27.2*
Oil	*43.9*	*14.1*	*9.5*	*8.5*	*13.0*	*10.8*	*10.8*
Gas	*2.4*	*25.5*	*41.6*	*39.3*	*22.6*	*23.3*	*20.1*
Comb. Renewables & Wastes	–	*11.2*	*14.4*	*14.8*	*10.9*	*8.4*	*10.7*
Geothermal	–	*5.3*	*4.3*	*4.2*	*7.7*	*11.9*	*13.5*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*22.2*	*23.2*	*19.3*	*20.3*	*28.0*	*23.2*	*17.6*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**2.15**	**3.54**	**4.96**	**5.01**	**6.29**	**7.61**	**9.88**
TOTAL OTHER SECTORS[8]	**1.72**	**2.30**	**2.63**	**2.71**	**3.15**	**3.93**	**4.57**
Coal[1]	0.19	0.15	0.11	0.14	0.23	0.38	0.59
Oil	0.57	0.37	0.33	0.31	0.54	0.63	0.81
Gas	0.09	0.18	0.33	0.34	0.41	0.59	0.66
Comb. Renewables & Wastes[2]	–	0.12	0.15	0.16	0.14	0.14	0.23
Geothermal	–	0.05	0.06	0.06	0.10	0.20	0.29
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.88	1.42	1.64	1.68	1.73	2.00	1.97
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*10.7*	*6.6*	*4.2*	*5.3*	*7.3*	*9.5*	*13.0*
Oil	*32.8*	*16.0*	*12.4*	*11.6*	*17.1*	*15.9*	*17.8*
Gas	*5.3*	*7.8*	*12.6*	*12.7*	*13.1*	*15.0*	*14.5*
Comb. Renewables & Wastes	–	*5.2*	*5.9*	*5.9*	*4.4*	*3.6*	*5.1*
Geothermal	–	*2.3*	*2.4*	*2.3*	*3.1*	*5.1*	*6.4*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*51.2*	*62.0*	*62.6*	*62.3*	*54.9*	*50.9*	*43.2*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**3.16**	**5.37**	**6.20**	**6.67**	**8.90**	**8.96**	**9.51**
OUTPUT (Mtoe)	**1.59**	**2.77**	**3.39**	**3.43**	**3.48**	**3.91**	**3.87**
(TWh gross)	18.53	32.27	39.47	39.91	40.52	45.50	44.96
Output Shares (%)							
Coal	*8.5*	*1.5*	*2.5*	*3.7*	*3.1*	*2.4*	*2.5*
Oil	*6.1*	*0.0*	–	–	–	–	–
Gas	*1.4*	*17.6*	*24.2*	*31.2*	*13.3*	*11.7*	*5.3*
Comb. Renewables & Wastes	–	*1.3*	*1.5*	*1.2*	*6.5*	*8.3*	*9.3*
Nuclear	–	–	–	–	–	–	–
Hydro	*77.3*	*72.3*	*62.4*	*53.8*	*63.9*	*59.5*	*60.7*
Geothermal	*6.7*	*6.8*	*7.4*	*8.2*	*11.2*	*13.5*	*17.1*
Solar/Wind/Other	–	*0.4*	*1.9*	*2.1*	*2.0*	*4.5*	*5.1*
TOTAL LOSSES	**2.35**	**4.09**	**3.82**	**4.28**	**6.57**	**6.42**	**7.32**
of which:							
Electricity and Heat Generation[10]	1.57	2.59	2.80	3.23	5.42	5.04	5.64
Other Transformation	0.36	0.60	–0.08	–0.05	0.44	0.48	0.62
Own Use and Losses[11]	0.43	0.90	1.09	1.10	0.71	0.90	1.06
Statistical Differences	**–0.13**	**–0.06**	**0.35**	**0.28**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	42.85	52.23	68.88	71.11	88.80	113.68	145.52
Population (millions)	2.97	3.36	3.83	3.85	4.28	4.60	4.87
TPES/GDP[12]	0.19	0.27	0.26	0.26	0.24	0.22	0.21
Energy Production/TPES	0.49	0.87	0.82	0.82	0.84	0.85	0.87
Per Capita TPES[13]	2.78	4.17	4.71	4.75	4.94	5.36	6.25
Oil Supply/GDP[12]	0.10	0.08	0.09	0.09	0.09	0.08	0.09
TFC/GDP[12]	0.14	0.19	0.20	0.19	0.16	0.16	0.16
Per Capita TFC[13]	2.04	2.97	3.62	3.57	3.40	3.96	4.75
Energy-related CO_2 Emissions (Mt CO_2)[14]	17.0	22.3	31.4	32.9	33.8	41.7	53.3
CO_2 Emissions from Bunkers (Mt CO_2)	1.6	2.4	2.5	2.7	3.1	3.3	3.7

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.5	4.1	2.6	1.4	1.6	1.6	2.1
Coal	–4.5	1.5	–0.3	16.0	1.8	4.5	4.1
Oil	–0.9	–0.5	4.7	–0.8	2.8	1.7	2.7
Gas	20.3	14.7	2.6	5.2	–6.3	1.0	–1.0
Comb. Renewables & Wastes	–	3.1	6.1	–4.2	3.2	2.6	2.7
Nuclear	–	–	–	–	–	–	–
Hydro	4.6	2.0	0.5	–12.9	2.1	0.4	0.1
Geothermal	–2.2	8.6	–0.7	8.3	8.2	0.4	2.7
Solar/Wind/Other	–	12.5	19.4	7.7	–0.2	10.0	1.1
TFC	2.1	3.5	3.4	–1.1	0.7	2.3	2.4
Electricity Consumption	3.0	3.5	1.9	1.4	0.9	1.2	–0.1
Energy Production	4.6	7.9	1.9	1.3	1.9	1.7	2.3
Net Oil Imports	–2.5	–5.4	7.8	2.2	3.4	2.3	2.7
GDP	0.0	1.8	2.8	3.2	2.5	2.5	2.5
Growth in the TPES/GDP Ratio	1.5	2.2	–0.2	–1.8	–0.9	–0.9	–0.3
Growth in the TFC/GDP Ratio	2.0	1.7	0.5	–4.2	–1.8	–0.2	–0.1

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**8.08**	**120.30**	**229.04**	**226.57**	**..**	**..**	**..**
Coal[1]		0.29	0.20	0.42	1.20	..	..	..
Oil		1.52	84.51	169.50	164.66	..	..	..
Gas		–	24.14	45.80	48.88	..	..	..
Comb. Renewables & Wastes[2]		–	1.03	1.36	1.47	..	..	..
Nuclear		–	–	–	–	..	..	..
Hydro		6.27	10.42	11.95	10.36	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.01	0.01	..	..	..
TOTAL NET IMPORTS[4]		**6.15**	**–96.94**	**–202.88**	**–202.06**	**..**	**..**	**..**
Coal[1]	Exports	0.09	0.17	0.39	1.01	..	..	..
	Imports	0.67	0.84	0.99	0.88	..	..	..
	Net Imports	0.58	0.67	0.60	–0.13	..	..	..
Oil	Exports	3.58	78.10	163.37	162.45	..	..	..
	Imports	10.23	4.47	4.53	4.47	..	..	..
	Bunkers	0.64	0.45	0.83	0.81	..	..	..
	Net Imports	6.01	–74.08	–159.67	–158.80	..	..	..
Gas	Exports	–	22.17	42.17	43.45	..	..	..
	Imports	–	–	–	–	..	..	..
	Net Imports	–	–22.17	–42.17	–43.45	..	..	..
Electricity	Exports	0.45	1.40	1.77	0.62	..	..	..
	Imports	0.01	0.03	0.13	0.92	..	..	..
	Net Imports	–0.45	–1.37	–1.64	0.31	..	..	..
TOTAL STOCK CHANGES		**0.41**	**–1.87**	**–0.37**	**2.10**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**14.63**	**21.49**	**25.79**	**26.61**	**..**	**..**	**..**
Coal[1]		0.91	0.86	1.08	0.94	..	..	..
Oil		7.90	8.57	9.41	8.08	..	..	..
Gas		–	1.98	3.63	5.42	..	..	..
Comb. Renewables & Wastes[2]		–	1.03	1.36	1.49	..	..	..
Nuclear		–	–	–	–	..	..	..
Hydro		6.27	10.42	11.95	10.36	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other[3]		–	0.00	0.01	0.01	..	..	..
Electricity Trade[5]		–0.45	–1.37	–1.64	0.31	..	..	..
Shares (%)								
Coal		*6.2*	*4.0*	*4.2*	*3.5*	..	..	..
Oil		*54.0*	*39.9*	*36.5*	*30.4*	..	..	..
Gas		–	*9.2*	*14.1*	*20.4*	..	..	..
Comb. Renewables & Wastes		–	*4.8*	*5.3*	*5.6*	..	..	..
Nuclear		–	–	–	–	..	..	..
Hydro		*42.8*	*48.5*	*46.3*	*38.9*	..	..	..
Geothermal		–	–	–	–	..	..	..
Solar/Wind/Other		–	–	–	–	..	..	..
Electricity Trade		*–3.1*	*–6.4*	*–6.4*	*1.2*	..	..	..

0 is negligible, – is nil, .. is not available.
Please note: Forecasts are not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**13.73**	**18.03**	**20.30**	**21.17**	**..**	**..**	**..**
Coal[1]	0.81	0.78	0.99	0.88	..	..	..
Oil	7.68	7.96	7.98	8.51	..	..	..
Gas	0.01	–	0.59	0.67	..	..	..
Comb. Renewables & Wastes[2]	–	0.90	1.19	1.31	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	5.23	8.33	9.42	9.66	..	..	..
Heat	–	0.07	0.13	0.16	..	..	..
Shares (%)							
Coal	*5.9*	*4.3*	*4.9*	*4.1*	..	..	..
Oil	*55.9*	*44.1*	*39.3*	*40.2*	..	..	..
Gas	*0.1*	–	*2.9*	*3.1*	..	..	..
Comb. Renewables & Wastes	–	*5.0*	*5.9*	*6.2*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*38.1*	*46.2*	*46.4*	*45.6*	..	..	..
Heat	–	*0.4*	*0.6*	*0.8*	..	..	..
TOTAL INDUSTRY[6]	**6.96**	**7.90**	**9.07**	**9.23**	**..**	**..**	**..**
Coal[1]	0.76	0.77	0.99	0.87	..	..	..
Oil	3.01	2.79	2.45	2.77	..	..	..
Gas	0.00	–	0.59	0.66	..	..	..
Comb. Renewables & Wastes[2]	–	0.38	0.59	0.71	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	3.20	3.94	4.44	4.20	..	..	..
Heat	–	0.02	0.02	0.02	..	..	..
Shares (%)							
Coal	*10.9*	*9.7*	*10.9*	*9.5*	..	..	..
Oil	*43.2*	*35.3*	*27.0*	*30.0*	..	..	..
Gas	–	–	*6.5*	*7.1*	..	..	..
Comb. Renewables & Wastes	–	*4.8*	*6.5*	*7.7*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*45.9*	*49.9*	*48.9*	*45.5*	..	..	..
Heat	–	*0.2*	*0.2*	*0.2*	..	..	..
TRANSPORT[7]	**2.62**	**4.22**	**4.58**	**4.67**	**..**	**..**	**..**
TOTAL OTHER SECTORS[8]	**4.15**	**5.92**	**6.65**	**7.28**	**..**	**..**	**..**
Coal[1]	0.06	0.01	0.00	0.00	..	..	..
Oil	2.10	1.02	1.08	1.22	..	..	..
Gas	0.01	–	0.00	0.01	..	..	..
Comb. Renewables & Wastes[2]	–	0.52	0.60	0.59	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	1.98	4.31	4.85	5.31	..	..	..
Heat	–	0.06	0.11	0.14	..	..	..
Shares (%)							
Coal	*1.3*	*0.2*	–	–	..	..	..
Oil	*50.6*	*17.2*	*16.2*	*16.8*	..	..	..
Gas	*0.2*	–	–	*0.1*	..	..	..
Comb. Renewables & Wastes	–	*8.7*	*9.1*	*8.2*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–	..	..	..
Electricity	*47.8*	*72.9*	*73.0*	*73.0*	..	..	..
Heat	–	*1.0*	*1.6*	*1.9*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**6.31**	**10.59**	**12.19**	**10.64**	**..**	**..**	**..**
OUTPUT (Mtoe)	**6.28**	**10.46**	**12.01**	**10.43**	**..**	**..**	**..**
(TWh gross)	73.03	121.61	139.61	121.28	..	..	..
Output Shares (%)							
Coal	*0.0*	*0.2*	*0.1*	*0.2*	..	..	..
Oil	*0.2*	*0.0*	*0.0*	*0.0*	..	..	..
Gas	–	–	*0.2*	*0.2*	..	..	..
Comb. Renewables & Wastes	–	*0.2*	*0.2*	*0.2*	..	..	..
Nuclear	–	–	–	–	..	..	..
Hydro	*99.8*	*99.6*	*99.5*	*99.3*	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	*0.0*	*0.0*	..	..	..
TOTAL LOSSES	**0.86**	**3.66**	**4.98**	**6.49**	**..**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	0.03	0.04	0.05	0.06	..	..	..
Other Transformation	0.09	–0.04	–0.06	–0.13	..	..	..
Own Use and Losses[11]	0.73	3.66	4.99	6.57	..	..	..
Statistical Differences	**0.05**	**–0.20**	**0.52**	**–1.06**	**..**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	70.52	123.12	175.85	178.39	..	..	..
Population (millions)	3.96	4.24	4.49	4.51	..	..	–
TPES/GDP[12]	0.21	0.17	0.15	0.15	..	..	..
Energy Production/TPES	0.55	5.60	8.88	8.52	..	..	..
Per Capita TPES[13]	3.70	5.07	5.74	5.90	..	..	..
Oil Supply/GDPY	0.11	0.07	0.05	0.05	..	..	..
TFC/GDP[12]	0.19	0.15	0.12	0.12	..	..	..
Per Capita TFC[13]	3.47	4.25	4.52	4.69	..	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	24.2	28.5	34.0	37.9	..	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	2.8	2.7	3.7	3.7	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	4.0	1.4	1.8	3.2	..	..	..
Coal	1.4	–1.3	2.2	–12.2	..	..	..
Oil	2.2	–0.4	0.9	–14.1	..	..	..
Gas	–	9.8	6.3	49.4	..	..	..
Comb. Renewables & Wastes	–	5.6	2.8	9.3	..	..	..
Nuclear	–	–	–	–	..	..	..
Hydro	3.3	2.9	1.4	–13.3	..	..	..
Geothermal	–	–	–	–	..	..	..
Solar/Wind/Other	–	–	–	–33.3	..	..	..
TFC	3.5	0.6	1.2	4.3	..	..	..
Electricity Consumption	3.6	2.3	1.2	2.5	..	..	..
Energy Production	33.7	9.1	6.7	–1.1	..	..	..
Net Oil Imports	–	20.4	8.0	–0.5	..	..	..
GDP	4.6	2.6	3.6	1.4	..	..	..
Growth in the TPES/GDP Ratio	–0.6	–1.2	–1.7	1.7	..	..	..
Growth in the TFC/GDP Ratio	–1.1	–2.0	–2.4	2.8	..	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**1.40**	**2.81**	**3.13**	**3.40**	**4.07**	**..**	**..**
Coal[1]		0.13	0.12	–	–	–	..	..
Oil		–	–	–	–	–	..	..
Gas		–	–	–	–	–	..	..
Comb. Renewables & Wastes[2]		0.64	1.89	2.05	2.06	2.22	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		0.63	0.79	0.97	1.21	1.11	..	..
Geothermal		–	0.00	0.07	0.09	0.07	..	..
Solar/Wind/Other[3]		–	0.01	0.03	0.04	0.67	..	..
TOTAL NET IMPORTS[4]		**5.69**	**14.82**	**21.45**	**21.56**	**22.09**	**..**	**..**
Coal[1]	Exports	0.01	0.01	0.05	–	–	..	..
	Imports	0.28	3.00	3.97	2.97	3.24	..	..
	Net Imports	0.27	2.99	3.91	2.97	3.24	..	..
Oil	Exports	0.23	2.50	1.44	1.40	–	..	..
	Imports	6.44	14.93	17.51	18.19	15.01	..	..
	Bunkers	0.80	0.61	0.66	0.48	1.36	..	..
	Net Imports	5.42	11.82	15.41	16.32	13.65	..	..
Gas	Exports	–	–	–	–	–	..	..
	Imports	–	–	2.04	2.25	5.20	..	..
	Net Imports	–	–	2.04	2.25	5.20	..	..
Electricity	Exports	0.01	0.15	0.32	0.30	–	..	..
	Imports	0.01	0.15	0.40	0.32	–	..	..
	Net Imports	–0.00	0.00	0.08	0.02	–	..	..
TOTAL STOCK CHANGES		**0.14**	**–0.47**	**0.04**	**–0.22**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**7.23**	**17.16**	**24.61**	**24.73**	**26.16**	**..**	**..**
Coal[1]		0.51	2.76	3.81	3.19	3.24	..	..
Oil		5.45	11.71	15.57	15.87	13.65	..	..
Gas		–	–	2.03	2.25	5.20	..	..
Comb. Renewables & Wastes[2]		0.64	1.89	2.05	2.06	2.22	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		0.63	0.79	0.97	1.21	1.11	..	..
Geothermal		–	0.00	0.07	0.09	0.07	..	..
Solar/Wind/Other[3]		–	0.01	0.03	0.04	0.67	..	..
Electricity Trade[5]		–0.00	0.00	0.08	0.02	–	..	..
Shares (%)								
Coal		*7.0*	*16.1*	*15.5*	*12.9*	*12.4*	..	..
Oil		*75.4*	*68.2*	*63.2*	*64.2*	*52.2*	..	..
Gas		–	–	*8.3*	*9.1*	*19.9*	..	..
Comb. Renewables & Wastes		*8.8*	*11.0*	*8.3*	*8.3*	*8.5*	..	..
Nuclear		–	–	–	–	–	..	..
Hydro		*8.7*	*4.6*	*4.0*	*4.9*	*4.3*	..	..
Geothermal		–	–	*0.3*	*0.4*	*0.3*	..	..
Solar/Wind/Other		–	*0.1*	*0.1*	*0.2*	*2.6*	..	..
Electricity Trade		–	–	*0.3*	*0.1*	–	..	..

0 is negligible, – is nil, .. is not available.
Please note: All forecast data are based on the 2001 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**6.11**	**13.42**	**19.51**	**19.64**	**20.73**	**..**	**..**
Coal[1]	0.19	0.59	0.43	0.19	0.34	..	..
Oil	4.59	8.97	13.10	13.08	11.83	..	..
Gas	0.05	0.05	0.83	1.04	1.80	..	..
Comb. Renewables & Wastes[2]	0.58	1.74	1.70	1.70	1.84	..	..
Geothermal	–	–	0.00	0.00	–	..	..
Solar/Wind/Other	–	0.01	0.02	0.02	0.06	..	..
Electricity	0.70	2.03	3.30	3.44	4.54	..	..
Heat	–	0.03	0.13	0.16	0.32	..	..
Shares (%)							
Coal	*3.1*	*4.4*	*2.2*	*1.0*	*1.6*	..	..
Oil	*75.1*	*66.8*	*67.1*	*66.6*	*57.1*	..	..
Gas	*0.8*	*0.4*	*4.3*	*5.3*	*8.7*	..	..
Comb. Renewables & Wastes	*9.5*	*13.0*	*8.7*	*8.7*	*8.9*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.1*	*0.1*	*0.1*	*0.3*	..	..
Electricity	*11.5*	*15.1*	*16.9*	*17.5*	*21.9*	..	..
Heat	–	*0.2*	*0.7*	*0.8*	*1.5*	..	..
TOTAL INDUSTRY[6]	**2.71**	**6.22**	**7.90**	**7.67**	**6.99**	**..**	**..**
Coal[1]	0.14	0.59	0.43	0.19	0.34	..	..
Oil	1.81	3.96	4.76	4.56	2.89	..	..
Gas	0.00	–	0.66	0.83	0.92	..	..
Comb. Renewables & Wastes[2]	0.32	0.59	0.55	0.55	0.59	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	0.44	1.05	1.37	1.39	1.93	..	..
Heat	–	0.03	0.13	0.15	0.32	..	..
Shares (%)							
Coal	*5.1*	*9.5*	*5.5*	*2.5*	*4.9*	..	..
Oil	*66.9*	*63.7*	*60.2*	*59.4*	*41.4*	..	..
Gas	*0.1*	–	*8.4*	*10.8*	*13.2*	..	..
Comb. Renewables & Wastes	*11.8*	*9.5*	*6.9*	*7.2*	*8.4*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*16.2*	*16.9*	*17.4*	*18.1*	*27.6*	..	..
Heat	–	*0.5*	*1.6*	*2.0*	*4.6*	..	..
TRANSPORT[7]	**1.95**	**3.82**	**6.67**	**6.70**	**7.44**	**..**	**..**
TOTAL OTHER SECTORS[8]	**1.46**	**3.37**	**4.95**	**5.26**	**6.30**	**..**	**..**
Coal[1]	0.04	0.00	–	–	–	..	..
Oil	0.87	1.21	1.70	1.86	1.55	..	..
Gas	0.05	0.05	0.17	0.21	0.88	..	..
Comb. Renewables & Wastes[2]	0.26	1.15	1.15	1.15	1.25	..	..
Geothermal	–	–	0.00	0.00	–	..	..
Solar/Wind/Other	–	0.01	0.02	0.02	0.06	..	..
Electricity	0.25	0.95	1.90	2.01	2.56	..	..
Heat	–	–	0.01	0.01	–	..	..
Shares (%)							
Coal	*2.4*	–	–	–	–	..	..
Oil	*59.7*	*35.9*	*34.4*	*35.3*	*24.6*	..	..
Gas	*3.2*	*1.5*	*3.5*	*4.0*	*14.0*	..	..
Comb. Renewables & Wastes	*17.9*	*34.1*	*23.2*	*21.9*	*19.8*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.3*	*0.4*	*0.4*	*1.0*	..	..
Electricity	*16.8*	*28.1*	*38.3*	*38.3*	*40.6*	..	..
Heat	–	–	*0.1*	*0.2*	–	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**1.33**	**5.10**	**7.62**	**7.85**	**9.63**	**..**	**..**
OUTPUT (Mtoe)	**0.84**	**2.44**	**3.73**	**3.97**	**5.19**	**..**	**..**
(TWh gross)	9.79	28.36	43.37	46.17	60.40	..	..
Output Shares (%)							
Coal	*3.9*	*32.1*	*33.9*	*29.5*	*21.7*	..	..
Oil	*19.2*	*33.1*	*19.4*	*20.2*	*7.9*	..	..
Gas	–	–	*16.5*	*15.6*	*33.7*	..	..
Comb. Renewables & Wastes	*2.0*	*2.4*	*3.6*	*3.5*	*3.3*	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	*74.8*	*32.3*	*26.1*	*30.4*	*21.4*	..	..
Geothermal	–	*0.0*	*0.2*	*0.2*	*0.1*	..	..
Solar/Wind/Other	–	*0.0*	*0.4*	*0.6*	*11.8*	..	..
TOTAL LOSSES	**1.23**	**3.21**	**5.16**	**5.06**	**5.44**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	0.49	2.63	3.75	3.71	4.12	..	..
Other Transformation	0.23	–0.38	0.16	–0.02	–	..	..
Own Use and Losses[11]	0.51	0.96	1.25	1.36	1.32	..	..
Statistical Differences	**–0.11**	**0.53**	**–0.06**	**0.04**	**–**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	57.68	98.55	129.27	131.40	179.09	..	..
Population (millions)	8.64	9.90	10.01	10.06	10.17	..	..
TPES/GDP[12]	0.13	0.17	0.19	0.19	0.15	..	..
Energy Production/TPES	0.19	0.16	0.13	0.14	0.16	..	..
Per Capita TPES[13]	0.84	1.73	2.46	2.46	2.57	..	..
Oil Supply/GDP[12]	0.09	0.12	0.12	0.12	0.08	..	..
TFC/GDP[12]	0.11	0.14	0.15	0.15	0.12	..	..
Per Capita TFC[13]	0.71	1.36	1.95	1.95	2.04	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	16.4	39.6	59.6	59.1	60.2	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	3.5	3.5	3.9	3.3	6.1	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	5.5	5.1	3.7	0.5	0.6	..	..
Coal	–2.4	18.2	3.3	–16.1	0.2	..	..
Oil	6.1	3.8	2.9	2.0	–1.7	..	..
Gas	–	–	–	10.9	9.7	..	..
Comb. Renewables & Wastes	3.2	8.5	0.8	0.2	0.8	..	..
Nuclear	–	–	–	–	–	..	..
Hydro	7.3	–1.8	2.1	23.9	–0.9	..	..
Geothermal	–	–	37.0	30.0	–3.0	..	..
Solar/Wind/Other	–	–	11.6	24.2	36.4	..	..
TFC	4.7	4.8	3.8	0.6	0.6	..	..
Electricity Consumption	8.5	5.3	5.0	4.1	3.1	..	..
Energy Production	4.4	4.1	1.1	8.5	2.0	..	..
Net Oil Imports	8.1	2.9	2.7	5.9	–2.0	..	..
GDP	2.9	3.4	2.8	1.7	3.5	..	..
Growth in the TPES/GDP Ratio	2.5	1.6	0.9	–1.2	–2.8	..	..
Growth in the TFC/GDP Ratio	1.8	1.3	1.0	–1.0	–2.8	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**11.3**	**34.7**	**31.4**	**33.0**	**..**	**..**	**..**
Coal[1]		6.5	11.9	7.7	7.4	..	..	..
Oil		0.7	1.2	0.2	0.3	..	..	..
Gas		0.0	1.3	0.1	0.5	..	..	..
Comb. Renewables & Wastes[2]		0.0	4.1	4.1	4.1	..	..	..
Nuclear		1.7	14.1	16.2	16.6	..	..	..
Hydro		2.5	2.2	2.5	3.5	..	..	..
Geothermal		–	–	0.0	0.0	..	..	..
Solar/Wind/Other[3]		–	0.0	0.4	0.6	..	..	..
TOTAL NET IMPORTS[4]		**42.5**	**56.6**	**94.2**	**93.9**	**..**	**..**	**..**
Coal[1]	Exports	0.0	0.0	0.5	0.4	..	..	..
	Imports	2.2	7.1	13.3	11.6	..	..	..
	Net Imports	2.2	7.1	12.7	11.2	..	..	..
Oil	Exports	4.3	12.3	7.6	6.4	..	..	..
	Imports	45.3	61.8	79.2	79.7	..	..	..
	Bunkers	1.4	3.7	6.0	6.7	..	..	..
	Net Imports	39.6	45.9	65.6	66.6	..	..	..
Gas	Exports	–	–	–	–	..	..	..
	Imports	0.9	3.7	15.5	15.8	..	..	..
	Net Imports	0.9	3.7	15.5	15.8	..	..	..
Electricity	Exports	0.2	0.3	0.7	0.6	..	..	..
	Imports	0.0	0.3	1.1	0.9	..	..	..
	Net Imports	–0.2	–0.0	0.4	0.3	..	..	..
TOTAL STOCK CHANGES		**–1.5**	**–0.1**	**–1.2**	**0.5**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**52.4**	**91.2**	**124.3**	**127.4**	**170.3**	**..**	**..**
Coal[1]		9.0	19.4	20.6	18.7	14.9	..	..
Oil		38.4	46.5	64.9	67.1	81.7	..	..
Gas		0.9	5.0	15.2	16.4	37.0	..	..
Comb. Renewables & Wastes[2]		0.0	4.1	4.1	4.1	13.6	..	..
Nuclear		1.7	14.1	16.2	16.6	16.6	..	..
Hydro		2.5	2.2	2.5	3.5	3.3	..	..
Geothermal		–	–	0.0	0.0	0.0	..	..
Solar/Wind/Other[3]		–	0.0	0.4	0.6	2.8	..	..
Electricity Trade[5]		–0.2	–0.0	0.4	0.3	0.4	..	..
Shares (%)								
Coal		*17.2*	*21.3*	*16.5*	*14.7*	*8.7*	..	..
Oil		*73.3*	*50.9*	*52.2*	*52.7*	*48.0*	..	..
Gas		*1.8*	*5.4*	*12.2*	*12.9*	*21.7*	..	..
Comb. Renewables & Wastes		–	*4.5*	*3.3*	*3.2*	*8.0*	..	..
Nuclear		*3.3*	*15.5*	*13.0*	*13.0*	*9.7*	..	..
Hydro		*4.7*	*2.4*	*2.0*	*2.8*	*2.0*	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other		–	–	*0.4*	*0.5*	*1.6*	..	..
Electricity Trade		*–0.3*	–	*0.3*	*0.2*	*0.2*	..	..

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

The forecast data for 2010 have been estimated by the IEA Secretariat based on the official 2011 Spanish forecast, assuming a linear growth between 2001 and 2011.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**39.9**	**62.5**	**89.2**	**93.3**	**127.8**	**..**	**..**
Coal[1]	4.0	3.2	1.3	1.5	2.3	..	..
Oil	30.1	39.9	55.9	57.6	73.9	..	..
Gas	0.7	4.6	12.4	13.5	22.8	..	..
Comb. Renewables & Wastes[2]	–	3.9	3.4	3.4	4.9	..	..
Geothermal	–	–	0.0	0.0	0.0	..	..
Solar/Wind/Other	–	–	0.0	0.0	0.3	..	..
Electricity	5.1	10.8	16.2	17.3	23.6	..	..
Heat	–	0.0	–	–	..	..	..
Shares (%)							
Coal	*9.9*	*5.2*	*1.5*	*1.6*	*1.8*	..	..
Oil	*75.6*	*63.9*	*62.6*	*61.7*	*57.8*	..	..
Gas	*1.8*	*7.4*	*13.9*	*14.5*	*17.8*	..	..
Comb. Renewables & Wastes	–	*6.3*	*3.8*	*3.7*	*3.8*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	*0.3*	..	..
Electricity	*12.7*	*17.3*	*18.2*	*18.5*	*18.5*	..	..
Heat	–	–	–	–	..	..	..
TOTAL INDUSTRY[6]	**20.7**	**25.3**	**34.3**	**36.2**	**46.6**	**..**	**..**
Coal[1]	3.6	2.9	1.2	1.4	2.2	..	..
Oil	13.4	11.3	14.7	15.2	16.1	..	..
Gas	0.4	3.8	9.6	10.5	17.2	..	..
Comb. Renewables & Wastes[2]	–	1.8	1.3	1.3	2.3	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	3.3	5.4	7.4	7.8	8.9	..	..
Heat	–	–	–	–	..	..	..
Shares (%)							
Coal	*17.5*	*11.6*	*3.6*	*3.9*	*4.6*	..	..
Oil	*64.7*	*44.6*	*43.0*	*42.1*	*34.5*	..	..
Gas	*2.0*	*14.9*	*28.1*	*28.9*	*36.8*	..	..
Comb. Renewables & Wastes	–	*7.3*	*3.8*	*3.6*	*5.0*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*15.8*	*21.5*	*21.5*	*21.5*	*19.1*	..	..
Heat	–	–	–	–	..	..	..
TRANSPORT[7]	**11.9**	**22.8**	**33.6**	**35.1**	**49.0**	**..**	**..**
TOTAL OTHER SECTORS[8]	**7.2**	**14.4**	**21.3**	**22.1**	**32.2**	**..**	**..**
Coal[1]	0.3	0.3	0.1	0.1	0.1	..	..
Oil	4.9	6.1	7.9	7.8	10.7	..	..
Gas	0.3	0.8	2.7	3.0	5.6	..	..
Comb. Renewables & Wastes[2]	–	2.1	2.1	2.1	2.1	..	..
Geothermal	–	–	0.0	0.0	0.0	..	..
Solar/Wind/Other	–	–	0.0	0.0	0.3	..	..
Electricity	1.7	5.1	8.5	9.1	13.4	..	..
Heat	–	0.0	–	–	–	..	..
Shares (%)							
Coal	*4.3*	*2.1*	*0.3*	*0.2*	*0.3*	..	..
Oil	*68.2*	*42.4*	*37.1*	*35.1*	*33.1*	..	..
Gas	*4.1*	*5.8*	*12.9*	*13.8*	*17.5*	..	..
Comb. Renewables & Wastes	–	*14.4*	*9.7*	*9.3*	*6.5*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	*0.1*	*0.2*	*1.0*	..	..
Electricity	*23.4*	*35.2*	*39.8*	*41.3*	*41.6*	..	..
Heat	–	–	–	–	–	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**12.6**	**33.0**	**45.0**	**45.4**	**61.1**	**..**	**..**
OUTPUT (Mtoe)	**6.5**	**13.0**	**19.1**	**20.2**	**27.4**	**..**	**..**
(TWh gross)	75.7	151.2	222.2	234.7	318.3	..	..
Output Shares (%)							
Coal	*18.9*	*40.1*	*36.4*	*30.6*	*16.1*	..	..
Oil	*33.2*	*5.7*	*10.2*	*10.5*	*4.6*	..	..
Gas	*1.0*	*1.0*	*9.1*	*10.0*	*31.4*	..	..
Comb. Renewables & Wastes	*0.1*	*0.4*	*0.9*	*1.4*	*7.2*	..	..
Nuclear	*8.7*	*35.9*	*28.0*	*27.1*	*20.0*	..	..
Hydro	*38.2*	*16.8*	*13.3*	*17.5*	*12.2*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.0*	*2.1*	*3.0*	*8.5*	..	..
TOTAL LOSSES	**12.5**	**28.4**	**35.3**	**34.1**	**42.5**	**..**	**..**
of which:							
Electricity and Heat Generation[10]	6.1	20.0	25.9	25.2	33.8	..	..
Other Transformation	2.7	2.3	1.3	1.1	..	..	..
Own Use and Losses[11]	3.7	6.1	8.0	7.7	8.7	..	..
Statistical Differences	**0.0**	**0.3**	**–0.1**	**0.0**	**–**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	346.85	542.10	705.15	724.01	937.02	..	..
Population (millions)	34.82	38.86	39.93	40.27	42.36	..	..
TPES/GDP[12]	0.15	0.17	0.18	0.18	0.18	..	..
Energy Production/TPES	0.22	0.38	0.25	0.26	..	..	..
Per Capita TPES[13]	1.50	2.35	3.11	3.16	4.02	..	..
Oil Supply/GDP[12]	0.11	0.09	0.09	0.09	0.09	..	..
TFC/GDP[12]	0.11	0.12	0.13	0.13	0.14	..	..
Per Capita TFC[13]	1.14	1.61	2.23	2.32	3.02	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	141.6	206.5	283.0	285.6	336.9	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	7.0	15.0	27.4	29.9	8.5	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	4.1	2.9	3.1	2.5	3.3	..	..
Coal	3.0	5.5	0.6	–8.8	–2.5	..	..
Oil	4.1	–0.5	3.4	3.5	2.2	..	..
Gas	6.7	12.3	11.8	7.8	9.5	..	..
Comb. Renewables & Wastes	24.8	49.4	0.1	–0.9	14.3	..	..
Nuclear	0.4	20.9	1.4	2.4	–0.0	..	..
Hydro	8.2	–5.3	1.5	38.7	–0.6	..	..
Geothermal	–	–	–	–	–7.4	..	..
Solar/Wind/Other	–	–	71.5	45.1	17.8	..	..
TFC	4.1	1.9	3.6	4.6	3.6	..	..
Electricity Consumption	6.4	3.6	4.1	6.6	3.5	..	..
Energy Production	5.5	7.5	–1.0	5.3	–	..	..
Net Oil Imports	3.2	–0.4	3.6	1.5	–	..	..
GDP	2.3	2.9	2.7	2.7	2.9	..	..
Growth in the TPES/GDP Ratio	1.8	0.0	0.5	–0.2	0.4	..	..
Growth in the TFC/GDP Ratio	1.8	–0.9	0.9	1.9	0.6	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**9.3**	**29.8**	**30.8**	**34.4**	**33.1**	**..**	**..**
Coal[1]		0.0	0.0	–	–	–	..	..
Peat		–	0.2	0.2	0.3	0.4	..	..
Oil		–	0.0	–	–	–	..	..
Gas		–	–	–	–	–	..	..
Comb. Renewables & Wastes[2]		3.5	5.5	8.5	8.2	9.0	..	..
Nuclear		0.6	17.8	14.9	18.8	17.8	..	..
Hydro		5.1	6.2	6.8	6.8	5.8	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	0.0	0.4	0.3	0.2	..	..
TOTAL NET IMPORTS[4]		**29.6**	**16.7**	**16.7**	**16.5**	**19.7**	**..**	**..**
Coal[1]	Exports	0.0	0.0	0.0	0.0	0.1	..	..
	Imports	1.7	2.6	2.4	2.4	2.3	..	..
	Net Imports	1.7	2.6	2.3	2.4	2.2	..	..
Peat	Exports	–	–	–	–	–	..	..
	Imports	–	–	–	–	–	..	..
	Net Imports	–	–	–	–	–	..	..
Oil	Exports	1.4	8.7	11.1	10.2	9.4	..	..
	Imports	30.4	23.1	25.8	25.5	26.9	..	..
	Bunkers	1.1	0.7	1.4	1.4	1.4	..	..
	Net Imports	27.8	13.8	13.3	13.9	16.0	..	..
Gas	Exports	–	–	–	–	–	..	..
	Imports	–	0.5	0.7	0.8	1.0	..	..
	Net Imports	–	0.5	0.7	0.8	1.0	..	..
Electricity	Exports	0.4	1.3	1.2	1.6	–	..	..
	Imports	0.5	1.1	1.6	1.0	0.5	..	..
	Net Imports	0.1	–0.2	0.4	–0.6	0.5	..	..
TOTAL STOCK CHANGES		**0.5**	**0.2**	**–0.0**	**0.2**	**–**	**..**	**..**
TOTAL SUPPLY (TPES)		**39.3**	**46.7**	**47.5**	**51.1**	**52.8**	**..**	**..**
Coal[1]		1.6	2.7	2.2	2.5	2.2	..	..
Peat		–	0.2	0.2	0.3	0.4	..	..
Oil		28.4	13.8	13.4	14.1	16.0	..	..
Gas		–	0.5	0.7	0.8	1.0	..	..
Comb. Renewables & Wastes[2]		3.5	5.5	8.5	8.2	9.0	..	..
Nuclear		0.6	17.8	14.9	18.8	17.8	..	..
Hydro		5.1	6.2	6.8	6.8	5.8	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other[3]		–	0.0	0.4	0.3	0.2	..	..
Electricity Trade[5]		0.1	–0.2	0.4	–0.6	0.5	..	..
Shares (%)								
Coal		*4.1*	*5.8*	*4.7*	*4.9*	*4.2*	..	..
Peat		–	*0.5*	*0.5*	*0.6*	*0.7*	..	..
Oil		*72.2*	*29.6*	*28.1*	*27.5*	*30.4*	..	..
Gas		–	*1.1*	*1.5*	*1.5*	*1.8*	..	..
Comb. Renewables & Wastes		*9.0*	*11.8*	*17.9*	*16.0*	*17.1*	..	..
Nuclear		*1.4*	*38.1*	*31.4*	*36.8*	*33.7*	..	..
Hydro		*13.1*	*13.4*	*14.2*	*13.3*	*10.9*	..	..
Geothermal		–	–	–	–	–	..	..
Solar/Wind/Other		–	–	*0.8*	*0.6*	*0.3*	..	..
Electricity Trade		*0.2*	*–0.3*	*0.8*	*–1.2*	*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	2000	2001	2010	2020	2030
TFC	**35.3**	**32.1**	**35.7**	**34.8**	**38.2**	**..**	**..**
Coal[1]	0.9	1.0	0.8	0.8	1.6	..	..
Peat	–	0.0	0.0	0.0	–	..	..
Oil	24.8	14.0	14.4	13.4	14.0	..	..
Gas	0.1	0.4	0.5	0.5	0.5	..	..
Comb. Renewables & Wastes[2]	3.5	4.6	5.5	5.0	6.2	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	..	..
Electricity	6.0	10.4	11.1	11.4	11.8	..	..
Heat	–	1.7	3.5	3.8	4.1	..	..
Shares (%)							
Coal	*2.6*	*3.3*	*2.2*	*2.2*	*4.1*	..	..
Peat	–	–	–	–	–	..	..
Oil	*70.4*	*43.7*	*40.3*	*38.5*	*36.7*	..	..
Gas	*0.3*	*1.1*	*1.3*	*1.5*	*1.3*	..	..
Comb. Renewables & Wastes	*9.8*	*14.4*	*15.3*	*14.3*	*16.3*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*16.9*	*32.2*	*31.0*	*32.7*	*30.8*	..	..
Heat	–	*5.3*	*9.9*	*10.8*	*10.8*	..	..
TOTAL INDUSTRY[6]	**15.5**	**13.3**	**14.6**	**14.0**	**16.6**	**..**	**..**
Coal[1]	0.9	1.0	0.8	0.8	1.6	..	..
Peat	–	0.0	0.0	0.0	–	..	..
Oil	8.3	3.5	3.4	3.4	3.9	..	..
Gas	0.0	0.3	0.3	0.3	0.3	..	..
Comb. Renewables & Wastes[2]	2.9	3.7	4.8	4.4	5.3	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	3.4	4.6	4.9	4.8	5.0	..	..
Heat	–	0.2	0.3	0.4	0.4	..	..
Shares (%)							
Coal	*5.7*	*7.6*	*5.5*	*5.3*	*9.5*	..	..
Peat	–	–	–	*0.1*	–	..	..
Oil	*53.4*	*26.5*	*23.3*	*24.4*	*23.8*	..	..
Gas	*0.1*	*1.9*	*2.0*	*2.4*	*1.9*	..	..
Comb. Renewables & Wastes	*18.9*	*27.7*	*33.2*	*31.3*	*31.7*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*21.9*	*35.0*	*33.6*	*33.9*	*30.4*	..	..
Heat	–	*1.3*	*2.4*	*2.6*	*2.7*	..	..
TRANSPORT[7]	**5.5**	**7.4**	**8.2**	**8.3**	**8.0**	**..**	**..**
TOTAL OTHER SECTORS[8]	**14.3**	**11.5**	**12.9**	**12.5**	**13.6**	**..**	**..**
Coal[1]	0.0	0.0	–	–	–	..	..
Peat	–	–	–	–	–	..	..
Oil	11.2	3.3	3.0	2.0	2.3	..	..
Gas	0.1	0.1	0.2	0.2	0.2	..	..
Comb. Renewables & Wastes[2]	0.5	1.0	0.6	0.6	1.0	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	0.0	0.0	0.0	0.0	..	..
Electricity	2.4	5.5	5.9	6.4	6.5	..	..
Heat	–	1.5	3.2	3.4	3.7	..	..
Shares (%)							
Coal	*0.3*	*0.4*	–	–	–	..	..
Peat	–	–	–	–	–	..	..
Oil	*78.7*	*28.9*	*23.4*	*15.8*	*17.1*	..	..
Gas	*0.7*	*1.0*	*1.3*	*1.3*	*1.4*	..	..
Comb. Renewables & Wastes	*3.6*	*8.4*	*4.9*	*4.7*	*7.0*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	–	–	–	..	..
Electricity	*16.6*	*47.9*	*45.6*	*51.0*	*47.4*	..	..
Heat	–	*13.4*	*24.8*	*27.2*	*27.1*	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**8.2**	**26.7**	**26.2**	**30.5**	**28.6**	..	..
OUTPUT (Mtoe)	**6.7**	**12.6**	**12.5**	**13.9**	**13.2**	..	..
(TWh gross)	78.1	146.0	145.6	161.7	153.0	..	..
Output Shares (%)							
Coal	*0.6*	*1.2*	*1.8*	*2.0*	*2.3*	..	..
Peat	–	*0.0*	*0.0*	*0.0*	*0.1*	..	..
Oil	*19.4*	*0.8*	*1.2*	*1.7*	*3.4*	..	..
Gas	–	*0.3*	*0.3*	*0.2*	*0.6*	..	..
Comb. Renewables & Wastes	*0.5*	*1.3*	*3.0*	*2.2*	*3.9*	..	..
Nuclear	*2.7*	*46.7*	*39.4*	*44.6*	*44.7*	..	..
Hydro	*76.7*	*49.7*	*54.0*	*49.0*	*43.8*	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	*0.0*	*0.3*	*0.3*	*1.3*	..	..
TOTAL LOSSES							
of which:	3.4	15.2	12.9	16.0	14.5	..	..
Electricity and Heat Generation[10]	1.5	12.2	10.6	13.2	10.7	..	..
Other Transformation	1.0	0.2	–0.1	0.4	1.4	..	..
Own Use and Losses[11]	1.0	2.8	2.4	2.4	2.4	..	..
Statistical Differences	**0.6**	**–0.7**	**–1.1**	**0.2**	**–**	**..**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	171.39	240.29	291.56	293.95	352.33	..	..
Population (millions)	8.14	8.56	8.87	8.90	9.18	..	..
TPES/GDP12	0.23	0.19	0.16	0.17	0.15	..	..
Energy Production/TPES	0.24	0.64	0.65	0.67	0.63	..	..
Per Capita TPES[13]	4.83	5.45	5.35	5.74	5.75	..	..
Oil Supply/GDP[12]	0.17	0.06	0.05	0.05	0.05	..	..
TFC/GDP[12]	0.21	0.13	0.12	0.12	0.11	..	..
Per Capita TFC[13]	4.34	3.76	4.03	3.92	4.16	..	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	84.9	51.2	51.4	48.1	49.5	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	3.9	3.0	5.8	6.6	6.8	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.5	0.8	0.2	7.5	0.4	..	..
Coal	1.6	3.9	–2.0	12.0	–1.3	..	..
Peat	–	–	–0.1	22.9	2.3	..	..
Oil	–1.3	–5.7	–0.3	5.3	1.5	..	..
Gas	–	–	2.8	9.7	2.6	..	..
Comb. Renewables & Wastes	1.8	3.1	4.4	–3.7	1.1	..	..
Nuclear	46.7	11.3	–1.7	25.8	–0.6	..	..
Hydro	0.3	1.6	0.8	0.7	–1.8	..	..
Geothermal	–	–	–	–	–	..	..
Solar/Wind/Other	–	–	27.4	4.4	15.5	..	..
TFC	0.4	–1.1	1.1	–2.5	1.0	..	..
Electricity Consumption	3.5	3.2	0.7	3.1	0.3	..	..
Energy Production	8.0	6.6	0.4	11.5	–0.4	..	..
Net Oil Imports	–0.2	–6.1	–0.4	5.1	1.6	..	..
GDP	1.8	2.1	2.0	0.8	2.0	..	..
Growth in the TPES/GDP Ratio	–0.3	–1.3	–1.7	6.6	–1.6	..	..
Growth in the TFC/GDP Ratio	–1.3	–3.1	–0.9	–3.3	–1.0	..	..

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**4.28**	**9.83**	**11.79**	**12.37**	**11.21**	**10.50**	**9.01**
Coal[1]		–	–	–	–	–	–	–
Oil		–	–	–	–	–	–	–
Gas		–	0.00	–	–	–	–	–
Comb. Renewables & Wastes[2]		0.24	1.02	1.60	1.67	2.03	2.10	2.03
Nuclear		1.64	6.18	6.91	7.01	6.29	5.52	4.10
Hydro		2.40	2.56	3.17	3.55	2.88	2.88	2.88
Geothermal		–	0.06	0.09	0.11	–	–	–
Solar/Wind/Other[3]		–	0.01	0.03	0.03	0.00	0.01	0.01
TOTAL NET IMPORTS[4]		**15.23**	**15.16**	**14.26**	**15.47**	**15.87**	**16.20**	**16.47**
Coal[1]	Exports	0.02	0.01	–	–	–	–	–
	Imports	0.24	0.35	0.19	0.13	0.10	0.10	0.10
	Net Imports	0.22	0.34	0.19	0.13	0.10	0.10	0.10
Oil	Exports	0.23	0.16	0.64	0.56	–	–	–
	Imports	15.38	13.54	12.90	14.27	13.04	12.94	12.63
	Bunkers	–	0.02	0.01	0.01	–	–	–
	Net Imports	15.16	13.36	12.25	13.71	13.04	12.94	12.63
Gas	Exports	–	–	–	–	–	–	–
	Imports	0.15	1.63	2.43	2.53	2.85	2.99	3.13
	Net Imports	0.15	1.63	2.43	2.53	2.85	2.99	3.13
Electricity	Exports	0.90	1.97	2.70	2.97	0.12	..	..
	Imports	0.60	1.79	2.09	2.07	..	0.17	0.61
	Net Imports	–0.30	–0.18	–0.61	–0.90	–0.12	0.17	0.61
TOTAL STOCK CHANGES		**0.22**	**0.12**	**0.43**	**0.18**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**19.72**	**25.11**	**26.48**	**28.02**	**27.08**	**26.70**	**25.48**
Coal[1]		0.33	0.36	0.14	0.15	0.10	0.10	0.10
Oil		15.26	13.46	12.73	13.87	13.04	12.94	12.63
Gas		0.15	1.63	2.43	2.53	2.85	2.99	3.13
Comb. Renewables & Wastes[2]		0.24	1.03	1.60	1.67	2.03	2.10	2.03
Nuclear		1.64	6.18	6.91	7.01	6.29	5.52	4.10
Hydro		2.40	2.56	3.17	3.55	2.88	2.88	2.88
Geothermal		–	0.06	0.09	0.11	–	–	–
Solar/Wind/Other[3]		–	0.01	0.03	0.03	0.00	0.01	0.01
Electricity Trade[5]		–0.30	–0.18	–0.61	–0.90	–0.12	0.17	0.61
Shares (%)								
Coal		*1.7*	*1.4*	*0.5*	*0.5*	*0.4*	*0.4*	*0.4*
Oil		*77.4*	*53.6*	*48.1*	*49.5*	*48.2*	*48.5*	*49.6*
Gas		*0.8*	*6.5*	*9.2*	*9.0*	*10.5*	*11.2*	*12.3*
Comb. Renewables & Wastes		*1.2*	*4.1*	*6.0*	*6.0*	*7.5*	*7.9*	*8.0*
Nuclear		*8.3*	*24.6*	*26.1*	*25.0*	*23.2*	*20.7*	*16.1*
Hydro		*12.2*	*10.2*	*12.0*	*12.7*	*10.6*	*10.8*	*11.3*
Geothermal		–	*0.2*	*0.3*	*0.4*	–	–	–
Solar/Wind/Other		–	–	*0.1*	*0.1*	–	–	–
Electricity Trade		*–1.5*	*–0.7*	*–2.3*	*–3.2*	*–0.5*	*0.6*	*2.4*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**17.57**	**19.66**	**21.18**	**21.56**	**21.76**	**21.89**	**21.69**
Coal[1]	0.29	0.35	0.14	0.15	0.10	0.10	0.10
Oil	14.30	12.85	13.12	13.19	12.65	12.56	12.26
Gas	0.24	1.52	2.23	2.32	2.68	2.77	2.85
Comb. Renewables & Wastes[2]	0.24	0.60	0.75	0.78	1.31	1.38	1.39
Geothermal	–	0.06	0.09	0.11	–	–	–
Solar/Wind/Other	–	0.01	0.02	0.03	–	–	–
Electricity	2.50	4.04	4.50	4.65	4.76	4.83	4.83
Heat	–	0.25	0.32	0.34	0.27	0.26	0.26
Shares (%)							
Coal	*1.6*	*1.8*	*0.7*	*0.7*	*0.5*	*0.4*	*0.5*
Oil	*81.4*	*65.3*	*62.0*	*61.2*	*58.1*	*57.4*	*56.5*
Gas	*1.3*	*7.7*	*10.5*	*10.7*	*12.3*	*12.6*	*13.1*
Comb. Renewables & Wastes	*1.4*	*3.0*	*3.5*	*3.6*	*6.0*	*6.3*	*6.4*
Geothermal	–	*0.3*	*0.4*	*0.5*	–	–	–
Solar/Wind/Other	–	–	*0.1*	*0.1*	–	–	–
Electricity	*14.2*	*20.5*	*21.3*	*21.6*	*21.9*	*22.1*	*22.3*
Heat	–	*1.3*	*1.5*	*1.6*	*1.2*	*1.2*	*1.2*
TOTAL INDUSTRY[6]	**4.78**	**3.93**	**4.75**	**4.90**	**4.85**	**4.89**	**5.03**
Coal[1]	0.08	0.33	0.13	0.14	0.10	0.10	0.10
Oil	3.70	1.31	1.73	1.80	1.42	1.38	1.39
Gas	0.05	0.59	0.76	0.78	1.14	1.14	1.19
Comb. Renewables & Wastes[2]	–	0.16	0.43	0.45	0.49	0.51	0.50
Geothermal	–	–	0.01	0.01	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.95	1.48	1.56	1.59	1.63	1.69	1.77
Heat	–	0.05	0.13	0.14	0.08	0.07	0.07
Shares (%)							
Coal	*1.6*	*8.4*	*2.7*	*2.9*	*2.0*	*2.0*	*2.0*
Oil	*77.4*	*33.4*	*36.3*	*36.7*	*29.3*	*28.3*	*27.7*
Gas	*1.1*	*15.1*	*16.0*	*15.9*	*23.4*	*23.3*	*23.7*
Comb. Renewables & Wastes	–	*4.1*	*9.1*	*9.1*	*10.2*	*10.5*	*9.9*
Geothermal	–	–	*0.1*	*0.2*	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*19.9*	*37.7*	*32.8*	*32.4*	*33.5*	*34.5*	*35.3*
Heat	–	*1.2*	*2.8*	*2.8*	*1.6*	*1.4*	*1.4*
TRANSPORT[7]	**4.29**	**6.29**	**7.06**	**6.87**	**7.10**	**7.43**	**7.47**
TOTAL OTHER SECTORS[8]	**8.49**	**9.44**	**9.38**	**9.80**	**9.81**	**9.58**	**9.20**
Coal[1]	0.21	0.02	0.01	0.01	0.00	0.00	0.00
Oil	6.48	5.47	4.57	4.76	4.43	4.06	3.72
Gas	0.19	0.92	1.47	1.54	1.54	1.63	1.66
Comb. Renewables & Wastes[2]	0.24	0.44	0.32	0.34	0.82	0.87	0.89
Geothermal	–	0.06	0.08	0.10	–	–	–
Solar/Wind/Other	–	0.01	0.02	0.02	–	–	–
Electricity	1.37	2.34	2.72	2.83	2.83	2.83	2.74
Heat	–	0.20	0.18	0.20	0.19	0.19	0.19
Shares (%)							
Coal	*2.5*	*0.2*	*0.1*	*0.1*	–	–	–
Oil	*76.3*	*57.9*	*48.7*	*48.6*	*45.2*	*42.4*	*40.4*
Gas	*2.2*	*9.8*	*15.7*	*15.7*	*15.7*	*17.0*	*18.0*
Comb. Renewables & Wastes	*2.8*	*4.6*	*3.4*	*3.4*	*8.4*	*9.1*	*9.7*
Geothermal	–	*0.6*	*0.9*	*1.0*	–	–	–
Solar/Wind/Other	–	*0.1*	*0.2*	*0.2*	–	–	–
Electricity	*16.1*	*24.7*	*29.0*	*28.9*	*28.8*	*29.5*	*29.8*
Heat	–	*2.1*	*2.0*	*2.1*	*1.9*	*2.0*	*2.1*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**4.48**	**9.39**	**11.12**	**11.66**	**10.07**	**9.35**	**7.91**
OUTPUT (Mtoe)	**3.17**	**4.70**	**5.67**	**6.07**	**5.22**	**5.00**	**4.56**
(TWh gross)	36.82	54.62	65.96	70.55	60.73	58.18	53.03
Output Shares (%)							
Coal	–	*0.1*	–	–	–	–	–
Oil	*7.1*	*0.5*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*
Gas	–	*0.6*	*1.5*	*1.2*	*1.7*	*2.2*	*2.7*
Comb. Renewables & Wastes	–	*1.0*	*2.4*	*2.1*	*3.2*	*3.6*	*4.2*
Nuclear	*17.1*	*43.3*	*40.1*	*38.0*	*39.8*	*36.4*	*29.6*
Hydro	*75.8*	*54.6*	*55.8*	*58.6*	*55.2*	*57.6*	*63.2*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*
TOTAL LOSSES	**2.17**	**5.09**	**5.92**	**6.04**	**5.31**	**4.81**	**3.80**
of which:							
Electricity and Heat Generation[10]	1.32	4.42	5.10	5.23	4.55	4.06	3.05
Other Transformation	0.14	0.01	–0.03	–0.02	0.00	–	–
Own Use and Losses[11]	0.72	0.66	0.85	0.83	0.76	0.75	0.74
Statistical Differences	**–0.02**	**0.36**	**–0.62**	**0.42**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	246.18	308.43	336.14	339.10	412.46	469.33	534.04
Population (millions)	6.44	6.71	7.18	7.23	7.50	7.40	7.40
TPES/GDP[12]	0.08	0.08	0.08	0.08	0.07	0.06	0.05
Energy Production/TPES	0.22	0.39	0.45	0.44	0.41	0.39	0.35
Per Capita TPES[13]	3.06	3.74	3.69	3.87	3.61	3.61	3.44
Oil Supply/GDP[12]	0.06	0.04	0.04	0.04	0.03	0.03	0.02
TFC/GDP[12]	0.07	0.06	0.06	0.06	0.05	0.05	0.04
Per Capita TFC[13]	2.73	2.93	2.95	2.98	2.90	2.96	2.93
Energy-related CO_2 Emissions (Mt CO_2)[14]	43.6	41.5	42.9	43.8	43.4	43.5	42.9
CO_2 Emissions from Bunkers (Mt CO_2)	2.1	3.2	4.8	4.6	4.6	4.6	4.6

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	0.2	2.1	0.5	5.8	–0.4	–0.1	–0.5
Coal	–6.3	4.5	–9.1	6.5	–4.5	–	0.3
Oil	–2.2	0.1	–0.6	9.0	–0.7	–0.1	–0.2
Gas	31.0	7.2	4.1	4.1	1.3	0.5	0.5
Comb. Renewables & Wastes	11.2	7.7	4.5	4.8	2.2	0.3	–0.3
Nuclear	11.0	6.5	1.1	1.4	–1.2	–1.3	–2.9
Hydro	2.1	–0.5	2.1	12.1	–2.3	–	–
Geothermal	–	–	4.1	17.6	–	–	–
Solar/Wind/Other	–	–	12.1	4.0	–21.3	5.2	1.8
TFC	–0.6	1.4	0.7	1.8	0.1	0.1	–0.1
Electricity Consumption	2.6	3.0	1.1	3.2	0.3	0.2	0.0
Energy Production	6.5	4.2	1.8	4.9	–1.1	–0.6	–1.5
Net Oil Imports	–1.6	–0.3	–0.9	11.9	–0.6	–0.1	–0.2
GDP	–0.4	2.3	0.9	0.9	2.2	1.3	1.3
Growth in the TPES/GDP Ratio	0.6	–0.2	–0.3	4.9	–2.5	–1.4	–1.7
Growth in the TFC/GDP Ratio	–0.3	–0.9	–0.1	0.9	–2.1	–1.2	–1.4

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

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**15.52**	**25.86**	**26.71**	**26.15**	**39.22**	**58.20**	**71.68**
Coal[1]		5.21	12.41	13.29	14.04	26.15	32.36	35.13
Oil		3.59	3.61	2.73	2.49	1.13	0.49	0.17
Gas		–	0.18	0.53	0.26	0.17	0.14	0.10
Comb. Renewables & Wastes[2]		6.45	7.21	6.56	6.32	4.42	3.93	3.75
Nuclear		–	–	–	–	–	7.30	14.60
Hydro		0.22	1.99	2.66	2.07	5.34	10.00	10.00
Geothermal		0.05	0.43	0.68	0.70	0.97	1.71	3.64
Solar/Wind/Other[3]		–	0.03	0.27	0.29	1.05	2.27	4.28
TOTAL NET IMPORTS[4]		**8.74**	**27.98**	**50.60**	**45.73**	**113.00**	**220.98**	**391.56**
Coal[1]	Exports	–	–	–	–	–	–	–
	Imports	0.01	4.21	9.25	5.63	13.55	75.21	163.21
	Net Imports	0.01	4.21	9.25	5.63	13.55	75.21	163.21
Oil	Exports	0.86	1.90	1.31	2.58	–	–	–
	Imports	9.68	23.18	30.72	29.35	50.04	71.41	102.20
	Bunkers	0.09	0.12	0.40	0.24	–	–	–
	Net Imports	8.73	21.16	29.01	26.53	50.04	71.41	102.20
Gas	Exports	–	–	–	–	–	–	–
	Imports	–	2.68	12.05	13.21	49.41	74.36	126.15
	Net Imports	–	2.68	12.05	13.21	49.41	74.36	126.15
Electricity	Exports	–	0.08	0.04	0.04	–	–	–
	Imports	–	0.02	0.33	0.39	–	–	–
	Net Imports	–	–0.06	0.29	0.36	–	–	–
TOTAL STOCK CHANGES		**0.11**	**–0.83**	**0.18**	**0.57**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**24.37**	**53.01**	**77.49**	**72.46**	**152.22**	**279.18**	**463.24**
Coal[1]		5.15	16.94	23.32	20.45	39.70	107.57	198.34
Oil		12.50	23.61	31.08	28.91	51.17	71.89	102.38
Gas		–	2.86	12.63	13.37	49.58	74.51	126.25
Comb. Renewables & Wastes[2]		6.45	7.21	6.56	6.32	4.42	3.93	3.75
Nuclear		–	–	–	–	–	7.30	14.60
Hydro		0.22	1.99	2.66	2.07	5.34	10.00	10.00
Geothermal		0.05	0.43	0.68	0.70	0.97	1.71	3.64
Solar/Wind/Other[3]		–	0.03	0.27	0.29	1.05	2.27	4.28
Electricity Trade[5]		–	–0.06	0.29	0.36	–	–	–
Shares (%)								
Coal		*21.1*	*32.0*	*30.1*	*28.2*	*26.1*	*38.5*	*42.8*
Oil		*51.3*	*44.5*	*40.1*	*39.9*	*33.6*	*25.8*	*22.1*
Gas		–	*5.4*	*16.3*	*18.4*	*32.6*	*26.7*	*27.3*
Comb. Renewables & Wastes		*26.5*	*13.6*	*8.5*	*8.7*	*2.9*	*1.4*	*0.8*
Nuclear		–	–	–	–	–	*2.6*	*3.2*
Hydro		*0.9*	*3.8*	*3.4*	*2.8*	*3.5*	*3.6*	*2.2*
Geothermal		*0.2*	*0.8*	*0.9*	*1.0*	*0.6*	*0.6*	*0.8*
Solar/Wind/Other		–	*0.1*	*0.3*	*0.4*	*0.7*	*0.8*	*0.9*
Electricity Trade		–	*-0.1*	*0.4*	*0.5*	–	–	–

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**20.04**	**40.55**	**57.13**	**51.79**	**111.84**	**197.52**	**322.00**
Coal[1]	2.94	7.57	10.13	7.02	15.56	55.68	112.31
Oil	9.70	20.80	26.92	25.01	44.17	63.07	90.64
Gas	0.04	0.72	4.49	4.45	25.25	29.71	33.76
Comb. Renewables & Wastes[2]	6.45	7.21	6.46	6.21	4.42	3.93	3.75
Geothermal	0.05	0.36	0.62	0.62	0.89	1.64	3.56
Solar/Wind/Other	–	0.03	0.26	0.29	0.60	1.12	1.93
Electricity	0.85	3.87	8.25	8.20	20.95	42.39	76.04
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*14.7*	*18.7*	*17.7*	*13.6*	*13.9*	*28.2*	*34.9*
Oil	*48.4*	*51.3*	*47.1*	*48.3*	*39.5*	*31.9*	*28.2*
Gas	*0.2*	*1.8*	*7.9*	*8.6*	*22.6*	*15.0*	*10.5*
Comb. Renewables & Wastes	*32.2*	*17.8*	*11.3*	*12.0*	*3.9*	*2.0*	*1.2*
Geothermal	*0.2*	*0.9*	*1.1*	*1.2*	*0.8*	*0.8*	*1.1*
Solar/Wind/Other	–	*0.1*	*0.5*	*0.6*	*0.5*	*0.6*	*0.6*
Electricity	*4.3*	*9.5*	*14.4*	*15.8*	*18.7*	*21.5*	*23.6*
Heat	–	–	–	–	–	–	–
TOTAL INDUSTRY[6]	**4.30**	**13.71**	**22.58**	**18.30**	**51.26**	**108.99**	**202.38**
Coal[1]	1.14	4.52	8.60	5.38	11.88	46.04	101.82
Oil	2.60	6.16	8.16	7.46	12.33	19.77	31.63
Gas	0.00	0.67	1.76	1.47	15.41	18.04	20.67
Comb. Renewables & Wastes[2]	–	–	–	–	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	0.01	0.10	0.12	0.27	0.51	0.96
Electricity	0.55	2.35	3.96	3.87	11.37	24.64	47.30
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*26.5*	*33.0*	*38.1*	*29.4*	*23.2*	*42.2*	*50.3*
Oil	*60.5*	*44.9*	*36.1*	*40.8*	*24.1*	*18.1*	*15.6*
Gas	*0.1*	*4.9*	*7.8*	*8.0*	*30.1*	*16.5*	*10.2*
Comb. Renewables & Wastes	–	–	–	–	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	*0.1*	*0.4*	*0.6*	*0.5*	*0.5*	*0.5*
Electricity	*12.9*	*17.2*	*17.6*	*21.2*	*22.2*	*22.6*	*23.4*
Heat	–	–	–	–	–	–	–
TRANSPORT[7]	**4.49**	**9.58**	**12.50**	**11.99**	**23.71**	**33.94**	**48.48**
TOTAL OTHER SECTORS[8]	**11.26**	**17.26**	**22.05**	**21.50**	**36.88**	**54.60**	**71.14**
Coal[1]	1.28	3.03	1.53	1.64	3.68	9.64	10.49
Oil	3.15	5.11	6.38	5.65	8.31	9.73	11.29
Gas	0.04	0.05	2.69	2.94	9.83	11.66	13.07
Comb. Renewables & Wastes[2]	6.45	7.21	6.46	6.21	4.42	3.93	3.75
Geothermal	0.05	0.36	0.62	0.62	0.89	1.64	3.56
Solar/Wind/Other	–	0.02	0.17	0.17	0.34	0.61	0.98
Electricity	0.29	1.49	4.22	4.27	9.41	17.40	28.01
Heat	–	–	–	–	–	–	–
Shares (%)							
Coal	*11.4*	*17.6*	*6.9*	*7.6*	*10.0*	*17.7*	*14.7*
Oil	*28.0*	*29.6*	*28.9*	*26.3*	*22.5*	*17.8*	*15.9*
Gas	*0.3*	*0.3*	*12.2*	*13.7*	*26.7*	*21.4*	*18.4*
Comb. Renewables & Wastes	*57.3*	*41.7*	*29.3*	*28.9*	*12.0*	*7.2*	*5.3*
Geothermal	*0.4*	*2.1*	*2.8*	*2.9*	*2.4*	*3.0*	*5.0*
Solar/Wind/Other	–	*0.1*	*0.7*	*0.8*	*0.9*	*1.1*	*1.4*
Electricity	*2.6*	*8.6*	*19.1*	*19.9*	*25.5*	*31.9*	*39.4*
Heat	–	–	–	–	–	–	–

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**2.77**	**11.08**	**24.54**	**24.77**	**56.01**	**116.54**	**206.29**
OUTPUT (Mtoe)	**1.07**	**4.95**	**10.74**	**10.55**	**24.65**	**48.72**	**85.17**
(TWh gross)	12.43	57.54	124.92	122.73	286.59	566.51	990.32
Output Shares (%)							
Coal	*26.1*	*35.1*	*30.6*	*31.3*	*33.3*	*37.2*	*35.3*
Oil	*51.4*	*6.9*	*8.4*	*8.5*	*0.0*	*–*	*0.0*
Gas	*–*	*17.7*	*36.1*	*40.4*	*43.1*	*35.0*	*44.5*
Comb. Renewables & Wastes	*1.6*	*–*	*0.2*	*0.1*	*–*	*–*	*–*
Nuclear	*–*	*–*	*–*	*–*	*–*	*4.9*	*5.7*
Hydro	*20.9*	*40.2*	*24.7*	*19.6*	*21.7*	*20.5*	*11.7*
Geothermal	*–*	*0.1*	*0.1*	*0.1*	*0.0*	*0.0*	*0.0*
Solar/Wind/Other	*–*	*–*	*0.0*	*0.1*	*1.8*	*2.4*	*2.8*
TOTAL LOSSES	**4.03**	**11.58**	**19.97**	**20.01**	**40.38**	**81.65**	**141.24**
of which:							
Electricity and Heat Generation[10]	1.70	6.13	13.80	14.22	31.36	67.82	121.12
Other Transformation	1.32	2.89	1.44	1.06	2.51	3.79	5.87
Own Use and Losses[11]	1.00	2.56	4.73	4.73	6.51	10.05	14.25
Statistical Differences	**0.30**	**0.88**	**0.40**	**0.66**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	68.40	144.57	205.47	190.29	413.30	797.95	1375.98
Population (millions)	38.45	56.20	67.46	68.61	74.12	81.92	88.87
TPES/GDP[12]	0.36	0.37	0.38	0.38	0.37	0.35	0.34
Energy Production/TPES	0.64	0.49	0.34	0.36	0.26	0.21	0.15
Per Capita TPES[13]	0.63	0.94	1.15	1.06	2.05	3.41	5.21
Oil Supply/GDP[12]	0.18	0.16	0.15	0.15	0.12	0.09	0.07
TFC/GDP[12]	0.29	0.28	0.28	0.27	0.27	0.25	0.23
Per Capita TFC[13]	0.52	0.72	0.85	0.75	1.51	2.41	3.62
Energy-related CO_2 Emissions (Mt CO_2)[14]	52.8	128.8	203.7	188.0	406.3	783.0	1333.5
CO_2 Emissions from Bunkers (Mt CO_2)	0.4	0.9	2.9	2.3	1.6	1.6	1.6

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	3.7	5.2	3.9	–6.5	8.6	6.3	5.2
Coal	4.1	9.0	3.2	–12.3	7.6	10.5	6.3
Oil	3.1	4.2	2.8	–7.0	6.5	3.5	3.6
Gas	–	–	16.0	5.8	15.7	4.2	5.4
Comb. Renewables & Wastes	3.1	–0.7	–0.9	–3.7	–3.9	–1.2	–0.5
Nuclear	–	–	–	–	–	–	7.2
Hydro	25.7	7.6	2.9	–22.2	11.1	6.5	–
Geothermal	3.8	19.7	4.7	1.8	3.8	5.9	7.8
Solar/Wind/Other	–	–	25.2	10.2	15.3	8.0	6.6
TFC	4.1	4.3	3.5	–9.3	8.9	5.9	5.0
Electricity Consumption	11.3	8.2	7.9	–0.6	11.0	7.3	6.0
Energy Production	1.9	3.7	0.3	–2.1	4.6	4.0	2.1
Net Oil Imports	5.1	5.5	3.2	–8.5	7.3	3.6	3.7
GDP	4.5	4.5	3.6	–7.4	9.0	6.8	5.6
Growth in the TPES/GDP Ratio	–0.8	0.7	0.3	1.0	–0.4	–0.5	–0.4
Growth in the TFC/GDP Ratio	–0.4	–0.2	–0.1	–2.1	–0.1	–0.9	–0.6

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	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**108.5**	**208.0**	**271.3**	**262.2**	**..**	**..**	**..**
Coal[1]		75.9	53.6	17.5	19.0	2.6	–	..
Oil		0.5	95.2	131.7	121.7	..	..	..
Gas		24.4	40.9	97.4	95.2	..	..	..
Comb. Renewables & Wastes[2]		–	0.6	2.1	2.3	10.4	10.5	..
Nuclear		7.3	17.1	22.2	23.5	18.9	7.7	..
Hydro		0.3	0.4	0.4	0.3	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**	**–42.7**	**–24.0**	**..**	**..**	**..**
Coal[1]	Exports	2.0	1.8	0.7	0.6	–	–	..
	Imports	1.1	10.3	14.9	22.8	18.8	15.6	..
	Net Imports	–0.9	8.5	14.2	22.2	18.8	15.6	..
Oil	Exports	20.9	76.5	117.6	109.5	..	..	..
	Imports	136.9	65.4	70.9	73.1	..	..	..
	Bunkers	5.4	2.5	2.1	2.3	..	..	..
	Net Imports	110.6	–13.6	–48.8	–38.8	..	..	..
Gas	Exports	–	–	11.3	10.7	..	..	..
	Imports	0.7	6.2	2.0	2.4	..	..	..
	Net Imports	0.7	6.2	–9.3	–8.3	..	..	..
Electricity	Exports	0.0	0.0	0.0	0.0	–	–	..
	Imports	0.0	1.0	1.2	0.9	0.4	0.3	..
	Net Imports	0.0	1.0	1.2	0.9	0.4	0.3	..
TOTAL STOCK CHANGES		**1.8**	**2.1**	**2.5**	**–3.0**	**..**	**..**	**..**
TOTAL SUPPLY (TPES)		**220.7**	**212.2**	**231.2**	**235.2**	**244.1**	**251.5**	**..**
Coal[1]		76.4	63.1	34.2	39.8	21.3	15.6	..
Oil		111.6	82.6	83.7	81.5	92.6	103.0	..
Gas		25.1	47.2	87.3	86.8	100.1	114.1	..
Comb. Renewables & Wastes[2]		–	0.6	2.1	2.3	10.4	10.5	..
Nuclear		7.3	17.1	22.2	23.5	18.9	7.7	..
Hydro		0.3	0.4	0.4	0.3	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	0.9	0.4	0.3	..
Shares (%)								
Coal		*34.6*	*29.7*	*14.8*	*16.9*	*8.7*	*6.2*	..
Oil		*50.5*	*38.9*	*36.2*	*34.6*	*37.9*	*40.9*	..
Gas		*11.4*	*22.2*	*37.7*	*36.9*	*41.0*	*45.3*	..
Comb. Renewables & Wastes		–	*0.3*	*0.9*	*1.0*	*4.3*	*4.2*	..
Nuclear		*3.3*	*8.1*	*9.6*	*10.0*	*7.8*	*3.1*	..
Hydro		*0.2*	*0.2*	*0.2*	*0.1*	*0.2*	*0.2*	..
Geothermal		–	–	–	–	–	–	..
Solar/Wind/Other		–	–	–	–	..	..	..
Electricity Trade		–	*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, exports of coal are IEA Secretariat estimates.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**147.1**	**145.4**	**160.7**	**161.4**	**180.0**	**195.6**	**..**
Coal[1]	26.5	10.8	3.1	4.3	3.6	3.3	..
Oil	77.0	68.8	73.9	72.5	84.9	95.2	..
Gas	23.6	41.8	52.2	52.9	57.9	61.3	..
Comb. Renewables & Wastes[2]	–	0.4	0.6	0.6	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	28.3	28.7	32.9	35.1	..
Heat	–	–	2.5	2.3	..	..	..
Shares (%)							
Coal	*18.0*	*7.4*	*2.0*	*2.7*	*2.0*	*1.7*	..
Oil	*52.3*	*47.3*	*46.0*	*44.9*	*47.2*	*48.7*	..
Gas	*16.1*	*28.7*	*32.5*	*32.8*	*32.2*	*31.3*	..
Comb. Renewables & Wastes	–	*0.3*	*0.4*	*0.4*	*0.4*	*0.4*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*13.6*	*16.2*	*17.6*	*17.8*	*18.3*	*17.9*	..
Heat	–	–	*1.6*	*1.4*	..	..	..
TOTAL INDUSTRY[6]	**65.0**	**42.8**	**43.9**	**43.4**	**48.1**	**50.0**	**..**
Coal[1]	13.3	6.4	1.6	2.4	2.9	2.9	..
Oil	33.7	15.7	16.1	15.2	17.0	17.1	..
Gas	10.1	12.0	15.2	15.0	17.0	17.8	..
Comb. Renewables & Wastes[2]	–	0.1	0.2	0.2	0.6	0.6	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	7.8	8.7	9.8	9.7	10.6	11.6	..
Heat	–	–	1.1	1.0	..	..	..
Shares (%)							
Coal	*20.5*	*14.9*	*3.6*	*5.5*	*6.0*	*5.7*	..
Oil	*51.8*	*36.8*	*36.6*	*35.0*	*35.3*	*34.2*	..
Gas	*15.6*	*27.9*	*34.5*	*34.5*	*35.3*	*35.6*	..
Comb. Renewables & Wastes	–	*0.2*	*0.5*	*0.5*	*1.2*	*1.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*12.1*	*20.2*	*22.3*	*22.3*	*22.0*	*23.2*	..
Heat	–	–	*2.5*	*2.3*	..	..	..
TRANSPORT[7]	**31.0**	**46.5**	**53.3**	**52.3**	**62.8**	**73.0**	**..**
TOTAL OTHER SECTORS[8]	**51.2**	**56.1**	**63.5**	**65.7**	**69.1**	**72.7**	**..**
Coal[1]	13.1	4.4	1.6	1.9	0.7	0.4	..
Oil	12.6	7.0	5.2	5.8	5.8	5.9	..
Gas	13.5	29.8	37.0	38.0	40.9	43.5	..
Comb. Renewables & Wastes[2]	–	0.3	0.4	0.4	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	17.8	18.3	21.6	22.7	..
Heat	–	–	1.4	1.3	..	..	..
Shares (%)							
Coal	*25.5*	*7.8*	*2.5*	*2.9*	*1.0*	*0.6*	..
Oil	*24.7*	*12.5*	*8.3*	*8.8*	*8.4*	*8.1*	..
Gas	*26.4*	*53.2*	*58.4*	*57.8*	*59.2*	*59.9*	..
Comb. Renewables & Wastes	–	*0.6*	*0.6*	*0.6*	*0.2*	*0.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*23.4*	*25.8*	*28.1*	*27.8*	*31.3*	*31.2*	..
Heat	–	–	*2.2*	*2.0*	..	..	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**72.5**	**74.4**	**80.8**	**85.0**	**79.4**	**74.9**	**..**
OUTPUT (Mtoe)	**24.2**	**27.3**	**32.2**	**33.0**	**36.2**	**38.2**	**..**
(TWh gross)	281.4	317.8	374.6	383.5	420.9	443.7	..
Output Shares (%)							
Coal	*62.1*	*65.0*	*32.7*	*34.8*	*15.8*	*9.4*	..
Oil	*25.6*	*10.9*	*2.3*	*1.9*	*0.4*	*0.3*	..
Gas	*1.0*	*1.6*	*39.6*	*37.2*	*56.0*	*73.6*	..
Comb. Renewables & Wastes	–	*0.2*	*1.2*	*1.3*	*9.3*	*8.9*	..
Nuclear	*10.0*	*20.7*	*22.7*	*23.5*	*17.3*	*6.7*	..
Hydro	*1.4*	*1.6*	*1.4*	*1.1*	*1.2*	*1.1*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.0*	*0.3*	*0.3*	–	–	..
TOTAL LOSSES	**72.7**	**67.5**	**70.1**	**73.9**	**64.1**	**55.9**	**..**
of which:							
Electricity and Heat Generation[10]	48.3	47.1	46.1	49.7	43.2	36.7	..
Other Transformation	7.1	4.1	4.7	5.0	2.6	2.5	..
Own Use and Losses[11]	17.3	16.3	19.4	19.1	18.3	16.7	..
Statistical Differences	**0.9**	**–0.7**	**0.3**	**–0.1**	**–**	**–**	**..**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	748.36	1040.25	1309.07	1334.80	1630.75	2037.13	..
Population (millions)	56.22	57.29	58.66	58.79	61.00	61.65	..
TPES/GDP[12]	0.29	0.20	0.18	0.18	0.15	0.12	..
Energy Production/TPES	0.49	0.98	1.17	1.11	..	..	..
Per Capita TPES[13]	3.93	3.70	3.94	4.00	4.00	4.08	..
Oil Supply/GDP[12]	0.15	0.08	0.06	0.06	0.06	0.05	..
TFC/GDP[12]	0.20	0.14	0.12	0.12	0.11	0.10	..
Per Capita TFC[13]	2.62	2.54	2.74	2.75	2.95	3.17	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	640.0	560.3	524.6	540.8	537.9	577.4	..
CO_2 Emissions from Bunkers (Mt CO_2)	25.4	20.9	30.3	33.0	25.9	25.9	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	–0.1	–0.3	0.9	1.7	0.4	0.3	..
Coal	–0.5	–1.5	–5.9	16.3	–6.7	–3.1	..
Oil	–2.6	–1.3	0.1	–2.7	1.4	1.1	..
Gas	8.3	1.4	6.3	–0.5	1.6	1.3	..
Comb. Renewables & Wastes	–	–	12.9	8.7	18.4	0.0	..
Nuclear	5.4	5.0	2.6	5.9	–2.4	–8.6	..
Hydro	1.6	1.9	–0.2	–20.1	2.4	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	23.8	4.3	–	–	..
TFC	0.1	–0.2	1.0	0.4	1.2	0.8	..
Electricity Consumption	0.9	1.0	1.8	1.3	1.5	0.6	..
Energy Production	10.1	0.7	2.7	–3.4	–	–	..
Net Oil Imports	–27.1	–	13.6	–20.5	–	–	..
GDP	1.5	2.2	2.3	2.0	2.3	2.2	..
Growth in the TPES/GDP Ratio	–1.5	–2.5	–1.4	–0.2	–1.8	–1.9	..
Growth in the TFC/GDP Ratio	–1.3	–2.3	–1.3	–1.5	–1.0	–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	2000	2001	2010	2020	2030
TOTAL PRODUCTION		**1455**	**1650**	**1675**	**1712**	**1892**	**2058**	**..**
Coal[1]		333	539	543	573	638	698	..
Oil		534	433	366	363	374	375	..
Gas		503	419	448	461	521	597	..
Comb. Renewables & Wastes[2]		37	62	73	71	91	107	..
Nuclear		23	159	208	211	221	223	..
Hydro		23	23	22	17	27	27	..
Geothermal		2	14	13	13	18	29	..
Solar/Wind/Other[3]		–	0	2	2	2	3	..
TOTAL NET IMPORTS[4]		**289**	**315**	**581**	**622**	**828**	**1079**	**..**
Coal[1]	Exports	31	67	37	30	23	19	..
	Imports	1	2	10	13	15	20	..
	Net Imports	–30	–65	–27	–17	–8	1	..
Oil	Exports	11	39	50	47	56	59	..
	Imports	316	413	601	620	795	997	..
	Bunkers	9	29	28	20	19	19	..
	Net Imports	296	346	523	554	719	919	..
Gas	Exports	2	2	6	9	14	10	..
	Imports	24	35	88	92	128	167	..
	Net Imports	22	33	82	84	113	157	..
Electricity	Exports	0	2	1	2	1	1	..
	Imports	1	2	4	3	4	2	..
	Net Imports	1	0	3	2	2	1	..
TOTAL STOCK CHANGES		**–8**	**–38**	**48**	**–53**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**1736**	**1928**	**2304**	**2281**	**2719**	**3137**	**..**
Coal[1]		311	458	542	545	630	699	..
Oil		824	770	893	904	1093	1294	..
Gas		515	439	549	517	634	754	..
Comb. Renewables & Wastes[2]		37	62	73	71	91	107	..
Nuclear		23	159	208	211	221	223	..
Hydro		23	23	22	17	27	27	..
Geothermal		2	14	13	13	18	29	..
Solar/Wind/Other[3]		–	0	2	2	2	3	..
Electricity Trade[5]		1	0	3	2	2	1	..
Shares (%)								
Coal		*17.9*	*23.8*	*23.5*	*23.9*	*23.2*	*22.3*	..
Oil		*47.5*	*40.0*	*38.7*	*39.6*	*40.2*	*41.2*	..
Gas		*29.6*	*22.8*	*23.8*	*22.7*	*23.3*	*24.0*	..
Comb. Renewables & Wastes		*2.2*	*3.2*	*3.2*	*3.1*	*3.3*	*3.4*	..
Nuclear		*1.3*	*8.3*	*9.0*	*9.2*	*8.1*	*7.1*	..
Hydro		*1.3*	*1.2*	*0.9*	*0.8*	*1.0*	*0.8*	..
Geothermal		*0.1*	*0.7*	*0.6*	*0.6*	*0.7*	*0.9*	..
Solar/Wind/Other		–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
Electricity Trade		*0.1*	–	*0.1*	*0.1*	*0.1*	–	..

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001	2010	2020	2030
TFC	**1246**	**1283**	**1571**	**1541**	**1828**	**2146**	**..**
Coal[1]	44	31	31	32	35	35	..
Oil	701	698	816	825	1013	1211	..
Gas	341	303	360	335	391	439	..
Comb. Renewables & Wastes[2]	16	23	51	49	18	20	..
Geothermal	–	0	1	1	–	–	..
Solar/Wind/Other	–	–	1	1	–	–	..
Electricity	143	226	301	287	349	413	..
Heat	–	2	10	10	23	29	..
Shares (%)							
Coal	*3.5*	*2.4*	*2.0*	*2.1*	*1.9*	*1.6*	..
Oil	*56.3*	*54.4*	*52.0*	*53.6*	*55.4*	*56.5*	..
Gas	*27.4*	*23.6*	*22.9*	*21.8*	*21.4*	*20.4*	..
Comb. Renewables & Wastes	*1.3*	*1.8*	*3.2*	*3.2*	*1.0*	*0.9*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.1*	–	–	..
Electricity	*11.5*	*17.6*	*19.2*	*18.7*	*19.1*	*19.2*	..
Heat	–	*0.2*	*0.6*	*0.6*	*1.3*	*1.3*	..
TOTAL INDUSTRY[6]	**406**	**377**	**487**	**471**	**497**	**573**	**..**
Coal[1]	31	21	29	30	32	32	..
Oil	161	149	160	168	182	212	..
Gas	151	124	155	139	166	191	..
Comb. Renewables & Wastes[2]	7	9	36	35	–	–	..
Geothermal	–	–	0	0	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	56	75	98	91	96	113	..
Heat	–	–	8	8	21	26	..
Shares (%)							
Coal	*7.5*	*5.7*	*6.0*	*6.3*	*6.5*	*5.6*	..
Oil	*39.7*	*39.4*	*32.9*	*35.7*	*36.6*	*36.9*	..
Gas	*37.3*	*32.8*	*31.9*	*29.6*	*33.5*	*33.4*	..
Comb. Renewables & Wastes	*1.8*	*2.4*	*7.4*	*7.4*	–	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*13.7*	*19.7*	*20.2*	*19.4*	*19.3*	*19.6*	..
Heat	–	–	*1.6*	*1.6*	*4.2*	*4.5*	..
TRANSPORT[7]	**420**	**502**	**610**	**609**	**805**	**982**	**..**
TOTAL OTHER SECTORS[8]	**420**	**404**	**474**	**461**	**526**	**591**	**..**
Coal[1]	14	10	2	2	2	3	..
Oil	137	63	63	65	54	52	..
Gas	173	164	189	181	205	224	..
Comb. Renewables & Wastes[2]	9	14	13	12	12	12	..
Geothermal	–	0	0	0	–	–	..
Solar/Wind/Other	–	–	1	1	–	–	..
Electricity	87	152	202	196	251	297	..
Heat	–	2	2	2	2	3	..
Shares (%)							
Coal	*3.2*	*2.4*	*0.5*	*0.5*	*0.5*	*0.5*	..
Oil	*32.6*	*15.6*	*13.4*	*14.1*	*10.2*	*8.8*	..
Gas	*41.2*	*40.6*	*39.9*	*39.4*	*38.9*	*37.9*	..
Comb. Renewables & Wastes	*2.1*	*3.4*	*2.8*	*2.7*	*2.2*	*2.0*	..
Geothermal	–	*0.1*	*0.1*	*0.1*	–	–	..
Solar/Wind/Other	–	–	*0.3*	*0.3*	–	–	..
Electricity	*20.8*	*37.5*	*42.6*	*42.5*	*47.7*	*50.3*	..
Heat	–	*0.5*	*0.4*	*0.4*	*0.5*	*0.5*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**507**	**768**	**933**	**933**	**1146**	**1315**	**..**
OUTPUT (Mtoe)	**169**	**274**	**346**	**332**	**416**	**490**	**..**
(TWh gross)	1966	3182	4026	3864	4834	5702	..
Output Shares (%)							
Coal	*46.2*	*53.4*	*52.9*	*51.3*	*49.7*	*47.9*	..
Oil	*17.1*	*4.1*	*2.9*	*3.5*	*1.4*	*1.2*	..
Gas	*18.6*	*12.0*	*15.8*	*16.7*	*21.9*	*27.2*	..
Comb. Renewables & Wastes	*0.0*	*2.1*	*1.8*	*1.8*	*2.1*	*2.0*	..
Nuclear	*4.5*	*19.2*	*19.8*	*20.9*	*17.5*	*15.0*	..
Hydro	*13.5*	*8.6*	*6.3*	*5.2*	*6.4*	*5.4*	..
Geothermal	*0.1*	*0.5*	*0.4*	*0.4*	*0.4*	*0.6*	..
Solar/Wind/Other	–	*0.1*	*0.2*	*0.2*	*0.5*	*0.6*	..
TOTAL LOSSES	**498**	**655**	**728**	**738**	**891**	**991**	**..**
of which:							
Electricity and Heat Generation[10]	338	492	572	586	704	792	..
Other Transformation	–1	15	4	5	24	22	..
Own Use and Losses[11]	160	147	152	147	162	177	..
Statistical Differences	**–7**	**–10**	**5**	**3**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001	2010	2020	2030
GDP (billion 1995 US$)	4005.10	6520.50	8955.10	8977.80	11943.43	16027.34	..
Population (millions)	211.94	249.98	275.42	285.91	300.24	325.33	..
TPES/GDP[12]	0.43	0.30	0.26	0.25	0.23	0.20	..
Energy Production/TPES	0.84	0.86	0.73	0.75	0.70	0.66	..
Per Capita TPES[13]	8.19	7.71	8.36	7.98	9.06	9.64	..
Oil Supply/GDP[12]	0.21	0.12	0.10	0.10	0.09	0.08	..
TFC/GDP[12]	0.31	0.20	0.18	0.17	0.15	0.13	..
Per Capita TFC[13]	5.88	5.13	5.70	5.39	6.09	6.60	..
Energy-related CO_2 Emissions (Mt CO_2)[14]	4703.9	4825.7	5689.7	5673.3	6736.3	7822.0	..
CO_2 Emissions from Bunkers (Mt CO_2)	45.2	129.8	146.4	113.5	112.0	112.9	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.3	0.2	1.8	–1.0	2.0	1.4	..
Coal	2.8	2.0	1.7	0.6	1.6	1.0	..
Oil	1.2	–1.2	1.5	1.3	2.1	1.7	..
Gas	–1.3	–0.7	2.2	–5.7	2.3	1.7	..
Comb. Renewables & Wastes	5.9	1.5	1.6	–2.7	2.8	1.6	..
Nuclear	20.3	7.7	2.7	1.3	0.5	0.1	..
Hydro	1.1	–0.3	–0.8	–20.5	4.9	–0.0	..
Geothermal	9.0	13.4	–0.7	–1.5	3.8	4.8	..
Solar/Wind/Other	–	–	22.7	–3.2	1.5	3.4	..
TFC	0.8	–0.2	2.0	–1.9	1.9	1.6	..
Electricity Consumption	3.1	2.5	2.9	–4.5	2.2	1.7	..
Energy Production	0.8	0.7	0.1	2.2	1.1	0.8	..
Net Oil Imports	5.1	–1.3	4.2	5.8	3.0	2.5	..
GDP	3.0	2.9	3.2	0.3	3.2	3.0	..
Growth in the TPES/GDP Ratio	–1.6	–2.6	–1.4	–1.2	–1.2	–1.5	..
Growth in the TFC/GDP Ratio	–2.1	–2.9	–1.1	–2.2	–1.3	–1.3	..

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

ANNEX A

ENERGY BALANCES AND KEY STATISTICAL DATA TABLES

Table A1

GDP Growth Rates for IEA Countries[1]

(annual average percentage change)

	1973-1979	1997	1998	1999	2000	2001	2002
Canada	3.9	4.2	4.1	5.5	4.6	1.5	3.3
United States	3.0	4.5	4.3	4.1	3.8	0.3	2.3
North America	**3.1**	**4.5**	**4.3**	**4.2**	**3.8**	**0.3**	**2.4**
Australia	2.5	4.5	5.3	4.0	1.8	3.9	3.5
Japan	3.5	1.8	–1.1	0.7	2.4	–0.6	–0.7
Korea	8.5	5.0	–6.7	10.9	9.3	3.0	6.0
New Zealand	0.0	1.9	0.4	4.7	2.6	3.2	3.8
Pacific	**3.5**	**2.2**	**–1.2**	**1.7**	**2.9**	**0.1**	**0.2**
Austria	3.0	1.6	3.9	2.7	3.5	0.7	1.0
Belgium	2.4	3.6	2.0	3.2	3.7	0.8	0.7
Czech Republic	2.5	–0.8	–1.0	0.5	3.3	3.3	1.8
Denmark	1.5	3.0	2.5	2.3	3.0	1.0	1.5
Finland	2.4	6.3	5.3	4.1	6.1	0.7	1.6
France	2.8	1.9	3.4	3.2	3.8	1.8	1.0
Germany	2.4	1.4	2.0	2.0	2.9	0.6	0.2
Greece	3.3	3.6	3.4	3.6	4.2	4.1	4.0
Hungary	4.3	4.6	4.9	4.2	5.2	3.8	3.1
Ireland	4.9	10.9	8.8	11.1	10.0	5.7	3.7
Italy	3.5	2.0	1.8	1.6	2.9	1.8	0.4
Luxembourg	1.3	7.7	7.5	6.0	8.9	1.0	0.6
Netherlands	2.6	3.8	4.3	4.0	3.3	1.3	0.1
Norway	4.6	5.2	2.6	2.1	2.4	1.4	2.0
Portugal	2.9	3.9	4.6	3.5	3.5	1.7	0.4
Spain	2.3	4.0	4.3	4.2	4.2	2.7	1.8
Sweden	1.8	2.4	3.6	4.6	4.4	0.8	2.2
Switzerland	–0.4	1.7	2.4	1.5	3.2	0.9	–0.2
Turkey	4.5	7.5	3.1	–4.7	7.4	–7.4	3.6
United Kingdom	1.5	3.4	2.9	2.4	3.1	2.0	1.5
IEA Europe	**2.4**	**2.6**	**2.9**	**2.6**	**3.5**	**1.3**	**0.9**
IEA Total	**2.9**	**3.1**	**2.3**	**2.9**	**3.5**	**0.7**	**1.3**

1. Data are in 1995 dollars at 1995 prices

Sources: *National Accounts, Volume 1*, OECD Paris, 2003, and *Main Economic Indicators*, OECD Paris, 2003.

Table A2

TPES/GDP Ratios for IEA Countries[1]

	1973	1979	2000	2001	2002[2]	Average Annual Growth Rates (%) 1990-1995	1996-2001
Canada	0.50	0.48	0.35	0.35	0.32	0.36	–2.9
United States	0.43	0.39	0.26	0.25	0.25	–0.8	–2.0
North America	**0.44**	**0.40**	**0.26**	**0.26**	**0.25**	**–0.7**	**–2.1**
Australia	0.29	0.30	0.24	0.25	0.25	–1.7	–1.1
Japan	0.12	0.11	0.09	0.09	0.09	1.1	–0.2
Korea	0.23	0.26	0.31	0.30	0.30	2.2	–0.5
New Zealand	0.19	0.21	0.26	0.26	0.25	–0.9	–0.4
Pacific	**0.14**	**0.13**	**0.12**	**0.12**	**0.12**	**1.7**	**0.33**
Austria	0.16	0.15	0.11	0.11	0.11	–0.4	–1.1
Belgium	0.27	0.24	0.19	0.18	0.18	–0.0	–1.8
Czech Republic	1.12	1.04	0.73	0.73	0.71	–1.9	–1.4
Denmark	0.15	0.15	0.09	0.10	0.09	0.7	–4.8
Finland	0.26	0.26	0.20	0.20	0.20	1.0	–3.3
France	0.18	0.16	0.15	0.15	0.15	0.1	–1.9
Germany	0.22	0.21	0.13	0.13	0.13	–2.8	–1.9
Greece	0.15	0.16	0.20	0.20	0.20	–0.1	–0.3
Hungary	0.63	0.65	0.46	0.45	0.43	0.3	–4.8
Ireland	0.27	0.25	0.14	0.13	0.13	–3.1	–4.2
Italy	0.20	0.18	0.14	0.14	0.14	–0.2	–0.6
Luxembourg	0.53	0.43	0.15	0.15	0.16	–4.8	–3.8
Netherlands	0.25	0.23	0.15	0.15	0.15	–0.5	–2.7
Norway	0.21	0.20	0.15	0.15	0.15	–1.6	0.0
Portugal	0.13	0.15	0.19	0.19	0.19	1.4	1.0
Spain	0.15	0.17	0.18	0.18	0.18	1.0	0.7
Sweden	0.23	0.23	0.16	0.17	0.17	0.7	–3.1
Switzerland	0.08	0.08	0.08	0.08	0.08	0.2	–0.2
Turkey	0.36	0.34	0.38	0.38	0.38	–0.1	0.5
United Kingdom	0.29	0.27	0.18	0.18	0.17	–0.7	–2.5
IEA Europe	**0.22**	**0.21**	**0.16**	**0.16**	**0.15**	**–0.8**	**–1.6**
IEA Total	**0.27**	**0.25**	**0.19**	**0.19**	**0.18**	**–0.3**	**–1.3**

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 2003, *National Accounts, Volume 1*, OECD Paris, 2002, and *Main Economic Indicators*, OECD Paris, 2003.

Table A3

TPES per Inhabitant for IEA Countries

(toe per capita)

	1973	1979	2000	2001	2002[1]	Average Annual Growth Rates (%) 1990-1995	1996-2001
Canada	7.16	7.88	8.16	7.98	7.65	0.9	0.0
United States	8.19	8.36	8.36	7.98	7.95	0.58	–0.2
North America	**8.09**	**8.31**	**8.34**	**7.98**	**7.93**	**0.62**	**–0.2**
Australia	4.23	4.70	5.70	5.94	6.23	0.35	1.6
Japan	2.98	3.06	4.13	4.09	4.01	2.2	0.3
Korea	0.63	1.07	4.07	4.11	4.23	8.7	2.8
New Zealand	2.78	2.88	4.71	4.75	4.72	0.43	1.4
Pacific	**2.58**	**2.76**	**4.28**	**4.29**	**4.30**	**3.01**	**1.0**
Austria	2.85	3.17	3.55	3.78	3.72	0.8	1.2
Belgium	4.76	4.93	5.79	5.74	5.73	1.2	0.6
Czech Republic	4.58	4.73	3.93	4.03	4.03	–2.8	–0.3
Denmark	3.95	4.16	3.63	3.69	3.64	2.4	–2.9
Finland	4.57	5.12	6.37	6.52	6.68	–0.2	0.8
France	3.31	3.41	4.25	4.36	4.37	0.7	0.5
Germany	4.28	4.73	4.18	4.26	4.19	–1.4	–0.3
Greece	1.38	1.68	2.55	2.62	2.69	0.6	2.6
Hungary	2.05	2.65	2.44	2.49	2.47	–2.0	–0.3
Ireland	2.34	2.63	3.77	3.89	3.97	0.9	3.4
Italy	2.35	2.51	2.97	2.97	2.92	0.9	1.2
Luxembourg	12.83	10.69	8.39	8.65	9.00	–2.5	0.9
Netherlands	4.65	4.91	4.74	4.81	4.81	1.0	–0.1
Norway	3.70	4.54	5.74	5.90	6.11	1.6	2.2
Portugal	0.84	1.03	2.46	2.46	2.52	3.1	4.2
Spain	1.50	1.80	3.11	3.16	3.24	2.3	4.1
Sweden	4.83	5.17	5.35	5.74	5.64	0.8	–0.1
Switzerland	3.06	3.15	3.69	3.87	3.73	–0.8	1.3
Turkey	0.63	0.70	1.15	1.06	1.08	1.2	–0.3
United Kingdom	3.93	3.91	3.94	4.00	3.87	0.8	–0.1
IEA Europe	**3.08**	**3.25**	**3.47**	**3.52**	**3.49**	**0.17**	**0.4**
IEA Total	**4.43**	**4.64**	**5.15**	**5.09**	**5.07**	**0.92**	**0.4**

1. Preliminary data.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris 2003, *National Accounts, Volume 1*, OECD Paris, 2002, and *Main Economic Indicators*, OECD Paris, 2003.

Table A4

TFC/GDP Ratios for IEA Countries[1]

	1973	1979	2000	2001	2002[2]	Average Annual Growth Rates (%) 1990-1995	1996-2001
Canada	0.42	0.38	0.28	0.27	0.26	0.1	-3.6
United States	0.31	0.27	0.17	0.18	0.17	-0.7	-1.9
North America	**0.32**	**0.28**	**0.18**	**0.18**	**0.18**	**-0.6**	**-2.1**
Australia	0.20	0.20	0.16	0.16	0.16	-1.2	-1.9
Japan	0.09	0.08	0.06	0.06	0.06	0.8	-0.2
Korea	0.19	0.20	0.21	0.20	0.20	2.9	-1.4
New Zealand	0.14	0.16	0.20	0.20	0.19	0.4	-0.3
Pacific	**0.10**	**0.09**	**0.08**	**0.08**	**0.08**	**1.7**	**0.03**
Austria	0.12	0.12	0.09	0.09	0.10	-0.6	-0.9
Belgium	0.20	0.18	0.14	0.13	0.13	0.6	-1.3
Czech Republic	0.82	0.83	0.46	0.45	0.45	-4.6	-2.1
Denmark	0.13	0.12	0.08	0.07	0.07	-0.0	-3.2
Finland	0.24	0.21	0.16	0.15	0.15	0.7	-2.6
France	0.14	0.13	0.10	0.10	0.10	0.3	-1.6
Germany	0.16	0.15	0.09	0.09	0.09	-2.5	-2.1
Greece	0.11	0.11	0.14	0.14	0.14	-0.1	-1.0
Hungary	0.50	0.51	0.33	0.32	0.31	-1.4	-4.2
Ireland	0.20	0.19	0.11	0.11	0.10	-3.0	-3.1
Italy	0.15	0.13	0.11	0.11	0.11	-0.3	-0.5
Luxembourg	0.35	0.32	0.15	0.14	0.15	-3.3	-2.4
Netherlands	0.19	0.19	0.12	0.12	0.12	-0.6	-2.5
Norway	0.19	0.18	0.12	0.12	0.12	-2.5	-1.1
Portugal	0.11	0.12	0.15	0.15	0.15	0.8	0.9
Spain	0.11	0.13	0.12	0.13	0.13	1.3	1.3
Sweden	0.21	0.19	0.13	0.12	0.12	1.2	-3.8
Switzerland	0.07	0.07	0.07	0.06	0.06	0.6	-1.1
Turkey	0.29	0.29	0.27	0.28	0.27	0.3	-1.2
United Kingdom	0.20	0.18	0.13	0.12	0.12	-0.8	-2.5
IEA Europe	**0.17**	**0.16**	**0.11**	**0.11**	**0.11**	**-0.8**	**-1.6**
IEA Total	**0.20**	**0.18**	**0.13**	**0.13**	**0.13**	**-0.3**	**-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, 2003, *National Accounts*, *Volume 1*, OECD Paris, 2002, and *Main Economic Indicators*, OECD Paris, 2003.

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	53.9	18.1	–	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	21.3	37.1	38.5	19.6	–	4.9	28.4	30.0	40.2	26.0	–	3.8
Ireland	7.2	22.0	77.1	–	–	0.8	8.9	22.5	71.5	5.2	–	0.8
Italy	128.9	6.3	77.6	11.0	0.6	4.4	141.1	7.4	70.8	16.1	0.5	5.3
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	14.6	6.2	54.0	–	–	39.8	18.5	5.4	48.7	3.8	–	42.1
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	24.4	21.1	51.3	–	–	27.6	30.3	21.6	49.5	28.9	–	–
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	**1284.2**	**26.7**	**57.8**	**9.9**	**1.5**	**4.1**	**1399.0**	**25.2**	**52.4**	**14.0**	**3.6**	**4.8**
IEA Total	**3592.7**	**21.1**	**54.1**	**19.1**	**1.4**	**4.3**	**3943.4**	**21.0**	**51.5**	**18.8**	**3.8**	**4.9**

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, 2003.

Table A5 *(continued)*

Total Energy Demand in IEA Countries

(Mtoe and %)

	2001						2002[1]						2001-2002
	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	248.2	12.4	35.8	28.8	8.1	15.0	239.7	12.8	36.2	27.8	8.1	15.1	-3.4
United States	2281.4	23.9	39.6	22.7	9.2	4.6	2286.7	23.6	39.0	23.4	9.4	4.6	0.2
North America	**2529.6**	**22.7**	**39.2**	**23.3**	**9.1**	**5.6**	**2526.4**	**22.6**	**38.7**	**23.8**	**9.3**	**5.6**	**-0.1**
Australia	115.6	47.9	28.7	17.6	-	5.8	122.7	48.0	29.1	17.6	-	5.4	6.1
Japan	520.7	19.2	49.2	12.4	16.0	3.1	510.9	19.5	50.1	12.3	15.1	3.1	-1.9
Korea	194.8	22.1	51.9	9.6	15.0	1.4	201.8	21.5	51.0	10.5	15.4	1.6	3.6
New Zealand	18.3	7.0	34.3	29.1	-	29.7	18.4	7.2	35.7	27.5	-	29.6	0.4
Pacific	**849.4**	**23.5**	**46.7**	**12.8**	**13.3**	**3.7**	**853.8**	**23.8**	**47.0**	**12.9**	**12.6**	**3.6**	**0.5**
Austria	30.7	12.2	42.8	22.6	-	22.5	30.3	12.3	43.5	22.4	-	21.8	-1.4
Belgium	59.0	13.1	41.1	22.3	20.5	3.0	58.8	15.7	38.2	22.1	21.0	2.9	-0.4
Czech Republic	41.4	50.9	20.3	19.4	9.3	0.1	41.3	49.7	19.9	18.7	11.8	-0.2	-0.2
Denmark	19.8	21.2	44.1	23.4	-	11.3	19.5	21.4	43.9	23.7	-	11.0	-1.3
Finland	33.8	18.1	27.9	11.0	17.6	25.6	34.7	19.1	28.6	10.6	16.8	24.9	2.6
France	265.6	4.8	35.3	13.8	41.3	4.8	266.3	5.0	34.6	13.9	42.7	3.8	0.3
Germany	351.1	24.2	38.3	21.5	12.7	3.2	343.1	24.3	37.6	22.0	12.5	3.6	-2.3
Greece	28.7	32.4	56.2	5.9	-	5.5	29.5	32.1	56.0	6.0	-	5.9	2.6
Hungary	25.3	14.3	26.1	42.3	14.6	2.7	25.1	13.4	26.0	43.0	14.5	3.2	-0.8
Ireland	15.0	17.5	57.0	23.9	-	1.6	15.5	17.0	57.4	23.5	-	2.2	3.1
Italy	172.0	7.8	50.3	33.8	-	8.1	169.1	8.0	49.8	34.1	-	8.2	-1.7
Luxembourg	3.8	2.9	64.8	18.1	-	14.2	4.0	2.3	63.0	26.1	-	8.6	5.2
Netherlands	77.2	10.8	38.1	46.0	1.3	3.7	77.2	10.7	38.6	46.0	1.3	3.4	0.0
Norway	26.6	3.5	30.4	20.4	-	45.7	27.7	1.6	20.8	35.2	-	42.4	4.1
Portugal	24.7	12.9	64.2	9.1	-	13.8	25.4	13.8	63.4	10.7	-	12.0	2.7
Spain	127.4	14.7	52.7	12.9	13.0	6.7	131.3	16.2	51.2	14.3	12.5	5.8	3.1
Sweden	51.1	5.4	27.5	1.5	36.8	28.7	50.3	5.5	27.1	1.6	35.6	30.1	-1.5
Switzerland	28.0	0.5	49.5	9.0	25.0	15.9	27.1	0.5	47.8	9.2	26.2	16.3	-3.4
Turkey	72.5	28.2	39.9	18.4	-	13.4	74.5	26.6	39.8	19.8	-	13.8	2.9
United Kingdom	235.2	16.9	34.6	36.9	10.0	1.5	228.5	15.7	35.3	37.3	10.0	1.6	-2.8
IEA Europe	**1688.9**	**15.6**	**39.7**	**22.9**	**14.6**	**7.1**	**1679.2**	**15.6**	**39.2**	**23.4**	**14.8**	**7.0**	**-0.6**
IEA Total	**5067.9**	**20.5**	**40.7**	**21.4**	**11.6**	**5.8**	**5059.4**	**20.5**	**40.3**	**21.8**	**11.7**	**5.7**	**-0.2**

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, 2003.

Table A5 *(continued)*

Total Energy Demand in IEA Countries

(Mtoe and %)

	2010						2020						2010-2020
	TPES	Shares of TPES					TPES	Shares of TPES					Change in TPES
	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[1] %	Mtoe	Coal %	Oil %	Natural Gas %	Nuclear %	Other[1] %	%
Canada	286.1	9.9	33.7	32.3	7.1	17.0	315.7	7.0	34.5	35.8	6.0	16.7	10.3
United States	2719.1	23.2	40.2	23.3	8.1	5.2	3137.3	22.3	41.2	24.0	7.1	5.3	15.4
North America	**3005.3**	**21.9**	**39.6**	**24.2**	**8.0**	**6.3**	**3453.0**	**20.9**	**40.6**	**25.1**	**7.0**	**6.4**	**14.9**
Australia	145.1	34.1	34.0	25.1	–	6.8	181.4	33.9	34.1	25.7	–	6.3	25.0
Japan	..	..	..	..	..	..	..	..	..	..	..	..	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	21.1	7.1	38.1	14.0	–	40.7	24.6	9.4	38.7	13.3	–	38.5	16.6
Pacific	..	..	..	..	..	..	..	..	..	..	..	..	..
Austria	32.3	9.2	38.9	28.0	–	24.0	34.9	6.0	40.3	29.5	–	24.3	8.2
Belgium	57.3	13.4	39.3	24.7	21.4	1.1	..	..	..	..	..	..	..
Czech Republic	42.1	33.5	21.4	26.4	15.9	2.8	44.0	28.0	21.4	30.3	15.2	5.2	4.5
Denmark	23.6	23.2	42.6	25.6	–	8.5	..	..	..	..	..	..	..
Finland	37.6	16.5	24.5	11.8	22.3	24.9	40.2	19.1	23.4	12.1	20.4	25.0	6.9
France	307.8	3.5	36.5	19.4	36.2	4.4	334.2	3.4	37.7	24.7	29.8	4.4	8.6
Germany	350.4	21.1	39.9	24.0	11.2	3.7	..	..	..	..	..	..	..
Greece	40.5	23.6	54.1	17.4	–	4.9	..	..	..	..	..	..	..
Hungary	26.9	13.1	26.6	42.7	13.4	4.1	27.7	12.1	26.9	43.5	13.0	4.6	3.3
Ireland	17.2	10.3	51.6	35.1	–	3.0	..	..	..	..	..	..	..
Italy	182.7	10.9	33.9	43.8	–	11.3	197.7	10.6	30.3	45.5	–	13.5	8.2
Luxembourg	3.7	2.7	48.4	39.5	–	9.5	..	..	..	..	..	..	..
Netherlands	79.4	10.2	36.6	46.4	1.2	5.6	86.7	10.8	33.8	49.7	–	5.8	9.2
Norway	..	..	..	..	..	..	..	..	..	..	..	..	..
Portugal	26.2	12.4	52.2	19.9	–	15.5	..	..	..	..	..	..	..
Spain	170.3	8.7	48.0	21.7	9.7	11.8	..	..	..	..	..	..	..
Sweden	52.8	4.8	30.4	1.8	33.7	29.2	..	..	..	..	..	..	..
Switzerland	27.1	0.4	48.2	10.5	23.2	17.7	26.7	0.4	48.5	11.2	20.7	19.3	-1.4
Turkey	152.2	26.1	33.6	32.6	–	7.7	279.2	38.5	25.8	26.7	2.6	6.4	83.4
United Kingdom	244.1	8.7	37.9	41.0	7.8	4.6	251.5	6.2	40.9	45.3	3.1	4.4	3.0
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 (Part 2.3).

Source: Country submissions.

Table A6

Development of IEA Energy Self-sufficiency by Product

(Mtoe and %)

	1973			1979			2000			2001			2002[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	572.6	580.0	101.3	575.4	611.0	106.2	570.5	587.0	102.9
Oil	905.0	630.2	69.6	975.6	581.7	59.6	980.4	494.8	50.5	992.5	493.5	49.7	978.8	498.6	50.9
Natural Gas	551.8	564.0	102.2	520.6	521.8	100.2	623.0	596.2	95.7	588.9	613.5	104.2	601.2	592.1	98.5
Total	**1897.4**	**1653.5**	**87.1**	**2072.0**	**1736.1**	**83.8**	**2554.8**	**2049.9**	**80.2**	**2529.6**	**2091.0**	**82.7**	**2526.4**	**2053.6**	**81.3**
Pacific															
Coal	89.8	66.1	73.6	89.0	70.3	79.0	183.7	168.8	91.9	199.9	185.2	92.7	203.2	191.4	94.2
Oil	297.2	20.8	7.0	322.0	23.8	7.4	408.2	37.3	9.1	396.7	38.1	9.6	401.1	37.1	9.3
Natural Gas	8.7	6.0	68.1	26.4	9.9	37.6	107.2	35.8	33.4	109.1	36.6	33.5	110.5	38.4	34.7
Total	**411.1**	**108.3**	**26.3**	**472.4**	**139.0**	**29.4**	**843.2**	**385.9**	**45.8**	**849.4**	**403.7**	**47.5**	**853.8**	**405.8**	**47.5**
IEA Europe															
Coal	342.7	303.2	88.5	352.8	296.6	84.1	264.2	140.9	53.3	264.0	140.6	53.3	262.2	135.8	51.8
Oil	742.0	22.8	3.1	732.8	118.0	16.1	661.4	338.7	51.2	671.3	322.0	48.0	657.9	317.6	48.3
Natural Gas	127.0	119.9	94.4	195.9	167.2	85.3	374.5	239.3	63.9	386.6	242.8	62.8	393.3	247.3	62.9
Total	**1284.2**	**517.8**	**40.3**	**1399.0**	**698.4**	**49.9**	**1657.0**	**1074.0**	**64.8**	**1688.9**	**1069.9**	**63.4**	**1679.2**	**1064.3**	**63.4**
IEA Total															
Coal	758.9	714.4	94.1	828.6	810.6	97.8	1020.5	889.7	87.2	1039.2	936.9	90.2	1035.9	914.2	88.2
Oil	1944.2	673.7	34.7	2030.5	723.5	35.6	2050.0	870.7	42.5	2060.5	853.6	41.4	2037.9	853.4	41.9
Natural Gas	687.5	689.8	100.3	743.0	698.9	94.1	1104.7	871.3	78.9	1084.7	892.9	82.3	1105.0	877.8	79.4
Total	**3592.7**	**2279.6**	**63.4**	**3943.4**	**2573.5**	**65.3**	**5054.9**	**3509.8**	**69.4**	**5067.9**	**3564.6**	**70.3**	**5059.4**	**3523.7**	**69.6**

1. Preliminary data.
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Table A7

Indigenous Production/Primary Energy Supply in IEA Countries, 2001

	Total Energy[1]	Coal[1]	Oil[1]	Gas[1]	Electricity[2]
Canada	1.528	1.225	1.466	2.129	1.041
United States	0.750	1.053	0.402	0.892	0.995
North America	**0.827**	**1.062**	**0.497**	**1.042**	**1.001**
Australia	2.166	3.242	1.054	1.434	1.000
Japan	0.200	0.016	0.003	0.033	1.000
Korea	0.176	0.038	0.006	–	1.000
New Zealand	0.816	1.864	0.289	1.000	1.000
Pacific	**0.475**	**0.927**	**0.096**	**0.335**	**1.000**
Austria	0.316	0.076	0.078	0.212	0.996
Belgium	0.222	0.015	–	–	0.896
Czech Republic	0.737	1.200	0.043	0.015	1.147
Denmark	1.373	–	1.990	1.639	1.016
Finland	0.448	0.226	0.006	–	0.882
France	0.502	0.125	0.019	0.041	1.143
Germany	0.381	0.684	0.029	0.211	0.994
Greece	0.347	0.902	0.011	0.024	0.955
Hungary	0.427	0.736	0.237	0.231	0.920
Ireland	0.115	0.308	–	0.184	1.010
Italy	0.153	–	0.048	0.215	0.849
Luxembourg	0.016	–	–	–	0.081
Netherlands	0.783	–	0.079	1.567	0.844
Norway	8.515	1.271	20.373	9.011	0.971
Portugal	0.137	–	–	–	0.995
Spain	0.259	0.393	0.005	0.029	0.986
Sweden	0.673	0.103	–	–	1.049
Switzerland	0.441	–	–	–	1.174
Turkey	0.361	0.686	0.086	0.019	0.967
United Kingdom	1.115	0.478	1.494	1.097	0.974
IEA Europe	**0.634**	**0.533**	**0.480**	**0.628**	**0.992**
IEA Total	**0.703**	**0.902**	**0.414**	**0.823**	**0.998**

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, 2003.

Table A8

Recent Energy and Oil Supply Trends for IEA Countries

(Mtoe and %)

	TPES					Oil Supply					Net Oil Imports[1]				
	2000	2001	% Chg.	2002[2]	% Chg.	2000	2001	% Chg.	2002[2]	% Chg.	2000	2001	% Chg.	2002[2]	% Chg.
Canada	250.9	248.2	-1.1	239.7	-3.4	87.8	88.8	1.1	86.8	-2.3	-39.1	-39.0 e	-0.4	-48.9 e	25.4
United States	2303.8	2281.4	-1.0	2286.7	0.2	892.5	903.7	1.3	892.1	-1.3	551.1	573.1	4.0	553.5 e	-3.4
North America	**2554.8**	**2529.6**	**-1.0**	**2526.4**	**-0.1**	**980.4**	**992.5**	**1.2**	**978.8**	**-1.4**	**511.9**	**534.1**	**4.3**	**504.7**	**-5.5**
Australia	109.8	115.6	5.3	122.7	6.1	36.5	33.2	-9.0	35.7	7.3	3.5	-0.1	-102.3	1.6 e	-2101.3
Japan	524.2	520.7	-0.7	510.9	-1.9	261.6	256.1	-2.1	256.1	-0.0	269.3	256.7	-4.7	259.1 e	0.9
Korea	191.2	194.8	1.9	201.8	3.6	103.8	101.1	-2.6	102.9	1.8	109.9	106.4	-3.2	106.3 e	-0.1
New Zealand	18.0	18.3	1.4	18.4	0.4	6.3	6.3	-0.8	6.6	4.6	4.5	4.6	2.4	5.1 e	10.7
Pacific	**843.2**	**849.4**	**0.7**	**853.8**	**0.5**	**408.2**	**396.7**	**-2.8**	**401.1**	**1.1**	**387.2**	**367.6**	**-5.1**	**372.0**	**1.2**
Austria	28.8	30.7	6.8	30.3	-1.4	12.2	13.1	7.8	13.2	0.4	11.0	11.7	6.4	12.5 e	7.2
Belgium	59.3	59.0	-0.5	58.8	-0.4	23.8	24.3	2.1	22.4	-7.5	29.2	29.8	2.0	29.2 e	-2.1
Czech Republic	40.4	41.4	2.5	41.3	-0.2	7.9	8.4	6.3	8.2	-1.9	7.5	8.2	8.7	8.0 e	-2.6
Denmark	19.4	19.8	2.0	19.5	-1.3	8.7	8.7	-0.1	8.6	-1.8	-8.5	-7.1	-16.3	-9.4 e	32.4
Finland	33.0	33.8	2.5	34.7	2.6	9.6	9.4	-2.1	9.9	5.4	10.8	10.4	-3.6	9.9 e	-4.5
France	257.4	265.6	3.2	266.3	0.3	87.2	93.8	7.5	92.1	-1.8	90.0	94.1 e	4.6	94.3 e	0.2
Germany	343.4	351.1	2.2	343.1	-2.3	131.7	134.5	2.1	128.9	-4.2	127.4	132.9	4.3	124.4 e	-6.4
Greece	27.8	28.7	3.2	29.5	2.6	15.6	16.1	3.4	16.5	2.3	19.3	19.3	0.4	20.3 e	5.0
Hungary	24.9	25.3	1.6	25.1	-0.8	6.9	6.6	-3.5	6.5	-1.3	5.2 e	4.7	-9.1	4.7 e	0.3
Ireland	14.3	15.0	4.5	15.5	3.1	8.1	8.5	6.0	8.9	3.9	8.1	9.0	11.1	9.1 e	0.9
Italy	171.7	172.0	0.2	169.1	-1.7	88.2	86.5	-1.8	84.2	-2.7	87.9	83.9	-4.5	82.4 e	-1.8
Luxembourg	3.7	3.8	4.1	4.0	5.2	2.3	2.5	6.2	2.5	2.3	2.4	2.5	2.8	2.6 e	4.2
Netherlands	75.5	77.2	2.3	77.2	0.0	28.6	29.5	3.2	29.8	1.2	41.9	41.8	-0.1	40.5 e	-3.2
Norway	25.8	26.6	3.2	27.7	4.1	9.4	8.1	-14.1	5.8	-28.8	-158.8	-158.0	-0.5	-151.9 e	-3.8
Portugal	24.6	24.7	0.5	25.4	2.7	15.6	15.9	2.0	16.1	1.5	16.1	16.8	4.5	16.2 e	-3.7
Spain	124.3	127.4	2.5	131.3	3.1	64.9	67.1	3.5	67.3	0.2	71.6	73.3	2.4	75.0 e	2.3
Sweden	47.5	51.1	7.5	50.3	-1.5	13.4	14.1	5.3	13.7	-2.9	14.6 e	15.3 e	4.8	14.3 e	-6.8
Switzerland	26.5	28.0	5.8	27.1	-3.4	12.7	13.9	9.0	12.9	-6.7	12.3	13.7	11.9	13.0 e	-5.1
Turkey	77.5	72.5	-6.5	74.5	2.9	31.1	28.9	-7.0	29.7	2.7	29.4	26.8	-9.0	27.3 e	1.8
United Kingdom	231.2	235.2	1.7	228.5	-2.8	83.7	81.5	-2.7	80.7	-0.9	-46.7	-36.5	-21.9	-38.4 e	5.2
IEA Europe	**1657.0**	**1688.9**	**1.9**	**1679.2**	**-0.6**	**661.4**	**671.3**	**1.5**	**657.9**	**-2.0**	**370.5**	**392.7**	**6.0**	**383.9**	**-2.3**
IEA Total	**5054.9**	**5067.9**	**0.3**	**5059.4**	**-0.2**	**2050.0**	**2060.5**	**0.5**	**2037.9**	**-1.1**	**1269.7**	**1294.5**	**2.0**	**1260.5**	**2.6**

1. Imports minus exports.
2. Preliminary data.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Table A9

Share of Oil Use by Sector in IEA Countries

(%)

	TFC				Industry[1]				Residential/Commercial[2]				Transport			
	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001
Canada	58.3	53.3	42.9	44.1	40.4	37.3	28.9	30.5	47.4	35.4	19.1	19.4	98.9	95.2	90.4	91.0
United States	56.3	57.7	52.0	53.6	39.7	48.3	32.9	35.7	32.6	25.0	13.4	14.1	95.9	96.9	97.2	97.2
North America	**56.5**	**57.2**	**51.0**	**52.6**	**39.8**	**47.0**	**32.4**	**35.0**	**34.0**	**26.1**	**14.0**	**14.7**	**96.1**	**96.7**	**96.6**	**96.7**
Australia	61.7	59.7	51.7	50.9	43.8	40.6	26.9	25.9	39.7	26.7	13.0	12.8	99.4	99.6	97.9	97.7
Japan	73.2	70.3	63.6	63.9	67.7	62.2	52.7	51.8	68.5	63.6	47.9	48.8	96.9	97.6	98.3	98.3
Korea	56.4	62.0	68.2	65.5	84.4	77.7	65.8	62.0	13.7	25.1	47.4	43.5	99.1	99.4	99.4	99.4
New Zealand	60.6	55.1	42.1	42.3	43.9	35.0	9.5	8.5	32.8	22.8	12.4	11.6	99.9	99.9	99.2	99.3
Pacific	**70.4**	**67.8**	**62.6**	**62.0**	**65.6**	**60.5**	**51.7**	**50.1**	**58.1**	**53.2**	**44.0**	**43.7**	**97.6**	**98.2**	**98.5**	**98.5**
Austria	60.4	54.9	45.2	45.9	51.7	40.1	28.1	29.0	48.6	44.7	25.5	26.5	92.9	94.8	92.3	91.8
Belgium	60.7	56.9	52.0	51.9	46.8	38.6	36.9	38.7	64.2	58.3	39.0	37.6	98.4	98.6	98.7	98.7
Czech Republic	24.4	24.8	30.0	30.9	27.3	26.0	24.6	25.9	5.4	8.8	2.0	1.7	88.0	88.6	94.7	95.4
Denmark	87.7	80.2	49.4	47.8	83.3	70.5	32.5	32.6	84.9	76.2	22.2	21.4	99.7	99.7	99.4	99.4
Finland	59.2	54.8	33.7	33.7	66.2	54.3	15.0	14.5	42.3	41.1	25.6	25.7	99.3	99.5	98.6	98.5
France	72.0	66.8	52.2	52.4	63.4	59.2	38.4	39.6	68.0	56.1	26.3	27.3	97.7	98.1	97.6	97.6
Germany	56.0	53.2	50.8	50.8	44.3	39.5	35.3	35.5	53.6	47.8	30.4	32.4	93.5	97.1	97.7	97.4
Greece	77.6	77.4	69.0	69.3	68.7	69.4	49.4	49.4	68.6	61.6	51.1	52.2	99.2	99.7	99.7	99.7
Hungary	39.1	42.2	32.1	29.9	29.6	32.7	31.2	26.2	35.7	36.5	8.3	7.0	81.2	90.6	97.3	97.2
Ireland	71.2	64.3	64.2	64.6	86.6	73.8	41.3	40.8	37.7	30.5	45.2	45.4	100.0	100.0	100.0	100.0
Italy	73.0	65.1	49.6	49.4	62.3	52.1	30.5	29.4	73.5	58.5	22.8	24.0	97.1	97.3	97.5	97.4
Luxembourg	52.1	43.8	64.6	65.9	38.6	19.9	9.0	8.7	78.4	67.8	46.1	47.3	99.0	99.2	99.6	99.6
Netherlands	50.5	42.6	41.1	41.4	48.8	46.7	40.4	42.3	34.2	16.8	3.8	3.6	99.0	99.0	99.0	99.1
Norway	55.9	52.6	39.3	40.2	43.2	43.3	27.0	30.0	50.6	37.3	16.2	16.8	98.3	98.3	97.1	96.9
Portugal	75.1	73.7	67.1	66.6	66.9	66.9	60.2	59.4	59.7	52.9	34.4	35.3	98.0	99.0	99.5	99.5
Spain	75.6	78.6	62.6	61.7	64.7	70.0	43.0	42.1	68.2	64.4	37.1	35.1	98.8	99.1	98.8	98.7
Sweden	70.4	62.8	40.3	38.5	53.4	48.1	23.3	24.4	78.7	62.6	23.4	15.8	96.8	96.9	96.7	96.6
Switzerland	81.4	75.3	62.0	61.2	77.4	64.0	36.3	36.7	76.3	70.7	48.7	48.6	95.9	95.8	96.8	96.6
Turkey	48.4	49.4	47.1	48.3	60.5	56.6	36.1	40.8	28.0	23.7	28.9	26.3	88.1	96.3	99.2	99.2
United Kingdom	52.3	48.5	46.0	44.9	51.8	45.6	36.6	35.0	24.7	21.6	8.3	8.8	99.1	99.1	98.6	98.5
IEA Europe	**60.7**	**56.7**	**49.7**	**49.6**	**52.6**	**47.6**	**35.3**	**35.6**	**52.3**	**44.2**	**24.1**	**24.5**	**96.5**	**97.8**	**98.0**	**97.9**
IEA Total	**59.6**	**58.3**	**52.4**	**53.0**	**49.1**	**49.3**	**37.1**	**38.2**	**43.3**	**36.1**	**22.3**	**22.9**	**96.3**	**97.2**	**97.3**	**97.3**

1. Includes non-energy use.
2. Includes public and agricultural use.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Table A10

Historical and Projected Oil Production in IEA Countries

(Mtoe)

	1973	1979	2001	2002[1]	2010	2020	2030
Canada	96.3	86.6	130.2	136.3	170.9	193.5	..
United States	533.8	495.1	363.2	362.3	373.9	374.7	..
North America	**630.2**	**581.7**	**493.5**	**498.6**	**544.8**	**568.2**	**..**
Australia	19.8	22.7	35.0	34.3	32.0	34.2	..
Japan	0.8	0.6	0.7	0.6	..	..	..
Korea	–	–	0.6	0.5	..	..	..
New Zealand	0.2	0.4	1.8	1.7	2.2	2.2	2.8
Pacific	**20.8**	**23.8**	**38.1**	**37.1**	**..**	**..**	**..**
Austria	2.7	1.8	1.0	1.0	1.0	1.1	..
Belgium	–	–	–	–	–	..	..
Czech Republic	0.0	0.3	0.4	0.4	0.4	0.4	0.4
Denmark	0.1	0.4	17.3	18.7	14.0	..	..
Finland	–	–	0.1	0.1	–	–	..
France	2.1	2.0	1.8	1.7	–	–	..
Germany	6.8	4.9	4.0	4.2	1.6	..	..
Greece	–	–	0.2	0.2	0.3	..	..
Hungary	2.0	2.4	1.6	1.5	1.0	0.8	0.7
Ireland	–	–	–	–	–	..	..
Italy	1.1	1.8	4.2	5.5	10.0	10.0	10.0
Luxembourg	–	–	–	–	–	..	..
Netherlands	1.6	1.6	2.3	3.2	0.8	0.8	..
Norway	1.5	18.6	164.7	158.4	..	..	..
Portugal	–	–	–	–	–	..	..
Spain	0.7	1.4	0.3	0.3	..	..	..
Sweden	–	0.0	–	–	–	..	..
Switzerland	–	–	–	–	–	–	–
Turkey	3.6	2.9	2.5	2.4	1.1	0.5	0.2
United Kingdom	0.5	79.9	121.7	120.0	..	..	..
IEA Europe	**22.8**	**118.0**	**322.0**	**317.6**	**..**	**..**	**..**
IEA Total	**673.7**	**723.5**	**853.6**	**853.4**	**..**	**..**	**..**

1. Preliminary data.

Note: The IEA Secretariat has estimated forecast data for certain countries. Please see Energy Balances and Key Statistical Data for details (Part 2.3).

Sources: *Energy Balances of OECD Countries*, Paris IEA/OECD, 2003, for 1973, 1979 and 2001; and country submissions for 2010, 2020 and 2030.

Table A11

Historical and Projected Net Oil Imports of IEA Countries[1]

(Mtoe)

	1979	2000	2001	2002[2]	2010	2020	2030
Canada	7.8	–39.1	–39.0 e	–48.9 e	–73.9	–83.9	..
United States	423.7	551.1	573.1	553.5 e	738.6	938.5	..
North America	**431.5**	**511.9**	**534.1**	**504.7 e**	**664.7**	**854.6**	**..**
Australia	10.8	3.5	–0.1	1.6 e	18.3	28.8	..
Japan	277.0	269.3	256.7	259.1 e	..	..	..
Korea	27.0	109.9	106.4	106.3 e	..	..	..
New Zealand	4.2	4.5	4.6	5.1 e	6.3	7.8	10.2
Pacific	**318.9**	**387.2**	**367.6**	**372.0 e**	**..**	**..**	**..**
Austria	11.4	11.0	11.7	12.5 e	11.8	13.2	..
Belgium	29.4	29.2	29.8	29.2 e	26.5	..	..
Czech Republic	11.2	7.5	8.2	8.0 e	8.6	9.0	9.3
Denmark	15.8	–8.5	–7.1	–9.4 e	–2.8	..	..
Finland	15.3	10.8	10.4	9.9 e	9.2	9.4	..
France	120.7	90.0	94.1 e	94.3 e	115.0	129.5	..
Germany	162.7	127.4	132.9	124.4 e	140.2	..	..
Greece	13.3	19.3	19.3	20.3 e	25.2	..	..
Hungary	9.8	5.2 e	4.7	4.7 e	6.2	6.7	7.0
Ireland	6.4	8.1	9.0	9.1 e	9.0	..	..
Italy	102.6	87.9	83.9	82.4 e	54.5	52.0	52.0
Luxembourg	1.4	2.4	2.5	2.6 e	1.8	..	..
Netherlands	41.4	41.9	41.8	40.5 e	49.4	49.7	..
Norway	–9.3	–158.8	–158.0	–151.9 e	..	..	..
Portugal	9.2	16.1	16.8	16.2 e	15.0	..	..
Spain	49.6	71.6	73.3	75.0 e	..	..	..
Sweden	28.4	14.6 e	15.3 e	14.3 e	17.5	..	..
Switzerland	13.8	12.3	13.7	13.0 e	13.0	12.9	12.6
Turkey	11.8	29.4	26.8	27.3 e	50.0	71.4	102.2
United Kingdom	19.2	–46.7	–36.5	–38.4 e	..	..	..
IEA Europe	**664.2**	**370.5**	**392.7**	**383.9 e**	**..**	**..**	**..**
IEA Total	**1414.6**	**1269.7**	**1294.5**	**1260.5 e**	**..**	**..**	**..**

1. Includes requirements for marine bunkers.
2. Preliminary data.
Note: The IEA Secretariat has estimated data for certain countries (e). Please see Energy Balances and Key Statistical Data for details (Part 2.3).
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003, for 1979, 2000 and 2001 and country submissions for 2010, 2020 and 2030.

Table A12

Total IEA Electricity Generation by Fuel

(TWh and %)

	1973		1979		2001		2002[1]	
	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %	Output TWh	Share %
Coal	1606.5	*37.2*	2019.6	*37.8*	3433.6	*37.7*	3465.2	*37.4*
Oil	1105.7	*25.6*	1052.3	*19.7*	465.5	*5.1*	488.4	*5.3*
Natural Gas	512.9	*11.9*	598.5	*11.2*	1538.6	*16.9*	1638.6	*17.7*
Comb. Renewables & Wastes	6.9	*0.2*	11.7	*0.2*	140.6	*1.5*	156.3	*1.7*
Nuclear	188.3	*4.4*	573.4	*10.7*	2263.9	*24.9*	2266.7	*24.5*
Hydro	891.2	*20.6*	1073.7	*20.1*	1186.8	*13.0*	1169.8	*12.6*
Geothermal	6.4	*0.1*	8.6	*0.2*	25.7	*0.3*	24.8	*0.3*
Solar/Wind	0.6	*0.0*	0.5	*0.0*	37.3	*0.4*	50.1	*0.5*
Total	**4318.4**	***100.0***	**5338.4**	***100.0***	**9097.3**	***100.0***	**9259.8**	***100.0***

1. Preliminary data.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2003.

Table A13

Electricity Generation in IEA Countries, 2001

	Energy Inputs[1] (Mtoe)	Electricity Output in TWh	Shares of Fuel in Electricity Generation (%)					
			Coal	Oil	Gas	Nuclear	Hydro	Other[2]
Canada	86.9	587.9	20.1	2.9	6.1	13.0	56.7	1.3
United States	932.5 e	3863.8	51.3	3.5	16.7	20.9	5.2	2.4
North America	**1019.4**	**4451.7**	**47.2**	**3.4**	**15.3**	**19.9**	**12.0**	**2.2**
Australia	57.3 e	216.9	78.3	1.3	12.1	-	7.6	0.7
Japan	217.2 e	1033.2	23.1	11.3	24.9	31.0	8.1	1.1
Korea	71.1 e	281.5	39.2	8.5	10.8	39.8	1.5	0.2
New Zealand	6.7	39.9	3.7	-	31.2	-	53.8	11.4
Pacific	**352.2**	**1571.5**	**33.1**	**9.2**	**20.7**	**27.5**	**8.0**	**1.1**
Austria	8.5	62.4	12.7	3.2	13.6	-	67.0	3.5
Belgium	18.7 e	78.6	16.2	2.1	20.1	59.0	0.6	2.1
Czech Republic	21.2	74.2	71.7	0.5	4.2	19.9	2.8	1.0
Denmark	8.9	37.7	47.3	11.1	24.6	-	0.1	17.0
Finland	16.1	74.5	23.5	0.9	15.5	30.6	17.7	11.8
France	127.5 e	546.0	4.5	1.0	3.1	77.1	13.6	0.7
Germany	136.8 e	579.8	51.9	1.1	9.9	29.5	3.5	4.1
Greece	12.0	53.1	66.8	16.0	11.6	-	4.0	1.8
Hungary	10.4	36.4	24.5	11.5	24.3	38.8	0.5	0
Ireland	5.3 e	24.6	37.6	21.1	37.1	-	2.4	1.7
Italy	50.4	271.9	13.5	27.6	38.3	-	17.2	3.4
Luxembourg	0.1	0.5	..	..	56.0	-	26.7	17.3
Netherlands	20.1 e	93.7	28.5	3.3	58.9	4.2	0.1	4.8
Norway	10.6 e	121.3	0.2	0.0	0.2	-	99.3	0.3
Portugal	7.8	46.2	29.5	20.2	15.6	-	30.4	4.2
Spain	45.4 e	234.7	30.6	10.5	10.0	27.1	17.5	4.4
Sweden	30.5	161.7	2.1	1.7	0.2	44.6	49.0	2.5
Switzerland	11.7 e	70.5	-	0.1	1.2	38.0	58.6	2.2
Turkey	24.8 e	122.7	31.3	8.5	40.4	-	19.6	0.3
United Kingdom	85.0 e	383.5	34.8	1.9	37.2	23.5	1.1	1.6
IEA Europe	**651.9**	**3074.1**	**26.4**	**5.6**	**17.3**	**30.8**	**17.1**	**2.8**
IEA Total	**2023.6**	**9097.3**	**37.7**	**5.1**	**16.9**	**24.9**	**13.0**	**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, 2003.

Table A14

Electricity Intensity of IEA Countries[1]

	1973	1979	1999	2000	2001	Average Annual Growth Rates (%) 1990-1995	1996-2001
Canada	0.80	0.82	0.81	0.81	0.79	–0.0	–2.8
United States	0.49	0.50	0.45	0.45	0.43	0.07	–2.3
North America	**0.52**	**0.52**	**0.48**	**0.48**	**0.46**	**0.03**	**–2.3**
Australia	0.33	0.40	0.46	0.46	0.46	–0.9	0.21
Japan	0.18	0.18	0.19	0.19	0.18	1.46	0.02
Korea	0.16	0.23	0.42	0.43	0.44	3.72	2.57
New Zealand	0.43	0.51	0.56	0.57	0.56	–1.2	–0.7
Pacific	**0.19**	**0.20**	**0.23**	**0.23**	**0.23**	**1.73**	**0.93**
Austria	0.21	0.22	0.22	0.22	0.23	–0.5	0.31
Belgium	0.23	0.25	0.28	0.27	0.27	1.50	–0.6
Czech Republic	0.96	1.05	1.14	1.14	1.13	0.68	–0.7
Denmark	0.15	0.18	0.18	0.18	0.18	–0.3	–2.8
Finland	0.37	0.43	0.51	0.49	0.50	2.64	–1.5
France	0.19	0.22	0.27	0.26	0.26	1.47	–1.1
Germany	0.25	0.27	0.21	0.21	0.22	–2.4	–0.4
Greece	0.18	0.22	0.37	0.38	0.38	2.20	1.08
Hungary	0.66	0.70	0.75	0.71	0.70	0.73	–3.2
Ireland	0.27	0.30	0.23	0.22	0.22	–0.3	–3.6
Italy	0.22	0.23	0.26	0.26	0.26	0.80	0.93
Luxembourg	0.41	0.42	0.26	0.25	0.24	–0.1	–3.2
Netherlands	0.20	0.22	0.22	0.22	0.22	0.49	–0.3
Norway	0.96	0.91	0.70	0.68	0.70	–1.9	–0.9
Portugal	0.17	0.23	0.34	0.34	0.35	1.97	1.98
Spain	0.21	0.26	0.31	0.32	0.33	0.93	2.45
Sweden	0.46	0.51	0.52	0.50	0.51	–1.1	–2.0
Switzerland	0.14	0.16	0.18	0.18	0.18	1.02	–0.1
Turkey	0.18	0.26	0.62	0.62	0.67	5.15	4.97
United Kingdom	0.38	0.37	0.30	0.30	0.30	–0.6	–1.3
IEA Europe	**0.26**	**0.28**	**0.28**	**0.28**	**0.29**	**–0.1**	**–0.2**
IEA Total	**0.33**	**0.34**	**0.34**	**0.34**	**0.33**	**0.36**	**–0.8**

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, 2003, *National Accounts, Volume 1*, OECD Paris, 2002, and *Main Economic Indicators*, OECD Paris, 2003.

Table A15

Electricity Generation in IEA Countries

(GW net)

	2001						
	Total Capacity						
	Coal	Oil	Natural Gas	Nuclear	Hydro	Other	Total
Canada	16.15	7.75	8.06	10.62	67.41	1.34	111.31
United States[1]	315.24	45.34	279.12	98.14	98.90	17.85	854.59
North America	**331.39**	**53.09**	**287.18**	**108.76**	**166.31**	**19.19**	**965.91**
Australia	28.52	1.78	7.59	0	7.69	1.21	46.80
Japan[2, 3]	41.43	65.33	58.86	45.91	46.39	4.27	262.18
Korea	15.99	9.62	12.97	13.72	3.91	0.55	56.76
New Zealand	0.31	0	2.33	0	5.26	0.71	8.61
Pacific	**86.25**	**76.73**	**81.76**	**59.62**	**63.25**	**6.75**	**374.36**
Austria	1.90	0.32	3.50	0	11.55	0.39	17.66
Belgium	2.07	0.30	5.38	5.74	1.42	0.63	15.53
Czech Republic	10.87	0.06	0.59	1.76	2.15	0.03	15.44
Denmark	5.21	1.89	2.68	0	0.01	2.98	12.77
Finland	5.12	1.40	2.69	2.64	2.90	1.74	16.48
France	12.75	10.46	3.28	63.18	25.03	0.81	115.51
Germany	49.76	6.76	20.93	22.40	8.98	10.84	119.67
Greece	4.52	2.00	1.11	0	3.08	0.29	10.99
Hungary	2.01	0.95	3.50	1.87	0.05	0.02	8.39
Ireland[2]	1.26	0.84	1.95	0	0.53	0.15	4.73
Italy	6.82	20.05	26.72	0	20.43	2.08	76.09
Luxembourg	0	0	0.07	0	1.14	0.02	1.23
Netherlands	3.57	0.89	14.89	0.45	0.04	0.55	20.38
Norway	0.08	0.01	0.04	0	28.13	0.16	28.42
Portugal	1.78	2.85	1.37	0	4.56	0.44	10.99
Spain	11.41	8.17	6.78	7.52	18.02	3.82	55.71
Sweden	0.69	5.22	0.35	9.44	16.24	1.72	33.65
Switzerland	0	0.13	0.33	3.20	13.24	0.37	17.26
Turkey	6.99	2.48	7.15	0	11.67	0.04	28.33
United Kingdom	33.43	5.72	22.61	12.49	4.30	1.26	79.80
IEA Europe	**160.20**	**70.48**	**125.91**	**130.67**	**173.45**	**28.33**	**689.04**
IEA Total	**577.84**	**200.29**	**494.84**	**299.05**	**403.01**	**54.27**	**2029.30**

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, 2001-2002

	Total Energy		Oil Products		Electricity		Gas		Coal	
	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial	Industry	Residential/ Commercial
Canada	3.2	-11.2	-1.1	-2.3	..	..	..	..	..	..
United States	-11.9	-8.8	-5.9	-8.2	-2.4	-2.7	-20.7	-14.3	5.6	..
Australia	8.9	-3.6	..	-4.5	8.9	0.2	..	..	..	..
Japan	9.4	-0.9	-1.6	-2.3	..	..	..	..	26.8	..
Korea	21.2	..	4.0	..	..	..	..	..	-1.1	..
New Zealand	3.9	-2.3	-5.1	-4.5	6.6	2.2	4.3	1.8	..	..
Austria	-2.1	-3.6	-0.1	-5.1	..	-0.0	..	-4.0	..	-0.3
Belgium	-0.0	-2.5	-5.6	-4.4	..	..	..	..	..	-0.4
Czech Republic	0.5	-0.8	-9.1	-11.6	0.8	7.8	-2.8	-0.3	3.8	6.9
Denmark	4.1	-3.3	-0.7	..	9.5	-1.0	..	-6.1	..	2.6
Finland	3.6	-1.7	-0.7	-4.5	8.9	3.0	-2.0	-14.7	0.7	..
France	-4.9	-1.8	-0.2	-3.9	0.7	-0.9	-12.8	0.8	..	..
Germany	-1.5	-0.9	1.7	0.9	..	..	..	..	..	..
Greece	-3.9	-4.6	-5.4	-5.9	-0.9	0.5	..	..	..	..
Hungary	10.0	-1.2	15.1	-6.0	7.8	-0.5	9.8	0.3	..	-0.6
Ireland	12.5	-7.5	5.8	-8.1	19.6	-8.6	23.1	-3.3	..	..
Italy	0.5	-2.6	5.8	-2.7	..	..	..	..	..	..
Luxembourg	-5.3	-3.8	-5.3	-4.6	..	6.4	..	..	..	..
Netherlands	-6.1	1.4	-2.5	-3.6	..	-1.7	-7.9	4.6	..	..
Norway	-21.5	74.3	-1.8	-7.7	..	..	..	..	..	..
Portugal	-3.6	-5.8	-1.8	-7.2	-1.7	-1.1	..	..	-20.5	..
Spain	-6.4	-3.4	1.0	-2.1	..	..	-11.2	-9.8	..	..
Sweden	-1.0	-3.1	-3.9	-3.8	..	..	..	..	..	..
Switzerland	-5.4	-4.6	-3.5	-4.9	-1.7	-1.3	-12.1	-7.5	-16.8	..
Turkey	3.6	-2.4	19.6	2.6	-2.6	-4.2	-11.7	-10.9	2.6	4.1
United Kingdom	-3.4	-0.6	-0.9	-5.0	-2.3	-1.2	-5.4	4.6	4.1	3.9

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Table A17

Tax as a Percentage of Oil Product Prices in IEA Countries, 1999-2002

	High Sulphur Fuel Oil Industry				Heating Oil Residential				Diesel Commercial/Transport				Premium Unleaded Gasoline (95 RON)[1] Transport			
	1999	2000	2001	2002	1999	2000	2001	2002	1999	2000	2001	2002	1999	2000	2001	2002
Canada	..	..	..	..	10.2	10.2	10.2	10.2	39.3	32.7	32.4	34.5	48.9	41.2	42.3	42.4
United States	..	..	..	..	..	..	..	..	39.1	29.6	31.8	34.0	28.2	22.6	23.1	24.8
Australia	..	..	..	..	..	..	..	..	..	..	..	..	60.9	51.2	52.8	53.6
Japan	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	57.8	53.8	52.4	53.3	59.5	54.1	53.6	55.3
Korea	..	9.1	9.6	10.7	..	24.4	26.9	32.8	..	38.4	41.5	48.7	..	..	..	..
New Zealand	..	..	..	..	..	..	..	..	0.9	0.6	0.6	0.6	49.9	42.5	43.0	46.3
Austria	..	..	..	..	42.2	33.6	35.0	36.6	54.5	44.7	46.5	48.3	67.6	60.6	62.6	64.1
Belgium	14.4	9.5	10.7	10.9	24.1	21.2	21.5	22.0	55.4	44.4	46.1	50.8	73.5	65.8	67.7	69.2
Czech Republic	..	..	..	..	30.5	27.3	29.4	18.0	49.7	40.2	41.3	45.8	62.8	55.8	57.7	62.1
Denmark	..	..	..	..	62.1	55.8	56.3	57.9	54.1	45.3	48.7	50.6	72.3	66.3	68.4	69.7
Finland	..	..	..	..	41.3	33.6	34.9	36.5	54.4	43.6	45.3	47.3	74.3	67.3	68.4	70.0
France	21.4	9.6	10.8	10.0	41.6	30.6	26.5	29.8	66.8	54.5	56.1	59.4	78.8	69.8	71.6	73.7
Germany	..	..	..	..	35.6	28.8	30.2	31.3	62.0	54.7	57.7	60.8	73.8	69.3	71.7	73.4
Greece	..	..	..	..	52.4	41.2	46.5	48.1	57.3	43.3	45.4	46.5	63.0	52.8	54.5	55.5
Hungary	..	..	..	..	..	..	..	..	56.4	46.6	48.1	51.3	66.8	60.0	61.3	64.1
Ireland	9.4	5.5	6.1	5.2	25.7	21.4	21.7	22.1	56.3	46.4	36.5	47.5	67.7	58.9	55.8	64.2
Italy	36.4	26.6	28.9	..	71.2	60.6	61.4	65.0	63.5	51.5	52.9	56.5	73.0	64.8	66.1	68.4
Luxembourg	..	..	..	..	13.1	12.2	12.4	12.5	53.6	42.2	44.3	45.9	63.9	55.7	57.5	58.8
Netherlands	..	..	..	..	46.0	40.7	46.3	50.5	58.3	49.0	49.6	51.8	73.3	66.4	68.8	70.9
Norway	..	..	..	..	30.0	32.9	36.7	37.7	59.2	54.2	48.2	49.6	74.7	68.7	67.6	70.0
Portugal	18.9	11.4	11.5	11.6	..	..	..	..	59.7	48.3	51.3	55.9	67.7	49.4	46.2	68.9
Spain	9.9	6.6	7.5	7.4	41.1	32.3	34.0	36.7	55.4	45.0	45.2	49.5	66.9	59.2	59.9	62.4
Sweden	..	..	..	..	62.3	53.2	56.9	60.6	49.8	43.3	44.0	46.5	73.1	67.0	67.6	69.6
Switzerland	..	..	..	..	11.4	9.6	9.5	9.3	75.6	63.2	65.9	69.2	69.0	60.3	62.1	64.3
Turkey	28.4	21.8	27.7	29.6	65.4	62.0	56.8	63.2	64.3	58.7	54.0	53.4	71.2	61.8	62.8	70.2
United Kingdom	27.9	21.7	22.4	..	26.3	19.2	21.1	24.4	77.5	69.9	69.9	71.3	81.5	75.5	76.1	77.5

1. Regular unleaded gasoline for Australia, Canada and Japan 1999 to 2002.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2003.

Table A18

Energy Balances and Key Statistical Data for IEA and Regions

		IEA Total				IEA North America				IEA Pacific				IEA Europe			
		1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001
SUPPLY																	Unit: Mtoe
TOTAL PRODUCTION		**2279.6**	**2573.5**	**3509.8**	**3564.6**	**1653.5**	**1736.1**	**2049.9**	**2091.0**	**108.3**	**139.0**	**385.9**	**403.7**	**517.8**	**698.4**	**1074.0**	**1069.9**
Coal[1]		714.4	810.6	889.7	936.9	345.1	443.6	580.0	611.0	66.1	70.3	168.8	185.2	303.2	296.6	140.9	140.6
Oil		673.7	723.5	870.7	853.6	630.2	581.7	494.8	493.5	20.8	23.8	37.3	38.1	22.8	118.0	338.7	322.0
Gas		689.8	698.9	871.3	892.9	564.0	521.8	596.2	613.5	6.0	9.9	35.8	36.6	119.9	167.2	239.3	242.8
Comb. Renewables & Wastes[2]		70.2	90.8	161.7	160.1	45.3	59.9	84.4	81.7	3.5	4.0	14.2	13.9	21.4	26.8	63.1	64.5
Nuclear		49.2	150.0	578.5	590.0	27.3	80.3	226.9	230.6	2.5	19.2	112.3	112.6	19.3	50.6	239.3	246.9
Hydro		76.6	92.3	109.4	102.1	39.6	45.3	52.6	45.9	8.1	10.1	11.4	10.9	29.0	37.0	45.4	45.3
Geothermal		5.6	7.4	22.2	22.5	2.1	3.5	13.1	12.9	1.3	1.7	5.0	5.3	2.2	2.2	4.1	4.3
Solar/Wind/Other[3]		0.0	0.1	6.3	6.6	-	-	2.0	1.9	-	0.0	1.1	1.1	0.0	0.0	3.2	3.6
TOTAL NET IMPORTS[4]		**1332.6**	**1425.2**	**1499.2**	**1541.4**	**253.8**	**374.4**	**448.8**	**489.6**	**307.7**	**338.7**	**463.8**	**439.7**	**771.2**	**712.2**	**586.6**	**612.2**
Coal[1]	Exports	84.1	113.4	192.7	199.5	38.7	51.5	58.9	50.9	18.2	26.7	117.6	127.7	27.2	35.2	16.2	20.9
	Imports	114.4	144.7	291.2	310.9	11.2	15.5	24.3	28.8	41.8	44.4	134.5	138.7	61.4	84.9	132.4	143.5
	Net Imports	30.3	31.3	98.5	111.4	-27.5	-36.1	-34.6	-22.1	23.6	17.7	17.0	11.0	34.2	49.7	116.2	122.6
Oil	Exports	233.1	251.9	706.4	696.6	74.1	40.4	143.5	143.4	7.3	4.2	69.5	73.7	151.6	207.3	493.5	479.5
	Imports	1596.3	1666.4	1976.1	1991.0	365.3	471.9	655.4	677.5	308.1	323.1	456.7	441.3	923.0	871.4	864.0	872.2
	Bunkers	71.0	74.0	85.0	76.6	9.2	26.0	29.2	20.6	19.4	14.5	12.0	11.0	42.3	33.6	43.8	45.0
	Net Imports	1292.3	1340.5	1184.7	1217.9	281.9	405.5	482.8	513.5	281.3	304.4	375.2	356.6	729.0	630.6	326.7	347.8
Gas	Exports	50.3	82.5	188.5	205.0	24.9	24.0	88.2	97.1	-	-	9.3	8.8	25.5	58.5	91.1	99.1
	Imports	60.0	135.3	403.0	414.9	24.2	29.0	89.1	95.5	2.8	16.7	80.9	80.9	33.0	89.6	233.0	238.4
	Net Imports	9.7	52.8	214.4	209.8	-0.7	5.0	0.9	-1.6	2.8	16.7	71.6	72.1	7.5	31.1	142.0	139.3
Electricity	Exports	6.7	10.3	27.6	26.5	1.6	2.9	5.6	4.9	-	-	-	-	5.0	7.4	22.0	21.6
	Imports	7.1	10.9	28.6	28.4	1.6	2.9	5.5	4.7	-	-	-	-	5.4	8.1	23.1	23.7
	Net Imports	0.4	0.6	1.0	1.9	0.0	-0.0	-0.1	-0.2	-	-	-	-	0.4	0.7	1.1	2.2
TOTAL STOCK CHANGES		**-19.5**	**-55.4**	**45.9**	**-38.1**	**-9.8**	**-38.5**	**56.0**	**-51.0**	**-4.8**	**-5.3**	**-6.5**	**6.0**	**-4.8**	**-11.6**	**-3.6**	**6.8**
TOTAL SUPPLY (TPES)		**3592.7**	**3943.4**	**5054.9**	**5067.9**	**1897.4**	**2072.0**	**2554.8**	**2529.6**	**411.1**	**472.4**	**843.2**	**849.4**	**1284.2**	**1399.0**	**1657.0**	**1688.9**
Coal[1]		758.9	828.6	1020.5	1039.2	326.3	386.8	572.6	575.4	89.8	89.0	183.7	199.9	342.7	352.8	264.2	264.0
Oil		1944.2	2030.5	2050.0	2060.5	905.0	975.6	980.4	992.5	297.2	322.0	408.2	396.7	742.0	732.8	661.4	671.3
Gas		687.5	743.0	1104.7	1084.7	551.8	520.6	623.0	588.9	8.7	26.4	107.2	109.1	127.0	195.9	374.5	386.6
Comb. Renewables & Wastes[2]		70.3	90.9	162.3	160.4	45.3	59.9	84.4	81.7	3.5	4.0	14.2	13.9	21.4	26.9	63.7	64.8
Nuclear		49.2	150.0	578.5	590.0	27.3	80.3	226.9	230.6	2.5	19.2	112.3	112.6	19.3	50.6	239.3	246.9
Hydro		76.6	92.3	109.4	102.1	39.6	45.3	52.6	45.9	8.1	10.1	11.4	10.9	29.0	37.0	45.4	45.3
Geothermal		5.6	7.4	22.2	22.5	2.1	3.5	13.1	12.9	1.3	1.7	5.0	5.3	2.2	2.2	4.1	4.3
Solar/Wind/Other[3]		0.0	0.1	6.3	6.6	-	-	2.0	1.9	-	0.0	1.1	1.1	0.0	0.0	3.2	3.6
Electricity Trade[5]		0.4	0.7	1.0	1.9	0.0	-0.0	-0.1	-0.2	-	-	-	-	0.4	0.7	1.1	2.2

Table A18 *(continued)*

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				IEA North America				IEA Pacific				IEA Europe			
	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001
SUPPLY																Unit: Mtoe
Fuel Shares (%)																
Coal	*21.1*	*21.0*	*20.2*	*20.5*	*17.2*	*18.7*	*22.4*	*22.7*	*21.9*	*18.8*	*21.8*	*23.5*	*26.7*	*25.2*	*15.9*	*15.6*
Oil	*54.1*	*51.5*	*40.6*	*40.7*	*47.7*	*47.1*	*38.4*	*39.2*	*72.3*	*68.2*	*48.4*	*46.7*	*57.8*	*52.4*	*39.9*	*39.7*
Gas	*19.1*	*18.8*	*21.9*	*21.4*	*29.1*	*25.1*	*24.4*	*23.3*	*2.1*	*5.6*	*12.7*	*12.8*	*9.9*	*14.0*	*22.6*	*22.9*
Comb. Renewables & Wastes	*2.0*	*2.3*	*3.2*	*3.2*	*2.4*	*2.9*	*3.3*	*3.2*	*0.9*	*0.9*	*1.7*	*1.6*	*1.7*	*1.9*	*3.8*	*3.8*
Nuclear	*1.4*	*3.8*	*11.4*	*11.6*	*1.4*	*3.9*	*8.9*	*9.1*	*0.6*	*4.1*	*13.3*	*13.3*	*1.5*	*3.6*	*14.4*	*14.6*
Hydro	*2.1*	*2.3*	*2.2*	*2.0*	*2.1*	*2.2*	*2.1*	*1.8*	*2.0*	*2.1*	*1.4*	*1.3*	*2.3*	*2.6*	*2.7*	*2.7*
Geothermal	*0.2*	*0.2*	*0.4*	*0.4*	*0.1*	*0.2*	*0.5*	*0.5*	*0.3*	*0.4*	*0.6*	*0.6*	*0.2*	*0.2*	*0.2*	*0.3*
Solar/Wind/Other	-	-	*0.1*	*0.1*	-	-	*0.1*	*0.1*	-	-	*0.1*	*0.1*	-	-	*0.2*	*0.2*
Electricity Trade	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*0.1*	*0.1*
DEMAND																Unit: Mtoe
FINAL CONSUMPTION BY SECTOR																
TFC	**2643.9**	**2840.3**	**3510.9**	**3490.8**	**1379.1**	**1460.6**	**1762.6**	**1725.6**	**297.8**	**332.2**	**559.5**	**559.1**	**966.9**	**1047.6**	**1188.7**	**1206.1**
Coal[1]	224.3	201.5	114.5	110.2	49.4	45.8	34.9	35.2	32.5	33.1	33.1	32.7	142.5	122.6	46.6	42.3
Oil	1575.1	1654.6	1839.5	1851.3	778.7	835.7	898.5	906.9	209.6	225.1	350.1	346.7	586.8	593.9	590.9	597.7
Gas	475.4	519.3	713.6	693.7	365.0	347.5	413.0	383.9	9.5	14.3	45.5	47.0	100.8	157.5	255.1	262.8
Comb. Renewables & Wastes[2]	47.2	61.3	115.1	112.4	23.6	33.8	61.1	58.7	3.5	3.8	8.2	7.8	20.0	23.7	45.7	46.0
Geothermal	0.0	0.1	1.9	2.0	-	-	0.5	0.6	-	-	0.3	0.3	0.0	0.1	1.1	1.1
Solar/Wind/Other	-	0.0	3.0	3.0	-	-	1.4	1.4	-	0.0	0.9	0.9	-	0.0	0.7	0.7
Electricity	314.2	389.3	682.5	674.7	162.3	196.8	342.3	328.6	42.7	55.7	118.6	119.0	109.2	136.9	221.5	227.1
Heat	7.6	14.2	40.7	43.5	0.1	1.0	10.8	10.4	0.0	0.1	2.6	4.7	7.5	13.0	27.3	28.4
Fuel Shares (%)																
Coal	*8.5*	*7.1*	*3.3*	*3.2*	*3.6*	*3.1*	*2.0*	*2.0*	*10.9*	*10.0*	*5.9*	*5.8*	*14.7*	*11.7*	*3.9*	*3.5*
Oil	*59.6*	*58.3*	*52.4*	*53.0*	*56.5*	*57.2*	*51.0*	*52.6*	*70.4*	*67.8*	*62.6*	*62.0*	*60.7*	*56.7*	*49.7*	*49.6*
Gas	*18.0*	*18.3*	*20.3*	*19.9*	*26.5*	*23.8*	*23.4*	*22.2*	*3.2*	*4.3*	*8.1*	*8.4*	*10.4*	*15.0*	*21.5*	*21.8*
Comb. Renewables & Wastes	*1.8*	*2.2*	*3.3*	*3.2*	*1.7*	*2.3*	*3.5*	*3.4*	*1.2*	*1.2*	*1.5*	*1.4*	*2.1*	*2.3*	*3.8*	*3.8*
Geothermal	-	-	*0.1*	*0.1*	-	-	-	-	-	-	*0.1*	*0.1*	-	-	*0.1*	*0.1*
Solar/Wind/Other	-	-	*0.1*	*0.1*	-	-	*0.1*	*0.1*	-	-	*0.2*	*0.2*	-	-	*0.1*	*0.1*
Electricity	*11.9*	*13.7*	*19.4*	*19.3*	*11.8*	*13.5*	*19.4*	*19.0*	*14.3*	*16.8*	*21.2*	*21.3*	*11.3*	*13.1*	*18.6*	*18.8*
Heat	*0.3*	*0.5*	*1.2*	*1.2*	-	*0.1*	*0.6*	*0.6*	-	-	*0.5*	*0.8*	*0.8*	*1.2*	*2.3*	*2.4*

Table A18 *(continued)*

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				IEA North America				IEA Pacific				IEA Europe			
	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001
DEMAND																Unit: Mtoe
TOTAL INDUSTRY[6]	**1046.0**	**1084.9**	**1198.0**	**1167.1**	**458.4**	**488.8**	**562.0**	**542.1**	**167.4**	**168.0**	**231.9**	**227.1**	**420.2**	**428.1**	**404.1**	**398.0**
Coal[1]	139.2	126.1	103.4	99.0	35.2	31.3	32.6	32.7	23.9	24.0	32.0	31.8	80.1	70.7	38.7	34.5
Oil	513.1	535.1	444.3	445.3	182.4	229.7	182.0	189.9	109.8	101.6	119.8	113.7	221.0	203.7	142.5	141.7
Gas	220.9	218.4	305.2	286.1	163.2	135.9	178.4	159.5	3.9	6.0	21.1	22.0	53.9	76.5	105.8	104.6
Comb. Renewables & Wastes[2]	18.0	20.8	66.3	63.8	12.9	13.7	44.5	42.8	1.5	2.1	6.0	5.5	3.6	4.9	15.7	15.4
Geothermal	-	-	0.4	0.4	-	-	0.1	0.1	-	-	0.3	0.3	-	-	0.0	0.0
Solar/Wind/Other	-	-	0.1	0.1	-	-	-	-	-	-	-	-	-	-	0.1	0.1
Electricity	152.2	180.2	263.2	255.5	64.6	77.2	115.7	108.5	28.3	34.2	52.7	52.0	59.3	68.9	94.9	95.0
Heat	2.5	4.4	15.1	16.9	0.1	1.0	8.7	8.5	-	-	-	1.8	2.5	3.4	6.4	6.7
Fuel Shares (%)																
Coal	*13.3*	*11.6*	*8.6*	*8.5*	*7.7*	*6.4*	*5.8*	*6.0*	*14.3*	*14.3*	*13.8*	*14.0*	*19.0*	*16.5*	*9.6*	*8.7*
Oil	*49.1*	*49.3*	*37.1*	*38.2*	*39.8*	*47.0*	*32.4*	*35.0*	*65.6*	*60.5*	*51.7*	*50.1*	*52.6*	*47.6*	*35.3*	*35.6*
Gas	*21.1*	*20.1*	*25.5*	*24.5*	*35.6*	*27.8*	*31.7*	*29.4*	*2.3*	*3.6*	*9.1*	*9.7*	*12.8*	*17.9*	*26.2*	*26.3*
Comb. Renewables & Wastes	*1.7*	*1.9*	*5.5*	*5.5*	*2.8*	*2.8*	*7.9*	*7.9*	*0.9*	*1.3*	*2.6*	*2.4*	*0.9*	*1.2*	*3.9*	*3.9*
Geothermal	-	-	-	-	-	-	-	-	-	-	*0.1*	*0.1*	-	-	-	-
Solar/Wind/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electricity	*14.6*	*16.6*	*22.0*	*21.9*	*14.1*	*15.8*	*20.6*	*20.0*	*16.9*	*20.3*	*22.7*	*22.9*	*14.1*	*16.1*	*23.5*	*23.9*
Heat	*0.2*	*0.4*	*1.3*	*1.5*	-	*0.2*	*1.5*	*1.6*	-	-	-	*0.8*	*0.6*	*0.8*	*1.6*	*1.7*
TRANSPORT[7]	**697.5**	**796.0**	**1172.6**	**1174.0**	**455.8**	**498.7**	**663.5**	**661.9**	**60.9**	**80.3**	**158.2**	**160.5**	**180.9**	**217.0**	**350.8**	**351.6**
TOTAL OTHER SECTORS[8]	**900.3**	**959.4**	**1140.3**	**1149.7**	**464.9**	**473.1**	**537.1**	**521.7**	**69.6**	**83.9**	**169.4**	**171.6**	**365.8**	**402.5**	**433.8**	**456.5**
Coal[1]	81.5	74.5	11.1	11.1	14.0	14.5	2.3	2.5	8.3	9.1	1.0	0.8	59.2	50.9	7.8	7.8
Oil	390.0	346.2	254.5	263.6	158.1	123.6	75.4	76.8	40.5	44.6	74.5	75.0	191.4	178.0	104.6	111.9
Gas	237.5	284.7	387.5	387.2	185.0	195.7	214.7	205.2	5.7	8.3	24.2	24.7	46.8	80.7	148.6	157.3
Comb. Renewables & Wastes[2]	29.2	40.5	46.6	46.3	10.8	20.1	15.0	14.1	2.0	1.7	2.2	2.2	16.4	18.7	29.5	29.9
Geothermal	0.0	0.1	1.5	1.6	-	-	0.4	0.4	-	-	0.1	0.1	0.0	0.1	1.1	1.1
Solar/Wind/Other	-	0.0	2.9	2.9	-	-	1.4	1.4	-	0.0	0.9	0.9	-	0.0	0.6	0.6
Electricity	157.1	203.7	410.5	410.4	97.0	119.2	225.9	219.3	13.2	20.1	64.0	65.0	46.8	64.5	120.7	126.1
Heat	5.0	9.8	25.6	26.6	-	0.0	2.1	2.0	0.0	0.1	2.6	2.9	5.0	9.7	20.9	21.7

Table A18 *(continued)*

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				IEA North America				IEA Pacific				IEA Europe			
	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001
DEMAND																Unit: Mtoe
Fuel Shares (%)																
Coal	*9.1*	*7.8*	*1.0*	*1.0*	*3.0*	*3.1*	*0.4*	*0.5*	*11.9*	*10.8*	*0.6*	*0.5*	*16.2*	*12.6*	*1.8*	*1.7*
Oil	*43.3*	*36.1*	*22.3*	*22.9*	*34.0*	*26.1*	*14.0*	*14.7*	*58.1*	*53.2*	*44.0*	*43.7*	*52.3*	*44.2*	*24.1*	*24.5*
Gas	*26.4*	*29.7*	*34.0*	*33.7*	*39.8*	*41.4*	*40.0*	*39.3*	*8.1*	*9.9*	*14.3*	*14.4*	*12.8*	*20.0*	*34.3*	*34.5*
Comb. Renewables & Wastes	*3.2*	*4.2*	*4.1*	*4.0*	*2.3*	*4.3*	*2.8*	*2.7*	*2.9*	*2.0*	*1.3*	*1.3*	*4.5*	*4.7*	*6.8*	*6.5*
Geothermal	–	–	*0.1*	*0.1*	–	–	*0.1*	*0.1*	–	–	–	–	–	–	*0.2*	*0.2*
Solar/Wind/Other	–	–	*0.3*	*0.2*	–	–	*0.3*	*0.3*	–	–	*0.6*	*0.5*	–	–	*0.1*	*0.1*
Electricity	*17.4*	*21.2*	*36.0*	*35.7*	*20.9*	*25.2*	*42.1*	*42.0*	*18.9*	*24.0*	*37.8*	*37.9*	*12.8*	*16.0*	*27.8*	*27.6*
Heat	*0.6*	*1.0*	*2.2*	*2.3*	–	–	*0.4*	*0.4*	–	*0.1*	*1.6*	*1.7*	*1.4*	*2.4*	*4.8*	*4.8*
ENERGY TRANSFORMATION AND LOSSES																
ELECTRICITY GENERATION[9]																
INPUT (Mtoe)	**983.6**	**1207.7**	**1998.3**	**2023.6**	**543.3**	**649.8**	**1020.2**	**1019.4**	**113.1**	**152.5**	**340.2**	**352.2**	**327.2**	**405.4**	**638.0**	**651.9**
OUTPUT (Mtoe)	**371.4**	**459.1**	**792.2**	**782.4**	**192.3**	**233.8**	**398.3**	**382.8**	**48.4**	**63.1**	**134.8**	**135.1**	**130.7**	**162.2**	**259.1**	**264.4**
(TWh gross)	4318.4	5338.4	9211.7	9097.3	2235.6	2718.8	4630.9	4451.7	563.2	733.7	1567.5	1571.5	1519.7	1885.9	3013.3	3074.1
Output Shares (%)																
Coal	*37.2*	*37.8*	*38.4*	*37.7*	*42.1*	*43.3*	*48.5*	*47.2*	*15.7*	*15.7*	*30.9*	*33.1*	*37.9*	*38.5*	*26.7*	*26.4*
Oil	*25.6*	*19.7*	*5.3*	*5.1*	*15.4*	*12.5*	*2.9*	*3.4*	*63.2*	*46.9*	*11.1*	*9.2*	*26.6*	*19.5*	*5.9*	*5.6*
Gas	*11.9*	*11.2*	*16.3*	*16.9*	*17.0*	*13.4*	*14.4*	*15.3*	*2.4*	*11.0*	*20.6*	*20.7*	*7.8*	*8.2*	*16.8*	*17.3*
Comb. Renewables & Wastes	*0.2*	*0.2*	*1.6*	*1.5*	*0.0*	*0.1*	*1.7*	*1.7*	*0.1*	*0.1*	*1.0*	*0.6*	*0.4*	*0.5*	*1.6*	*1.7*
Nuclear	*4.4*	*10.7*	*24.1*	*24.9*	*4.7*	*11.2*	*18.8*	*19.9*	*1.7*	*10.0*	*27.5*	*27.5*	*4.9*	*10.3*	*30.5*	*30.8*
Hydro	*20.6*	*20.1*	*13.8*	*13.0*	*20.6*	*19.4*	*13.2*	*12.0*	*16.7*	*16.0*	*8.5*	*8.0*	*22.2*	*22.8*	*17.5*	*17.1*
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*	*0.3*	*0.4*	–	–	*0.1*	*0.2*	–	*0.0*	*0.1*	*0.1*	*0.0*	*0.0*	*0.8*	*0.9*
TOTAL LOSSES (Mtoe)	**964.5**	**1102.6**	**1541.1**	**1569.7**	**529.2**	**605.8**	**787.2**	**798.6**	**118.8**	**142.2**	**280.2**	**287.5**	**316.5**	**354.7**	**473.7**	**483.5**
of which:																
Electricity and Heat Generation[10]	603.5	733.0	1157.8	1189.4	351.0	415.0	606.7	621.9	64.6	89.2	202.1	211.2	187.9	228.9	348.9	356.3
Other Transformation	80.4	96.0	55.5	56.3	1.3	33.4	0.5	1.3	32.1	25.0	33.8	32.6	47.1	37.6	21.2	22.5
Own Use and Losses[11]	280.5	273.7	327.8	323.9	176.9	157.4	180.0	175.4	22.2	28.1	44.3	43.8	81.5	88.2	103.5	104.8
Statistical Differences	**–15.6**	**0.4**	**3.0**	**7.4**	**–10.9**	**5.6**	**5.0**	**5.4**	**–5.5**	**–1.9**	**3.5**	**2.8**	**0.8**	**–3.3**	**–5.4**	**–0.8**

Table A18 *(continued)*

Energy Balances and Key Statistical Data for IEA and Regions

	IEA Total				IEA North America				IEA Pacific				IEA Europe			
	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001	1973	1979	2000	2001
INDICATORS																Unit: Mtoe
GDP (billion 1995 US$)	13078	15529	27134	27311	4324	5185	9662	9695	2952	3638	6820	6826	5802	6707	10652	10790
Population (millions)	811	851	981	995	234	249	306	317	159	171	197	198	417	430	478	480
TPES/GDP[12]	0.27	0.25	0.19	0.19	0.44	0.40	0.26	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	0.69	0.70	0.87	0.84	0.80	0.83	0.26	0.29	0.46	0.48	0.40	0.50	0.65	0.63
Per Capita TPES[13]	4.43	4.64	5.15	5.09	8.09	8.31	8.34	7.98	2.58	2.76	4.28	4.29	3.08	3.25	3.47	3.52
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	0.06	0.06
TFC/GDP[12]	0.20	0.18	0.13	0.13	0.32	0.28	0.18	0.18	0.10	0.09	0.08	0.08	0.17	0.16	0.11	0.11
Per Capita TFC[13]	3.26	3.34	3.58	3.51	5.88	5.86	5.76	5.44	1.87	1.94	2.84	2.83	2.32	2.44	2.49	2.51
Energy-related CO_2 Emissions (Mt CO_2)[14]	9836.74	10369.10	11755.50	11818.04	5079.05	5298.77	6218.25	6192.76	1131.93	1249.33	1932.19	1970.59	3625.76	3821.00	3605.06	3654.69
CO_2 Emissions from Bunkers (Mt CO_2)	299.42	312.97	477.03	444.50	51.53	105.19	152.78	119.98	69.58	53.32	68.45	65.67	178.31	154.46	255.80	258.85
GROWTH RATES (% per year)																Unit: Mtoe
	73-79	**79-01**	**91-01**	**00-01**	**73-79**	**79-01**	**91-01**	**00-01**	**73-79**	**79-01**	**91-01**	**00-01**	**73-79**	**79-01**	**91-01**	**00-01**
TPES	1.6	1.2	1.6	0.3	1.5	1.0	1.6	-1.0	2.3	2.8	2.8	0.7	1.4	0.9	1.0	1.9
Coal	1.5	1.1	0.8	1.8	2.9	1.9	1.9	0.5	-0.2	3.9	3.7	8.8	0.5	-1.4	-2.5	-0.1
Oil	0.7	0.1	1.4	0.5	1.3	0.1	1.8	1.2	1.3	1.0	1.4	-2.8	-0.2	-0.4	0.7	1.5
Gas	1.3	1.8	2.5	-1.8	-1.0	0.6	1.4	-5.5	20.3	7.0	4.9	1.8	7.5	3.3	4.0	3.2
Comb. Renewables & Wastes	4.4	2.7	1.8	-1.1	4.8	1.5	1.0	-3.2	2.3	6.1	3.9	-1.8	3.9	4.3	2.4	1.7
Nuclear	20.4	6.7	2.3	2.0	19.7	5.2	1.9	1.6	40.1	8.8	4.8	0.2	17.4	7.8	1.8	3.2
Hydro	3.2	0.5	0.1	-6.7	2.3	0.1	-1.1	-12.6	3.8	0.4	-1.0	-4.9	4.1	1.0	2.0	-0.3
Geothermal	4.9	5.4	0.6	0.9	9.0	6.4	-1.1	-1.5	4.7	5.5	4.9	5.0	0.2	3.2	1.8	3.7
Solar/Wind/Other	7.2	23.7	23.6	7.3	-	-	20.6	-2.8	-	18.9	23.9	-2.0	-1.4	22.9	25.6	18.1
TFC	**1.2**	**1.0**	**1.6**	**-0.6**	**1.0**	**0.8**	**1.8**	**-2.1**	**1.8**	**2.5**	**2.4**	**-0.1**	**1.3**	**0.7**	**1.0**	**1.5**
Electricity Consumption	3.6	2.7	2.1	-1.1	3.3	2.5	1.8	-4.0	4.5	3.7	2.9	0.3	3.8	2.4	2.1	2.5
Energy Production	2.0	1.6	1.3	1.6	0.8	0.9	0.8	2.0	4.3	5.2	3.9	4.6	5.1	2.1	1.3	-0.4
Net Oil Imports	0.6	-0.5	1.9	2.8	6.2	1.1	5.6	6.4	1.3	0.8	1.2	-5.0	-2.4	-2.8	-1.4	6.4
GDP	2.9	2.7	2.4	0.7	3.1	3.0	3.3	0.3	3.5	3.0	1.6	0.1	2.4	2.3	2.1	1.3
Growth in the TPES/GDP Ratio	-1.3	-1.5	-0.7	-0.4	-1.5	-2.0	-1.6	-1.3	-1.2	-0.2	1.2	0.7	-1.0	-1.4	-1.0	0.6
Growth in the TFC/GDP Ratio	-1.7	-1.7	-0.7	-1.2	-2.0	-2.2	-1.5	-2.4	-1.7	-0.5	0.8	-0.2	-1.1	-1.6	-1.0	0.2

Table A18 (Footnotes)

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 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 2001 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.

e = estimate.

GOVERNMENT ENERGY R&D BUDGETS

Table B1

IEA Government R&D Budgets in National Currencies

(millions except for Japanese and Turkish currencies. which are in billions)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	362.4	367.6	315.7	322.0	322.0	300.6	265.9	249.6	248.6	266.5	293.2	298.4
United States	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	2 814.4	2 847.3
Australia	..	..	110.4	..	116.3	..	157.6	..	..	..	..	..
Japan	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	..	4.7	3.8	4.4	5.3	5.1	6.4	6.1	6.4	8.9	10.1
Austria	17.8	15.3	20.8	23.6	24.1	24.3	25.7	27.4	26.5	..	..	..
Belgium[2]	8.9	9.6	16.6	17.4	43.8	56.4	54.5	70.4	49.7	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	262.0	310.0	302.0	259.0	245.1	217.6	258.3	316.2	312.6	327.1	328.0	159.6
Finland	36.1	38.3	39.8	48.2	58.2	56.1	79.4	81.9	77.6	65.5	62.6	..
France	466.3	444.3	448.9	424.3	501.9	483.2	488.2	527.1	617.1	586.7	441.6	403.5
Germany[3]	441.2	363.1	366.0	300.0	262.2	285.0	259.2	280.1	187.7	268.6	292.5	278.0
Greece	4.6	3.5	3.3	3.3	6.1	7.5	14.3	..	..	5.7	7.0	8.8
Hungary	..	..	..	..	44.6	10.5	..	122.0	86.1	389.6	350.9	740.6
Ireland	..	..	..	..	..	..	..	..	..	..	..	3.7
Italy	407.3	..	229.7	225.4	243.8	237.8	221.9	222.1	..	262.7	283.0	286.6
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	138.0	136.0	153.6	165.9	121.2	127.1	144.9	137.3	139.8	126.3	172.3	..
Norway	368.5	391.9	366.5	355.7	304.4	288.3	281.8	277.4	371.6	370.0	384.5	387.9
Portugal	5.1	4.7	3.2	2.7	1.4	1.7	1.2	1.6	2.0	1.5	1.0	2.6
Spain	78.0	66.0	58.0	64.1	60.0	59.3	60.3	47.4	50.0	49.3	49.7	50.8
Sweden	567.0	714.1	553.1	598.0	452.9	413.1	467.0	440.0	590.0	646.5	763.1	..
Switzerland	199.0	220.6	223.3	220.8	215.1	206.7	196.9	182.6	179.9	166.8	172.8	180.0
Turkey[5]	9.7	23.6	41.2	42.1	189.1	274.8	1 608.9	1 387.8	1 406.3	2 730.6	9 661.9	23 107.5
United Kingdom	142.9	133.5	98.8	50.9	52.9	36.4	49.3	43.8	42.8	48.0	30.4	38.1
European Commission[6]	..	..	..	..	..	..	..	..	..	..	..	..

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
2. Figure for 1991 refers to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
3. Data do not include the new Länder of Germany prior to 1992.
4. Luxembourg has no energy R&D programme.
5. The strong increase in the budget is due to high inflation rate in Turkey and to new RD&D activities.
6. No information on R&D budgets has been provided by the European Commission.

Note: Budgets provided for recent years by some countries may have been estimated.

Source: Country submissions.

Table B2

IEA Government R&D Budgets in 2002 National Currencies

(millions except for Japanese and Turkish currencies. which are in billions)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	425.4	425.9	360.7	363.7	355.8	326.7	285.6	269.2	263.9	272.1	296.2	298.4
United States	3 203.8	2 724.9	2 663.8	2 813.0	2 716.1	2 377.8	2 133.5	2 169.8	2 423.1	2 345.2	2 845.3	2 847.3
Australia	..	..	131.7	..	135.7	..	176.6	..	..	..	..	..
Japan	367.0	370.0	378.9	405.8	418.5	434.6	412.6	417.0	414.6	426.8	428.9	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	2.4	..	5.4	4.4	4.9	5.8	5.6	6.8	6.6	6.8	8.9	10.1
Austria	21.5	17.9	23.7	26.1	26.0	25.9	27.1	28.7	27.6	..	..	..
Belgium[2]	11.1	11.6	19.3	19.8	49.0	62.5	59.6	75.7	52.8	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	332.2	381.9	367.0	309.3	287.7	249.2	289.6	350.9	337.9	341.0	332.8	159.6
Finland	44.4	46.7	47.3	56.3	65.3	63.1	87.5	87.6	83.2	68.4	63.5	..
France	544.9	509.3	502.4	466.6	542.6	515.1	513.9	550.0	640.8	605.8	449.5	403.5
Germany[3]	534.2	418.6	407.0	325.4	278.7	299.9	271.0	289.6	193.1	276.9	297.3	278.0
Greece	10.2	6.8	5.5	5.0	8.4	9.6	17.1	..	..	6.1	7.2	8.8
Hungary	..	..	..	..	101.4	19.7	..	171.4	111.6	460.0	380.5	740.6
Ireland	..	..	..	..	..	..	..	..	..	..	..	3.7
Italy	580.9	..	301.6	286.0	294.5	272.9	248.6	242.3	..	275.9	289.7	286.6
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	181.9	175.3	194.1	204.9	147.0	152.3	170.3	158.6	159.0	138.0	178.8	..
Norway	516.4	551.2	504.6	490.9	407.2	369.8	350.8	347.9	438.5	376.4	384.5	387.9
Portugal	8.7	7.2	4.6	3.6	1.7	2.2	1.4	1.9	2.2	1.6	1.0	2.6
Spain	117.5	93.1	78.4	83.2	74.3	70.9	70.5	54.1	55.5	52.9	51.2	50.8
Sweden	687.3	857.1	646.3	682.8	499.5	449.4	499.1	466.2	621.0	674.0	779.4	..
Switzerland	228.1	246.1	242.7	235.9	227.5	217.6	207.8	192.7	188.6	172.7	176.6	180.0
Turkey	3 252.5	4 837.5	5 031.1	2 492.1	5 981.5	4 888.1	15 762.7	7 739.5	5 041.3	6 530.6	14 294.0	23 107.5
United Kingdom	190.9	171.4	123.7	62.9	63.8	42.4	55.9	48.3	46.0	50.4	31.3	38.1
European Commission[5]	..	..	..	..	..	..	..	..	..	..	..	..

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
2. Figure for 1991 refers to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
3. Data do not include the new Länder of Germany prior to 1992.
4. Luxembourg has no energy R&D programme.
5. No information on R&D budgets has been provided by the European Commission.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B3

IEA Government R&D Budgets

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e	2002 exch. rates (Unit per $)
Canada[1]	271.6	272.0	230.3	232.2	227.2	208.6	182.4	171.9	168.5	173.7	189.1	190.5	1.566
United States	3 203.8	2 724.9	2 663.8	2 813.0	2 716.1	2 377.8	2 133.5	2 169.8	2 423.1	2 345.2	2 845.3	2 847.3	1.0
Australia	..	..	71.6	..	73.7	..	95.9	..	..	..	..	..	1.841
Japan	2 928.8	2 952.9	3 023.8	3 238.9	3 339.8	3 468.2	3 293.2	3 327.8	3 309.1	3 406.1	3 423.4	..	125.30
Korea	..	..	..	..	..	..	..	..	..	..	..	..	1 251.0
New Zealand	1.1	..	2.5	2.0	2.3	2.7	2.6	3.2	3.0	3.1	4.1	4.7	2.163
Austria	20.3	16.9	22.3	24.6	24.5	24.4	25.6	27.1	26.0	..	..	..	1.061
Belgium [2]	10.4	10.9	18.2	18.6	46.2	58.9	56.2	71.4	49.7	..	..	..	1.061
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..	32.73
Denmark	42.1	48.4	46.6	39.2	36.5	31.6	36.7	44.5	42.9	43.3	42.2	20.2	7.884
Finland	41.8	44.0	44.6	53.0	61.5	59.5	82.4	82.5	78.4	64.5	59.9	..	1.061
France	513.6	480.0	473.5	439.7	511.4	485.5	484.3	518.3	604.0	571.0	423.7	380.3	1.061
Germany[3]	503.5	394.5	383.6	306.7	262.7	282.7	255.4	273.0	182.0	261.0	280.2	262.0	1.061
Greece	9.6	6.4	5.2	4.8	8.0	9.1	16.1	..	..	5.8	6.8	8.3	1.061
Hungary	..	..	..	..	0.4	0.1	..	0.7	0.4	1.8	1.5	2.9	257.4
Ireland	..	..	..	..	..	..	..	..	..	..	..	3.5	1.061
Italy	547.5	..	284.2	269.6	277.6	257.2	234.3	228.4	..	260.1	273.1	270.1	1.061
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–	1.061
Netherlands	171.5	165.2	182.9	193.1	138.5	143.5	160.5	149.5	149.9	130.1	168.5	..	1.061
Norway	64.7	69.0	63.2	61.5	51.0	46.3	43.9	43.6	54.9	47.1	48.1	48.6	7.986
Portugal	8.2	6.8	4.3	3.4	1.6	2.0	1.3	1.8	2.1	1.5	0.9	2.4	1.061
Spain	110.7	87.7	73.9	78.4	70.0	66.9	66.5	51.0	52.3	49.9	48.3	47.9	1.061
Sweden	70.7	88.2	66.5	70.2	51.4	46.2	51.3	48.0	63.9	69.3	80.2	..	9.72
Switzerland	146.5	158.1	155.9	151.5	146.1	139.8	133.5	123.8	121.1	110.9	113.4	115.6	1.557
Turkey	2.2	3.2	3.3	1.6	4.0	3.2	10.4	5.1	3.3	4.3	9.5	15.3	1512 300
United Kingdom	286.2	257.0	185.5	94.3	95.6	63.6	83.9	72.4	69.0	75.6	47.0	57.1	0.667
Total Reported[5]	**8 954.8**	**..**	**8 005.6**	**8 096.5**	**8 146.1**	**7 777.7**	**7 450.0**	**7 413.4**	**..**	**..**	**..**	**..**	
European Commission[6]	..	..	..	..	..	..	..	..	..	..	..	..	1.117

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
2. Figure for 1991 refers to Wallonia only. From 1991 to 1994, nuclear data are not available and therefore are not included in the budget.
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.
6. No information on R&D budgets has been provided by the European Commission.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B4

IEA Government Budgets on Energy R&D

(per thousand units of GDP)

	R&D/GDP including nuclear research								
	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	0.42	0.40	0.36	0.30	0.27	0.25	0.25	0.27	0.26
United States	0.35	0.33	0.28	0.24	0.23	0.25	0.23	0.28	0.27
Australia	..	0.24	..	0.29	..	..	..	..	..
Japan	0.88	0.90	0.90	0.84	0.86	0.85	0.85	0.86	..
Korea	..	..	..	..	..	..	..	..	..
New Zealand	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.08
Austria	0.14	0.14	0.14	0.14	0.14	0.13	..	..	..
Belgium	0.09	0.22	0.27	0.25	0.31	0.21	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..
Denmark	0.27	0.24	0.21	0.23	0.27	0.26	0.25	0.24	0.12
Finland	0.55	0.61	0.57	0.74	0.71	0.64	0.50	0.46	..
France	0.37	0.42	0.40	0.39	0.40	0.46	0.41	0.30	0.27
Germany	0.17	0.15	0.16	0.14	0.15	0.09	0.13	0.14	0.13
Greece	0.05	0.08	0.09	0.15	..	..	0.05	0.05	0.06
Hungary	..	0.01	0.00	..	0.01	0.01	0.03	0.02	0.04
Ireland	..	..	..	..	..	..	..	..	0.03
Italy	0.26	0.26	0.24	0.22	0.21	..	0.23	0.23	0.23
Luxembourg[2]	–	–	–	–	–	–	–	–	–
Netherlands	0.57	0.40	0.40	0.43	0.39	0.37	0.31	0.40	..
Norway	0.40	0.32	0.28	0.25	0.24	0.30	0.25	0.25	0.25
Portugal	0.04	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.02
Spain	0.16	0.14	0.13	0.12	0.09	0.09	0.08	0.08	0.07
Sweden	0.37	0.26	0.24	0.26	0.23	0.29	0.31	0.35	..
Switzerland	0.62	0.59	0.56	0.53	0.48	0.46	0.41	0.42	0.43
Turkey	0.01	0.02	0.02	0.06	0.03	0.02	0.02	0.05	0.08
United Kingdom	0.07	0.07	0.05	0.06	0.05	0.05	0.05	0.03	0.04

	R&D/GDP excluding nuclear research								
	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	0.20	0.19	0.20	0.17	0.16	0.17	0.18	0.21	0.21
United States	0.29	0.26	0.24	0.20	0.20	0.22	0.20	0.25	0.25
Australia	..	0.22	..	0.29	..	..	..	..	..
Japan	0.22	0.22	0.22	0.21	0.25	0.24	0.25	0.25	..
Korea	..	..	..	..	..	..	..	..	..
New Zealand	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.08
Austria	0.13	0.13	0.13	0.13	0.13	0.12	..	..	..
Belgium	0.09	0.10	0.10	0.08	0.09	0.04	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..
Denmark	0.26	0.24	0.20	0.23	0.25	0.23	0.23	0.22	0.10
Finland	0.48	0.55	0.49	0.67	0.64	0.56	0.44	0.41	..
France	0.04	0.04	0.04	0.03	0.03	0.04	0.04	0.05	0.06
Germany	0.07	0.06	0.07	0.06	0.06	0.05	0.06	0.08	0.07
Greece	0.05	0.07	0.08	0.14	..	..	0.04	0.05	0.06
Hungary	..	0.01	0.00	..	0.01	0.00	0.03	0.02	0.04
Ireland	..	..	..	..	..	..	..	..	0.03
Italy	0.15	0.16	0.14	0.12	0.12	..	0.13	0.14	0.15
Luxembourg[2]	–	–	–	–	–	–	–	–	–
Netherlands	0.42	0.35	0.36	0.38	0.36	0.34	0.26	0.35	..
Norway	0.34	0.26	0.23	0.20	0.19	0.25	0.21	0.21	0.22
Portugal	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.01
Spain	0.09	0.07	0.07	0.06	0.05	0.05	0.04	0.04	0.04
Sweden	0.30	0.23	0.21	0.23	0.21	0.27	0.29	0.33	..
Switzerland	0.44	0.43	0.40	0.37	0.34	0.34	0.28	0.29	0.31
Turkey	0.00	0.02	0.01	0.05	0.02	0.02	0.02	0.05	0.08
United Kingdom	0.04	0.04	0.03	0.04	0.03	0.03	0.03	0.02	0.02

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
2. Luxembourg has no energy R&D programme.
Note: Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B5

IEA Government R&D Budgets for Conservation

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	27.5	23.3	25.5	37.9	37.0	37.9	36.6	37.3	39.6	31.0	39.3	48.1
United States	267.3	343.2	361.8	492.9	570.7	456.9	420.8	451.5	507.4	557.5	588.0	578.1
Australia	..	..	4.3	..	8.8	..	6.2	..	..	..	..	..
Japan[2]	16.4	16.3	25.2	211.4	225.1	257.1	250.0	403.6	491.4	535.9	568.9	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	0.5	..	0.4	0.3	0.5	0.5	0.4	0.2	0.5	0.5	0.3	0.4
Austria	6.4	5.4	8.0	9.8	8.9	9.0	8.5	6.8	7.5	..	..	..
Belgium[3]	7.1	3.1	6.6	9.0	8.1	10.4	9.2	13.5	4.0	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	8.2	9.2	6.6	5.5	4.7	4.9	7.4	8.5	9.4	12.7	9.9	0.3
Finland	13.4	13.8	14.4	15.8	21.5	21.2	35.3	42.8	35.6	26.9	23.9	..
France	17.6	17.0	11.0	7.5	7.2	6.5	4.2	6.0	11.3	11.6	11.3	17.8
Germany[4]	16.3	11.5	10.9	12.5	14.3	20.7	13.5	12.2	11.2	8.7	22.6	17.8
Greece	1.2	0.2	0.2	1.3	1.5	1.9	4.9	..	..	0.5	0.5	1.4
Hungary	..	..	..	..	–	–	..	–	..	0.9	0.1	0.2
Ireland	..	..	..	..	..	..	..	..	..	..	..	2.4
Italy	52.9	..	51.6	48.7	51.4	52.1	48.2	48.1	..	22.9	24.1	23.6
Luxembourg[5]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	55.5	43.7	62.6	48.1	51.1	58.7	61.2	61.2	61.9	40.0	60.8	..
Norway	13.7	16.2	15.5	8.9	2.1	1.9	1.8	1.7	1.6	1.7	1.5	1.9
Portugal	1.1	0.6	1.0	0.4	0.8	0.7	0.6	0.1	0.2	0.2	0.3	0.3
Spain	41.5	12.1	4.7	7.6	5.9	3.6	3.6	6.7	3.1	4.1	2.3	2.1
Sweden	24.0	27.1	21.8	20.6	18.7	21.7	16.1	13.5	20.2	25.0	32.4	..
Switzerland	21.3	23.9	25.4	28.9	27.5	25.7	20.3	19.4	21.4	16.6	17.1	19.3
Turkey	–	–	1.1	–	0.2	0.2	0.1	0.2	0.2	0.5	1.4	3.3
United Kingdom	27.1	33.5	38.0	4.3	2.7	2.3	1.7	0.9	1.2	2.3	–	0.8
Total Reported[6]	**619.3**	**..**	**696.4**	**971.3**	**1 068.7**	**993.9**	**950.4**	**1 133.9**	**..**	**..**	**..**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
2. The items included in Conservation were expanded in 1994. Earlier budgetary data are not comparable.
3. Figure for 1991 refers to Wallonia only.
4. Data do not include the new Länder of Germany prior to 1992.
5. Luxembourg has no energy R&D programme.
6. Yearly totals are not comparable because of missing data.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B6

IEA Government R&D Budgets for Oil & Gas

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	81.8	68.4	49.0	39.4	36.5	42.9	35.9	36.8	37.1	34.1	41.7	36.7
United States	98.1	104.2	186.5	113.0	124.9	85.7	74.0	78.3	77.2	89.6	113.1	102.5
Australia	..	..	30.8	..	25.6	..	53.3	..	..	..	..	..
Japan	93.4	98.2	103.5	109.6	124.8	123.4	119.6	90.0	30.5	24.3	31.2	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	..	1.2	0.4	0.4	0.5	0.5	0.6	0.5	0.5	1.4	2.1
Austria	0.5	0.7	0.3	0.2	0.3	0.6	0.2	0.2	0.1	..	..	..
Belgium	–	–	–	–	–	0.1	0.1	–	0.2	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	–	2.5	2.9	3.2	3.3	2.7	2.4	2.0	2.4	1.8	1.7	–
Finland	–	–	–	–	–	–	2.1	2.3	2.6	1.3	2.5	..
France	34.6	33.1	30.7	30.7	29.4	29.0	28.6	28.3	28.2	29.7	32.4	26.8
Germany[2]	6.9	6.3	3.7	2.6	0.7	–	–	–	–	–	–	–
Greece	–	0.1	0.1	0.6	1.0	1.1	1.7	..	..	–	..	..
Hungary	..	..	..	..	–	–	..	–	–	0.5	0.1	0.1
Ireland	..	..	..	..	..	..	..	..	..	..	..	–
Italy	–	..	–	–	–	–	–	–	..	–	–	–
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	0.7	6.9	9.8	12.5	8.9	8.9	9.9	8.3	7.9	8.7	7.5	..
Norway	18.8	19.7	17.3	27.3	25.4	22.3	21.2	20.3	33.0	25.5	23.6	18.6
Portugal	–	–	–	0.3	0.2	0.1	0.1	0.1	0.1	0.1	–	–
Spain	–	–	–	–	–	–	–	–	0.1	1.4	–	0.2
Sweden	1.8	1.1	–	–	–	–	–	–	–	..	–	..
Switzerland	11.1	12.3	12.3	11.6	11.0	8.6	9.4	8.2	7.8	7.1	7.2	7.7
Turkey	–	0.2	0.1	0.1	2.7	1.9	3.9	0.8	0.1	0.1	1.9	2.1
United Kingdom	1.6	6.9	6.4	5.0	10.8	5.1	7.5	6.0	4.0	4.4	3.3	3.3
Total Reported[4]	**349.4**	**360.6**	**454.7**	**356.4**	**405.8**	**332.9**	**370.4**	**282.1**	**231.9**	**229.0**	**..**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
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.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B7

IEA Government R&D Budgets for Coal

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	23.8	18.0	10.9	7.9	9.8	7.1	2.4	3.9	5.1	3.0	3.1	2.6
United States	845.8	371.2	278.5	446.3	215.6	294.6	104.7	111.9	133.7	125.1	243.5	321.9
Australia	..	..	13.0	..	12.6	..	15.8	..	..	..	..	..
Japan	200.2	205.5	234.0	232.1	214.0	191.1	169.2	153.7	118.4	75.2	39.6	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	0.2	..	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2
Austria	0.4	0.5	1.1	0.6	0.5	1.1	1.4	0.3	0.5	..	..	..
Belgium[2]	0.9	1.3	1.1	1.6	1.3	1.5	2.1	0.4	0.6	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	5.9	6.3	5.1	4.5	2.7	0.8	–	–	–	–	–	–
Finland	4.6	4.4	2.9	3.6	3.1	3.4	3.4	2.8	2.9	2.6	2.1	..
France	5.0	4.9	5.1	5.1	5.1	4.7	4.7	0.1	–	..	–	–
Germany[3]	53.9	39.1	23.1	16.9	12.2	3.3	1.3	1.2	9.6	8.9	16.8	17.7
Greece	1.4	0.6	0.4	0.4	0.7	0.7	2.0	..	..	..	..	..
Hungary	..	..	..	..	–	–	..	–	..	..	0.2	0.2
Ireland	..	..	..	..	..	..	..	..	..	..	..	–
Italy	–	..	–	–	–	–	–	–	..	–	–	–
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	12.7	7.2	7.5	12.8	3.4	3.4	2.8	2.0	0.8	0.1	0.1	..
Norway	0.1	0.1	0.1	–	–	–	–	–	–	–	–	–
Portugal	0.8	1.6	0.6	–	–	–	–	0.1	0.2	0.3	0.2	0.2
Spain	3.4	2.3	1.5	4.2	4.7	4.1	3.8	2.6	5.0	1.7	4.2	3.9
Sweden	1.3	1.4	0.7	0.6	0.4	0.2	0.1	–	–	0.2	0.1	..
Switzerland	1.2	0.2	0.1	0.3	0.4	–	–	–	–	–	–	–
Turkey	2.0	0.6	0.4	0.1	0.2	0.1	3.1	1.6	1.3	1.3	4.6	8.0
United Kingdom	8.4	7.7	13.8	6.0	8.9	8.4	4.1	2.2	1.0	2.6	5.7	4.5
Total Reported[5]	**1 172.2**	**672.9**	**600.1**	**743.3**	**495.7**	**524.7**	**321.3**	**283.3**	**279.5**	**221.2**	**320.4**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
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.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B8

IEA Government R&D Budgets for Conventional Nuclear

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	107.2	117.0	114.0	114.1	111.7	84.8	82.1	68.6	52.3	46.1	38.6	38.8
United States	691.6	263.2	137.7	109.7	95.0	43.3	61.3	21.4	23.8	36.0	47.8	49.2
Australia	..	..	0.7	..	5.0	..	0.7	..	..	..	..	..
Japan	1 618.5	1 656.7	1 709.9	1 758.6	1 924.1	2 033.1	1 948.5	1 914.4	1 943.8	1 855.4	1 940.3	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	..	–	–	–	–	–	–	–	–	–	–
Austria	0.4	0.4	0.5	0.6	0.5	0.8	0.6	–	0.4	..	..	..
Belgium[2]	..	..	..	..	22.5	33.0	33.8	45.6	35.1	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	0.6	0.8	0.8	0.8	0.5	0.5	0.5	2.8	2.7	2.6	2.3	1.9
Finland	8.4	8.4	7.9	6.7	5.7	7.3	6.7	7.0	7.7	6.0	5.5	..
France	373.8	351.7	345.5	324.5	416.3	392.7	399.4	430.4	504.2	470.0	321.4	255.4
Germany[3]	172.3	91.7	81.4	67.0	65.8	51.5	36.5	34.9	19.6	22.5	15.7	8.0
Greece	0.1	–	–	0.2	0.2	0.3	0.2	..	..	..	..	..
Hungary	..	..	..	..	–	–	..	0.2	0.4	..	–	0.5
Ireland	..	..	..	..	..	..	..	..	..	..	..	–
Italy	56.3	..	49.7	50.0	39.8	35.9	35.5	31.9	..	45.9	44.8	43.7
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	22.4	30.9	25.3	12.6	12.0	10.6	10.2	4.1	6.7	1.0	0.9	..
Norway	8.9	9.2	9.2	8.7	8.8	8.4	8.1	9.1	8.6	7.8	7.5	6.9
Portugal	1.3	1.1	0.3	2.2	0.1	0.1	0.1	–	–	–	–	–
Spain	17.9	21.6	18.8	17.8	16.7	16.7	16.4	7.7	5.0	13.5	13.8	13.6
Sweden	1.3	1.4	1.4	1.3	1.2	1.1	0.9	0.9	0.9	0.9	0.9	..
Switzerland	26.8	24.1	23.7	23.8	23.0	19.9	20.4	19.1	13.9	18.9	17.6	16.1
Turkey	–	0.9	1.2	0.9	0.6	0.8	1.2	0.8	0.2	0.1	0.2	0.2
United Kingdom	42.2	37.1	20.7	14.8	13.2	7.0	1.7	3.3	–	–	–	–
Total Reported[5]	**3 150.0**	**..**	**2 548.9**	**2 514.4**	**2 762.6**	**2 747.7**	**2 664.6**	**2 602.4**	**..**	**..**	**..**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
2. From 1991 to 1994, nuclear data are not available.
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.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B9

IEA Government R&D Budgets for Nuclear Breeders

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	–	–	–	–	–	–	–	0.2	0.4	0.4	0.4	0.4
United States	–	–	–	–	–	–	–	–	–	–	–	–
Australia	..	..	–	..	–	..	–	..	..	..	..	..
Japan	494.2	441.8	439.0	395.8	308.6	285.7	245.4	211.9	195.9	334.9	275.6	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	..	–	–	–	–	–	–	–	–	–	–
Austria	–	–	–	–	–	–	–	–	–	..	..	..
Belgium	..	..	..	..	–	–	–	–	–	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	–	–	–	–	–	–	–	..	–	–	–	–
Finland	–	–	0.1	–	0.8	–	–	–	–	–	–	..
France	36.9	26.4	42.0	33.7	14.3	13.8	11.0	20.2	18.7	10.7	–	3.8
Germany[2]	22.1	3.8	–	–	–	–	–	–	–	–	–	–
Greece	–	–	–	–	–	–	–	..	..	..	..	..
Hungary	..	..	..	..	–	–	..	–	–	..	–	–
Ireland	..	..	..	..	..	..	..	..	..	..	..	–
Italy	–	..	–	–	–	–	–	–	..	–	–	–
Luxembourg[3]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	1.7	0.5	0.5	22.2	–	–	–	–	–	13.1	12.9	..
Norway	–	–	–	–	–	–	–	–	–	–	–	–
Portugal	–	–	–	–	–	–	–	–	–	–	–	–
Spain	–	–	–	–	–	–	–	–	–	0.8	–	–
Sweden	4.0	4.3	4.1	4.0	3.6	3.2	2.8	2.9	2.8	2.8	2.8	..
Switzerland	1.0	1.4	1.2	0.5	0.9	0.9	0.3	0.1	0.1	–	0.1	–
Turkey	–	–	–	–	–	–	–	–	–	–	–	–
United Kingdom	120.9	99.4	46.9	1.9	0.2	–	–	–	–	–	–	–
Total Reported[4]	**680.9**	**577.5**	**533.9**	**457.9**	**328.4**	**303.6**	**259.6**	**235.3**	**217.9**	**362.8**	**291.8**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
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.

Note: Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B10

IEA Government R&D Budgets for Nuclear Fusion

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	9.3	9.4	6.1	6.1	5.9	6.6	–	2.4	0.1	0.8	0.8	0.8
United States	346.5	400.2	394.3	378.6	415.4	264.3	238.2	232.9	233.0	246.5	251.2	241.1
Australia	..	..	–	..	–	..	–	..	..	..	..	..
Japan	228.0	244.1	263.1	266.0	273.2	303.4	282.7	229.0	225.6	218.2	187.9	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	..	–	–	–	–	–	–	–	–	–	–
Austria	2.0	1.5	1.7	1.1	1.1	0.6	1.1	2.4	2.5	..	..	..
Belgium[2]	..	..	..	..	3.3	4.6	4.8	5.0	5.5	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	1.9	2.0	1.2	–	–	–	–	1.8	1.8	1.8	1.2	1.3
Finland	–	–	–	–	–	0.9	1.5	1.0	2.4	1.4	1.1	..
France	38.3	39.9	33.9	33.5	34.3	34.2	33.6	29.5	29.4	28.2	30.7	35.8
Germany[3]	119.2	121.7	123.7	106.7	91.4	97.7	106.9	119.1	60.0	118.8	105.6	106.0
Greece	0.1	–	–	–	–	–	–	..	..	..	..	..
Hungary	..	..	..	..	–	–	..	–	–	..	–	–
Ireland	..	..	..	..	..	..	..	..	..	..	..	–
Italy	93.7	..	81.2	65.7	66.4	72.3	70.9	68.0	..	60.0	58.5	47.1
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	10.4	25.4	14.2	16.1	7.0	5.9	8.0	7.5	8.1	9.1	7.2	..
Norway	–	–	–	–	–	–	–	–	–	–	–	–
Portugal	1.7	1.0	0.9	–	–	–	–	–	–	–	–	1.6
Spain	11.2	9.6	10.1	16.3	15.5	15.5	15.3	14.2	16.0	10.0	10.0	9.7
Sweden	8.4	8.2	8.6	9.0	1.6	1.5	1.2	1.2	1.1	1.1	1.0	..
Switzerland	23.9	22.9	22.5	19.3	17.1	20.0	20.7	16.8	17.0	16.1	15.9	16.1
Turkey	–	–	–	–	–	–	–	–	–	–	–	–
United Kingdom	40.2	31.4	30.0	29.6	28.7	21.0	28.9	21.5	23.2	26.9	22.6	21.9
Total Reported[5]	**934.8**	**..**	**991.6**	**948.0**	**961.0**	**848.5**	**813.9**	**752.1**	**..**	**..**	**..**	**..**

1. All data refer to the fiscal year. April 2002 to March 2003 for 2002.
2. From 1991 to 1994. nuclear data are not available.
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.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B11

IEA Government R&D Budgets for Renewables

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	9.2	10.6	9.5	11.0	10.7	10.7	8.2	8.5	10.3	19.2	16.9	17.1
United States	184.9	259.2	248.3	254.7	307.8	227.0	213.8	262.2	273.3	218.0	253.1	247.4
Australia	..	..	7.1	..	3.4	..	5.0	..	..	..	..	..
Japan	106.4	101.8	105.8	97.8	98.3	100.1	99.3	109.9	117.1	141.0	128.0	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	0.4	..	0.7	0.8	0.9	1.1	1.1	1.3	0.9	1.0	1.7	1.2
Austria	4.5	3.9	5.2	6.8	8.0	6.2	7.4	9.7	9.1	..	..	..
Belgium[2]	0.3	1.9	2.2	2.3	3.8	2.8	3.1	1.3	1.0	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	17.7	18.8	20.0	17.4	16.3	13.1	16.9	18.6	15.9	16.0	17.8	9.2
Finland	1.8	1.9	5.7	5.4	5.5	7.0	11.3	8.2	9.0	8.6	7.9	..
France	7.3	7.1	5.2	4.9	4.8	4.5	2.8	3.7	12.2	12.8	17.3	22.3
Germany[3]	105.3	111.0	121.2	80.0	70.6	87.6	68.7	76.9	67.8	71.1	67.5	54.6
Greece	4.3	4.6	3.2	1.7	3.1	2.9	6.1	..	..	1.8	2.6	3.1
Hungary	..	..	..	..	0.4	0.1	..	–	–	0.4	1.0	1.7
Ireland	..	..	..	..	..	..	..	..	..	..	..	0.6
Italy	35.2	..	26.1	29.5	40.2	37.6	34.6	32.3	..	22.1	36.5	49.0
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	34.6	20.6	20.5	25.6	22.9	27.6	36.7	40.3	42.0	31.4	44.2	..
Norway	11.1	12.2	9.7	8.0	5.2	4.8	4.8	5.6	5.5	5.5	4.3	4.0
Portugal	1.8	2.4	1.5	0.6	0.5	1.1	0.6	1.2	1.3	0.8	0.4	0.3
Spain	16.1	22.0	19.8	14.5	14.0	14.0	14.0	17.5	14.9	16.2	15.2	15.5
Sweden	10.2	24.8	12.4	15.0	11.6	7.4	7.6	12.3	12.0	23.3	25.2	..
Switzerland	31.7	37.6	39.2	37.0	36.1	34.4	36.4	35.4	36.3	26.3	25.4	25.7
Turkey	0.1	1.2	0.3	0.4	0.1	0.1	1.9	1.6	1.1	1.2	0.4	0.6
United Kingdom	34.3	31.0	28.5	16.9	16.5	10.8	7.3	5.4	7.4	6.9	9.4	19.5
Total Reported[5]	**617.1**	**..**	**692.1**	**630.2**	**680.8**	**601.1**	**587.5**	**652.0**	**..**	**..**	**..**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
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.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B12

Total Reported Government R&D Budgets for Renewable Energy Sources

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Solar Heating	53.5	257.9	51.9	55.7	47.0	31.6	33.4	30.8	28.4	34.4	30.4	..
Solar Photo-Electric	209.5	144.5	374.3	218.5	236.4	212.3	212.2	237.1	239.7	267.7	244.9	..
Solar Thermal-Electric	43.7	18.4	22.5	58.0	51.4	44.2	43.1	30.8	31.4	21.4	39.3	..
Wind	89.2	66.5	76.8	86.7	111.6	105.1	91.2	95.4	91.9	82.7	99.7	..
Ocean	12.0	3.0	4.2	3.9	2.2	2.0	2.2	10.8	6.6	7.1	10.1	..
Biomass	106.8	81.8	76.9	133.8	138.7	124.7	126.5	172.8	164.0	142.1	173.1	..
Geothermal	97.5	84.6	76.1	62.3	79.1	69.1	68.5	65.5	62.0	51.0	60.4	..
Large Hydro (>10 MW)	4.3	8.5	8.1	9.7	12.6	9.1	7.0	5.7	6.7	4.6	1.9	..
Small Hydro (<10 MW)	0.5	7.4	1.4	1.7	1.7	2.8	3.4	3.1	6.5	5.7	3.2	..
TOTAL	**617.1**	**672.5**	**692.1**	**630.2**	**680.8**	**601.1**	**587.5**	**652.0**	**637.3**	**623.5**	**674.9**	**..**

Notes: Yearly totals are not comparable because of missing data (see Table B11). Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B13

IEA Government R&D Budgets for Electricity

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	3.1	8.3	9.0	8.4	8.2	7.0	3.9	4.2	4.3	14.7	18.8	19.1
United States	67.4	48.2	49.8	133.6	148.4	133.8	136.3	135.4	134.4	128.1	136.7	144.9
Australia	..	..	5.3	..	4.3	..	3.9	..	..	..	..	..
Japan	88.6	90.1	55.5	63.5	63.5	66.2	68.0	117.2	122.1	151.9	174.1	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	..	–	–	0.1	0.2	0.2	0.2	0.6	0.5	0.4	0.5
Austria	5.1	3.2	3.4	4.3	3.6	4.2	3.7	4.1	3.0	..	..	..
Belgium[2]	0.1	2.4	7.0	3.9	5.4	5.3	1.7	4.6	2.7	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	4.0	4.7	5.4	3.9	3.8	4.1	4.1	4.2	3.8	3.4	3.7	3.3
Finland	11.0	12.9	11.1	15.5	15.7	11.8	15.2	13.9	14.5	12.5	12.9	..
France	–	–	–	–	–	–	–	–	–	0.7	1.9	4.2
Germany[3]	5.8	4.4	2.4	2.9	2.0	11.4	19.7	20.9	7.5	20.4	39.9	46.2
Greece	0.9	0.1	–	0.1	0.1	0.1	0.2	..	..	2.1	2.2	2.4
Hungary	..	..	..	..	–	–	..	0.2	–	..	–	0.2
Ireland	..	..	..	..	..	..	..	..	..	..	..	0.4
Italy	51.7	..	10.9	19.0	15.1	15.5	14.2	14.9	..	77.4	75.5	73.7
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	1.7	20.2	33.1	35.8	15.3	17.3	17.7	12.1	10.1	9.5	9.4	..
Norway	0.8	3.3	3.2	3.2	4.0	3.0	2.6	2.4	2.0	5.7	2.8	3.9
Portugal	–	–	–	–	–	–	–	–	–	–	0.1	–
Spain	–	–	–	–	0.3	0.3	0.3	0.4	1.2	1.6	0.8	0.8
Sweden	2.4	1.8	3.4	8.3	3.9	1.0	9.5	6.8	14.0	7.2	8.8	..
Switzerland	20.7	24.9	20.9	18.2	18.3	19.5	15.3	16.9	16.4	17.8	20.5	20.6
Turkey	–	–	0.1	0.1	–	–	0.1	0.1	0.5	1.1	0.7	0.7
United Kingdom	2.2	3.1	–	6.9	5.5	1.9	1.9	2.0	2.3	2.7	2.5	2.8
Total Reported[5]	**265.6**	**..**	**220.6**	**327.7**	**317.5**	**302.5**	**318.8**	**360.2**	**..**	**..**	**..**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
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.

Note: Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B13a

IEA Government R&D Budgets for Energy Systems Analysis & Others

(US$ million at 2002 prices and exchange rates)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002e
Canada[1]	9.7	16.9	6.3	7.6	7.4	11.6	13.3	10.1	19.2	24.5	29.5	27.0
United States	702.1	935.2	1 007.0	884.1	838.3	872.3	884.3	876.1	1 040.2	944.5	1 211.7	1 162.2
Australia	..	..	10.3	..	14.1	..	11.0	..	..	..	..	..
Japan	83.2	98.2	87.8	104.1	108.2	108.1	110.6	98.0	64.1	69.2	77.7	..
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	–	..	–	0.2	0.1	–	–	0.6	0.3	0.3	0.1	0.3
Austria	1.0	1.4	2.1	1.1	1.6	2.0	2.7	3.5	2.9	..	..	..
Belgium[2]	2.0	2.2	1.2	1.8	1.8	1.1	1.4	1.0	0.6	..	..	..
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark	3.7	4.2	4.5	3.9	5.3	5.5	5.4	6.6	6.7	5.0	5.6	4.3
Finland	2.6	2.5	2.6	6.1	9.1	7.9	7.1	4.4	3.7	5.4	3.9	..
France	–	–	–	–	–	–	–	–	–	7.3	8.6	14.1
Germany[3]	1.8	5.1	17.2	18.1	5.8	10.4	8.8	7.8	6.4	10.6	12.1	11.7
Greece	1.7	0.9	1.3	0.5	1.3	2.1	1.0	..	..	–	..	..
Hungary	..	..	..	..	–	–	..	0.3	–	..	–	–
Ireland	..	..	..	..	..	..	..	..	..	..	..	–
Italy	257.7	..	64.7	56.7	64.7	43.8	30.9	33.3	..	31.8	33.8	33.0
Luxembourg[4]	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	31.7	9.8	9.4	7.5	17.9	11.1	14.0	14.1	12.5	17.3	25.4	..
Norway	11.2	8.4	8.2	5.3	5.5	5.9	5.5	4.5	4.2	1.0	8.4	13.2
Portugal	1.4	0.1	–	–	–	–	–	0.2	0.2	0.2	–	–
Spain	20.6	20.1	18.9	18.1	13.0	12.7	13.0	1.9	7.1	0.6	2.0	2.0
Sweden	17.3	18.1	14.0	11.3	10.2	10.2	13.0	10.4	12.7	8.7	8.9	..
Switzerland	8.8	10.7	10.5	11.9	11.7	10.6	10.5	8.0	8.3	8.1	9.6	10.3
Turkey	–	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.3	0.4
United Kingdom	9.3	6.9	1.1	8.9	9.2	7.1	30.7	31.2	29.9	29.8	3.4	4.2
Total Reported[5]	**1 165.7**	**..**	**1 267.3**	**1 147.4**	**1 125.6**	**1 122.7**	**1 163.4**	**1 112.0**	**..**	**..**	**..**	**..**

1. All data refer to the fiscal year, April 2002 to March 2003 for 2002.
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.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Table B14

IEA Government Energy R&D Expenditure by Country, 2001 and 2002

(US$ million at 2002 prices and exchange rates)

	Australia[1]				Austria[2]			
	2001		2002		2001		2002	
	$	%	$	%	$	%	$	%
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 2001 and 2002.
2. Austria has not provided data for 2001 and 2002.
3. Belgium has not provided data for 2001 and 2002.
4. All data refer to the fiscal year, April 2002 to March 2003 for 2002.

Note: Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Belgium[3]				Canada[4]				Denmark			
2001		2002		2001		2002e		2001		2002e	
$	%	$	%	$	%	$	%	$	%	$	%
..	..	..	..	17.83	9.42	17.54	9.20	8.40	19.91	0.34	1.69
..	..	..	..	8.81	4.66	9.33	4.90	1.12	2.65	–	–
..	..	..	..	9.01	4.76	17.53	9.20	–	–	–	–
..	..	..	..	3.69	1.95	3.75	1.97	0.35	0.82	–	–
..	**..**	**..**	**..**	**39.34**	**20.80**	**48.15**	**25.27**	**9.87**	**23.38**	**0.34**	**1.69**
..	..	..	..	7.20	3.81	4.45	2.34	1.34	3.17	–	–
..	..	..	..	4.61	2.44	3.75	1.97	–	–	–	–
..	..	..	..	15.02	7.94	15.81	8.30	–	–	–	–
..	..	..	..	14.87	7.86	12.70	6.67	0.39	0.91	–	–
..	..	..	..	41.69	22.04	36.71	19.27	1.72	4.09	–	–
..	..	..	..	0.27	0.14	0.28	0.15	–	–	–	–
..	..	..	..	0.52	0.27	0.39	0.21	–	–	–	–
..	..	..	..	1.29	0.68	1.27	0.67	–	–	–	–
..	..	..	..	1.05	0.55	0.64	0.33	–	–	–	–
..	..	..	..	3.12	1.65	2.58	1.36	–	–	–	–
..	**..**	**..**	**..**	**44.81**	**23.69**	**39.29**	**20.62**	**1.72**	**4.09**	**–**	**–**
..	..	..	..	1.37	0.73	1.31	0.69	1.03	2.44	–	–
..	..	..	..	2.84	1.50	2.14	1.12	3.47	8.23	–	–
..	..	..	..	0.30	0.16	0.39	0.20	–	–	–	–
..	..	..	..	4.51	2.38	3.84	2.01	4.50	10.67	–	–
..	..	..	..	1.87	0.99	1.44	0.76	6.47	15.34	8.50	41.99
..	..	..	..	–	–	–	–	1.80	4.27	–	–
..	..	..	..	5.97	3.15	6.78	3.56	5.06	11.98	0.66	3.26
..	..	..	..	0.22	0.12	0.39	0.21	–	–	–	–
..	..	..	..	..	..	2.72	1.42	–	–	–	–
..	..	..	..	..	..	1.92	1.01	–	–	–	–
..	..	..	..	4.36	2.31	4.63	2.43	–	–	–	–
..	**..**	**..**	**..**	**16.93**	**8.95**	**17.08**	**8.97**	**17.84**	**42.26**	**9.16**	**45.24**
..	..	..	..	0.40	0.21	0.42	0.22	–	–	–	–
..	..	..	..	36.40	19.25	36.69	19.25	–	–	–	–
..	..	..	..	0.52	0.27	0.43	0.22	–	–	–	–
..	..	..	..	1.32	0.70	1.26	0.66	2.32	5.49	1.85	9.15
..	..	..	..	0.40	0.21	0.42	0.22	–	–	–	–
..	..	..	..	39.04	20.64	39.21	20.58	2.32	5.49	1.85	9.15
..	..	..	..	0.78	0.41	0.79	0.41	1.20	2.84	1.26	6.20
..	**..**	**..**	**..**	**39.82**	**21.05**	**39.99**	**20.99**	**3.51**	**8.32**	**3.11**	**15.35**
..	..	..	..	10.11	5.34	9.60	5.04	1.34	3.17	0.99	4.89
..	..	..	..	4.93	2.61	3.78	1.99	0.90	2.13	0.19	0.94
..	..	..	..	3.73	1.97	5.68	2.98	1.47	3.48	2.11	10.40
..	**..**	**..**	**..**	**18.77**	**9.92**	**19.06**	**10.01**	**3.71**	**8.78**	**3.29**	**16.23**
..	..	..	..	2.64	1.39	1.61	0.85	2.15	5.09	1.42	7.02
..	..	..	..	26.84	14.19	25.35	13.30	3.41	8.08	2.93	14.46
..	**..**	**..**	**..**	**29.48**	**15.58**	**26.96**	**14.15**	**5.56**	**13.17**	**4.35**	**21.48**
..	**..**	**..**	**..**	**189.14**	**100.00**	**190.54**	**100.00**	**42.21**	**100.00**	**20.24**	**100.00**

Table B14 *(continued)*

IEA Government Energy R&D Expenditure by Country, 2001 and 2002

(US$ million at 2002 prices and exchange rates)

	Finland[1]				France			
	2001		2002		2001		2002e	
	$	%	$	%	$	%	$	%
1.1 Industry	11.33	18.93	..	..	2.01	0.48	3.77	0.99
1.2 Residential. Commercial	6.83	11.41	..	..	1.44	0.34	2.92	0.77
1.3 Transportation	3.94	6.58	..	..	4.22	1.00	6.41	1.69
1.4 Other Conservation	1.77	2.96	..	..	3.65	0.86	4.71	1.24
TOTAL CONSERVATION	**23.88**	**39.88**	**..**	**..**	**11.32**	**2.67**	**17.81**	**4.68**
2.1 Enhanced Oil & Gas	–	–	..	..	–	–	–	–
2.2 Refining. Transp. & Stor.	2.52	4.21	..	..	4.51	1.06	3.68	0.97
2.3 Oil Shale & Tar Sands	–	–	..	..	0.38	0.09	–	–
2.4 Other Oil & Gas	–	–	..	..	27.53	6.50	23.09	6.07
Total Oil & Gas	2.52	4.21	..	..	32.43	7.65	26.77	7.04
3.1 Coal Prod. Prep. & Trans.	0.03	0.05	..	..	–	–	–	–
3.2 Coal Combustion	0.14	0.23	..	..	–	–	–	–
3.3 Coal Conversion	–	–	..	..	–	–	–	–
3.4 Other Coal	1.94	3.25	..	..	–	–	–	–
Total Coal	2.11	3.53	..	..	–	–	–	–
TOTAL FOSSIL FUELS	**4.63**	**7.73**	**..**	**..**	**32.43**	**7.65**	**26.77**	**7.04**
4.1 Solar Heating & Cooling	0.03	0.05	..	..	1.06	0.25	1.13	0.30
4.2 Solar Photo-Electric	–	–	..	..	7.77	1.83	11.97	3.15
4.3 Solar Thermal-Electric	0.15	0.26	..	..	–	–	–	–
Total Solar	0.18	0.30	..	..	8.83	2.08	13.10	3.44
5. Wind	0.68	1.14	..	..	2.40	0.57	3.77	0.99
6. Ocean	–	–	..	..	–	–	–	–
7. Biomass	6.45	10.77	..	..	2.30	0.54	3.20	0.84
8. Geothermal	–	–	..	..	3.65	0.86	2.17	0.57
9.1 Large Hydro (>10 MW)	–	–	..	..	–	–	–	–
9.2 Small Hydro (<10 MW)	0.63	1.05	..	..	0.10	0.02	0.09	0.02
Total Hydro	0.63	1.05	..	..	0.10	0.02	0.09	0.02
TOTAL RENEWABLE ENERGY	**7.94**	**13.26**	**..**	**..**	**17.27**	**4.08**	**22.34**	**5.87**
10.1 Nuclear LWR	3.71	6.19	..	..	42.21	9.96	17.91	4.71
10.2 Other Converter Reactors	–	–	..	..	–	–	16.02	4.21
10.3 Nuclear Fuel Cycle	1.01	1.69	..	..	164.05	38.72	82.00	21.56
10.4 Nuclear Supporting Tech.	0.78	1.30	..	..	115.12	27.17	139.49	36.68
10.5 Nuclear Breeder	–	–	..	..	–	–	3.77	0.99
Total Nuclear Fission	5.50	9.18	..	..	321.39	75.86	259.19	68.15
11. Nuclear Fusion	1.14	1.91	..	..	30.70	7.25	35.82	9.42
TOTAL NUCLEAR	**6.64**	**11.09**	**..**	**..**	**352.09**	**83.11**	**295.00**	**77.57**
12.1 Electric Power Conversion	7.54	12.59	..	..	1.92	0.45	4.24	1.12
12.2 Electricity Transm. & Distr.	4.97	8.30	..	..	–	–	–	–
12.3 Energy Storage	0.43	0.71	..	..	–	–	–	–
TOTAL POWER & STORAGE	**12.93**	**21.59**	**..**	**..**	**1.92**	**0.45**	**4.24**	**1.12**
13.1 Energy Systems Analysis	3.69	6.16	..	..	8.63	2.04	14.14	3.72
13.2 Other Tech. or Research	0.18	0.30	..	..	–	–	–	–
TOTAL OTHER TECH./RESEARCH	**3.86**	**6.45**	**..**	**..**	**8.63**	**2.04**	**14.14**	**3.72**
TOTAL ENERGY R&D	**59.88**	**100.00**	**..**	**..**	**423.66**	**100.00**	**380.30**	**100.00**

1. Other coal refers to peat. Finland has not provided data for 2002.
Note: Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Germany				Greece				Hungary			
2001		2002e		2001		2002e		2001		2002e	
$	%	$	%	$	%	$	%	$	%	$	%
4.88	1.74	5.37	2.05	..	..	..	..	0.06	3.73	0.15	5.06
14.37	5.13	10.08	3.85	..	..	..	..	–	–	0.03	1.01
–	–	–	–	..	..	..	..	0.08	5.41	–	–
3.35	1.20	2.36	0.90	..	..	..	..	–	–	–	–
22.60	**8.07**	**17.81**	**6.80**	**0.51**	**7.59**	**1.38**	**16.52**	**0.14**	**9.15**	**0.17**	**6.08**
–	–	–	–	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	0.15	10.12	0.14	4.79
–	–	–	–	..	..	..	..	0.15	10.12	0.14	4.79
–	–	–	–	..	..	..	..	–	–	–	–
15.80	5.64	16.68	6.37	..	..	..	..	0.22	14.89	0.20	7.06
0.96	0.34	1.04	0.40	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	–	–
16.76	5.98	17.72	6.76	..	..	..	..	0.22	14.89	0.20	7.06
16.76	**5.98**	**17.72**	**6.76**	**0.45**	**6.67**	**0.48**	**5.78**	**0.37**	**25.01**	**0.34**	**11.85**
11.40	4.07	7.16	2.73	..	..	..	..	0.29	19.77	0.50	17.47
27.01	9.64	24.32	9.28	..	..	..	..	–	–	–	–
1.53	0.55	1.04	0.40	..	..	..	..	–	–	–	–
39.94	14.26	32.52	12.41	..	..	..	..	0.29	19.77	0.50	17.47
16.86	6.02	14.42	5.50	..	..	..	..	–	–	0.23	8.10
–	–	–	–	..	..	..	..	–	–	–	–
3.83	1.37	3.68	1.40	..	..	..	..	0.68	46.08	0.92	32.07
6.90	2.46	3.96	1.51	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	–	–
67.53	**24.10**	**54.57**	**20.83**	**2.61**	**38.56**	**3.08**	**36.89**	**0.97**	**65.85**	**1.66**	**57.64**
10.06	3.59	3.49	1.33	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	–	–
5.65	2.02	4.52	1.73	..	..	..	..	–	–	–	–
–	–	–	–	..	..	..	..	–	–	0.50	17.42
–	–	–	–	..	..	..	..	–	–	–	–
15.71	5.61	8.01	3.06	..	..	..	..	–	–	0.50	17.42
105.55	37.68	106.03	40.47	..	..	..	..	–	–	–	–
121.26	**43.28**	**114.04**	**43.53**	**0.96**	**14.22**	**1.03**	**12.31**	**–**	**–**	**0.50**	**17.42**
29.21	10.43	36.38	13.88	..	..	..	..	–	–	–	–
7.47	2.67	7.07	2.70	..	..	..	..	–	–	0.20	7.02
3.26	1.16	2.73	1.04	..	..	..	..	–	–	–	–
39.94	**14.26**	**46.18**	**17.63**	**2.23**	**32.95**	**2.38**	**28.50**	**–**	**–**	**0.20**	**7.02**
0.96	0.34	0.75	0.29	..	..	..	..	–	–	–	–
11.11	3.97	10.93	4.17	..	..	..	..	–	–	–	–
12.07	**4.31**	**11.69**	**4.46**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
280.16	**100.00**	**262.02**	**100.00**	**6.78**	**100.00**	**8.34**	**100.00**	**1.48**	**100.00**	**2.88**	**100.00**

Table B14 *(continued)*

IEA Government Energy R&D Expenditure by Country, 2001 and 2002

(US$ million at 2002 prices and exchange rates)

	Ireland				Italy			
	2001		2002e		2001		2002e	
	$	%	$	%	$	%	$	%
1.1 Industry	..	..	0.35	10.08	9.65	3.53	9.43	3.49
1.2 Residential. Commercial	..	..	2.04	58.99	14.47	5.30	14.14	5.23
1.3 Transportation	..	..	0.05	1.36	–	–	–	–
1.4 Other Conservation	..	..	–	–	–	–	–	–
TOTAL CONSERVATION	**..**	**..**	**2.44**	**70.44**	**24.12**	**8.83**	**23.56**	**8.72**
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	..	..	–	–	4.44	1.63	3.77	1.40
4.2 Solar Photo-Electric	..	..	0.02	0.54	13.51	4.95	9.43	3.49
4.3 Solar Thermal-Electric	..	..	–	–	15.92	5.83	33.46	12.39
Total Solar	..	..	0.02	0.54	33.87	12.40	46.65	17.27
5. Wind	..	..	0.19	5.45	0.48	0.18	0.47	0.17
6. Ocean	..	..	0.23	6.68	–	–	–	–
7. Biomass	..	..	0.09	2.72	2.12	0.78	1.89	0.70
8. Geothermal	..	..	–	–	–	–	–	–
9.1 Large Hydro (>10 MW)	..	..	–	–	–	–	–	–
9.2 Small Hydro (<10 MW)	..	..	0.02	0.54	–	–	–	–
Total Hydro	..	..	0.02	0.54	–	–	–	–
TOTAL RENEWABLE ENERGY	**..**	**..**	**0.55**	**15.94**	**36.47**	**13.36**	**49.01**	**18.14**
10.1 Nuclear LWR	..	..	–	–	–	–	–	–
10.2 Other Converter Reactors	..	..	–	–	–	–	–	–
10.3 Nuclear Fuel Cycle	..	..	–	–	44.77	16.40	43.73	16.19
10.4 Nuclear Supporting Tech.	..	..	–	–	–	–	–	–
10.5 Nuclear Breeder	..	..	–	–	–	–	–	–
Total Nuclear Fission	..	..	–	–	44.77	16.40	43.73	16.19
11. Nuclear Fusion	..	..	–	–	58.47	21.41	47.13	17.45
TOTAL NUCLEAR	**..**	**..**	**–**	**–**	**103.24**	**37.81**	**90.86**	**33.64**
12.1 Electric Power Conversion	..	..	0.09	2.72	28.95	10.60	28.28	10.47
12.2 Electricity Transm. & Distr.	..	..	0.33	9.54	34.74	12.72	33.93	12.56
12.3 Energy Storage	..	..	–	–	11.77	4.31	11.50	4.26
TOTAL POWER & STORAGE	**..**	**..**	**0.42**	**12.26**	**75.45**	**27.63**	**73.70**	**27.29**
13.1 Energy Systems Analysis	..	..	–	–	–	–	–	–
13.2 Other Tech. or Research	..	..	0.05	1.36	33.77	12.37	32.99	12.21
TOTAL OTHER TECH./RESEARCH	**..**	**..**	**0.05**	**1.36**	**33.77**	**12.37**	**32.99**	**12.21**
TOTAL ENERGY R&D	**..**	**..**	**3.46**	**100.00**	**273.06**	**100.00**	**270.12**	**100.00**

1. Japan has not provided data for 2002
2. Korea has not provided data for 2001 and 2002.
3. Luxembourg has no energy R&D programme.

Note: Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Japan[1] 2001 $	%	2002 $	%	Korea[2] 2001 $	%	2002 $	%	Luxembourg[3] 2001 $	%	2002 $	%
488.52	14.27	..	..	..	..	..	..	–	–	–	–
29.38	0.86	..	..	..	..	..	..	–	–	–	–
31.97	0.93	..	..	..	..	..	..	–	–	–	–
19.04	0.56	..	..	..	..	..	..	–	–	–	–
568.91	**16.62**	**..**	**..**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
23.84	0.70	..	..	..	..	..	..	–	–	–	–
2.14	0.06	..	..	..	..	..	..	–	–	–	–
–	–	..	..	..	..	..	..	–	–	–	–
5.24	0.15	..	..	..	..	..	..	–	–	–	–
31.22	0.91	..	..	..	..	..	..	–	–	–	–
5.55	0.16	..	..	..	..	..	..	–	–	–	–
9.08	0.27	..	..	..	..	..	..	–	–	–	–
23.70	0.69	..	..	..	..	..	..	–	–	–	–
1.31	0.04	..	..	..	..	..	..	–	–	–	–
39.64	1.16	..	..	..	..	..	..	–	–	–	–
70.87	**2.07**	**..**	**..**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
0.46	0.01	..	..	..	..	..	..	–	–	–	–
79.20	2.31	..	..	..	..	..	..	–	–	–	–
–	–	..	..	..	..	..	..	–	–	–	–
79.65	2.33	..	..	..	..	..	..	–	–	–	–
7.78	0.23	..	..	..	..	..	..	–	–	–	–
6.00	0.18	..	..	..	..	..	..	–	–	–	–
15.79	0.46	..	..	..	..	..	..	–	–	–	–
18.73	0.55	..	..	..	..	..	..	–	–	–	–
–	–	..	..	..	..	..	..	–	–	–	–
–	–	..	..	..	..	..	..	–	–	–	–
–	–	..	..	..	..	..	..	–	–	–	–
127.96	**3.74**	**..**	**..**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
95.79	2.80	..	..	..	..	..	..	–	–	–	–
65.78	1.92	..	..	..	..	..	..	–	–	–	–
762.45	22.27	..	..	..	..	..	..	–	–	–	–
1 016.31	29.69	..	..	..	..	..	..	–	–	–	–
275.62	8.05	..	..	..	..	..	..	–	–	–	–
2 215.95	64.73	..	..	..	..	..	..	–	–	–	–
187.89	5.49	..	..	..	..	..	..	–	–	–	–
2 403.83	**70.22**	**..**	**..**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
107.37	3.14	..	..	..	..	..	..	–	–	–	–
45.73	1.34	..	..	..	..	..	..	–	–	–	–
21.03	0.61	..	..	..	..	..	..	–	–	–	–
174.13	**5.09**	**..**	**..**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
1.30	0.04	..	..	..	..	..	..	–	–	–	–
76.37	2.23	..	..	..	..	..	..	–	–	–	–
77.67	**2.27**	**..**	**..**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**
3 423.37	**100.00**	**..**	**..**	**..**	**..**	**..**	**..**	**–**	**–**	**–**	**–**

Table B14 *(continued)*

IEA Government Energy R&D Expenditure by Country, 2001 and 2002

(US$ million at 2002 prices and exchange rates)

	Netherlands[1]				New Zealand			
	2001		2002		2001		2002e	
	$	%	$	%	$	%	$	%
1.1 Industry	25.92	15.38	..	..	0.22	5.38	0.18	3.91
1.2 Residential. Commercial	17.60	10.45	..	..	–	–	0.13	2.72
1.3 Transportation	13.50	8.01	..	..	–	–	–	–
1.4 Other Conservation	3.81	2.26	..	..	0.09	2.13	0.07	1.60
TOTAL CONSERVATION	**60.83**	**36.10**	**..**	**..**	**0.31**	**7.52**	**0.38**	**8.23**
2.1 Enhanced Oil & Gas	6.75	4.00	..	..	1.44	34.77	1.82	39.06
2.2 Refining. Transp. & Stor.	–	–	..	..	–	–	–	–
2.3 Oil Shale & Tar Sands	–	–	..	..	–	–	–	–
2.4 Other Oil & Gas	0.78	0.46	..	..	–	–	0.32	6.92
Total Oil & Gas	7.53	4.47	..	..	1.44	34.77	2.14	45.98
3.1 Coal Prod. Prep. & Trans.	–	–	..	..	0.04	1.05	0.04	0.93
3.2 Coal Combustion	–	–	..	..	0.13	3.07	0.07	1.61
3.3 Coal Conversion	–	–	..	..	–	–	0.05	1.11
3.4 Other Coal	0.10	0.06	..	..	–	–	–	–
Total Coal	0.10	0.06	..	..	0.17	4.13	0.17	3.65
TOTAL FOSSIL FUELS	**7.63**	**4.53**	**..**	**..**	**1.61**	**38.90**	**2.31**	**49.63**
4.1 Solar Heating & Cooling	0.20	0.12	..	..	–	–	–	–
4.2 Solar Photo-Electric	16.92	10.04	..	..	0.09	2.24	0.14	3.08
4.3 Solar Thermal-Electric	–	–	..	..	0.11	2.64	0.06	1.22
Total Solar	17.11	10.16	..	..	0.20	4.88	0.20	4.30
5. Wind	13.40	7.95	..	..	0.11	2.58	0.11	2.28
6. Ocean	0.29	0.17	..	..	–	–	–	–
7. Biomass	13.40	7.95	..	..	0.43	10.33	0.25	5.46
8. Geothermal	–	–	..	..	0.96	23.25	0.67	14.42
9.1 Large Hydro (>10 MW)	–	–	..	..	–	–	–	–
9.2 Small Hydro (<10 MW)	–	–	..	..	–	–	–	–
Total Hydro	–	–	..	..	–	–	–	–
TOTAL RENEWABLE ENERGY	**44.20**	**26.23**	**..**	**..**	**1.70**	**41.04**	**1.23**	**26.46**
10.1 Nuclear LWR	0.49	0.29	..	..	–	–	–	–
10.2 Other Converter Reactors	0.39	0.23	..	..	–	–	–	–
10.3 Nuclear Fuel Cycle	–	–	..	..	–	–	–	–
10.4 Nuclear Supporting Tech.	–	–	..	..	–	–	–	–
10.5 Nuclear Breeder	12.91	7.66	..	..	–	–	–	–
Total Nuclear Fission	13.79	8.18	..	..	–	–	–	–
11. Nuclear Fusion	7.24	4.29	..	..	–	–	–	–
TOTAL NUCLEAR	**21.03**	**12.48**	**..**	**..**	**–**	**–**	**–**	**–**
12.1 Electric Power Conversion	7.82	4.64	..	..	0.42	10.04	0.47	10.00
12.2 Electricity Transm. & Distr.	0.59	0.35	..	..	–	–	–	–
12.3 Energy Storage	0.98	0.58	..	..	–	–	–	–
TOTAL POWER & STORAGE	**9.39**	**5.57**	**..**	**..**	**0.42**	**10.04**	**0.47**	**10.00**
13.1 Energy Systems Analysis	4.50	2.67	..	..	–	–	0.10	2.19
13.2 Other Tech. or Research	20.93	12.42	..	..	0.10	2.50	0.16	3.49
TOTAL OTHER TECH./RESEARCH	**25.43**	**15.09**	**..**	**..**	**0.10**	**2.50**	**0.26**	**5.69**
TOTAL ENERGY R&D	**168.51**	**100.00**	**..**	**..**	**4.14**	**100.00**	**4.66**	**100.00**

1. The Netherlands has not provided data for 2002.
Note: Budgets provided for recent years by some countries may have been estimated.
Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Norway				Portugal				Spain			
2001		2002e		2001		2002e		2001		2002e	
$	%	$	%	$	%	$	%	$	%	$	%
0.13	0.26	0.13	0.26	0.31	33.51	0.27	10.92	0.83	1.72	0.76	1.59
1.38	2.86	1.77	3.63	–	–	–	–	0.59	1.22	0.59	1.24
–	–	–	–	–	–	–	–	0.85	1.76	0.79	1.65
–	–	–	–	–	–	–	–	–	–	–	–
1.50	**3.12**	**1.89**	**3.89**	**0.31**	**33.51**	**0.27**	**10.92**	**2.27**	**4.71**	**2.15**	**4.49**
4.72	9.80	3.67	7.55	0.01	0.94	0.00	0.08	–	–	–	–
1.93	4.01	1.50	3.09	–	–	–	–	–	–	0.21	0.43
–	–	–	–	–	–	–	–	–	–	–	–
16.97	35.24	13.47	27.74	–	–	–	–	–	–	–	–
23.62	49.05	18.65	38.39	0.01	0.94	0.00	0.08	–	–	0.21	0.43
–	–	–	–	0.01	1.46	0.04	1.81	–	–	–	–
–	–	–	–	0.08	8.01	0.11	4.63	4.15	8.60	3.82	7.97
–	–	–	–	0.02	2.50	0.03	1.23	–	–	–	–
–	–	–	–	0.04	4.16	0.06	2.31	0.05	0.11	0.05	0.10
–	–	–	–	0.15	16.13	0.24	9.95	4.20	8.71	3.86	8.07
23.62	**49.05**	**18.65**	**38.39**	**0.16**	**17.17**	**0.25**	**10.07**	**4.20**	**8.71**	**4.07**	**8.50**
0.30	0.62	0.31	0.64	0.04	3.75	0.02	0.66	0.05	0.10	0.05	0.10
0.91	1.90	1.29	2.66	0.04	4.79	0.02	0.62	2.35	4.87	2.38	4.98
–	–	–	–	–	–	0.05	1.85	6.55	13.58	6.90	14.41
1.21	2.52	1.60	3.30	0.08	8.43	0.08	3.13	8.95	18.54	9.33	19.49
0.81	1.69	0.63	1.29	0.01	0.73	0.01	0.42	2.07	4.29	1.86	3.88
0.25	0.52	0.16	0.34	0.18	19.25	0.02	0.62	–	–	–	–
0.89	1.85	0.58	1.19	0.09	9.37	0.13	5.17	4.14	8.59	4.34	9.07
–	–	–	–	0.03	3.33	0.02	1.00	–	–	–	–
1.13	2.34	1.06	2.19	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–
1.13	2.34	1.06	2.19	–	–	–	–	–	–	–	–
4.30	**8.92**	**4.03**	**8.30**	**0.39**	**41.10**	**0.25**	**10.38**	**15.16**	**31.41**	**15.53**	**32.44**
–	–	–	–	–	–	–	–	1.49	3.08	1.38	2.87
–	–	–	–	–	–	–	–	–	–	–	–
1.88	3.90	1.88	3.87	–	–	–	–	7.61	15.77	7.54	15.75
5.63	11.70	5.01	10.31	–	–	–	–	4.71	9.76	4.67	9.74
–	–	–	–	–	–	–	–	–	–	–	–
7.51	15.60	6.89	14.18	–	–	–	–	13.81	28.61	13.58	28.37
–	–	–	–	–	–	1.60	65.43	9.98	20.68	9.71	20.28
7.51	**15.60**	**6.89**	**14.18**	**–**	**–**	**1.60**	**65.43**	**23.79**	**49.30**	**23.29**	**48.64**
–	–	0.88	1.80	0.04	4.79	0.03	1.16	–	–	–	–
2.32	4.81	1.68	3.45	0.01	1.56	0.01	0.31	0.85	1.76	0.84	1.75
0.48	0.99	1.31	2.71	–	–	–	–	–	–	–	–
2.79	**5.80**	**3.87**	**7.97**	**0.06**	**6.35**	**0.04**	**1.47**	**0.85**	**1.76**	**0.84**	**1.75**
1.13	2.34	1.73	3.56	0.01	0.94	0.01	0.35	0.55	1.15	0.55	1.14
7.30	15.16	11.52	23.72	0.01	0.94	0.03	1.39	1.43	2.97	1.45	3.03
8.43	**17.50**	**13.25**	**27.28**	**0.02**	**1.87**	**0.04**	**1.74**	**1.99**	**4.12**	**2.00**	**4.17**
48.15	**100.00**	**48.57**	**100.00**	**0.94**	**100.00**	**2.44**	**100.00**	**48.26**	**100.00**	**47.88**	**100.00**

Table B14 *(continued)*

IEA Government Energy R&D Expenditure by Country, 2001 and 2002

(US$ million at 2002 prices and exchange rates)

	Sweden[1]				Switzerland			
	2001		2002		2001		2002e	
	$	%	$	%	$	%	$	%
1.1 Industry	5.00	6.24	..	..	1.30	1.14	1.93	1.67
1.2 Residential. Commercial	4.09	5.10	..	..	4.77	4.21	5.78	5.00
1.3 Transportation	20.16	25.15	..	..	6.05	5.34	6.42	5.56
1.4 Other Conservation	3.19	3.97	..	..	4.99	4.40	5.14	4.44
TOTAL CONSERVATION	**32.44**	**40.46**	**..**	**..**	**17.12**	**15.10**	**19.27**	**16.67**
2.1 Enhanced Oil & Gas	–	–	..	..	7.24	6.38	7.71	6.67
2.2 Refining. Transp. & Stor.	–	–	..	..	–	–	–	–
2.3 Oil Shale & Tar Sands	–	–	..	..	–	–	–	–
2.4 Other Oil & Gas	–	–	..	..	–	–	–	–
Total Oil & Gas	–	–	..	..	7.24	6.38	7.71	6.67
3.1 Coal Prod. Prep. & Trans.	–	–	..	..	–	–	–	–
3.2 Coal Combustion	–	–	..	..	–	–	–	–
3.3 Coal Conversion	–	–	..	..	–	–	–	–
3.4 Other Coal	0.13	0.17	..	..	–	–	–	–
Total Coal	0.13	0.17	..	..	–	–	–	–
TOTAL FOSSIL FUELS	**0.13**	**0.17**	**..**	**..**	**7.24**	**6.38**	**7.71**	**6.67**
4.1 Solar Heating & Cooling	1.56	1.94	..	..	4.19	3.69	4.50	3.89
4.2 Solar Photo-Electric	1.23	1.53	..	..	10.90	9.61	10.92	9.44
4.3 Solar Thermal-Electric	–	–	..	..	0.90	0.79	0.64	0.56
Total Solar	2.78	3.47	..	..	15.98	14.10	16.06	13.89
5. Wind	3.62	4.51	..	..	0.93	0.82	1.28	1.11
6. Ocean	–	–	..	..	–	–	–	–
7. Biomass	17.40	21.70	..	..	4.45	3.92	4.50	3.89
8. Geothermal	0.43	0.53	..	..	2.01	1.77	1.93	1.67
9.1 Large Hydro (>10 MW)	–	–	..	..	0.77	0.68	0.64	0.56
9.2 Small Hydro (<10 MW)	0.97	1.21	..	..	1.30	1.15	1.28	1.11
Total Hydro	0.97	1.21	..	..	2.07	1.83	1.93	1.67
TOTAL RENEWABLE ENERGY	**25.20**	**31.43**	**..**	**..**	**25.43**	**22.43**	**25.69**	**22.22**
10.1 Nuclear LWR	–	–	..	..	0.86	0.76	0.64	0.56
10.2 Other Converter Reactors	–	–	..	..	1.76	1.55	1.28	1.11
10.3 Nuclear Fuel Cycle	0.91	1.14	..	..	3.46	3.05	3.21	2.78
10.4 Nuclear Supporting Tech.	–	–	..	..	11.47	10.12	10.92	9.44
10.5 Nuclear Breeder	2.76	3.45	..	..	0.07	0.06	–	–
Total Nuclear Fission	3.68	4.59	..	..	17.63	15.55	16.06	13.89
11. Nuclear Fusion	1.03	1.28	..	..	15.87	14.00	16.06	13.89
TOTAL NUCLEAR	**4.71**	**5.87**	**..**	**..**	**33.50**	**29.54**	**32.11**	**27.78**
12.1 Electric Power Conversion	7.05	8.79	..	..	4.94	4.36	5.14	4.44
12.2 Electricity Transm. & Distr.	1.19	1.49	..	..	5.21	4.60	5.14	4.44
12.3 Energy Storage	0.52	0.65	..	..	10.35	9.12	10.28	8.89
TOTAL POWER & STORAGE	**8.76**	**10.93**	**..**	**..**	**20.50**	**18.08**	**20.55**	**17.78**
13.1 Energy Systems Analysis	2.47	3.08	..	..	7.43	6.55	7.71	6.67
13.2 Other Tech. or Research	6.47	8.07	..	..	2.18	1.92	2.57	2.22
TOTAL OTHER TECH./RESEARCH	**8.94**	**11.15**	**..**	**..**	**9.61**	**8.47**	**10.28**	**8.89**
TOTAL ENERGY R&D	**80.18**	**100.00**	**..**	**..**	**113.39**	**100.00**	**115.61**	**100.00**

1. Sweden has not provided data for 2002.

Note: Budgets provided for recent years by some countries may have been estimated.

Sources: *OECD Economic Outlook*, OECD Paris, 2002, and country submissions.

Turkey				United Kingdom				United States			
2001		2002e		2001		2002e		2001		2002e	
$	%	$	%	$	%	$	%	$	%	$	%
1.29	13.65	2.02	13.22	–	–	–	–	150.25	5.28	144.13	5.06
0.00	0.00	0.00	0.00	–	–	–	–	131.65	4.63	125.22	4.40
0.08	0.83	1.27	8.31	–	–	0.82	1.44	258.20	9.07	246.14	8.64
0.00	0.02	0.01	0.06	–	–	–	–	47.87	1.68	62.59	2.20
1.37	**14.50**	**3.30**	**21.59**	**–**	**–**	**0.82**	**1.44**	**587.97**	**20.66**	**578.07**	**20.30**
1.90	20.07	2.09	13.67	2.00	4.27	1.94	3.40	68.41	2.40	75.35	2.65
0.04	0.37	0.02	0.14	–	–	–	–	21.08	0.74	14.19	0.50
–	–	0.00	0.01	–	–	–	–	–	–	–	–
–	–	0.00	0.00	1.33	2.83	1.36	2.39	23.64	0.83	12.96	0.46
1.93	20.44	2.11	13.82	3.33	7.09	3.31	5.79	113.13	3.98	102.50	3.60
1.66	17.53	1.66	10.87	–	–	–	–	4.34	0.15	4.90	0.17
2.91	30.75	6.30	41.25	5.69	12.11	4.51	7.89	175.29	6.16	219.97	7.73
0.00	0.01	0.00	0.00	–	–	–	–	7.64	0.27	25.00	0.88
0.00	0.00	0.00	0.00	–	–	–	–	56.27	1.98	72.05	2.53
4.56	48.29	7.96	52.12	5.69	12.11	4.51	7.89	243.54	8.56	321.92	11.31
6.50	**68.73**	**10.08**	**65.95**	**9.02**	**19.21**	**7.81**	**13.68**	**356.67**	**12.54**	**424.42**	**14.91**
0.03	0.36	0.04	0.26	–	–	–	–	3.95	0.14	4.71	0.17
0.03	0.31	0.03	0.17	2.78	5.93	8.10	14.18	75.88	2.67	71.55	2.51
–	–	–	–	–	–	–	–	13.86	0.49	13.18	0.46
0.06	0.67	0.07	0.43	2.78	5.93	8.10	14.18	93.70	3.29	89.44	3.14
0.08	0.84	0.10	0.68	2.17	4.61	3.15	5.51	39.99	1.41	38.21	1.34
–	–	–	–	1.55	3.29	3.75	6.56	–	–	–	–
0.06	0.62	0.05	0.31	2.78	5.93	4.20	7.35	87.21	3.07	87.68	3.08
0.25	2.59	0.43	2.81	–	–	0.30	0.53	27.21	0.96	27.04	0.95
–	–	–	–	–	–	–	–	..	..	..	..
–	–	–	–	0.15	0.33	–	–	..	..	..	..
–	–	–	–	0.15	0.33	–	–	5.04	0.18	4.99	0.18
0.45	**4.71**	**0.65**	**4.23**	**9.44**	**20.09**	**19.49**	**34.13**	**253.15**	**8.90**	**247.36**	**8.69**
0.01	0.08	0.03	0.18	–	–	–	–	..	..	..	..
0.00	0.00	0.00	0.00	–	–	–	–	..	..	..	..
0.00	0.05	–	–	–	–	–	–	..	..	..	..
0.16	1.65	0.14	0.89	–	–	–	–	47.82	1.68	49.24	1.73
–	–	–	–	–	–	–	–	–	–	–	–
0.17	1.78	0.16	1.08	–	–	–	–	47.82	1.68	49.24	1.73
–	–	–	–	22.63	48.19	21.93	38.41	251.22	8.83	241.10	8.47
0.17	**1.78**	**0.16**	**1.08**	**22.63**	**48.19**	**21.93**	**38.41**	**299.04**	**10.51**	**290.34**	**10.20**
0.21	2.24	0.28	1.84	2.47	5.27	2.85	4.99	84.44	2.97	74.78	2.63
0.45	4.80	0.42	2.73	–	–	–	–	46.26	1.63	..	..
0.03	0.30	0.00	0.00	–	–	–	–	6.05	0.21	70.14	2.46
0.69	**7.34**	**0.70**	**4.57**	**2.47**	**5.27**	**2.85**	**4.99**	**136.75**	**4.81**	**144.92**	**5.09**
0.10	1.08	0.08	0.56	0.46	0.99	0.45	0.79	..	..	..	..
0.18	1.86	0.31	2.03	2.94	6.26	3.75	6.56	1 211.72	42.59	1 162.15	40.82
0.28	**2.94**	**0.40**	**2.59**	**3.40**	**7.25**	**4.20**	**7.35**	**1 211.72**	**42.59**	**1 162.15**	**40.82**
9.45	**100.00**	**15.28**	**100.00**	**46.96**	**100.00**	**57.11**	**100.00**	**2 845.29**	**100.00**	**2 847.26**	**100.00**

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

Member countries* of the IEA seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1. **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3. **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays Principle.

4. **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA members wish to retain and improve the nuclear

* 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, the United Kingdom, the United States.

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.)

COMMUNIQUE

MEETING OF THE IEA GOVERNING BOARD AT MINISTERIAL LEVEL, 28-29 APRIL 2003

We, the energy ministers of IEA member countries, meeting in Paris on the 28-29 April 2003, agree:

Energy Security, Environmental Protection and Economic Growth – "The Three E's" – remain robust as the IEA's guiding principles for energy policy. Reaching our shared goals requires constant adaptation to changing circumstances and renewal of commitment. This is particularly true in the context of the current geopolitical instability in key energy-producing regions, price volatility, demand growth and a growing threat to our environment.

Energy Security Remains our Focus

We strongly affirm our readiness to combat any disruption of oil supplies, including through the judicious use of emergency oil stocks, demand restraint and other appropriate response measures.

We welcome the benefit of reinforced dialogue between producers and consumers of oil, as well as between the IEA and OPEC secretariats, which has contributed to mitigating the effects of potentially serious crises in world markets and the economy. We appreciate OPEC Ministers' commitment to keep world oil markets amply supplied, and we call for attention to the correlation between oil market volatility and low industry stocks, and the importance of maintaining adequate stocks to anticipate seasonal needs and to promote oil market stability.

The Eighth International Energy Forum (IEF), held in Osaka last September, made a substantial contribution to that dialogue. We look forward to the Ninth IEF, to be held from 22 to 24 May 2004 in Amsterdam, the Netherlands, and pledge our active support for greater co-operation between consumers and producers.

Recent energy market events have provided a sharp reminder of the central role of energy for our near-term security. Insecurity arises from a range of issues, including geopolitical instability, natural disasters, terrorism and even poor regulatory design. Increasingly tight capacity in energy infrastructure and production facilities and diminished potential for fuel substitution demand renewed attention to existing energy security policies and procedures. Growing oil demand in IEA member and non-member countries, particularly in transport, requires greater effort by importing countries to build and hold appropriate emergency stocks.

Addressing the Challenges of Investment, Diversification, Efficiency and Technology

Meeting the longer-term challenges of maintaining a secure, efficient and safe energy system will require near-term action. Substantial new investment will be needed to provide secure supply, to reduce growing energy-related greenhouse gas emissions and to overcome the problem of the lack of access to electricity for more than a quarter of the world's population.

Diversity by energy type, source and route remains essential to improving energy security. Each country has chosen its own mix of fuels among oil, gas, coal, nuclear and renewables based on energy resource endowments and national policies. We call for the continuing development of policies and programs, consistent with national priorities, to promote diversification, including increased support for energy research, development, demonstration and deployment. We remain particularly interested in the acceleration of the commercial availability of cleaner technologies with low pollution and carbon emissions.

While appreciating that much has been done since the first oil shock of 1973 to reduce energy use per unit of output, more can and must be done. We commit ourselves to achieving greater energy efficiency both through national programs and through international technology collaboration. To do so, we will increase incentives to efficiency in market and consumer behaviour, in particular in the transport sector, for buildings and equipment. We will also seek to reduce energy intensity through R&D, technological innovation and international collaboration.

Our high and rising dependence on oil, particularly in transport, poses significant economic, security and environmental challenges. We recognise the importance of working together, and with the private sector, to accelerate research and development in fuel efficiency and competitive alternative fuel sources and carriers in our economies and worldwide. We note, in particular, our intent to further develop the technologies for a hydrogen future.

We note the increasing reliance on natural gas in the energy mix as well as the growing dependence in many countries on natural gas imports, and have considered its implication for overall energy security. Notwithstanding the regionally discrete nature of gas markets, national level production and distribution problems can nonetheless affect global energy markets. We call on the Secretariat to continue its assessment of these vulnerabilities, and to identify policy options and strategies, including securing diverse gas sources and routes as well as technology development, to contribute to a greater security of gas supply. The collaboration of government and industry is essential to this effort.

Strengthening and extending the forces of the marketplace within and beyond our borders can contribute to enhancing energy security, economic growth and environmental protection. We commit ourselves to strengthen the policy framework permitting markets to meet our global investment and trade needs and to promote enabling environments that will attract private investment.

Promoting International Co-operation

We affirm the increasing importance of IEA non-member countries in world energy markets and warmly welcome the participation of Russian Energy Minister Igor Yusufov at this meeting. We will engage Russia and other key countries more actively in our dialogue on energy policy, and we direct the Secretariat to reinforce a world-view in its work. In particular, we encourage the acceleration of energy security co-operation with international organisations and IEA non-member countries, especially those critical to global energy supply and demand. We recognise that only through a more global framework can security be assured.

Committing to Sustainable Development

We acknowledge the importance of, and our commitment to, implementing the agreements reached at the Johannesburg World Summit on Sustainable Development of September 2002. We particularly commit ourselves to enhance the role of renewables and other lower carbon-emitting sources of energy in the energy mix, and work to shape a future where basic energy services will be available to an increasing number of the world's citizens. We will continue our efforts to mitigate the impact of energy use on the global environment, and in particular on the global climate system, consistent with our efforts under the UN Framework Convention on Climate Change. We will continue to stimulate the development of new market-oriented instruments essential to reaching our sustainable development goals at lower costs. We also call for the further development of technologies needed to meet these goals, and to this end, with the help of the Secretariat, call for a review of the focus of our co-operative R&D programs in strategic areas.

We reaffirm our commitment to promoting a sustainable energy future, meeting the social, environmental and economic challenges this entails.

MEASUREMENT OF FINANCIAL SUPPORT FOR COAL PRODUCTION

The Producer Subsidy Equivalent (PSE) measures financial support for coal production. The PSE includes support for the production of coal that the industry would normally be expected to cover in a competitive environment. This includes direct state payments, the value of protection provided by import constraints and the effects of special sales agreements.

Support for production is normally either direct budgetary assistance, or price support. Many direct payments to producers help to maintain domestic production and are included in the PSE. Other direct payments are designed to speed contraction of the industry, or are otherwise unrelated to current production, and are taken into account.

Price support is typically provided by government-imposed limits on coal imports, or as the result of agreements between coal producers and large coal consumers (usually electric utilities), sometimes involving government in tripartite agreements. Published information on these arrangements is limited. The practical effect of these arrangements is to protect indigenous coal production. It is necessary to select a reference price for comparable coal qualities, against which the domestic price is to be compared, to measure the degree of support provided through higher prices.

Although an average PSE per tonne produced is calculated, some mines may require more support than the average and some less, perhaps none at all.

Table 1

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 USD)	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 USD)	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	n.a.
	Aid per tce (in Yen)	17 289	15 649	17 192	17 184	16 878	15 553	16 849	13 772	15 107	n.a.
	Aid per tce (in USD)	128.54	123.52	154.60	168.14	179.36	142.95	139.24	105.62	134.29	n.a.
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 USD)	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 USD)	151.61	248.32	160.02	70.66	141.95	98.79	81.60	104.54	155.8	220.95
United Kingdom	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 USD)	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.

Table 2

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 (USD/tce)	52.00	51.81	44.70	43.68	50.20	48.64	47.89	41.28	36.80	36.61
Coking coal (USD/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.

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. Although these terms are generally written out on first mention and abbreviated subsequently, this glossary provides a quick and central reference for many of the abbreviations used.

AMEM	ASEAN Energy Ministers' Meeting
APEC	Asian Pacific Economic Co-operation
APM	Administrative Pricing Mechanism
APSA	ASEAN Petroleum Security Agreement
ASCOPE	ASEAN Council on Petroleum
ASEAN	Association of South-East Asian Nations
bcf	billion cubic feet
BEE	Bureau of Energy Efficiency
CDM	Clean Development Mechanism
CERT	Committee on Energy Research and Technology
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term "co-generation" is used
CNOOC	China National Offshore Oil Corporation
CO_2	carbon dioxide
COP	Conference of the Parties
CRE	Energy Regulatory Commission
CSD	Commission for Sustainable Development
CTI	Climate Technology Initiative
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
FERC	Federal Electricity Regulatory Commission
FSU	Former Soviet Union
GDP	gross domestic product
GHG	greenhouse gas

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, the United Kingdom, the United States
IEF	International Energy Forum
IEP	International Energy Program
IPHE	International Partnership for the Hydrogen Economy
IPP	independent power producer
ISO`	independent system operator
JCC	Japanese crude cocktail
JI	Joint Implementation
kb/d	thousand barrels per day
kWh	kilowatt-hour, or one kilowatt $\times$ one hour, or one watt $\times$ one hour $\times 10^3$
LDC	local distribution company
LNG	liquefied natural gas
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature
mb/d	million barrels per day
MBtu	million British thermal units
mcm	million cubic metres
MEDT	Ministry of Economic Development and Trade
Mt	million tonnes
Mtoe	million tonnes of oil equivalent; *see* toe
NGL	natural gas liquids
NSO	Neutral Transmission System Organisation
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of Petroleum Exporting Countries
PSA	production-sharing agreement
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well

RTO	regional transmission organisations
SOME	ASEAN Senior Officials Meeting on Energy
tcf	trillion cubic feet
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
TRC	Tradable Renewable Energy Certificates
TPA	third-party access
TPES	total primary energy supply
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WSSD	World Summit for Sustainable Development
1Q	first quarter
2Q	second quarter
3Q	third quarter
4Q	fourth quarter

Average exchange rates in 2002 were as follow:

Australia	A$ 1	= US$ 0.543
Canada	C$ 1	= US$ 0.639
Czech Republic	Kcs 1	= US$ 0.0306
Denmark	DKr 1	= US$ 0.127
Hungary	Ft 1	= US$ 0.0039
Japan	¥ 1	= US$ 0.008
Korea	W 1	= US$ 0.0008
New Zealand	NZ$ 1	= US$ 0.462
Norway	NKr 1	= US$ 0.125
Sweden	SKr 1	= US$ 0.103
Switzerland	SF 1	= US$ 0.642
Turkey	TL 1 000	= US$ 0.0007
United Kingdom	£ 1	= US$ 1.490
Euro	€ 1	= US$ 0.943

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 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 2001 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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