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Preface

This report presents international energy projections through 2030, prepared by the Energy Information Administration, including outlooks for major energy fuels and associated carbon dioxide emissions.

The *International Energy Outlook 2007* (*IEO2007*) presents an assessment by the Energy Information Administration (EIA) of the outlook for international energy markets through 2030. U.S. projections appearing in *IEO2007* are consistent with those published in EIA's *Annual Energy Outlook 2007* (*AEO2007*), which was prepared using the National Energy Modeling System (NEMS). *IEO2007* is provided as a service to energy managers and analysts, both in government and in the private sector. The projections are used by international agencies, Federal and State governments, trade associations, and other planners and decisionmakers. They are published pursuant to the Department of Energy Organization Act of 1977 (Public Law 95-91), Section 205(c).

Projections in *IEO2007* are divided according to Organization for Economic Cooperation and Development members (OECD) and non-members (non-OECD). There are three basic country groupings in the OECD: North America (United States, Canada, and Mexico); OECD Europe; and OECD Asia (Japan, South Korea, and Australia/New Zealand) (see Appendix K for complete regional definitions). Non-OECD is divided into five separate regional subgroups: non-OECD Europe and Eurasia, non-OECD Asia, Africa, Middle East, and Central and South America. Russia is represented in non-OECD Europe and Eurasia; China and India are represented in non-OECD Asia; and Brazil is represented in Central and South America.

IEO2007 focuses exclusively on marketed energy. Nonmarketed energy sources, which continue to play an important role in some developing countries, are not included in the estimates. The *IEO2007* projections are based on U.S. and foreign government laws in effect on January 1, 2007. The potential impacts of pending or proposed legislation, regulations, and standards are not reflected in the projections, nor are the impacts of legislation for which the implementing mechanisms have not yet been announced.

The report begins with a review of world trends in energy demand and the major macroeconomic assumptions used in deriving the *IEO2007* projections, along with the major sources of uncertainty in the forecast. The time frame for historical data begins with 1980 and extends to 2004, and the projections extend to 2030. High economic growth and low economic growth cases were developed to depict a set of alternative growth paths for the energy forecast. The two cases consider higher and lower growth paths for regional gross domestic product (GDP) than are assumed in the reference case. New to this report, *IEO2007* also includes a high world oil price case and, alternatively, a low world oil price case. The resulting projections—and the uncertainty associated with international energy projections in general—are discussed in Chapter 1, "World Energy and Economic Outlook."

Regional projections of end-use energy consumption in the residential, commercial, industrial, and transportation sectors are presented in Chapter 2, which also reviews worldwide forecasts for end-use sector energy consumption. Regional projections for energy consumption by fuel—liquids (primarily petroleum), natural gas, and coal—are presented in Chapters 3, 4, and 5, along

Objectives of the *IEO2007* Projections

The projections in *IEO2007* are not statements of what will happen, but what might happen given the specific assumptions and methodologies used. The projections provide an objective, policy-neutral reference case that can be used to analyze international energy markets. As a policy-neutral data and analysis organization, EIA does not propose, advocate, or speculate on future legislative and regulatory changes.

Models are abstractions of energy production and consumption activities, regulatory activities, and producer and consumer behavior. The projections are highly dependent on the data, analytical methodologies, model structures, and specific assumptions used in their development. Trends depicted in the analysis are indicative of tendencies in the real world rather than representations of specific real-world outcomes. Even where trends are stable and well understood, the projections are subject to uncertainty. Many events that shape energy markets are random and cannot be anticipated, and assumptions concerning future technology characteristics, demographics, and resource availability are necessarily uncertain.

with reviews of the current status of each fuel on a worldwide basis. Chapter 6 discusses the projections for world electricity markets—including nuclear power, hydropower, and other commercial renewable energy resources—and presents forecasts of world installed generating capacity. Finally, Chapter 7 discusses the outlook for global carbon dioxide emissions.

Appendix A contains summary tables for the *IEO2007* reference case projections of world energy consumption, GDP, energy consumption by fuel, carbon dioxide emissions, and regional population growth. Summary tables of projections for the high and low economic growth cases are provided in Appendixes B and C, respectively, and high and low world oil price projections are provided in Appendixes D and E, respectively. Reference case projections of delivered energy consumption by end-use sector and region are presented in Appendix F. Appendix G contains summary tables of projections for world liquids production in all cases. Appendix H contains summary tables of reference case projections for installed electric power capacity by fuel and regional electricity generation by fuel. Appendix I includes a set of comparisons of projections from the International Energy Agency's *World Energy Outlook 2006* with the *IEO2007* projections. Comparisons of the *IEO2007* and *IEO2006* projections are also presented in Appendix I. Appendix J describes the models used to generate the *IEO2007* projections, and Appendix K defines the regional designations included in the report.

List of Acronyms

AEO2007	*Annual Energy Outlook 2007*
Btu	British thermal unit
CAFE	corporate average fuel economy
EIA	Energy Information Administration
EU	European Union
GDP	gross domestic product
IEA	International Energy Agency
IEO2007	*International Energy Outlook 2007*
LNG	liquefied natural gas
MY	model year
NAFTA	North American Free Trade Agreement
NEMS	National Energy Modeling System
NHDP	National Highways Development Project (India)
OECD	Organization for Economic Cooperation and Development
OPEC	Organization of the Petroleum Exporting Countries
Pemex	Petróleos Mexicanos
r/p	reserve-to-production ratio
SAGE	System for the Analysis of Global Energy Markets
SEC	Securities and Exchange Commission (U.S.)
STEO	*Short-Term Energy Outlook*
UAE	United Arab Emirates
USGS	U.S. Geological Survey
WEPS+	World Energy Projections Plus
WPPI	Wind Power Production Incentive (Canada)

Highlights

World marketed energy consumption is projected to increase by 57 percent from 2004 to 2030. Total energy demand in the non-OECD countries increases by 95 percent, compared with an increase of 24 percent in the OECD countries.

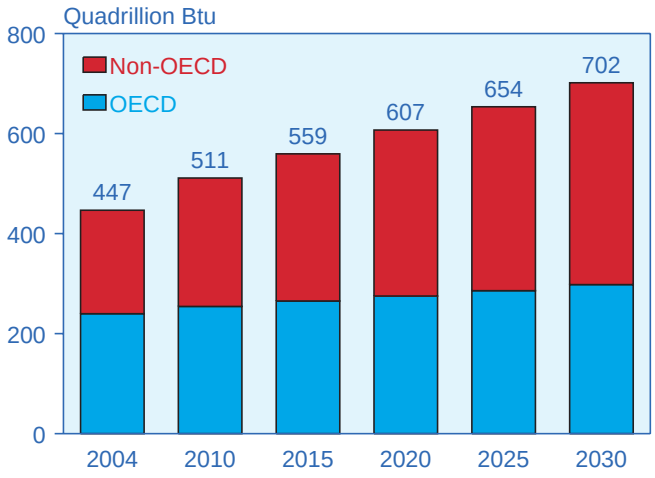
In the *IEO2007* reference case—which reflects a scenario where current laws and policies remain unchanged throughout the projection period—world marketed energy consumption is projected to grow by 57 percent over the 2004 to 2030 period. Total world energy use rises from 447 quadrillion British thermal units (Btu) in 2004 to 559 quadrillion Btu in 2015 and then to 702 quadrillion Btu in 2030 (Figure 1). Global energy demand grows despite the relatively high world oil and natural gas prices that are projected to persist into the mid-term outlook.

The most rapid growth in energy demand from 2004 to 2030 is projected for nations outside the Organization for Economic Cooperation and Development (non-OECD nations). Total non-OECD energy demand increases by 95 percent in the *IEO2007* reference case projection, as compared with an increase of 24 percent in OECD energy use. The robust growth in demand among the non-OECD nations is largely the result of strong projected economic growth. In all the non-OECD regions combined, economic activity—as measured by GDP in purchasing power parity terms—increases by 5.3 percent per year on average, as compared with an average of 2.5 percent per year for the OECD economies.

Trends in end-use sector energy consumption can vary widely, according to the level and pace of economic development in a given region. In the OECD region, where energy markets generally are well established, demand for delivered energy in each of the end-use sectors grows more slowly than in the non-OECD nations (Figure 2). For the industrial sector, energy-intensive industries continue to expand more rapidly in the non-OECD countries, where investors are attracted by lower costs and fewer environmental constraints, than in the OECD countries. In 1980, the OECD accounted for 52 percent of the world's industrial sector energy use. In 2004 the OECD share had fallen to 44 percent, and it is projected to decline to 33 percent in 2030, as non-OECD industrial energy use outpaces that in the OECD (Figure 3). For the OECD countries, industrial sector energy use is projected to grow at an average rate of 0.6 percent per year from 2004 to 2030; for the non-OECD countries, the projected increase averages 2.5 percent per year.

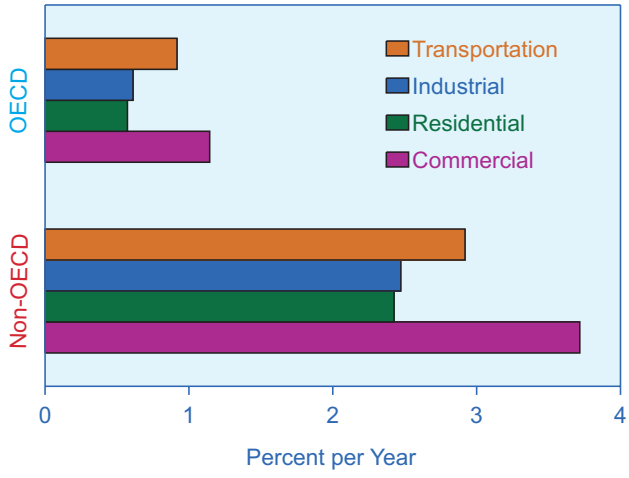
As in the industrial sector, energy use in the buildings and transportation sectors is projected to grow more slowly in the OECD countries than in the non-OECD countries in the *IEO2007* reference case. With slow or declining population growth in many OECD nations,

Figure 1. World Marketed Energy Consumption by Region, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 2. Average Annual Growth in Delivered Energy Consumption by Region and End-Use Sector, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

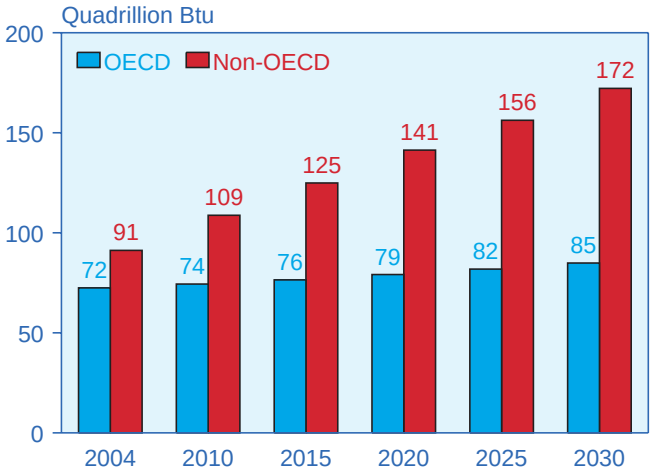
generally slow growth in energy use in the buildings sectors is projected, averaging 0.6 percent per year in the residential sector and 1.1 percent per year in the commercial sector from 2004 to 2030. For the non-OECD region as a whole, strong growth in demand for energy is projected in the buildings sectors, averaging 2.4 percent per year in the residential sector and 3.7 percent per year in the commercial sector.

Historically, growth in transportation activity has been linked closely to income growth, indicating a strong relationship between per-capita GDP and passenger car travel per capita, especially in countries with developing economies. With robust economic growth projected for the developing non-OECD nations, transportation sector energy use increases by an average of 2.9 percent per year from 2004 to 2030, requiring extensive investment in the construction of transportation infrastructure (highways, fueling stations, airport facilities, rail systems, etc.) to support the fast-paced growth in demand. In the OECD countries, where extensive infrastructure is in place already and GDP is projected to grow much more slowly, demand for transportation fuels increases by 0.9 percent per year.

The *IEO2007* reference case projects increased world consumption of marketed energy from all sources over the 2004 to 2030 projection period (Figure 4). Fossil fuels (petroleum and other liquid fuels,[1] natural gas, and coal) are expected to continue supplying much of the energy used worldwide. Liquids supply the largest share of world energy consumption over the projection period, but their share falls from 38 percent in 2004 to 34 percent in 2030, largely in response to a reference case scenario in which real world oil prices remain near the current level through 2030. Liquids remain the dominant energy source, given their importance in the transportation and industrial end-use sectors; however, their share of the world energy market in this year's outlook is lessened in the projection, as other fuels replace liquids where possible outside those sectors. Fossil fuel prices in the reference case also support renewed interest in expanding the use of nuclear power and renewable energy sources to generate electricity.

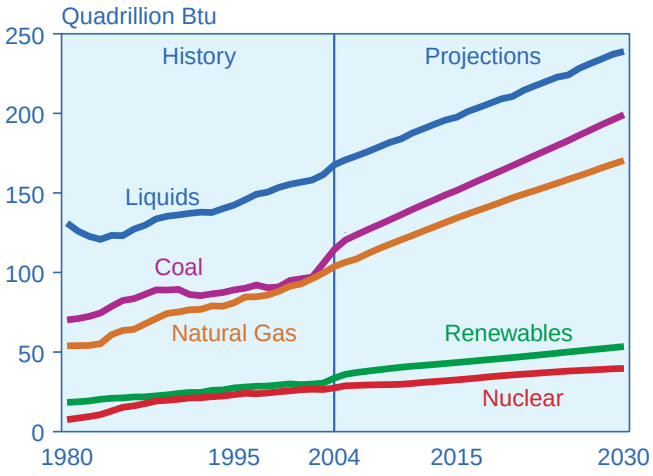
World use of petroleum and other liquids grows from 83 million barrels oil equivalent per day in 2004 to 97 million barrels per day in 2015 and 118 million barrels per day in 2030 in the reference case.[2] In most regions of the world, the role of liquid fuels outside the transportation sector continues to erode. Liquids remain the most important fuels for transportation, because there are few alternatives that can compete widely with petroleum-based liquid fuels. On a global basis, the transportation sector accounts for 68 percent of the total projected increase in liquids use from 2004 to 2030, followed by the industrial sector, which accounts for another 27 percent of the increase.

Figure 3. Industrial Sector Delivered Energy Consumption by Region, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 4. World Marketed Energy Use by Fuel Type, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

[1]Petroleum and other liquid fuels include petroleum-derived fuels and non-petroleum-derived fuels, such as ethanol and biodiesel, coal-to-liquids, and gas-to-liquids. Petroleum coke, which is a solid, is included. Also included are natural gas liquids, crude oil consumed as a fuel, and liquid hydrogen.

[2]Throughout this report, liquids energy use is reported on a barrel equivalent basis, rather than a volumetric basis, because of the inclusion of biofuels (specifically, ethanol) in the liquids total. Ethanol is only two-thirds as efficient as petroleum-based motor gasoline.

To meet the increment in world liquids demand in the reference case, total supply in 2030 is projected to be 35 million barrels per day higher than the 2004 level of 83 million barrels per day. Conventional liquids production by members of the Organization of the Petroleum Exporting Countries (OPEC) contributes about 21 million barrels per day to the total increase, and conventional liquids production in non-OPEC countries adds another 6 million barrels per day (Figure 5). Unconventional resources (including biofuels, coal-to-liquids, and gas-to-liquids) from both OPEC and non-OPEC sources are expected to become increasingly competitive. World production of unconventional resources, which totaled only 2.6 million barrels per day in 2004, is projected to increase to 10.5 million barrels per day and account for 9 percent of total world liquids supply in 2030, on an oil equivalent basis, in the *IEO2007* reference case.

Natural gas consumption increases on average by 1.9 percent per year in the reference case, from a world total of 99.6 trillion cubic feet in 2004 to 129.0 trillion cubic feet in 2015 and 163.2 trillion cubic feet in 2030. Rising world oil prices after 2015 increase the demand for—and then the price of—natural gas, as it is used to displace the use of liquids in the industrial and electric power sectors. Although natural gas prices vary by region, they tend to rise as demand increases. Higher natural gas prices, in turn, make coal more cost-competitive, especially in the electric power sector. Among the end-use sectors, the industrial sector remains the largest consumer of natural gas worldwide, accounting for 43 percent of the world's total projected natural gas consumption in 2030.

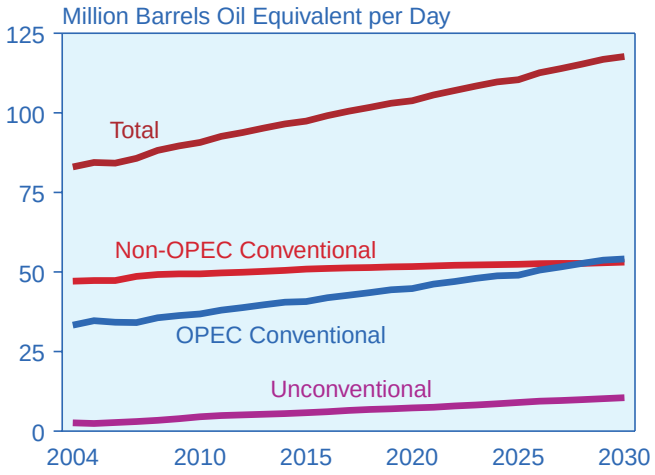
Coal is the fastest-growing energy source worldwide in the *IEO2007* reference case projections. World coal consumption is projected to increase from 114.5 quadrillion Btu in 2004 to 199.1 quadrillion Btu in 2030, at an average annual rate of 2.2 percent. World coal consumption increased sharply from 2003 to 2004, largely because of a 17-percent increase on a Btu basis in non-OECD Asia (mainly, China and India). Coal's share of total world energy use is projected to increase from 26 percent in 2004 to 28 percent in 2030.

The electric power sector accounts for about two-thirds of the world's coal consumption throughout the projection period, and the industrial sector accounts for most of the remainder. China's industrial sector is projected to account for about 78 percent of the total net increase in industrial coal use worldwide. China has abundant coal resources, limited reserves of oil and natural gas, and a leading position in world steel production.

World net electricity generation grows by 85 percent in the *IEO2007* reference case, from 16,424 billion kilowatthours in 2004 to 22,289 billion kilowatthours in 2015 and 30,364 billion kilowatthours in 2030. Most of the projected increase in electricity demand is in the non-OECD nations, where electricity generation increases on average by 3.5 percent per year from 2004 to 2030, as compared with 1.3 percent per year in the OECD nations. Coal and natural gas remain the most important fuels for electricity generation throughout the projection period, together accounting for 80 percent of the total increment in world electric power generation from 2004 to 2030 in the reference case (Figure 6).

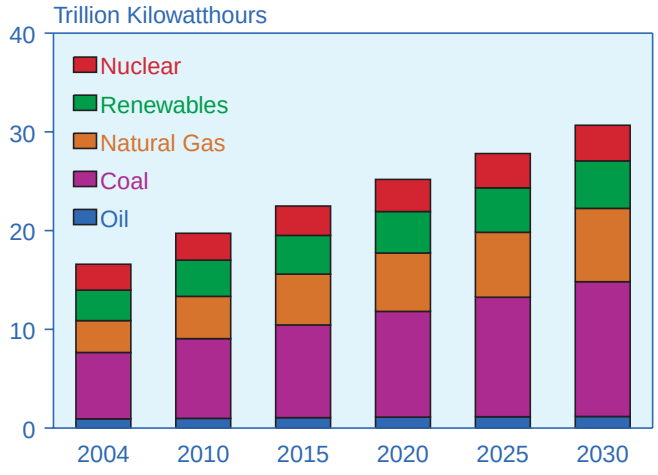
Electricity generation from nuclear power is projected to increase from 2,619 billion kilowatthours in 2004 to 3,619 billion kilowatthours in 2030. Higher fossil fuel prices, energy security concerns, improved reactor designs, and

Figure 5. World Liquids Production, 2004-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 6. World Electricity Generation by Fuel, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

environmental considerations are expected to improve the prospects for new nuclear power capacity in many parts of the world, and a number of countries are expected to build new nuclear power plants. In the *IEO2007* reference case, the world's installed nuclear capacity grows from 368 gigawatts in 2004 to 481 gigawatts in 2030. Declines in nuclear capacity are projected only in OECD Europe, where several countries (including Germany and Belgium) have either plans or mandates to phase out nuclear power, and where some older reactors are expected to be retired and not replaced.

Nuclear power generation in the non-OECD countries is projected to increase by 4.0 percent per year from 2004 to 2030. The largest increase in installed nuclear generating capacity is expected in non-OECD Asia, where annual increases in nuclear capacity average 6.3 percent and account for 68 percent of the total projected increase in nuclear power capacity for the non-OECD region as a whole. Of the 58 gigawatts of additional installed nuclear generating capacity projected for non-OECD Asia between 2004 and 2030, 36 gigawatts is projected for China and 17 gigawatts for India. Russia also is expected to add substantial nuclear generating capacity over the mid-term projection, increasing capacity by 20 gigawatts.

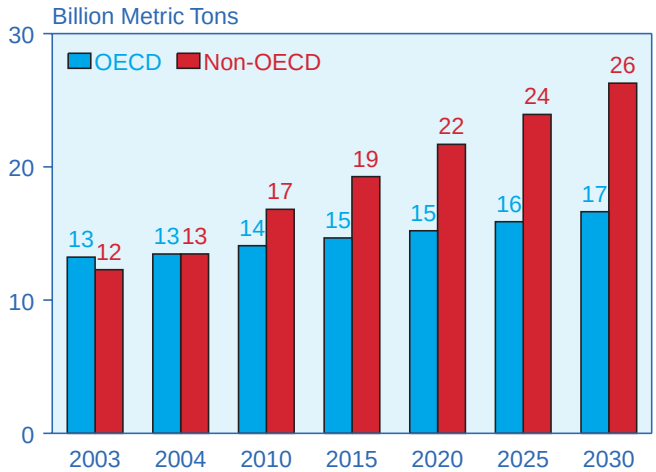
The use of hydroelectricity and other grid-connected renewable energy sources is expected to continue to expand over the projection period, increasing by 1.9 percent per year, at the same rate of growth as natural gas consumption in the reference case. Higher fossil fuel prices, particularly for natural gas in the electric power sector, allow renewable energy sources to compete economically in some areas. Where they are not economically competitive with fossil fuels, renewable energy sources may be supported by government policies and incentives. The renewables share of total world energy consumption is expected to rise from 7 percent in 2004 to 8 percent in 2030.

Much of the growth in renewable energy consumption is projected to come from mid- to large-scale hydroelectric facilities in non-OECD Asia and Central and South America, where several countries have hydropower facilities either planned or under construction. Outside of Canada and Turkey, hydropower capacity is not expected to grow substantially in the OECD nations, because most hydroelectric resources in the region already have been developed or lie far from population centers. Instead, most of the increase in OECD renewable energy consumption is expected to be in the form of nonhydroelectric resources, such as wind, solar, geothermal, municipal solid waste, and biomass.

In recent years, atmospheric concentrations of carbon dioxide—one of the most important greenhouse gases in the atmosphere—have been increasing at a rate of about 0.5 percent annually. Because anthropogenic (human-caused) emissions of carbon dioxide result primarily from the combustion of fossil fuels for energy, energy use has emerged at the center of the climate change debate. World carbon dioxide emissions continue to increase steadily in the *IEO2007* reference case, from 26.9 billion metric tons in 2004 to 33.9 billion metric tons in 2015 and 42.9 billion metric tons in 2030, an increase of 59 percent over the projection period.

From 2003 to 2004, carbon dioxide emissions from the non-OECD countries grew by almost 10 percent, largely because of a 17-percent increase in coal use in non-OECD Asia, while emissions from the OECD countries grew by less than 2 percent. The result of the large increase in non-OECD emissions was that 2004 marked the first time in history that energy-related carbon dioxide emissions from the non-OECD countries exceeded those from the OECD countries—although by only about 8 million metric tons (Figure 7). Further, because the projected average annual increase in emissions from 2004 to 2030 in the non-OECD countries (2.6 percent) is more than three times the increase projected for the OECD countries (0.8 percent), carbon dioxide emissions from the non-OECD countries in 2030, at 26.2 billion metric tons, are projected to exceed those from the OECD countries by 57 percent.

Figure 7. World Carbon Dioxide Emissions by Region, 2003-2030



Sources: **2003 and 2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Chapter 1

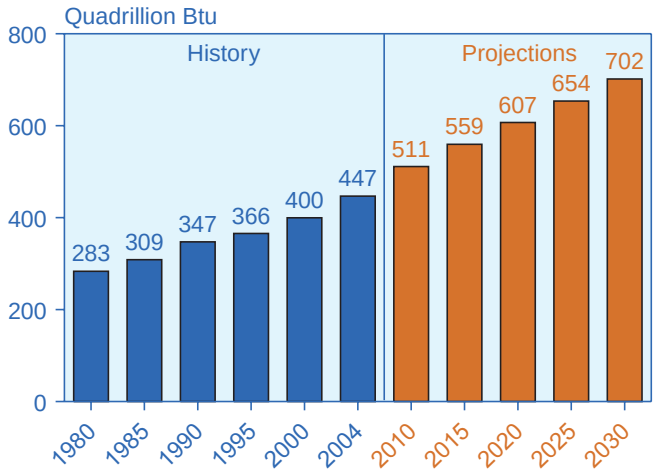
World Energy and Economic Outlook

In the IEO2007 reference case, total world consumption of marketed energy is projected to increase by 57 percent from 2004 to 2030. The largest projected increase in energy demand is for the non-OECD region.

The *IEO2007* reference case—which reflects a scenario where current laws and policies remain unchanged throughout the projection period—projects strong growth for worldwide energy demand from 2004 to 2030. Total world consumption of marketed energy is projected to increase from 447 quadrillion Btu in 2004 to 559 quadrillion Btu in 2015 and then to 702 quadrillion Btu in 2030—a 57-percent increase over the projection period (Table 1 and Figure 8).

The largest projected increase in energy demand is for the non-OECD region. Generally, countries outside the OECD[3] have higher projected economic growth rates and more rapid population growth than the OECD nations. In the *IEO2007* reference case, energy consumption in the non-OECD region is projected to grow at an average annual rate of 2.6 percent from 2004 through 2030. In the OECD region, where national economies are more mature and population growth is expected to be relatively slower, energy use is projected to grow at the much slower average rate of 0.8 percent per year over

Figure 8. World Marketed Energy Consumption, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table 1. World Marketed Energy Consumption by Country Grouping, 2004-2030
(Quadrillion Btu)

Region	2004	2010	2015	2020	2025	2030	Average Annual Percent Change, 2003-2030
OECD	**239.8**	**254.4**	**265.2**	**275.1**	**285.9**	**298.0**	**0.8**
North America	120.9	130.3	137.4	145.1	153.0	161.6	1.1
Europe	81.1	84.1	85.8	86.1	87.5	89.2	0.4
Asia	37.8	39.9	42.1	43.9	45.4	47.2	0.9
Non-OECD	**206.9**	**256.6**	**294.2**	**331.9**	**367.8**	**403.5**	**2.6**
Europe and Eurasia	49.7	54.7	59.4	64.4	68.7	71.5	1.4
Asia	99.9	131.0	154.7	178.8	202.5	227.6	3.2
Middle East	21.1	26.3	29.5	32.6	35.5	38.2	2.3
Africa	13.7	16.9	19.2	21.2	23.1	24.9	2.3
Central and South America	22.5	27.7	31.5	34.8	38.0	41.4	2.4
Total World	**446.7**	**511.1**	**559.4**	**607.0**	**653.7**	**701.6**	**1.8**

Note: Totals may not equal sum of components due to independent rounding.
Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

[3]For consistency, OECD includes all members of the organization as of February 1, 2007, throughout all the time series presented in this publication.

the projection period. Energy use in the non-OECD region is projected to surpass that in the OECD region by 2010, and to be 35 percent greater than the non-OECD total in 2030 (Figure 9).

Much of the growth in energy demand among the non-OECD economies occurs in non-OECD Asia, which includes China and India. Energy demand in the non-OECD Asia region is projected to grow at an average rate of 3.2 percent per year, more than doubling over the 2004 to 2030 period and accounting for more than 65 percent of the increase in energy use for the non-OECD region as a whole. In 2004, energy consumption in the countries of non-OECD Asia made up just over 48 percent of the non-OECD total; in 2030, its share is projected to be above 56 percent (Figure 10).

Strong growth in energy demand is also projected for the other non-OECD regions. In the reference case projections, energy consumption increases at average annual rates of 2.4 percent in Central and South America, 2.3 percent in the Middle East and in Africa, and 1.4 percent in non-OECD Europe and Eurasia.

This chapter presents an overview of the *IEO2007* outlook for energy consumption by primary energy source and a look at the major assumptions that form the basis for the projections that appear in the report. It includes a discussion of the *IEO2007* macroeconomic forecast in the context of the key OECD and non-OECD regions.

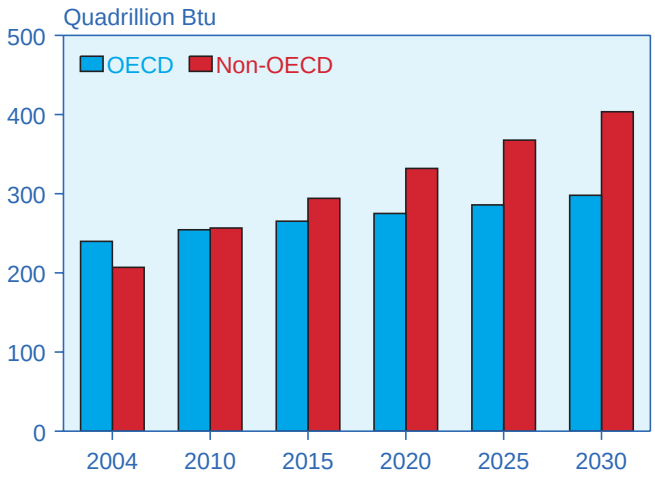
As with any set of projections, there is significant uncertainty associated with the *IEO2007* energy projections. This chapter includes discussion of two sets of sensitivity cases, which vary some of the assumptions behind the *IEO2007* projections: high and low macroeconomic growth cases and high and low world oil price cases. These cases are intended to illustrate alternative scenarios rather than to identify any bounds on uncertainty, which can be affected by policy and technology developments, as well as price and growth paths. Also included is a discussion of the possible effects of future trends in energy intensity (the relationship between energy use and economic growth) on the reference case projections.

Outlook for World Energy Consumption

The *IEO2007* reference case projects increased world consumption of marketed energy from all sources over the 2004 to 2030 period. Fossil fuels continue to supply much of the increment in marketed energy use worldwide throughout the projections. Liquids (primarily, oil and other petroleum products) are expected to continue to provide the largest share of world energy consumption over the projection period, but their share falls from 38 percent in 2004 to 34 percent in 2030 (Figure 11), largely because rising world oil prices dampen the demand for liquids after 2015.

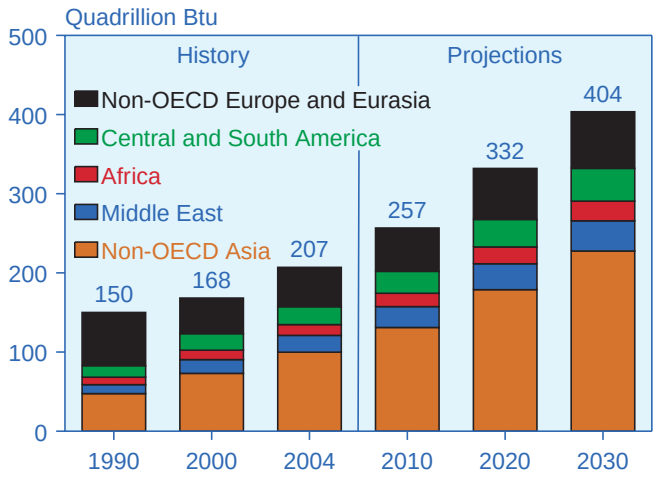
Worldwide liquids consumption is projected to increase from 83 million barrels per day in 2004 to 97 million barrels per day in 2015 and 118 million barrels per day in 2030. Liquids remain the most important fuels for transportation, because there are few alternatives that can be expected to compete widely with petroleum-based liquids; however, the role of oil outside the transportation sector continues to be eroded because of high world oil prices in most regions of the world. On a global basis, the transportation sector accounts for 68 percent of the total projected increase in liquids use between 2004 and 2030,

Figure 9. World Marketed Energy Use: OECD and Non-OECD, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 10. Marketed Energy Use in the Non-OECD Economies by Region, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

followed by the industrial sector, which accounts for another 27 percent of the increment in world liquids demand.

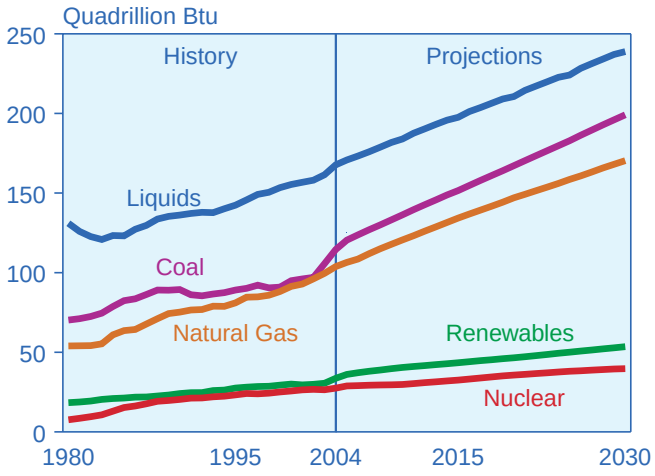
Natural gas consumption increases by 1.9 percent per year on average over the projection period, from about 100 trillion cubic feet in 2004 to 163 trillion cubic feet in 2030. Rising world oil prices increase the demand for natural gas, as it is used to displace the use of liquids in the industrial and electric power sectors in many parts of the world. Industrial uses throughout the world are projected to make up 43 percent of total natural gas use in 2030. In addition, natural gas is both a more efficient fuel for electric power generation and less carbon intensive than other fossil fuels, and as a result it is an attractive energy source for the world's power generation. It is the world's fastest-growing energy source for electricity generation in the *IEO2007* reference case projection, leading to an increase in the electric power sector share of total natural gas use worldwide, from 31 percent in 2004 to 36 percent in 2030.

Natural gas prices are likely to vary from region to region, depending on the size of available resources and their distance from end-use markets. In the United States, dependence on relatively expensive domestic supplies of unconventional natural gas and imports of liquefied natural gas (LNG) is expected to increase over the projection period, and projected prices in the U.S. market thus tend to be at the high end of the range. In Russia and the Middle East, where domestic resources of conventional natural gas are both abundant and readily accessible, natural gas prices are among the lowest in the world.

World coal consumption increased sharply from 2003 to 2004, largely because of a 17-percent increase on a Btu basis in non-OECD Asia (China and India). As a result, coal's share of total world energy use climbed from 25 percent in 2003 to 26 percent in 2004. With oil and natural gas prices expected to continue rising, coal is an attractive fuel for nations with access to ample coal resources—notwithstanding government policies aimed at reducing coal use—and its share of world energy consumption is projected to increase further, to 28 percent in 2030. In the *IEO2007* reference case projection, coal use worldwide increases by 37 quadrillion Btu from 2004 to 2015 and by another 48 quadrillion Btu from 2015 to 2030. In particular, the United States, China, and India are well-positioned to displace more expensive fuels with coal, and together the three nations account for 86 percent of the expected increase from 2004 to 2030 (Figure 12). Decreases in coal consumption are projected only for OECD Europe and Japan, where population growth is slow or declining, electricity demand growth is slow, and natural gas and nuclear power are likely to continue providing significant amounts of electricity.

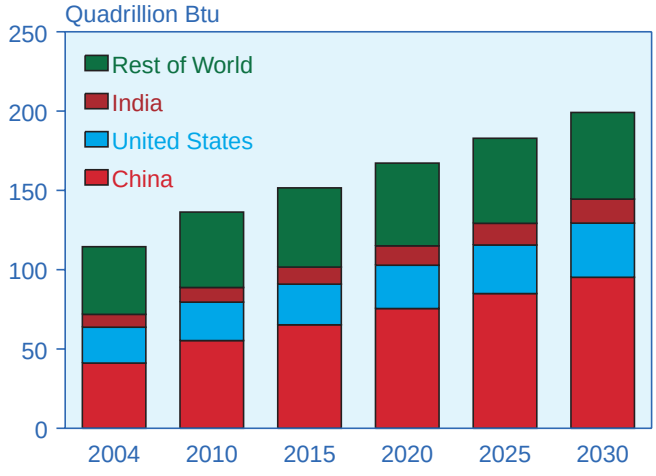
Worldwide, electricity generation in 2030 is projected to total 30,364 billion kilowatthours, nearly double the 2004 total of 16,424 billion kilowatthours. The strongest growth in net electricity consumption is projected for the non-OECD region, averaging 3.5 percent per year in the *IEO2007* reference case (Figure 13). Robust economic growth in many of the non-OECD countries is expected to boost demand for electricity to run newly purchased home appliances for air conditioning, cooking, space and water heating, and refrigeration and to support the

Figure 11. World Marketed Energy Use by Fuel Type, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 12. World Coal Consumption by Region, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

expansion of commercial services, including hospitals, office buildings, and shopping malls. In the OECD nations, where infrastructures are well established and population growth is slower, electricity generation is expected to grow by 1.3 percent per year on average over the projection period.

Natural gas and coal are projected to provide larger shares of the total energy used for electricity generation worldwide in 2030 than they did in 2004. The natural gas share increases from 20 percent to 24 percent and the coal share from 41 percent to 45 percent. The relative environmental benefits and efficiency of natural gas make it an attractive fuel choice for generation in many nations; however, higher oil and natural gas prices make coal the economic choice in the United States and non-OECD Asia, where coal resources are ample.

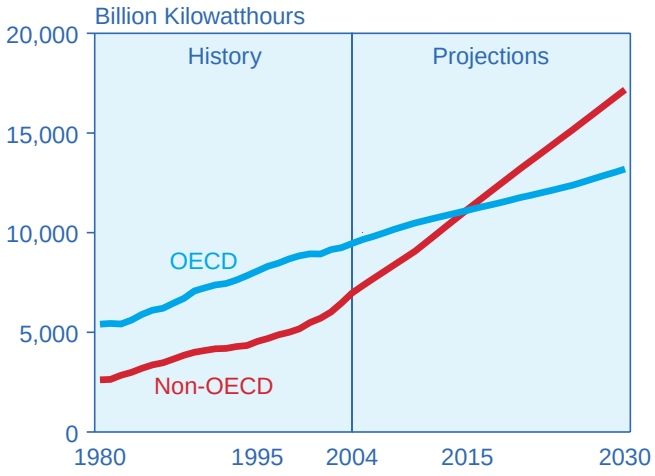
Electricity generation from nuclear power is projected to increase from 2,619 billion kilowatthours in 2004 to 2,972 billion kilowatthours in 2015 and 3,619 billion kilowatthours in 2030. Higher fossil fuel prices, energy security concerns, and environmental considerations are expected to improve the prospects for new nuclear power capacity in many parts of the world. In the *IEO2007* reference case, the world's total installed nuclear capacity rises from 368 gigawatts in 2004 to 481 gigawatts in 2030. Declines in nuclear capacity are projected only for OECD Europe, where several countries have either plans or mandates to phase out nuclear power, and some older reactors are expected to be retired and not replaced.

Nuclear power generation in the non-OECD countries is projected to increase by 4.0 percent per year from 2004 to 2030. The largest increase in installed nuclear generating capacity is projected for non-OECD Asia, which accounts for 68 percent of the total projected increase in nuclear power capacity for the non-OECD region as a whole (Figure 14). Of the 58 gigawatts of additional installed nuclear generating capacity projected for non-OECD Asia between 2004 and 2030, 36 gigawatts is projected for China and 17 gigawatts for India. Russia also is expected to add substantial nuclear generating capacity over the mid-term projection, increasing capacity by 20 gigawatts. Several OECD nations with existing nuclear programs also increase their nuclear capacity in the *IEO2007* reference case, with South Korea adding a net 16 gigawatts, Japan 14 gigawatts, the United States 13 gigawatts, and Canada 6 gigawatts.

The use of hydroelectricity and other grid-connected renewable energy sources is expected to continue to expand over the projection period, increasing by 1.9 percent per year, at the same rate of growth as natural gas consumption in the reference case. Higher fossil fuel prices, particularly for natural gas in the electric power sector, along with government policies and programs to support renewable energy, allow renewable fuels to compete economically. The renewable share of total world energy use increases from 7 percent in 2004 to 8 percent in 2030.

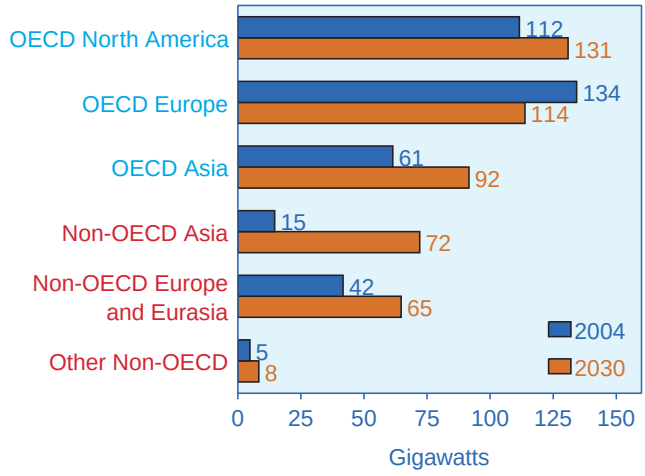
Much of the growth in renewable energy consumption is projected to come from mid- to large-scale hydroelectric facilities in non-OECD Asia and Central and South America, where several countries have hydropower facilities either planned or under construction. In non-OECD Asia, India has about 12,020 megawatts of hydroelectric capacity under construction, and letters of award have been issued for the 1,000-megawatt Tehri Pass project (scheduled for completion by 2012) and the

Figure 13. World Electric Power Generation by Region, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 14. World Nuclear Generating Capacity by Region, 2004 and 2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

1,200-megawatt Kotlibhel-IA project [*1*]. China also has a number of large-scale hydroelectric projects under construction, including the 18,200-megawatt Three Gorges Dam project (expected to be fully operational by 2009) and the 12,600-megawatt Xiluodu project on the Jisha River (scheduled for completion in 2020, as part of a 14-facility hydropower development plan) [2]. In the non-OECD region of Central and South America, Brazil has plans for a number of new hydropower projects that the country hopes to complete to keep up with electricity demand after 2010, including the 3,150-megawatt Santo Antonio and 3,300-megawatt Jirau projects on the Madeira River [*3*].

Outside of Canada and Turkey, hydropower capacity is not expected to grow substantially in the OECD nations, because most hydroelectric resources in the region already have been developed or lie far from population centers. Instead, most of the increase in OECD renewable energy consumption is expected to be in the form of nonhydroelectric resources, such as wind, solar, geothermal, municipal solid waste, and biomass.

World Economic Outlook

Economic growth is among the most important factors to be considered in projecting changes in the world's energy consumption. In the *IEO2007* projections, assumptions about regional economic growth—measured in terms of GDP in real 2000 U.S. dollars at purchasing power parity rates—underlie the projections of regional energy demand.

The macroeconomic framework employed for the economic growth projections reflects the interaction of many important economic variables and underlying relationships, both in the short term and in the medium to long term. In the short term, households and businesses make spending decisions (the demand side) based on current financial conditions—for example, interest rates or the price of goods to be purchased.

In the long term, it is the ability to produce goods and services (the supply side) that ultimately determines the growth potential for any country's economy. Growth potential is influenced by population growth, labor force participation rates, productivity growth, and capital accumulation. In addition, for the developing economies, progress in building human and physical capital infrastructures, establishing credible regulatory mechanisms to govern markets, and ensuring political stability play more important roles in determining their medium- to long-term growth potential.

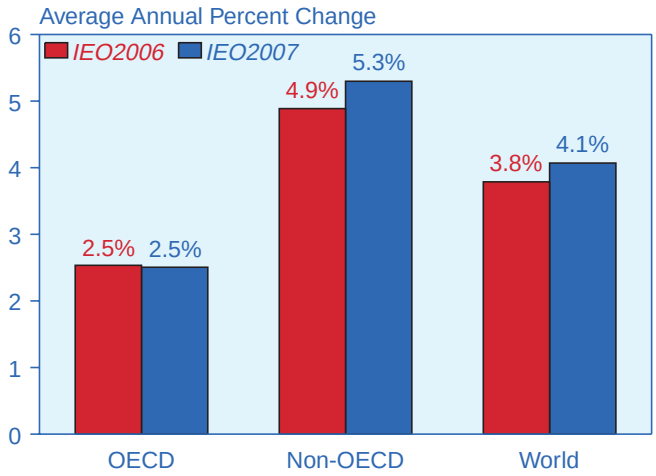
Over the 2004 to 2030 period, world real GDP growth is projected to average 4.1 percent annually in the reference case (Table 2 and Figure 15). When compared with the *IEO2006* reference case projection, the world economic growth projection in the *IEO2007* reference case is higher primarily because of more optimistic assumptions about the growth prospects of non-OECD countries, particularly, China and India.

The projected annual growth in world GDP over the next 25 years is higher than the rate recorded over the past 25 years, mainly because the countries that are expected to see more rapid growth make up an increasing share of world GDP. A number of the developing non-OECD nations have undertaken significant reforms over the past several years. Improved macroeconomic policies, trade liberalization, more flexible exchange rate regimes, and lower fiscal deficits have lowered their national inflation rates, reduced uncertainty, and improved their overall investment climates. More microeconomic structural reforms, such as privatization and regulatory reform, have also played key roles. In general, such reforms have resulted in growth rates that are above historical trends in many of the emerging economies over the past 5 to 10 years.

OECD Economies

In the United States, compared with the second half of the 1990s, GDP growth rates were lower from 2000 to 2002 but rebounded to 2.5 percent in 2003, 3.9 percent in 2004, and 3.2 percent in 2005. GDP growth in 2006 is estimated at 3.3 percent. A downturn in the housing sector has been the major source of weakening over the past year, and reductions in manufacturing output indicate that the slowdown has spread throughout the economy. At the same time, however, corporate finances have been healthy, and real nonresidential investment has remained robust. The depreciation of the U.S. dollar

Figure 15. Comparison of *IEO2006* and *IEO2007* Projections for OECD, Non-OECD, and World GDP Growth Rates, 2004-2030



Sources: ***IEO2006***: Energy Information Administration, *International Energy Outlook 2006*, DOE/EIA-0484(2006) (Washington, DC, June 2006), web site www.eia.doe.gov/oiaf/ieo. ***IEO2007***: Derived from Global Insight, Inc., *World Overview*, Fourth Quarter 2006 (Lexington, MA, January 2007).

against other major currencies has also boosted demand for domestic output.

In the reference case projections, the U.S. economy stabilizes at its long-term growth path by 2010. GDP is projected to grow by an average of 2.9 percent per year from 2004 to 2030—slower than the 3.1-percent annual average over the 1980 to 2004 period—because of the retirement of the baby boom generation and the resultant slowing of labor force growth.

Canada's labor force growth is projected to slow in the medium to long term, however, as baby boomers retire. The country's overall economic growth is projected to fall from the current average of 2.9 percent per year to averages of 2.6 percent per year from 2007 to 2015 and 2.1 percent per year from 2015 to 2030.

In Mexico, real GDP is projected to grow by an average of 3.6 percent per year from 2004 to 2030. Mexico's strong performance in the past 5 years has been the result of favorable developments in several areas. First, lower inflation has allowed the central bank to lower key policy rates, which has encouraged domestic demand through greater investment. Second, high oil prices continue to spur government spending, including investment in infrastructure projects. Third, remittances from Mexicans working abroad continue to grow

Table 2. Average Annual Growth in World Gross Domestic Product by Selected Countries and Regions, 1980-2030
(Percent per Year)

Region	History				Projections			
	1980-2004	2004	2005	2006	2007	2007-2015	2015-2030	2004-2030
OECD North America	**3.0**	**3.9**	**3.2**	**3.4**	**2.6**	**2.9**	**2.9**	**2.9**
United States	3.1	3.9	3.2	3.3	2.5	2.9	2.9	2.9
Canada	2.8	3.3	2.9	2.9	2.6	2.6	2.1	2.3
Mexico	2.5	4.2	3.0	4.4	3.8	3.6	3.6	3.6
OECD Europe	**2.4**	**2.6**	**2.1**	**3.0**	**2.3**	**2.4**	**2.2**	**2.3**
OECD Asia	**2.9**	**2.8**	**2.8**	**2.9**	**2.6**	**2.2**	**1.5**	**1.9**
Japan	2.3	2.3	2.6	2.5	2.1	1.4	0.7	1.1
South Korea	6.9	4.7	4.0	5.0	5.0	4.6	2.7	3.5
Australia/New Zealand	3.3	3.7	2.6	2.6	2.5	2.9	3.0	2.9
Total OECD	**2.7**	**3.2**	**2.7**	**3.1**	**2.5**	**2.6**	**2.4**	**2.5**
Non-OECD Europe and Eurasia	**0.0**	**8.2**	**6.6**	**7.1**	**6.6**	**4.7**	**3.5**	**4.3**
Russia	-0.4	7.2	6.4	6.4	5.7	4.1	3.1	3.7
Other	0.5	9.5	7.0	8.1	7.7	5.5	4.0	4.9
Non-OECD Asia	**7.1**	**8.7**	**8.5**	**8.6**	**8.0**	**6.3**	**5.1**	**5.8**
China	9.8	10.1	9.9	10.5	9.5	7.2	5.4	6.5
India	5.8	8.5	8.7	7.9	7.6	5.9	5.0	5.7
Other	5.3	6.5	5.9	5.8	5.4	4.9	4.3	4.6
Middle East	**2.4**	**6.5**	**5.7**	**5.0**	**5.2**	**4.5**	**3.8**	**4.2**
Africa	**2.6**	**5.1**	**4.9**	**5.4**	**5.4**	**5.1**	**4.6**	**4.9**
Central and South America	**2.2**	**6.0**	**4.6**	**4.8**	**4.7**	**4.0**	**3.7**	**3.9**
Brazil	2.1	4.9	2.3	3.0	4.0	3.6	3.3	3.4
Total Non-OECD	**3.9**	**7.9**	**7.3**	**7.5**	**7.0**	**5.7**	**4.7**	**5.3**
Total World								
Purchasing Power Parity Rates	**3.3**	**5.4**	**4.9**	**5.3**	**4.8**	**4.2**	**3.8**	**4.1**
Market Exchange Rates	**2.9**	**4.0**	**3.5**	**3.9**	**3.3**	**3.2**	**2.9**	**3.1**

Note: All regional real GDP growth rates presented in this table are based on 2000 purchasing power parity weights for the individual countries in each region, except for the final line of the table, which presents world GDP growth rates based on 2000 market exchange rate weights for all countries.

Sources: **Historical Growth Rates:** Global Insight, Inc., *World Overview* (Lexington, MA, various issues). **Projected GDP Growth Rates:** Global Insight, Inc., *World Overview*, Fourth Quarter 2006 (Lexington, MA, January 2007); and Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington DC, February 2007). GDP growth rates for China and India were adjusted downward, based on the analyst's judgment.

rapidly, boosting domestic consumption. Finally, Mexico's industrial production follows, and is heavily influenced by, U.S. GDP growth and outsourcing of employment. Global financial markets remain friendly to Mexico in terms of the availability and cost of credit and the volume of foreign direct investment. In general, strong trade ties with the United States are expected to help cushion Mexico from deeper economic troubles. By the same token, Mexico's future growth is also more dependent on U.S. growth.

Over the long term, OECD Europe's GDP is projected to grow by 2.3 percent per year from 2004 to 2030 in the reference case, in line with what OECD considers to be potential output growth in the region's economies [*4*]. According to the International Monetary Fund, structural impediments to economic growth still remain in many countries of OECD Europe, related to the region's labor markets, product markets, and costly social welfare systems. Reforms to improve the competitiveness of European labor and product markets could yield significant dividends in terms of increases in regional output [*5*].

After a decade of stagnation and several false starts, economic growth in Japan has been more robust since 2003. While low by the standards of pre-1990 Japan, the recent growth in GDP exceeds the potential (no more than 2 percent real growth) for a country with a declining labor force and population and an industrial technology that has already caught up with, and in some cases surpassed, the best elsewhere in the world [*6*]. With the continued decline in its labor force over the projection period, Japan's annual GDP growth is projected to slow, averaging 1.4 percent from 2007 to 2015 and 0.7 percent from 2015 to 2030. In the short term, Japan's highly skilled labor force and strong work ethic are expected to support the projected average growth rate of 1.4 percent per year, as more flexible labor policies allowing greater mobility for workers are adopted.

Economic growth in the rest of OECD Asia is expected to be somewhat stronger than in Japan. In the medium to long term, South Korea's growth is projected to taper off and be sustained by productivity growth as labor force growth slows. Prospects in both Australia and New Zealand are healthy, given their consistent track records of fiscal prudence and structural reforms aimed at maintaining competitive product markets and flexible labor markets.

Non-OECD Economies

Over the 2004 to 2030 period, economic growth in non-OECD Europe and Eurasia as a whole is projected to average 4.3 percent annually. For the past several years, the non-OECD nations of Europe and Eurasia have largely been sheltered from global economic uncertainties, recording strong economic growth in each year since 2000, primarily as a result of robust domestic demand, the growth bonus associated with ascension of some countries (including Estonia, Latvia, Lithuania, and Slovenia) to the European Union, and the impacts of rising oil prices on the oil-exporting nations of the region (including Russia, Kazakhstan, Azerbaijan, and Turkmenistan). High world oil prices have stimulated investment outlays, especially in the energy sector of the Caspian region; however, given the volatility of energy market prices, it is unlikely that the region's economies will be able to sustain the growth rates recently achieved until diversification from energy becomes more broadly based. The long-term growth prospects for the former Soviet Republic economies of Eurasia hinge on their success in economic diversification, as well as further improvements in domestic product and financial markets.

Much of the growth in world economic activity between 2004 and 2030 is expected to occur among the nations of non-OECD Asia, where regional GDP growth is projected to average 5.8 percent per year. China, non-OECD Asia's largest economy, is expected to continue playing a major role on both the supply and demand sides of the global economy. *IEO2007* projects an average annual growth rate of approximately 6.5 percent for China's economy over the 2004 to 2030 period. The country's economic growth is expected to be the highest in the world.

Structural issues that have implications for medium- to long-term growth in China include the pace of reform affecting inefficient state-owned companies and a banking system that is carrying a significant amount of nonperforming loans. The development of domestic capital markets to maintain macroeconomic stability and ensure that China's large savings are used efficiently supports the medium-term growth projection.

India is another Asian country with a rapidly emerging economy. The medium-term prospects for India's economy are positive, as it continues to privatize state enterprises and increasingly adopts free market policies. Average annual GDP growth in India over the 2004 to 2030 projection period is 5.7 percent. Accelerating structural reforms—including ending regulatory impediments to the consolidation of labor-intensive industries, labor market and bankruptcy reforms, and agricultural and trade liberalization—remains essential to stimulate potential growth and reduce poverty in the medium to long term. With its vast and relatively cheap labor force, India is well positioned to reap the benefits of globalization.

In the rest of non-OECD Asia, economic activity has remained robust, with exports increasing in response to a rebound in global demand for high-technology products and stronger import demand from China [*7*]. Over

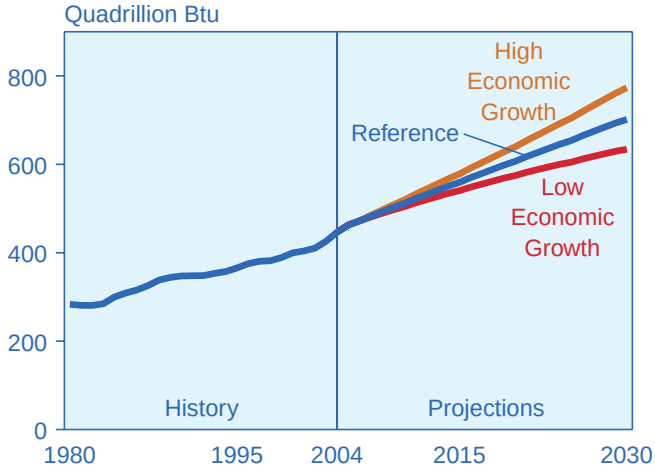
the medium term, national economic growth rates in the region are expected to be roughly constant over the 2004 to 2015 period, before tapering off gradually to an average of 4.3 percent per year from 2015 to 2030 as labor force growth rates decline and economies mature.

Although the nations of Central and South America registered a combined 6-percent increase in GDP in 2004 (their best performance in 20 years), the region's growth prospects are hampered by a weak international credit environment, as well as domestic economic and/or political problems in a number of countries. Growth in the region remains heavily dependent on the volume of foreign capital flows.

Rising oil production and prices have helped boost economic growth in the oil-exporting countries of the Middle East. Many of the oil-importing countries in the region have also benefited from spillover effects on trade, tourism, and financial flows from the region's oil exporters. Real GDP growth in the Middle East region in 2006 is estimated at 5 percent. Medium-term prospects for the region remain favorable, given that a significant portion of the recent increase in oil revenues is expected to be permanent.

Economic growth in Africa has maintained a healthy pace of more than 4 percent per year since 2000, driven by increased earnings from hydrocarbon exports, strong global demand and favorable international prices for some other export commodities, vigorous domestic demand, and significant foreign direct investment and foreign aid [*8*]. Over the 2004 to 2030 period, Africa's combined economy is projected to grow at an annual rate of 4.9 percent. This projection, optimistic by historical standards, is supported by the region's strong economic activity over the past 5 years, which has resulted from expansion of primary exports and robust domestic demand in many of Africa's national economies. Nevertheless, both economic and political factors—such as low savings and investment rates, lack of strong economic and political institutions, limited quantity and quality of infrastructure and human capital, negative perceptions on the part of international investors, protracted civil unrest and political disturbances, and especially the impact of HIV/AIDS on population growth—present formidable obstacles to growth in a number of African countries.

Figure 16. World Marketed Energy Consumption in Three Economic Growth Cases, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Alternative Macroeconomic Growth Cases

Expectations for the future rates of economic growth are a major source of uncertainty in the *IEO2007* projections. To illustrate the uncertainties associated with economic growth trends, *IEO2007* includes a high macroeconomic growth case and a low macroeconomic growth case in addition to the reference case. The two alternative growth cases use different assumptions about future economic growth paths, while maintaining the same relationship between changes in GDP and changes in energy consumption that is used in the reference case.

In the high economic growth case, 0.5 percentage point is added to the growth rate assumed for each region or country in the reference case. In the low economic growth case, 0.5 percentage point is subtracted from the reference case growth rate. The *IEO2007* reference case shows total world energy consumption reaching 702 quadrillion Btu in 2030—298 quadrillion Btu in the OECD countries and 404 quadrillion Btu in the non-OECD countries. In the high economic growth case, total world energy use in 2030 is projected at 773 quadrillion Btu, 72 quadrillion Btu (or about 36 million barrels oil equivalent per day) higher than in the reference case. In the low economic growth case, world energy consumption in 2030 is projected to be 68 quadrillion Btu (34 million barrels oil equivalent per day) lower than in the reference case. Thus, there is a range of 140 quadrillion Btu—about one-fifth of the total consumption projected for 2030 in the reference case—between the projections for 2030 in the high and low macroeconomic growth cases (Figure 16).

Alternative World Oil Price Cases

The impacts of world oil prices on energy demand and its composition are another large source of uncertainty in the *IEO2007* projections. To illustrate the impacts, *IEO2007* includes two alternative price cases. In the *IEO2007* high world oil price case, world oil prices climb from $43 per barrel (2005 real dollars) in 2004 to $100 per

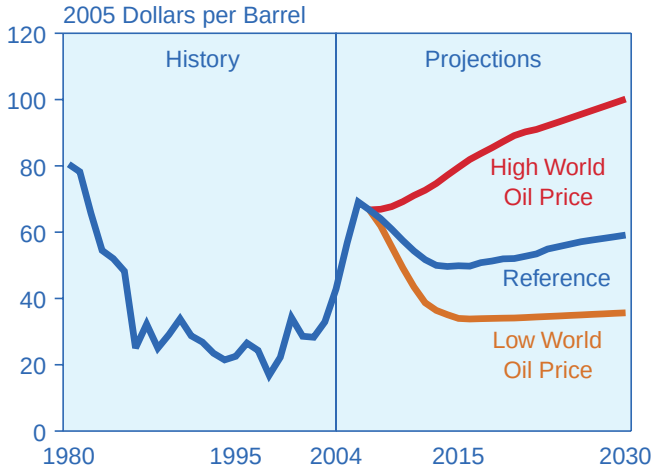
barrel in 2030. In the low price case, oil prices moderate fairly quickly to $49 per barrel in 2010 and then further to $34 per barrel in 2015 and remain at that level through 2030 (Figure 17). Despite the considerable difference between oil prices in the low and high price cases in 2030 (around $70 per barrel), the projections for total world energy consumption in the reference and alternative oil price cases do not vary substantially.

There is, however, a larger impact on the energy mix. In 2030, total world energy use in the high and low world oil price cases is separated by only 38 quadrillion Btu (Figure 18). In comparison, the difference between the low and high macroeconomic growth case projections is 140 quadrillion Btu. The potential effects of higher and lower oil prices on world GDP can also be seen in the low and high world oil price cases (see box on page 14). In the long run, the projections for economic growth are not affected substantially by the oil price assumptions. The most significant variations are GDP increases of around 1 percent in the low price case relative to the reference case in 2015 for some regions outside the Middle East and, in the oil-exporting Middle East region only, a 1-percent drop in GDP in 2015. In 2030, however, there are virtually no differences among GDP projections for any region in the different cases, because the world's economies have had sufficient time to adjust to the lower or higher oil prices.

The most significant impacts of the higher and lower world oil price assumptions are on the mix of energy fuels consumed in each region, particularly liquids and coal (Figure 19). In the high price case, total world energy use in 2030 is about 20 quadrillion Btu lower, and world liquids consumption is 29 quadrillion Btu lower, than projected in the reference case. Natural gas consumption is also lower in 2030, by a more modest 5 quadrillion Btu, whereas the projections for coal, nuclear power, and renewable energy consumption are higher than those in the reference case.

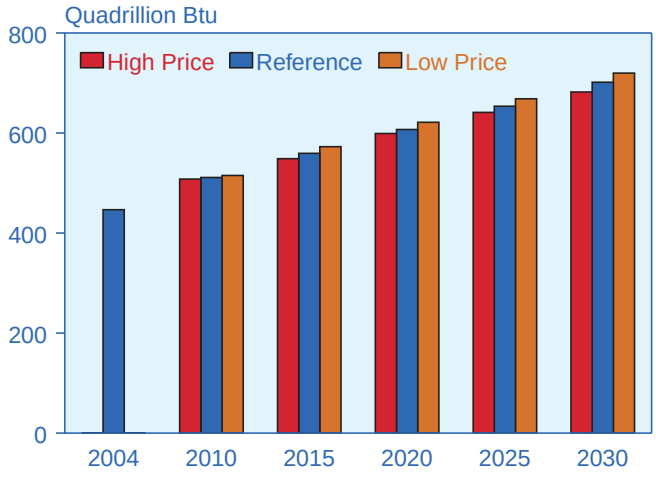
In the low world oil price case, lower prices both allow consumers to increase their use of liquids for transportation purposes and discourage the migration away from liquids to other energy sources in sectors where fuel substitution is fairly easy to achieve (as opposed to the transportation sector, where there are still relatively few alternatives to petroleum-based fuels). Total liquids

Figure 17. World Oil Prices in Three World Oil Price Cases, 1980-2030



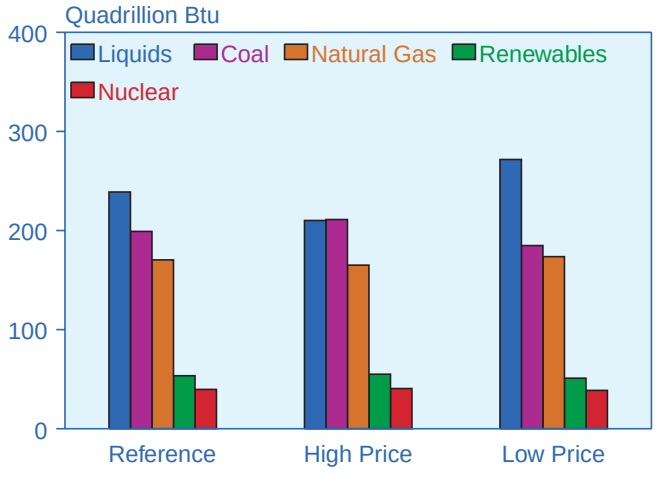
Source: Energy Information Administration (EIA), *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), web site www.eia.doe.gov/oiaf/aeo.

Figure 18. World Marketed Energy Consumption in Three World Oil Price Cases, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 19. World Marketed Energy Consumption in Three World Oil Price Cases, 2030



Note: Liquids supply sources include both conventional and unconventional sources.

Source: Energy Information Administration, System for the Analysis of Global Energy Markets (2007).

World GDP: Potential Impacts of High and Low Oil Prices

Price paths in the *IEO2007* high and low world oil price cases are not characterized by disruption but rather represent sustained movements relative to the reference case oil price path. The assumptions behind the oil price cases are that the price changes do not come as a shock and that the central banks of developed countries are able to carry out active monetary policies effectively, because core inflation does not get out of hand and exchange rates do not change from those in the reference case. Further, it is assumed that national fiscal policies do not vary from those in the reference case. If any of these assumptions were changed, the economic projections in the alternative cases would be altered.

Global Insight, Inc.'s Global Scenario Model was employed to project the alternative paths of world economic growth in the high and low world oil price cases relative to the reference case. The figures below represent percentage differences, over time, in nominal world oil prices (left) and real world GDP (right) in the high and low world oil price cases relative to those in the reference case. In the high price case, oil prices rise steadily to 62 percent above reference case prices within 8 years (2014). Thereafter the difference widens gradually, to 76 percent above reference case prices in 2030. In the low price case, oil prices are 28 percent below reference case prices in 2013, after which the difference widens to 43 percent in 2030.

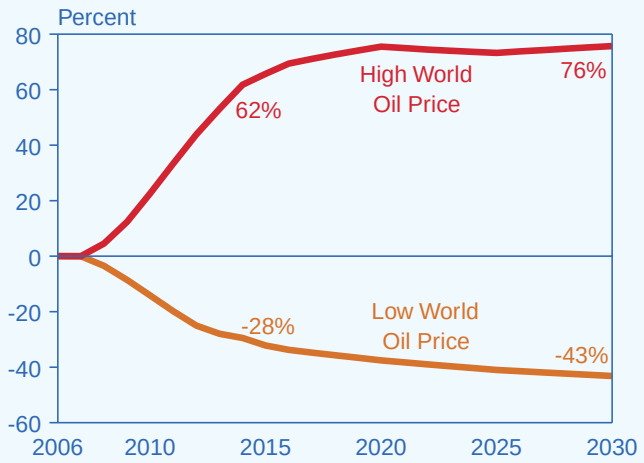
Because world oil prices fall proportionately less in the low price case than they rise in the high price case (relative to the reference case), changes in GDP projections in the two price cases relative to those in the reference case are not symmetrical. Also, because most of the deviation from reference case prices in the high and low cases occurs by approximately 2014, differences from the reference case GDP projections are greatest at that point in time, then begin to narrow as the rates at which oil prices change become more similar across the three cases.

Higher (and lower) oil prices relative to the reference case affect national economies both internally and in their interactions with other nations through exports and imports. In the short term, as higher oil prices feed through the economy and reduce purchasing power, real aggregate expenditures on goods and services decline.[a] With aggregate demand for output falling behind aggregate supply, unemployment increases, energy-intensive capital stock begins to become obsolete, and real GDP is lower.

In oil-importing countries that also have major oil-producing sectors, like the United States, higher oil prices increase the flow of economic resources into oil production activities. At the same time, national expenditures on petroleum imports increase, with negative repercussions for real GDP. Countries wholly dependent on oil imports, like Japan, are forced to spend more for their energy purchases. Oil-importing countries with export-dependent economies, like South Korea, are affected even more severely, as their energy expenditures climb while export revenues fall because worldwide demand is lower. In addition, with

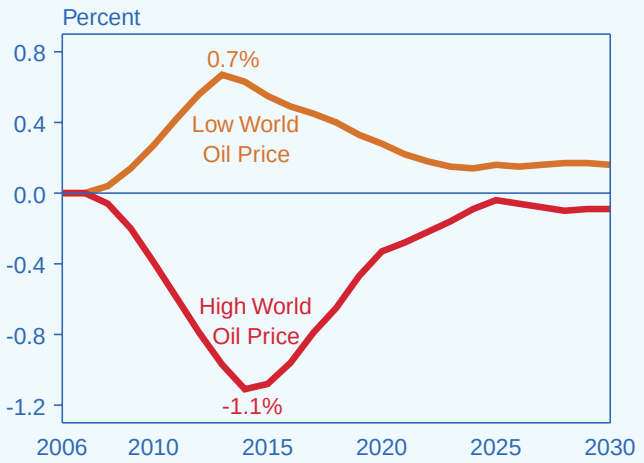
(continued on page 15)

Differences from Reference Case World Oil Price Projections in the High and Low World Oil Price Cases, 2006-2030



Source: Global Insight, Inc., Global Scenario Model (February 2007).

Differences from Reference Case World Real GDP Projections in the High and Low World Oil Price Cases, 2006-2030



Source: Global Insight, Inc., Global Scenario Model (February 2007).

[a]The discussion here focuses on economic effects in the high oil price case. In the low oil price case, effects will be diametrically opposite.

World GDP: Potential Impacts of High and Low Oil Prices (Continued)

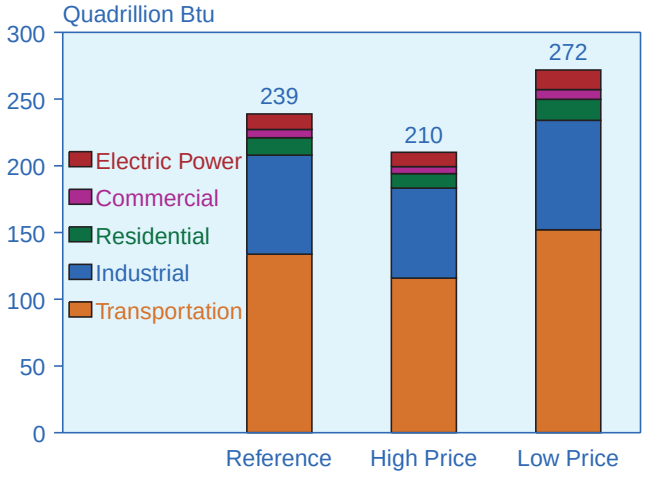
higher aggregate prices, interest rates tend to rise. Oil-exporting countries, like Saudi Arabia and Russia, see more revenue from their oil exports, boosting incomes and increasing their demand for goods and services and their real GDP.

Over time, the world economy adjusts back to its long-term (reference case) growth path. In the medium term, increases in unemployment lead to downward adjustments in wages and prices. In developed countries, central banks react by lowering key policy rates, thus boosting interest-sensitive aggregate demand. After 2015, the rebound effects of lower employment costs, lower prices, and lower interest rates outweigh the contractionary effects of higher oil prices, leading to stronger real GDP growth and lower inflation. As aggregate demand increases in the oil-exporting countries with higher oil revenues, their demand for imports grows, increasing the demand for exports from the oil-importing countries. As a result, in 2030, the world economy ends up with almost the same real GDP growth rate and unemployment rate as in the reference case, although the composition and sources of world output, international trade, and capital flows are qualitatively different from those in the reference case.

Real GDP in the high and low world oil price cases deviates from its reference case path for a considerable period of time, but as the world economy adjusts to the higher or lower oil prices, the deviation becomes smaller. Thus, world real GDP in 2030 is approximately the same in the three cases. Using 2006 and 2030 as end points to compute average annual growth rates in world real GDP, the rates in the three cases are approximately the same; however, that calculation does not portray adequately the dynamic movements of the world economy and the extent of the differences across the three cases. The present discounted sum of changes in real GDP over the projection period gives a better indication of net effects on the world economy. The sums of the changes in world GDP from the reference case (discounted at 7 percent) in the low and high price cases over the 2006-2030 period are $2,937 billion and -$4,226 billion, respectively, representing approximately 0.3 percent and -0.4 percent of the sum of discounted real GDP in the reference case—taking into account factor displacements, dislocations, and adjustments as well as gainers and losers within and across countries.

consumption in 2030 is 33 quadrillion Btu higher in the low price case than projected in the reference case, reflecting increased demand in all the end-use sectors. The transportation sector shows the largest increase in liquids consumption in 2030 in the low world oil price relative to the reference case, at 18 quadrillion Btu (Figure 20).

Figure 20. World Liquids Consumption in Three World Oil Price Cases, 2030



Source: Energy Information Administration, System for the Analysis of Global Energy Markets (2007).

In the *IEO2007* reference case, world oil prices rise steadily after 2015, to $59 per barrel in 2030. As a result, liquids consumption is curtailed in countries that have other fuel options available—especially in the electric power sector, where coal and other fuels can be substituted. In the reference case, worldwide use of liquids for electricity generation grows by only 1.0 quadrillion Btu from 2004 to 2030. In the low world oil price case, the corresponding increase is 4.0 quadrillion Btu, as countries in both the OECD and non-OECD regions retain their oil-fired generating capacity in the lower price environment.

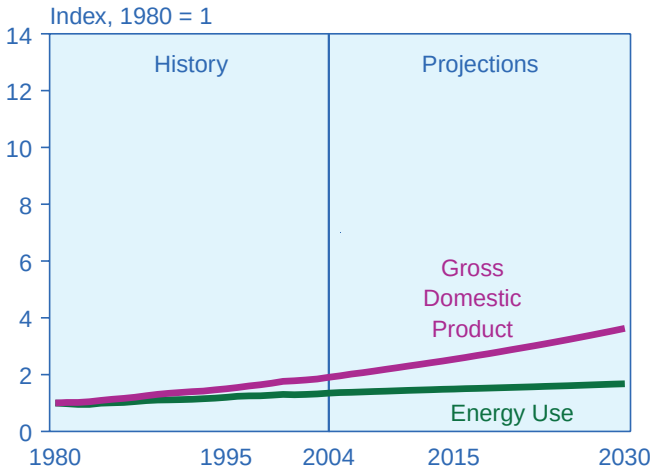
Trends in Energy Intensity

Another major source of uncertainty in the projections is the changing relationship of energy use to GDP—or energy intensity—over time. Economic growth and energy demand are linked, but the strength of that link varies among regions. In the OECD nations, history shows the link to be a relatively weak one, with energy demand lagging behind economic growth (Figure 21). In the non-OECD region, except for non-OECD Europe and Eurasia, economic growth has been closely correlated with energy demand growth for much of the past three decades (Figure 22). Only recently, within the past decade or so, has economic growth begun to outpace the growth in energy use among the world's emerging economies.

Historically, non-OECD Europe and Eurasia have had higher levels of energy intensity than either the OECD or other non-OECD economies. In non-OECD Europe and Eurasia, energy consumption generally grew more rapidly than GDP until 1990 (Figure 23), when the collapse of the Soviet Union created a situation in which both income and energy use declined but GDP fell more quickly. As a result, energy intensity increased. Only since the late 1990s, after the 1997 devaluation of the Russian ruble, did the Russian and Ukrainian industrial sectors begin to strengthen. Since then, economic growth in non-OECD Europe and Eurasia has begun to outpace growth in energy use significantly, and energy intensity has begun a precipitous decline. The region's energy intensity is projected to continue declining in the *IEO2007* reference case, while still remaining higher than in any other part of the world (Figure 24).

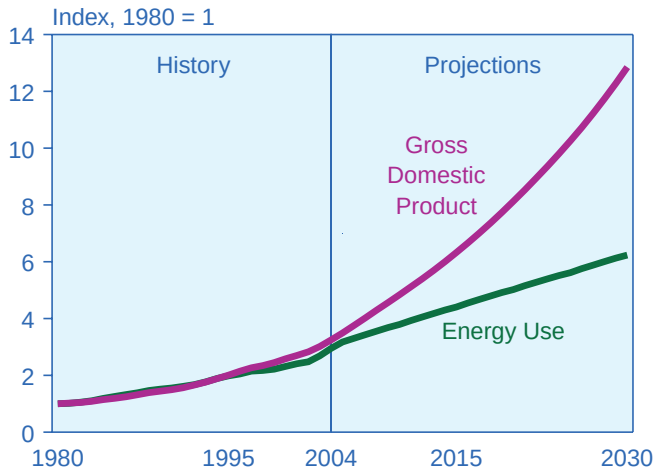
The stage of economic development and the standard of living of individuals in a given region strongly influence

Figure 21. Growth in Energy Use and Gross Domestic Product for the OECD Economies, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

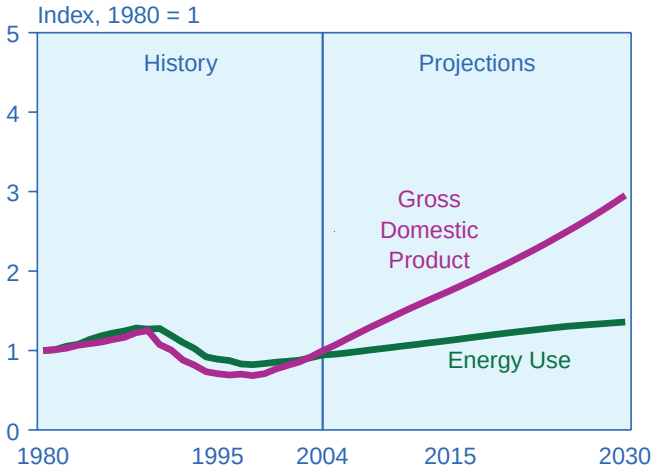
Figure 22. Growth in Energy Use and Gross Domestic Product for the Non-OECD Economies, 1980-2030



Note: Non-OECD economies in this figure exclude non-OECD Europe and Eurasia.

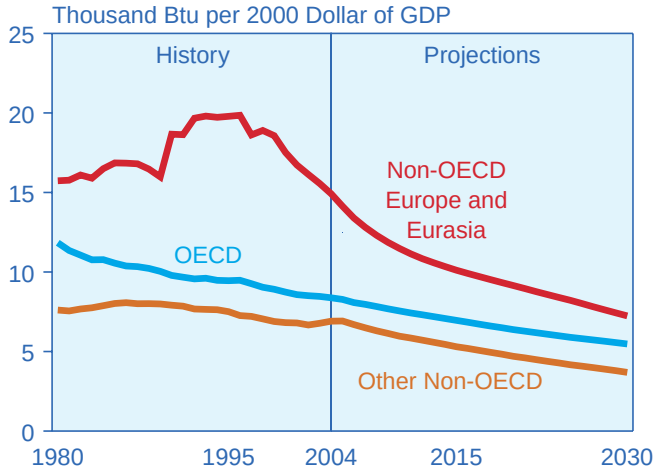
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 23. Growth in Energy Use and Gross Domestic Product for the Non-OECD Economies of Europe and Eurasia, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 24. Energy Intensity by Region, 1980-2030



Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

the link between economic growth and energy demand. Advanced economies with high living standards have relatively high levels of energy use per capita, but they also tend to be economies where per capita energy use is stable or changes very slowly. In the OECD economies, there is a high penetration rate of modern appliances and motorized personal transportation equipment. To the extent that spending is directed to energy-consuming goods, it involves more often than not purchases of new equipment to replace old capital stock. The new stock is often more efficient than the equipment it replaces, resulting in a weaker link between income and energy demand.

The pace of improvement in energy intensity may change, given different assumptions of macroeconomic growth over time. Faster growth in income generally leads to a faster rate of improvement (decline) in energy intensity. In the *IEO2007* high macroeconomic growth case, worldwide energy intensity is projected to decline by 2.3 percent per year on average from 2004 to 2030, as compared with 2.2 percent in the reference case. On the other hand, slower economic growth generally leads to a slower rate of improvement in energy intensity. In the low macroeconomic growth case, world energy intensity is projected to decline by an average of only 2.1 percent per year over the projection period.

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Chapter 2

Energy Consumption by End-Use Sector

In the IEO2007 projections, end-use energy consumption depends on resource endowment, economic growth, and other political, social, and demographic factors.

One way of looking at the future of world energy markets is to consider trends in energy consumption at the end-use sector level. With the exception of the transportation sector, which is dominated by petroleum-based liquids products at present, the mix of energy use in the residential, commercial, and industrial sectors varies widely by region, depending on a combination of regional factors, such as the availability of energy resources, the level of economic development, and political, social, and demographic factors. This chapter outlines *IEO2007* reference case projections for delivered energy consumption by end-use sector in the OECD and non-OECD regions.

Transportation Sector

Energy use in the transportation sector includes the energy consumed in moving people and goods by road, rail, air, water, and pipeline. The road transport component includes light-duty vehicles, such as automobiles, sport utility vehicles, minivans, small trucks, and motorbikes, as well as heavy-duty vehicles, such as large trucks used for moving freight and buses for passenger travel. Growth in economic activity and population growth are the key factors that determine transportation sector energy demand. Economic growth spurs growth in industrial output, which requires the movement of raw materials to manufacturing sites as well as movement of manufactured goods to end users. In developing economies, increased economic activity expands per-capita income; and as standards of living rise, demand for personal transportation increases.

Over the next 25 years, demand for petroleum and other liquid fuels is expected to increase more rapidly in the transportation sector than in any of the other end-use sectors. In the OECD countries, which are projected to remain the greatest users of energy for transportation, the transportation sector's share of total liquids demand is projected to rise from 58 percent in 2004 to 63 percent in 2030. In the non-OECD countries, the transportation sector is projected to account for a rising share of liquids consumption, and the liquids share of transportation energy use grows from 42 percent in 2004 to nearly 50 percent in 2030.

A primary factor contributing to the expected increase in energy demand for transportation is steadily increasing demand for personal travel in both the developing and mature economies. Increases in urbanization and in personal incomes have contributed to increases in air travel as well as increased motorization (i.e., more vehicles) in the growing economies. Modal shifts in the transport of goods are expected to result from strong GDP growth in both OECD and non-OECD economies. For freight transportation, trucking is expected to lead the growth in demand for transportation fuels. In addition, as trade among countries increases, the volumes of freight transported by air and marine vessels is expected to increase rapidly over the projection period [***1***].

In the price environment of the past several years, alternative transportation fuels have received growing attention worldwide. The United States, for instance, has passed legislation to increase the amount of ethanol in the U.S. liquids mix and has increased funding for research on cellulosic biofuels. In OECD Europe, there has been a major push to increase the use of alternative fuels for transportation, including natural gas. Alternative fuels remain fairly expensive, however. Barring any widespread increase in penetration of new technologies, whether driven by policy changes or other factors, the world's use of alternative fuels in the transportation sector is expected to remain relatively modest through 2030 in both OECD and non-OECD countries.

OECD Countries

Energy demand for transportation in the OECD economies is projected to grow at an average annual rate of 0.9 percent, from 57.9 quadrillion Btu in 2004 to 63.7 quadrillion Btu in 2015 and 73.4 quadrillion Btu in 2030 (Figure 25). As a whole, the OECD transportation sector can be characterized as fully established, with extensive infrastructure that includes highways, airport facilities, and rail systems. Transportation uses are expected to account for nearly all the growth in demand for liquids in the OECD countries over the projection period.

In the United States, the transportation sector continues to account for almost one-fourth of the country's total energy consumption; and in the *IEO2007* reference case, U.S. transportation energy demand is projected to grow from 27.9 quadrillion Btu in 2004 to 32.1 quadrillion Btu in 2015 and 39.3 quadrillion Btu in 2030. The United States is the largest user of transportation energy among the OECD nations and is projected to consume

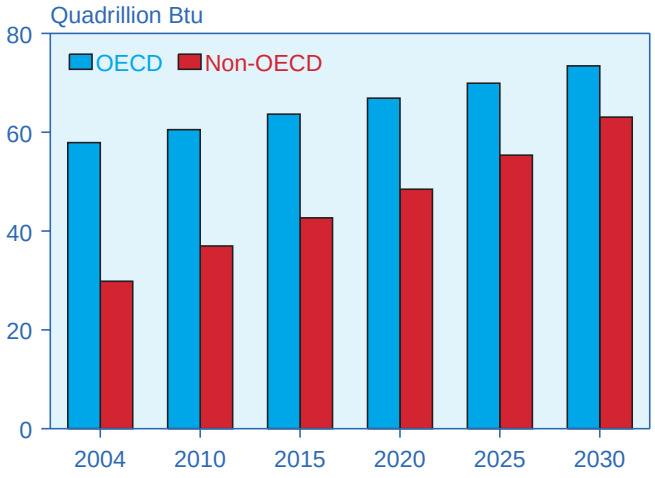
54 percent of the region's total for the transportation sector in 2030. Freight trucks are projected to be the fastest growing mode of travel in the United States, with vehicle miles traveled by freight trucks increasing at an average rate of 2.2 percent per year from 2004 to 2030, while their energy use increases by 1.8 percent per year. U.S. air travel is projected to increase by an average of 1.7 percent per year over the period; however, advanced aircraft technologies are expected to improve the efficiency of air travel, and so fuel use for air travel grows by only 1.4 percent per year.

Income growth and stable fuel prices are expected to continue the demand for larger, more powerful vehicles in the United States; however, advanced technologies and materials are expected to provide increased performance and size while improving new vehicle fuel economy. In March 2006, the National Highway Traffic Safety Administration finalized corporate average fuel economy (CAFE) standards requiring higher fuel economy performance for light-duty trucks in model years (MY) 2008 through 2011 [*2*]. The new CAFE standards specify a continuous mathematical function that determines minimum fuel economy requirements by vehicle footprint, defined as the wheelbase (the distance from the center of the front axle to the center of the rear axle) times the average track width (the distance between the center lines of the tires) of the vehicle in square feet. U.S. fuel economy standards for cars are assumed to remain at the current (2004) level of 27.5 miles per gallon through 2030.

In Mexico, strong GDP growth (3.6 percent per year) is projected to increase energy consumption in the transportation sector at an average rate of 2.3 percent per year, from 1.8 quadrillion Btu in 2004 to 2.3 quadrillion Btu in 2015, and 3.3 quadrillion Btu in 2030. The projected increase in transportation fuel use is based on expected growth in trade with the United States and overall improvement in the country's standard of living [*3*].

Transportation energy demand in OECD Europe is projected to increase by only 0.2 percent per year, from current usage of 18.5 quadrillion Btu in 2004 to 18.9 quadrillion Btu in 2015 and 19.6 quadrillion Btu in 2030. The transportation share of total energy use in OECD Europe is projected to decline slightly, from 23 percent in 2004 to about 22 percent in 2030. Low population growth, high taxes on transportation fuels, and environmental policies to discourage growth in transportation energy use are expected to slow the growth of transportation demand in OECD Europe.

Figure 25. OECD and Non-OECD Transportation Sector Delivered Energy Consumption, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Non-OECD Countries

The projected average growth rate of transportation energy use in the non-OECD countries from 2004 to 2030, at 2.9 percent per year, is more than triple the projected rate for OECD countries, and their use of liquids in the transportation sector is expected to double over the period (Figure 25). Among the non-OECD countries, China, India, and the nations of Central and South America are expected to be significant contributors to the growth in transportation sector energy consumption. China and India are expected to show the largest increases among the non-OECD countries. The combined growth rate for transportation energy use in all the countries of Central and South American economies is projected to be similar to that in India.

Historically, growth in transportation activity has been tied to income growth, indicating a strong relationship between per-capita GDP and passenger car travel per capita in countries with developing economies [*4*]. In many countries of OECD Asia, the availability of financing and an increase in the debt tolerance of middle class families are contributing to increased vehicle purchases.

Total transportation energy demand in the non-OECD countries is projected to grow from 29.8 quadrillion Btu in 2004 to 42.7 quadrillion Btu in 2015 and 63.1 quadrillion Btu in 2030. The transportation sector is projected to account for nearly 60 percent of the total increase in liquids use in non-OECD countries from 2004 to 2030. The growth in transportation energy use is expected to be led by greater demand for aviation fuel. Expanding ownership of private automobiles and an increasing role of trucking in freight transportation also play a significant role in the expected increase in energy demand. In 2004, the non-OECD economies accounted for about 34 percent of world energy use for transportation. In 2030, their share is projected to be 46 percent, as the gap

between transportation energy consumption in the non-OECD and OECD economies narrows substantially over the projection period (Figure 25).

China's energy use for transportation is projected to grow by an average of 4.9 percent per year, from 4.4 quadrillion Btu in 2004 to 7.7 quadrillion Btu in 2015 and 15.5 quadrillion Btu in 2030. Virtually all the growth in transportation energy consumption in China is projected to be in the form of liquids, mostly petroleum-based. As the country's economy expands, its energy use for air travel is expected to grow more rapidly than energy use for road transport (see box on page 22). Personal travel in China has soared in the past two decades, with passenger miles traveled increasing fivefold [***5***]. Still, in 2005 there were 4.5 million automobiles in China [***6***], as compared with 130.8 million automobiles in the United States [***7***].

After China, India is expected to experience the fastest expansion in transportation sector energy use in the world. India's transportation energy use is projected to grow at an average rate of 3.3 percent per year in the *IEO2007* reference case, compared with the world average of 1.7 percent per year. In comparison with other countries in the emerging, non-OECD Asia region, India's transportation infrastructure is well developed and used effectively by a large section of the population. Its railways are particularly established—although many rural areas still are largely inaccessible by rail. The *IEO2007* reference case anticipates that India will continue to expand its public transportation networks over the projection period, allowing robust increases in both road and rail transport and resulting in a more than doubling of transportation energy use between 2004 and 2030.

The pace and extent of transportation infrastructure improvements in China and India will influence the pace of growth in their transportation energy use. Interconnecting cities with major ports will allow goods and people to flow more quickly, making motorized road travel—for both freight transport and personal motor vehicles—more attractive. India launched its National Highways Development Project (NHDP) in 1998 to modernize its major highways [***8***]. The first phase of the project—the "Golden Quadrilateral," a 3,625-mile multilane highway system that connects Delhi, Mumbai, Chennai, and Calcutta—was completed at the end of 2006. The second phase—the North-South and East-West national highways that will connect the outermost points of the country—will comprise more than 4,200 miles of highway, with a scheduled completion date of December 2007. Additional NHDP projects are scheduled beyond that.

Transportation infrastructure investments are also occurring in China. In Beijing, a considerable amount of road construction and repair is underway in advance of the 2008 Olympic Games, with more than 40 main roads being repaired and 27 new arteries and 9 expressways under construction [***9***]. The country also has an ambitious plan to construct a 53,125-mile national expressway network to connect all its major transportation hubs, including railways, airports, and ports [***10***]. The "7918 Network" will, upon completion in 2020, connect Beijing with 7 major population centers or transportation hubs; 9 highways will connect the northern and southern parts of the country; and 18 highways will provide east-west connections. The need to expand road infrastructure is also evident in China's rural areas. For example, the Xinjiang Uighur Autonomous Region has announced plans to invest some $1.2 billion on road works in 2007, to build more than 2,400 miles of new roadway [***11***].

The Middle East has a relatively small population and is not a major energy consumer but rather an exporter; however, rapid population growth in the region is expected to result in increased demand for transportation. The region's energy demand for transportation is projected to grow from 4.5 quadrillion Btu in 2004 to 6.9 quadrillion Btu in 2015 and 9.0 quadrillion Btu in 2030.

Residential Sector

Energy use in the residential sector, which accounted for about 11 percent of worldwide delivered energy consumption in 2004, is defined as the energy consumed by households, excluding transportation uses. For residential buildings, the physical size of the structures is one key indicator of the amount of energy used by their occupants. Larger homes require more energy to provide heating, air conditioning, and lighting, and they tend to include more energy-using appliances, such as televisions and laundry equipment. Smaller structures require less energy, because they contain less space to be heated or cooled, produce less heat transfer with the outdoor environment, and typically have fewer occupants.

The type and amount of energy used by households vary from country to country, depending on income levels, natural resources, climate, and available energy infrastructure. In general, typical households in the OECD use more energy than those in non-OECD nations, in part because higher income levels allow OECD households to purchase more energy-using equipment. Consequently, residential sector energy use in the OECD countries accounts for about 60 percent of the world's residential delivered energy use, although the OECD nations account for only 18 percent of the world's population.

Whereas households in the OECD nations used more energy in 2004 in total than did the non-OECD nations, more rapid growth of residential energy consumption is

China's Transportation Sector: Recent Developments and Long-Term Projections

What happens in China in terms of liquids demand can have a substantial impact on world oil markets. China, with a rapidly expanding transportation sector, is the world's fastest-growing oil consumer. In the past 2 years, China alone accounted for more than 30 percent of the world's incremental consumption of liquid fuels.[a] China's strong growth in consumption helped to support high world oil prices in 2005 and 2006.

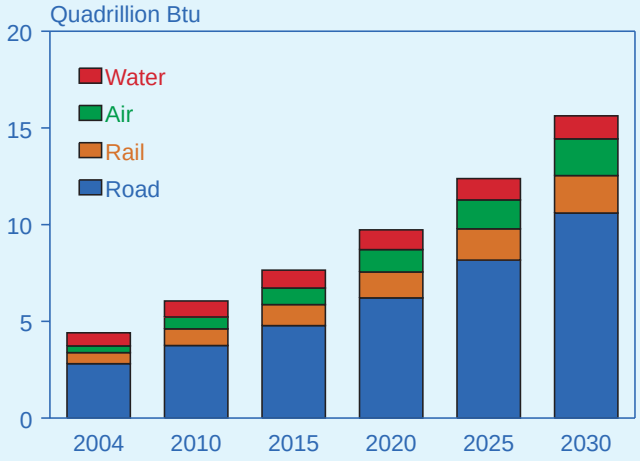
Transportation use is likely to define much of the growth in China's liquids consumption. An understanding of potential developments in China's transportation energy use over the coming decades is important, because it can allow analysts to consider how China's liquids markets will evolve and their potential impacts on world oil markets.

Economic growth, rapid urbanization, and the emergence of a modern transportation system all have contributed to the recent increase in China's liquids consumption. In the *IEO2007* reference case, total liquids consumption in China is projected to average 3.5-percent growth annually—higher than the growth rate for any other country in the world—and to reach 32 quadrillion Btu (about 16 million barrels oil equivalent per day) in 2030. In comparison, U.S. liquids consumption grows at an average rate of 1.0 percent per year over the projection period, to more than 52 quadrillion Btu in 2030. China is projected to account for 28 percent of the total increase in world liquids consumption from 2004 to 2030 and for 14 percent of the world's total consumption in 2030, nearly double its share in 2004.

In the *IEO2007* projections, China's energy use for transportation grows at a rate that is only about 20 percent less than its GDP growth rate, and the transportation share of its total liquids use increases from 32 percent in 2004 to 47 percent by 2030. Similar trends have characterized other developing economies in the past, both in the west and in Asian countries, including South Korea and Japan. High rates of economic growth in developing economies (particularly if growth is linked to manufacturing) typically require increased transportation services to connect production facilities with raw materials and energy sources, and to transport manufactured goods to consumer markets in growing urban areas. In addition, rising per-capita incomes historically have been associated with rapid increases in personal travel by road and air.

In China, most of the growth in transportation energy consumption is expected to be for road use (see figure below). Total transportation energy use is projected to increase by more than 11 quadrillion Btu from 2004 to 2030, and road vehicles are projected to account for nearly 70 percent of the increase. Air, rail, and marine transportation modes account for 14, 12, and 5 percent of the projected increase, respectively. Factors affecting the projections for transportation energy use by mode include urbanization and expansion of the middle class, efficiency improvements, consumer preferences, costs, and lag times associated with infrastructure development.

Transportation Energy Use in China by Mode, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

In the projections by travel mode, China's energy use for air travel has the highest growth rate, consistently exceeding the growth rate for GDP despite the expectation of significant improvements in fuel efficiency for air travel (see top figure on page 23). Similarly, Boeing Commercial Airplanes has estimated that revenue passenger-miles in China will grow about 20 percent faster than GDP from 2005 to 2025.[b] Energy use for rail transportation (both passenger and freight) increases more slowly, at about 75 percent the rate of GDP growth on average from 2004 to 2030.[c]

(continued on page 23)

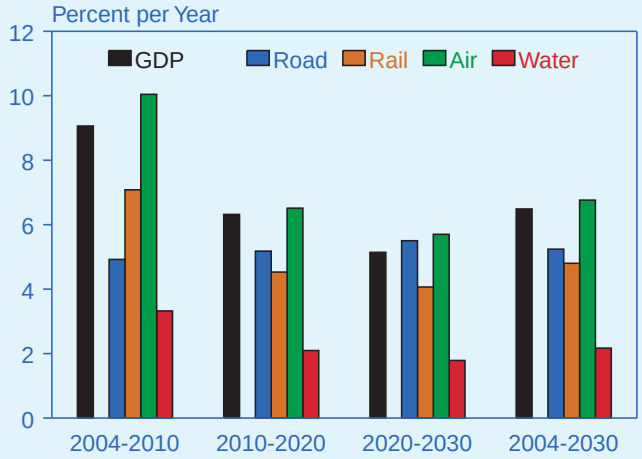
[a]Energy Information Administration, *International Petroleum Monthly* (February 7, 2007), web site www.eia.doe.gov/ipm; and *Short-Term Energy Outlook* (February 2007), web site www.eia.doe.gov/emeu/steo.

[b]Boeing Commercial Airplanes, *Current Market Outlook 2006* (Seattle, WA), p. 24, web site www.boeing.com/commercial/cmo/pdf/CMO_06.pdf.

[c]The energy use projection incorporates an estimated 15-percent efficiency improvement over the forecast.

China's Transportation Sector: Recent Developments and Long-Term Projections (Continued)

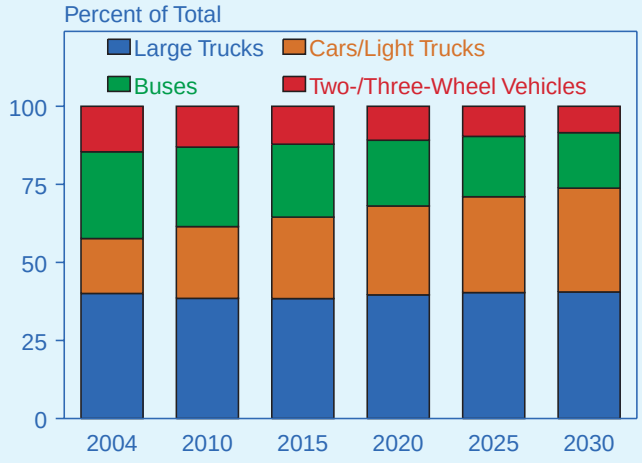
Average Annual Growth in China's GDP and Transportation Energy Use by Mode, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

As China's per-capita income rises, cars are expected to be the mode of choice for an increasing share of passenger travel, as has been observed in other developing economies. Buses and two- and three-wheeled vehicles, which accounted for 42 percent of road energy use in China in 2004, are projected to decline to a 26-percent share in 2030, while the share represented by cars and light trucks increases from 18 percent in 2004 to 33 percent in 2030 (see figure below).

China's Energy Use for Road Transportation by Vehicle Type, 2004-2030

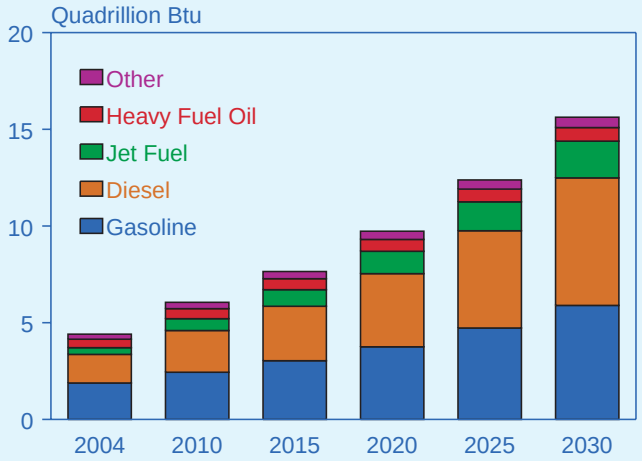


Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

The projections for road transportation assume that the ongoing development of China's road infrastructure will keep pace with increases in vehicle use. From 1994 to 2004, the country's total highway length grew at an average annual rate of 5.3 percent,[d] and similar increases will be needed annually from 2004 to 2030. If the pace of infrastructure construction cannot be maintained, China's transportation energy use could grow more slowly than projected.

Consumption of all transportation fuels in China (with the exception of coal used in older steam locomotives) increases in the projections (see figure below). Total liquids consumption for transportation in 2030 is projected to be 11.2 quadrillion Btu more than the 2004 total. Diesel fuel, gasoline, and jet fuel account for 46 percent, 36 percent, and 14 percent of the increase, respectively; and diesel fuel and gasoline together account for 80 percent of China's total projected energy use for transportation in 2030. Consumption of diesel fuel is expected to increase more rapidly than gasoline use, however, because it is the primary rail fuel and a major fuel for marine transport, and because diesel-fueled trucks are projected to account for an increasing share of total fuel use by large trucks. Following historical trends, coal use in China's transportation sector is projected to decline steadily, as diesel locomotives replace older railroad equipment.

China's Transportation Energy Use by Fuel Type, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

[d]National Bureau of Statistics of China, *China Statistical Yearbook 2005* (Beijing, People's Republic of China: China Statistics Press), web site www.stats.gov.cn/tjsj/ndsj/2005/indexeh.htm.

projected for the non-OECD than for the OECD countries, and in 2020 non-OECD residential energy use is expected to exceed OECD residential energy use (Figure 26). Worldwide, the projected increase in residential electricity demand accounts for nearly 60 percent of the growth in overall residential energy demand from 2004 through 2030. By 2025, electricity overtakes natural gas as the world's largest source of energy for household use.

OECD Countries

Households in OECD nations use energy more intensively than those in non-OECD nations, primarily because of their higher income levels. The United States and OECD Europe together consumed nearly one-half (49 percent) of the world's delivered residential energy in 2004; however, their share is expected to fall to 38 percent in 2030 as a result of increasing efficiency and slower growth in residential energy use than projected for the non-OECD countries.

Growth in electricity use in the OECD countries accounts for about 81 percent of the total projected growth in OECD residential energy demand (Figure 27), which will require additional power plants and corresponding increases in fuel use for electricity generation. Mexico's residential energy use is projected to show the highest rate of increase among the OECD nations, as its real GDP grows at a projected rate that is 44 percent higher than the OECD average. In OECD Asia, residential (and total) energy demand is projected to grow very little, because little or no growth is expected in the region's total population.

Non-OECD Countries

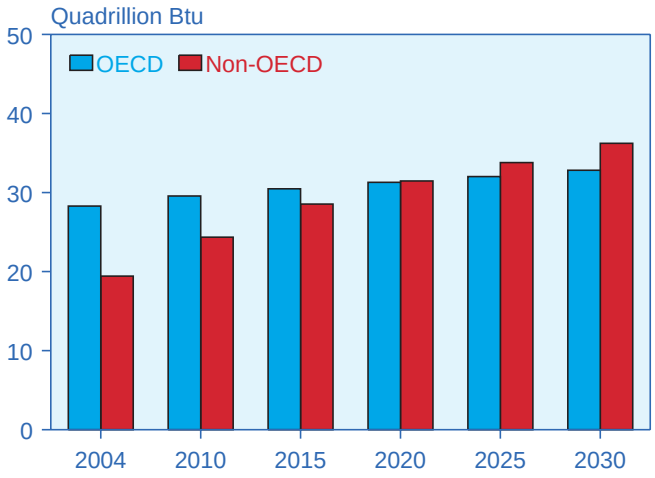
Household energy use is projected to increase more rapidly in the non-OECD countries than in the OECD countries over the coming decades (Figure 27). In China and India, population growth, rising income levels, and urbanization are expected to produce large increases in demand for residential energy services. For the non-OECD region as a whole, real GDP is projected to grow by more than 5 percent per year on average from 2004 through 2030, population is projected to grow by more than 1 percent per year, and household energy use is projected to grow at a robust rate of 2.4 percent per year, as higher incomes foster increased use of energy-using appliances. As a result, households in the non-OECD nations are projected to consume about 10 percent more energy than households in the OECD nations in 2030, requiring more than 86 percent more energy in 2030 than was consumed in the region in 2004. China and India are expected to account for more than 40 percent of the increase in residential energy use in the non-OECD countries through 2030, as their economies continue to grow rapidly over the projection period.

In many non-OECD countries today, households still use traditional, non-marketed energy sources, including wood and waste, for heating and cooking. Regional economic development should displace some of that use as incomes rise and marketed fuels, such as propane and electricity, become more widely accessible.

Commercial Sector

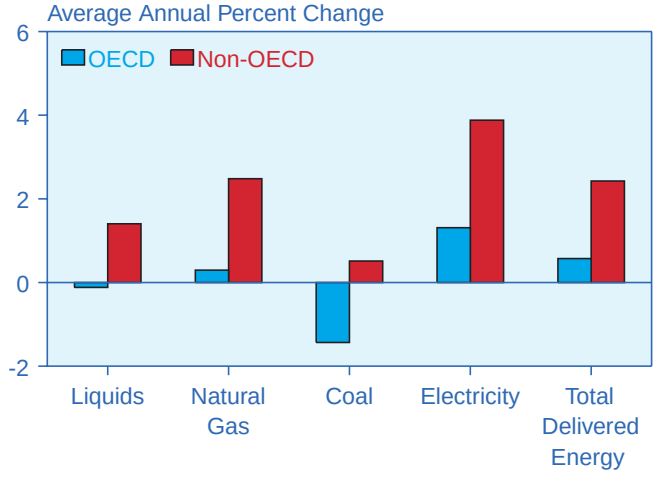
The commercial sector—often referred to as the services sector or the services and institutional sector—consists

Figure 26. OECD and Non-OECD Residential Sector Delivered Energy Consumption, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 27. Growth in OECD and Non-OECD Residential Sector Delivered Energy Consumption by Fuel, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

of businesses, institutions, and organizations that provide services. The sector encompasses many different types of buildings and a wide range of activities and energy-related services. Examples of commercial sector facilities include schools, stores, correctional institutions, restaurants, hotels, hospitals, museums, office buildings, banks, and even stadiums that hold sporting events. Most commercial energy use occurs in buildings or structures, supplying services such as space heating, water heating, lighting, cooking, and cooling. Energy consumed for services not associated with buildings, such as for traffic lights and city water and sewer services, is also categorized as commercial sector energy use.

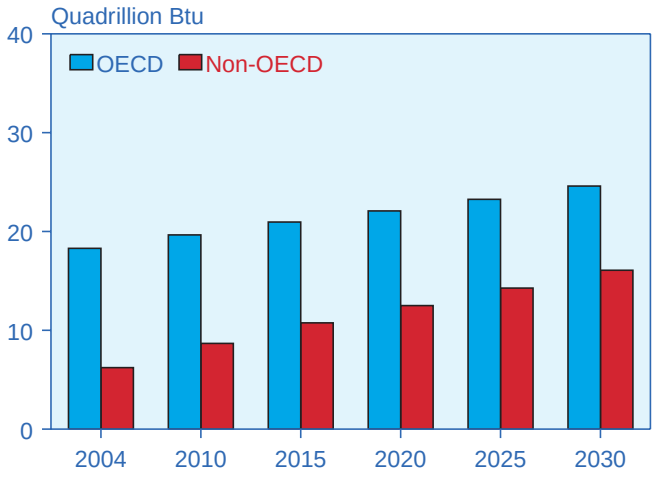
Economic and population growth trends drive commercial sector activity and the resulting energy use. The need for services (health, education, financial, government) increases as populations increase. The degree to which these additional needs are met depends in large measure on economic resources—whether from domestic or foreign sources—and economic growth. Economic growth also determines the degree to which additional commercial sector activities are offered and utilized. Higher levels of economic activity and disposable income lead to increased demand for hotels and restaurants to meet business and leisure requirements; for office and retail space to house and service new and expanding businesses; and for cultural and leisure space such as theaters, galleries, and arenas.

OECD Countries

Slow population growth in most of the OECD nations contributes to a slower rate of increase in the region's commercial energy demand in the *IEO2007* projections than has been seen in the past. In addition, continued efficiency improvements are expected to moderate the growth of energy demand over time, as energy-using equipment is replaced with newer, more efficient stock. Conversely, strong economic growth is expected to include continued growth in business activity, with its associated energy use, in areas such as retail and wholesale trade and business, financial, and leisure services. The combination of these factors causes commercial delivered energy consumption in the OECD countries to increase by an average of 1.2 percent per year from 2004 to 2030 in the reference case (Figure 28). Although the fastest growth in commercial energy demand among the OECD economies is expected to be in the countries with the fastest economic growth (Mexico and South Korea), the United States remains the largest consumer of commercial delivered energy in the OECD, accounting for one-half of the 24.6 quadrillion Btu of commercial energy use in the OECD as a whole in 2030.

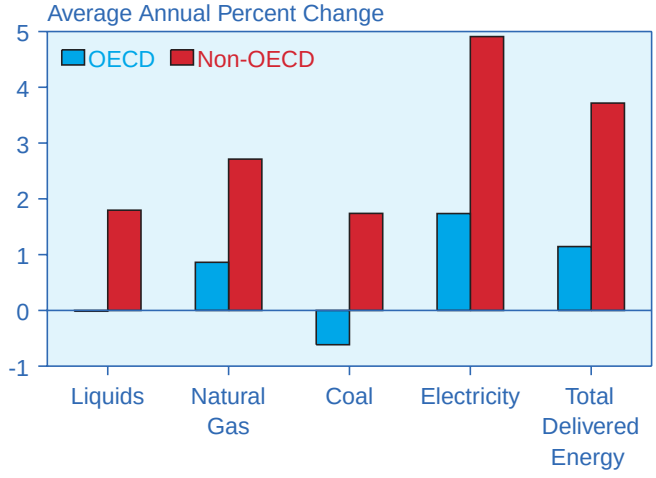
Commercial electricity demand in the OECD nations is projected to grow by 1.7 percent per year from 2004 to 2030, with continued advances in technology and the introduction of new electronic appliances and equipment (Figure 29). Electricity delivered to commercial consumers in the OECD countries, which totaled 8.6 quadrillion Btu in 2004, is projected to reach 10.8 quadrillion Btu in 2015 and 13.5 quadrillion Btu in 2030, surpassing projected OECD residential electricity use of 12.9 quadrillion Btu by the end of the projection period. Natural gas continues to displace petroleum products and coal as the preferred heating fuel in the OECD region.

Figure 28. OECD and Non-OECD Commercial Sector Delivered Energy Consumption, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 29. Growth in OECD and Non-OECD Commercial Sector Delivered Energy Consumption by Fuel, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Non-OECD Countries

Economic growth and commerce are expected to increase rapidly in the non-OECD nations, fueling additional energy demand in the services sector. Faster population growth is also expected, relative to that in the OECD countries, portending increases in the need for education, health care, and social services and the energy required to provide them. Under these circumstances, commercial delivered energy use in non-OECD countries is projected to double between 2004 and 2020, to 12.5 quadrillion Btu, and to continue growing to 16.1 quadrillion Btu in 2030. Over the 2004 to 2030 period, commercial energy use in the non-OECD region increases at an average annual rate of 3.7 percent.

Electricity demand for commercial applications is projected to grow rapidly in the non-OECD nations as more clinics, schools, and businesses gain access to electricity. Annual growth in commercial delivered electricity use averages 4.9 percent through 2030 (Figure 29), with projected consumption of 6.1 quadrillion Btu in 2015 and 10.5 quadrillion Btu in 2030. The largest increases in commercial electricity demand are projected for nations with rapidly growing economies, particularly China and India, as their burgeoning economies foster increases in demand for services.

In the *IEO2007* projections, commercial demand for natural gas grows by 3.6 percent per year from 2004 to 2015 and by 2.7 percent from 2004 to 2030, as several countries focus on expanding the infrastructure necessary for delivery of the fuel. Commercial sector liquids consumption is projected to increase from 1.6 quadrillion Btu in 2004 to 2.2 quadrillion Btu in 2015 and 2.5 quadrillion Btu in 2030 in the non-OECD region, increasing more rapidly in areas where the availability of natural gas is limited. Commercial sector coal use in the non-OECD countries increases from 0.5 quadrillion Btu in 2004 to 0.8 quadrillion Btu in 2030, with most of the growth occurring between 2004 and 2015. Coal remains an economically attractive choice for commercial water heating, space heating, and cooking in non-OECD countries in the projections, especially in China and India, which together account for around 80 percent of non-OECD commercial coal use from 2004 through 2030.

Industrial Sector

Energy is consumed in the industrial sector by a diverse group of industries—including manufacturing, agriculture, mining, and construction—and for a wide range of activities, such as process and assembly uses, space conditioning, and lighting. Inputs that typically are considered energy products are included in industrial sector energy use. For example, natural gas and petroleum products used as feedstocks to produce non-energy products, such as plastics, are counted as energy used in the industrial sector. Industrial sector energy demand varies across regions and countries of the world, based on the level and mix of economic activity, technological development, and population, among other factors.

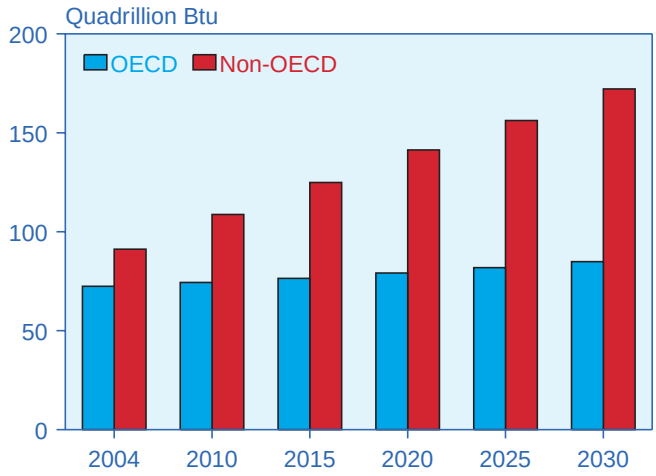
The industrial sector is the largest of the end-use sectors, consuming more than 50 percent of the delivered energy worldwide in 2004. Worldwide, energy consumption in the industrial sector is projected to increase by an average of 1.8 percent per year from 2004 through 2030, as compared with 1.0-percent average annual growth in the global population. Industrial energy consumption is expected to increase in all countries and regions; however, much slower growth in industrial sector energy use is projected for the OECD region than for the non-OECD region, with annual average increases of 0.6 percent and 2.5 percent, respectively (Figure 30).

OECD Countries

Industrial sector energy use among the OECD nations increases by 0.6 percent per year in the *IEO2007* reference case, from 72.4 quadrillion Btu in 2004 to 84.9 quadrillion Btu in 2030. The United States accounts for more than one-third of the OECD's total industrial energy consumption in 2030, and OECD Europe accounts for approximately another one-third of the OECD total, just as they did in 2004.

The OECD economies generally have more energy-efficient industrial operations and a mix of industrial output that is more heavily weighted toward non-energy-intensive sectors than do the non-OECD countries. Also, in the United States, the manufacturing share of total economic output has declined steadily over the past two decades, while the output share for service

Figure 30. OECD and Non-OECD Industrial Sector Delivered Energy Consumption, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

industries (included in the commercial sector) has increased. These general trends are projected to continue.

Similar developments are expected for the other OECD economies, as increasing international trade fosters a shift toward a less energy-intensive mix of industrial activity. For example, many of Japan's heavy industries are reducing their output as demand for energy-intensive materials increasingly is met by imports from China and other Asian countries. In the projections, the industrial sector in Mexico has the fastest energy consumption growth among the OECD countries, at nearly 2.2 percent per year. In Germany, a decline in industrial energy intensity in the early 1990s was largely the result of closures of heavy industries in the former East Germany after reunification. Much of the inefficient, energy-intensive capacity in the eastern part of Germany has already been shut down, but further improvements are projected as capital stock is replaced and modernized.

Electricity accounted for about 16 percent of OECD industrial energy use in 2004, and its share increases slightly over the projection period. Oil and natural gas were the most heavily used fuels in the OECD countries' industrial sectors in 2004, together accounting for two-thirds of the energy consumed in the sector. The two energy sources are projected to maintain their overall share in 2030, but consumption of natural gas is projected to grow almost five times as rapidly as that of liquids (Figure 31). Electricity and coal make up the bulk of the remaining projected energy consumption, while renewables remain a minor energy source for the sector.

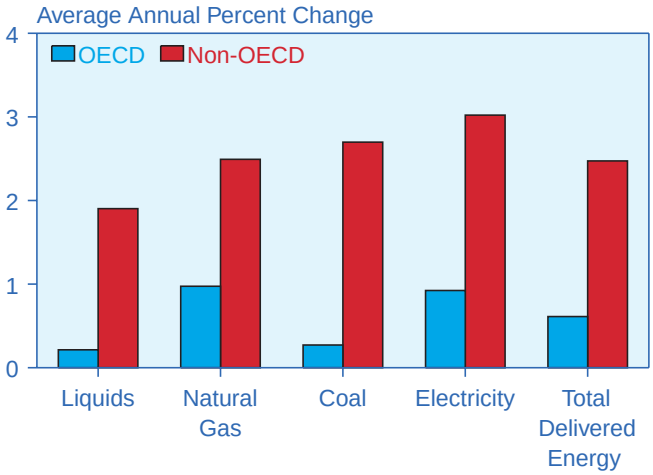
Non-OECD Countries

Industrial sector energy consumption is projected to increase by 2.5 percent per year in the non-OECD countries between 2004 and 2030 (Figure 30). The non-OECD economies generally have higher industrial sector energy consumption relative to GDP than do the OECD countries. On average, the ratio is almost 40 percent higher in the non-OECD countries. This is particularly true of Russia and the Eastern European countries which still have energy-inefficient capital remaining from the days of central planning. Per dollar of GDP, Russia's industrial sector consumed almost 8,000 Btu of delivered energy in 2004, and the non-OECD European and other Eurasian countries averaged 5,500 Btu, as compared with the overall non-OECD average of 3,500 Btu per dollar of GDP and the overall OECD average of around 2,500 Btu per dollar of GDP. As inefficient facilities in non-OECD Europe and Eurasia are replaced with modern capacity, industrial energy intensities in the region are expected to decline more rapidly than in most of the rest of the world.

Of the non-OECD economies, China, India, and the other Asian nations are expected to have the most rapid increases in industrial sector energy consumption between 2004 and 2030. Whereas the economies of the OECD countries have largely moved away from heavy, energy-intensive industries (such as steel and cement) toward a greater emphasis on light manufacturing and service activities, the economies of many of the non-OECD countries and regions have growing energy-intensive, heavy manufacturing sectors.

Although electricity is expected to become an increasingly important component of industrial sector delivered energy demand in the non-OECD economies, oil, coal, and natural gas were the most heavily used fuels in 2004, and they are projected to remain so in 2030. Liquids use in the non-OECD industrial sector increases at a slower rate than natural gas or coal use (Figure 31). The continued importance of coal in the non-OECD industrial sector is largely attributable to China, which accounts for 70 percent of industrial coal use in the non-OECD economies in 2030.

Figure 31. Growth in OECD and Non-OECD Industrial Sector Delivered Energy Consumption by Fuel, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

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Chapter 3

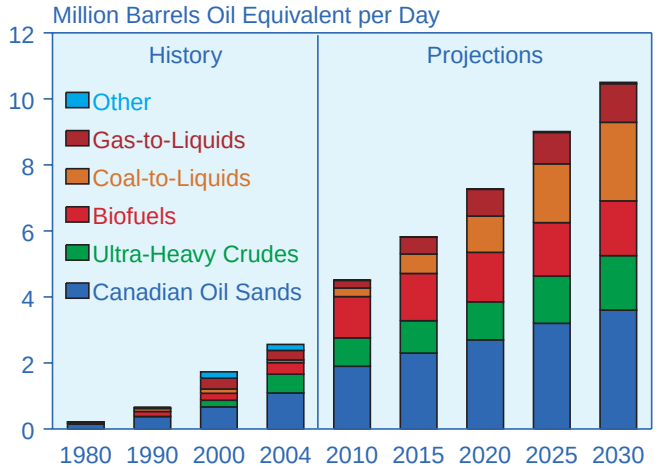
Petroleum and Other Liquid Fuels

World liquids consumption in the IEO2007 reference case increases from 83 million barrels per day in 2004 to 118 million barrels per day in 2030. Two-thirds of the increment is projected for use in the transportation sector.

In the *IEO2007* reference case, world consumption of petroleum and other liquid fuels[4] grows from 83 million barrels oil equivalent per day in 2004 to 97 million in 2015 and 118 million in 2030. The demand for liquids increases strongly in the projections, despite world oil prices that remain above $49 per barrel[5] throughout the period. Much of the overall increase in liquids consumption is projected for the nations of non-OECD Asia, where strong economic growth is expected.

To meet the increase in liquids consumption in the *IEO2007* reference case, liquids production is projected to increase by 14 million barrels per day from 2004 to 2015 and by an additional 20 million barrels per day from 2015 to 2030. OPEC producers[6] are expected to provide more than one-half of the additional production in 2015 (8 million barrels per day) and more than two-thirds in 2030 (23 million barrels per day).

Figure 32. World Unconventional Liquids Production in the Reference Case, 1980-2030



Note: "Other" includes shale oils and other unidentified sources of unconventional liquid fuels.

Sources: **1980-2004:** Energy Information Administration (EIA), *Short-Term Energy Outlook* (October 2006), and *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea.. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

In the reference case projections, sustained high world oil prices support a substantial increase in non-OPEC liquids production. Non-OPEC production in 2030 is projected to be 12 million barrels per day higher than in 2004, representing 35 percent of the increase in total world production over the 2004 total. The estimates of production increases are based on current proved reserves and a country-by-country assessment of ultimately recoverable petroleum, as well as the potential for unconventional liquids production.

The world oil prices in the *IEO2007* reference case—and in the high world oil price case—also are projected to make previously uneconomical, unconventional resources available. In 2004, world production of unconventional liquids totaled only 2.6 million barrels per day; in 2030, in the reference case, unconventional liquids production totals 10.5 million barrels per day (Figure 32) and accounts for nearly 9 percent of total world liquids production.

World Liquids Consumption

World liquids consumption in the *IEO2007* reference case increases to 118 million barrels per day (239 quadrillion Btu) in 2030, as the world continues to experience strong economic growth. Two-thirds of the increment in world liquids consumption in the reference case is projected for use in the transportation sector, where there are few competitive alternatives to petroleum (Figure 33). The industrial sector accounts for a 27-percent share of the projected increase, mostly for use in chemical and petrochemical processes.

The largest increases in consumption between 2004 and 2030 are projected for North America and non-OECD Asia, at 7 and 15 million barrels per day, respectively (Figure 34). Outside North America, liquids consumption in the OECD regions generally grows more slowly,

[4]"World Petroleum and Other Liquid Fuels" refers to all conventional crude oil and energy liquid substitutes (such as ethanol, coal-to-liquids, and gas-to-liquids), expressed in million barrels oil equivalent per day. Throughout this chapter, the term "liquids" is used to refer to petroleum and other liquid fuels.

[5]All prices are in real 2005 dollars, unless otherwise noted.

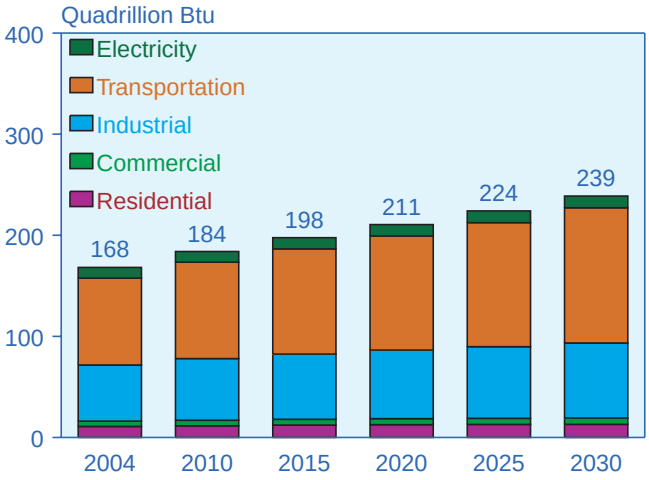
[6]Angola officially joined OPEC on February 1, 2007. In the remainder of this chapter, all references to OPEC include Angola. In addition, all time series have been updated to reflect country groupings as of March 1, 2007, so that Angola's liquids production is included in the OPEC totals for 1980 through 2030. Angola's production in 2030 is projected to be 3.1 million barrels per day.

reflecting expectations of slow growth or declines in population and slow economic growth in most of the OECD nations over the next two decades.

Strong expansion of liquids use is projected for the non-OECD countries, fueled by robust economic growth, burgeoning industrial activity, and rapidly expanding transportation use. The fastest growth in oil consumption is projected for the economies of non-OECD Asia, averaging 2.7 percent per year from 2004 to 2030. For the other non-OECD regions, annual consumption growth averages 1.0 percent in non-OECD Europe and Eurasia, 2.1 percent in the Middle East, 2.3 percent in Central and South America, and 2.2 percent in Africa.

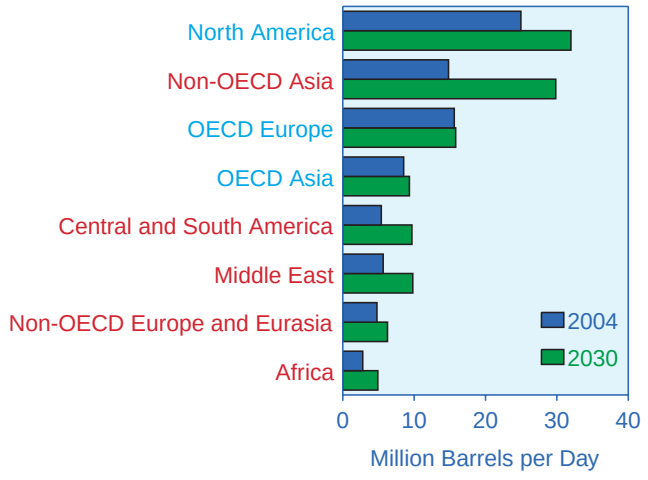
Non-OECD Asia accounts for 43 percent of the overall increase in world liquids consumption, with projected increases of 6.5 million barrels per day from 2004 to 2015 and another 8.5 million barrels per day from 2015 to 2030. China, India, and the other nations of non-OECD Asia are expected to experience combined economic growth of 5.8 percent per year from 2004 to 2030, the highest rate among all the world regions. The robust expansion of GDP projected for non-OECD Asia contributes to a 2.7-percent average annual increase in the region's liquids use.

Figure 33. World Liquids Consumption by Sector, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 34. World Liquids Consumption by Region and Country Group, 2004 and 2030

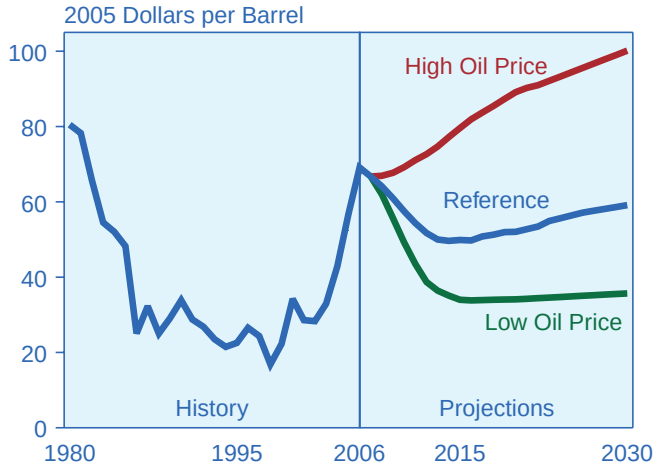


Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

World Oil Prices

The world oil price cases in this report are the same as those in EIA's *Annual Energy Outlook* 2007. In the reference case, world oil prices decline from $68 per barrel in 2006 to $49 per barrel in 2014, then rise to $59 per barrel in 2030 ($95 per barrel on a nominal basis). Total world liquids consumption rises to 118 million barrels per day in 2030 in the reference case. The low and high price cases are included to illustrate uncertainties in the reference case projections (Figure 35). In the low price case, world oil prices are projected to be $36 per barrel in 2030 ($58 per barrel on a nominal basis). In the high price case, oil prices are projected to be $100 per barrel in 2030 ($157 per barrel on a nominal basis). The projections for total liquids consumption in 2030 range from 103 million barrels per day in the high price case to 134 million barrels per day in the low price case, indicating the substantial range of uncertainty in the world's future oil markets.

Figure 35. World Oil Prices in Three Cases, 1980-2030



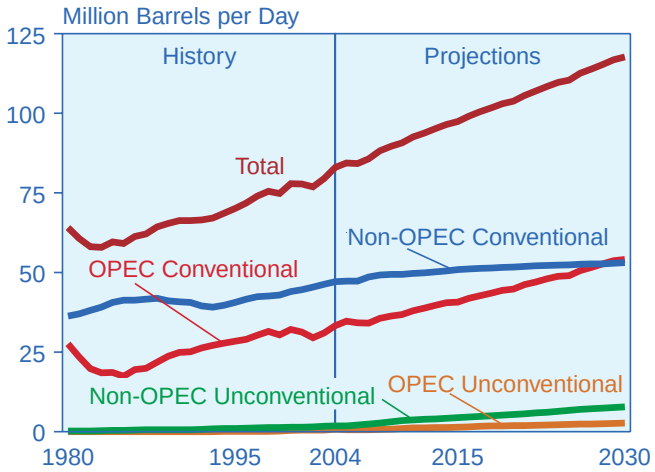
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007).

World Liquids Production

In the *IEO2007* reference case, world liquids production in 2030 exceeds the 2004 level by 35 million barrels per day (Figure 36). Increases in production are expected for both OPEC and non-OPEC producers; however, 65 percent of the total increase is expected to come from OPEC areas. In 2030, OPEC is expected to produce 57 million barrels per day and non-OPEC producers 61 million barrels per day in the reference case. Over the past two decades, the growth in non-OPEC liquids production has resulted in an OPEC market share substantially below its high of 52 percent in 1973. In 2004, OPEC produced 41 percent of the world's liquids supply. High oil prices, new exploration and production technologies, aggressive cost-reduction programs by industry, and the emergence of unconventional resources contribute to the outlook for continued growth in non-OPEC liquids production.

The reference case outlook for liquids production was formulated in a two-stage approach. The mid-term projections (through 2015) are based primarily on the current activities of the oil industry and national governments, including: current production volumes; recent rates of decline in output from producing fields; planned exploration, development, and enhanced oil recovery activities; country-specific policies and fiscal regimes; and current conflicts and social unrest that could interrupt production and make incremental investments more risky. After 2015, the reference case assumes that production decisions are made primarily on economic grounds, based on assessments of the resource base, with less weight placed on current political conditions.

Figure 36. OPEC and Non-OPEC Conventional and Unconventional Liquids Production, 1980-2030



Sources: **1980-2004:** Energy Information Administration (EIA), *Short-Term Energy Outlook* (October 2006), and *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea.. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

The *IEO2007* reference case projects greater reliance on OPEC oil supplies than was anticipated in last year's outlook. In *IEO2006*, OPEC's total liquids production (excluding Angola) was projected to increase by nearly 15 million barrels per day from 2003 to 2030; in *IEO2007*, the projected increase in OPEC production (excluding Angola) is about 22 million barrels per day over the same period. An extensive review of anticipated investment in exploration and production through 2015 was conducted for *IEO2007*. As a result, the projections of non-OPEC supply from several key producers were lowered. However, the investment that several OPEC members (notably, Saudi Arabia and Angola) currently are making to expand their oil production capacity is expected to more than offset the slower expansion of non-OPEC supply projected in this year's outlook.

There are several regions where production is restrained through 2015 in the reference case. For instance, in the key resource-rich countries of Mexico and Venezuela, expected investment levels are lower than those assumed in the *IEO2006* reference case. In both countries, liquids production is projected not to expand (and, in Mexico, to decline) until after 2015, when economic decisions on investment allow production to improve. Also, North Sea production is projected to decline more rapidly than in last year's outlook. The rate of decline in North Sea production over recent years has been higher than observed in earlier years, and economics do not support a reversal of the declining trend in the *IEO2007* reference case. In Iran and Iraq, political developments are assumed to keep production levels fairly flat until after 2015, when investment and production are projected to grow strongly through 2030.

IEO2007 includes supply estimates for the low and high world oil price cases, based on the availability of world crude oil resources. In the high price case, worldwide crude oil resources are assumed to be 15 percent smaller and therefore more expensive to produce than in the reference case, and the preferred production levels of OPEC producers are reduced. In the low price case, worldwide crude oil resources are assumed to be 15 percent larger and therefore less expensive therefore to produce than in the reference case, and the preferred production levels of OPEC producers are increased. In each of three oil price cases, a business-as-usual oil market environment is assumed. The *IEO2007* cases do not consider disruptions in oil production for any reason (war, terrorist activity, weather, geopolitics).

Non-OPEC Production

The world oil prices projected in the *IEO2007* reference case allow non-OPEC suppliers to expand their production through 2030. Non-OPEC production increases

steadily in the projections, from 49 million barrels per day in 2004 to 61 million barrels per day in 2030, as high prices attract investment in areas previously considered uneconomical. The non-OPEC market share in 2030, however, at 52 percent of the world's liquids production, is lower than its 2004 share of 59 percent.

Non-OPEC conventional liquids production in the reference case increases from 47 million barrels per day in 2004 to 51 million barrels per day in 2015 and 53 million barrels per day in 2030, and unconventional liquids production from non-OPEC suppliers rises to 4 million barrels per day in 2015 and 8 million barrels per day in 2030. In the high world oil price case, non-OPEC unconventional liquids production rises to 11 million barrels per day in 2030, as compared with 4 million barrels per day in 2030 in the low price case, where most unconventional liquids are not economically competitive.

North Sea production is projected to decline more rapidly in the *IEO2007* reference case than was projected in *IEO2006*. Production from Norway, OECD Europe's largest producer, appears to have peaked at about 3.4 million barrels per day in 2001, and it is projected to continue declining to about 1.4 million barrels per day in 2030 as the larger and older fields mature. Production from the United Kingdom, which peaked in 1999 at 3.0 million barrels per day, is projected to fall to 0.5 million barrels per day in 2030.

Oil production in the non-OECD Europe and Eurasia region is projected to reach nearly 15.0 million barrels per day in 2015, based in large part on the potential investment outlook for the Caspian Basin region, where long-term production potential still is regarded with considerable optimism. Caspian output more than doubles from the 2004 level to 4.3 million barrels per day in 2015 in the reference case and increases steadily thereafter. Current uncertainty about export routes from the Caspian Basin region is assumed to be resolved.

North African producers Egypt and Tunisia produce mainly from mature fields, and the *IEO2007* reference case assumes few additions to resources in the future. As a result, their production volumes decline gradually in the projections. In East Africa, Sudan is expected to produce significant volumes by the end of this decade, with the potential to exceed 700,000 barrels per day in 2010. Eritrea, Somalia, and South Africa also have some resource potential, but they are not expected to produce significant volumes until late in the projections.

Several West African producers—Cameroon, Chad, Congo (Brazzaville), Equatorial Guinea, Gabon, Mauritania, Niger, Sao Tome and Principe, and Ivory Coast—are expected to reap the benefits of substantial exploration activity, especially if current high oil prices persist. West African producers with offshore tracts are expected to increase output by up to 1.1 million barrels per day by the end of the projection period.

Oil producers in the Pacific Rim are expected to increase their production volumes as a result of enhanced exploration and extraction technologies. India's deepwater prospects are expected to show some encouraging production increases in this decade, with the potential for significant increases near the end of the projection period. China's conventional oil production is projected to decline slightly, to about 3.3 million barrels per day in 2030. Vietnam's long-term production potential is viewed with considerable optimism, although exploration activity has been slower than originally anticipated. Output from Vietnamese fields is projected to reach 504,000 barrels per day in 2015.

Malaysia is not expected to find significant new reserves; its output has already peaked and is expected to decline gradually through the end of the projection period, to less than 500,000 barrels per day in 2030. Papua New Guinea continues to add to its proved reserves and is expected to achieve production volumes approaching 110,000 barrels per day in 2015, followed by only a modest decline over the remainder of the projection period. Exploration and test-well activity have pointed to some production potential for Bangladesh and Myanmar (formerly Burma), but significant output is not expected until after 2010.

In North America, U.S. output that rises to 10.1 million barrels per day in 2020 and remains fairly flat through the end of the projection period is expected to be supplemented by significant production increases in Canada. Canada's conventional oil output contracts steadily in the reference case, by about 0.5 million barrels per day over the next 25 years, but an additional 2.5 million barrels per day of unconventional output from oil sands projects more than offsets the decline in conventional supplies. Since the publication of *IEO2006*, Mexico's state oil company, Petróleos Mexicanos (Pemex), has announced annual production decline rates of 14 percent in its largest oil field at Cantarell [***1***]. The *IEO2007* reference case does not anticipate adequate investments through 2015, and as a result, production in Mexico is projected to fall to 3.0 million barrels per day in 2015 (see box on page 33). *IEO2007* assumes that declining revenue from oil production in Mexico ultimately will encourage government action to increase investment and technology access in the petroleum sector after 2015. Given the country's available resource base, such action eventually should reverse the decline in production.

Liquids producers in South America have potential for increasing output over the next decade. Brazil became a million barrel per day producer of crude oil in 1999, with considerable production potential waiting to be tapped. Brazil's production rises throughout the projection

Reassessing the Potential for Oil Production in Mexico

Projections for Mexico's crude oil production in *IEO2007* are much lower than those in *IEO2006*. In last year's outlook, oil production in Mexico was projected to increase steadily, to 5.0 million barrels per day in 2030, despite an anticipated decline in production from the country's largest oil field, Cantarell (see map on page 34).[a] *IEO2007*, instead, projects a decline to 3.0 million barrels per day in 2012, followed by a gradual recovery to 3.5 million barrels per day in 2030. The new assessment reflects the anticipated decline in Cantarell production, assumptions about announced projects and recent discoveries, and long-term assumptions about economic motivations and national oil industry policy that better reflect the country's production potential.

Cantarell is, by far, Mexico's most important oil field today. In 2004, Cantarell held more than 26 percent of Mexico's total remaining oil reserves and produced 2.1 million barrels per day, accounting for more than 61 percent of the country's total crude oil output.[b] Since its peak production in 2004, Cantarell has been in decline. According to Lui Ramirez Corzo, the former president of Pemex, the Cantarell decline rate is likely to average 14 percent per year from 2007 to 2015, implying that Pemex will have to develop other fields if it is to offset the decline.[c]

Crude oil production from the KMZ complex—consisting of the Ku, Maloob, and Zaap fields—has been discussed as a possible new source of liquids production. There have been reports that the complex could produce enough crude oil to compensate for the yearly reduction in production from Cantarell.[d] In 2005, the combined production of the KMZ fields was just 316 thousand barrels per day, or about 16 percent of Cantarell's production in the same year; however, Pemex has estimated that KMZ could produce 800 thousand barrels per day by 2008. Achieving that goal would require 35-percent annual increases in production from KMZ from 2006 to 2008.

Although increasing crude oil production at KMZ would lessen the degree to which the Cantarell decline affects Mexico's total output of crude oil over the next few years, total proved ultimately recoverable reserves at the complex are only 21 percent as large as those at Cantarell. Consequently, KMZ production cannot be sustained at the levels necessary to counteract Cantarell's decline in the long run. If Cantarell does decline at the expected rate, production at the KMZ complex would have to increase by about 17 percent per year to offset the lost production. Since 1993, when the three major fields at KMZ came on line, annual production increases have averaged 4 percent—significantly less than would be necessary to maintain Mexico's current level of output. The *IEO2007* reference case projects modest growth for KMZ production as a result of nitrogen injection.

The Tabasco state, containing the Jujo and Tecominoacan fields, is also frequently mentioned as an oil-producing region with the potential to compensate for some of Cantarell's decline; however, the two fields have combined proven ultimate recoverable reserves of only 1,690 million barrels, or 11 percent the size of Cantarell. In addition, their production levels have been declining for almost two decades, and in 2005 they produced a combined total of only 72 thousand barrels per day. Pemex has announced plans to increase production from the Jujo and Tecominoacan fields significantly by using nitrogen injection, but even with enhanced recovery, it is unlikely that their output will be sufficient to slow the rate of decline in Mexico's total crude oil output beyond the short term.

The most promising possibility for offsetting the impact of Cantarell's decline on the rest of Mexico's crude oil production is deepwater production in the Gulf of Mexico, where recent discoveries include Chuktah-201, Nab-1, Noxal-1, and Lacach-1 (still under construction). Production levels from the deepwater fields will depend on Pemex's financial ability to implement the technology needed to access them. To date, the deepest production achieved by Pemex has been 3,068 feet. Lacach-1 is planned to reach 3,241 feet.[e] In the U.S. Gulf of Mexico, however, drilling depths routinely exceed 6,500 feet and can be more than 9,800 feet.

Pemex has been discussing the possibility of service contracts with foreign oil companies that have experience in exploring deepwater reserves, but agreements have yet to be reached. So far, the service agreements

(continued on page 34)

[a]The Cantarell complex comprises the Akal, Nohoch, Chac, Akal, Kutz, Ixtoc, and Sihil fields. The largest, Akal, produced 2,079 thousand barrels per day or 90 percent of Cantarell's crude production in 2004.

[b]I.H.S. Energy database. Unless otherwise noted, all data cited in this text box were obtained or derived from the I.H.S. Energy database.

[c]A. Harrup, "Pemex CEO Says Cantarell Decline by Average of 14 Percent per Year," Dow Jones Newswires (November 16, 2006).

[d]Pemex Online, Investor Relations, "Issues Related to the Cantarell Complex," (August 12, 2005), web site http://www.pemex.com/index.cfm?action=content&sectionID=8&catID=428&subcatID=3679.

[e]Pemex Online, web site www.pemex.com/files/content/dcf_ccw_0609_i_061105.pdf.

Reassessing the Potential for Oil Production in Mexico (Continued)

Mexico's Major Southern Offshore Oil Fields

Source: I.H.S. Energy Database, web site http://energy.ihs.com.

offered by Pemex would return set fees to foreign companies rather than allowing them to own shares of the oil produced or discovered, because a clause in the Mexican constitution bars foreign investment in the oil industry. Although the clause has allowed Pemex to maintain ownership of all its oil reserves, it also has prevented it from benefiting from technological advances that have allowed other national and major independent oil companies to improve their production opportunities.

Promising deepwater discoveries in the Gulf are taken into consideration in this year's assessment of Mexico's oil production potential; however, the *IEO2007* reference case assumes a considerable time lag between the discoveries and the date when Pemex will have the technology necessary to develop the fields effectively, based on assumptions both about the technology and about the financial resources available to exploit the deepwater resources. Pemex spent about $4.5 billion on deepwater exploration from 2000 to 2004, and it estimates that an additional $15 billion will be needed over the next 15 years to continue their development. Other estimates of the necessary capital investment are as high as $10 billion annually.

Financial resource estimates affect not only the *IEO-2007* assumptions about Mexico's deepwater resource development but also the assumptions about Pemex's general exploration and development programs. Although Pemex increased the amount of funding allocated to exploration and development programs in 2005, it spent only $10.3 billion in 2004 and $10.5 billion in 2005.[f] By some estimates, Pemex may need to invest as much as $32 billion annually in exploration and development to prevent a sharp decline in oil production.[g,h] The lack of available funds is largely

(continued on page 35)

[f]Pemex Online, Investor Relations, "Annual Report 2005: Business Highlights," web site www.pemex.com/files/dcf/Businesshighlights2005.pdf. Assumed conversion rate is $0.09147 per peso.

[g]A. Harrup, "Pemex CEO Says Cantarell Decline by Average of 14 Percent per Year," Dow Jones Newswires (November 16, 2006).

[h]C. Bremer, "Analysis—Mexico Seen Struggling To Stem Oil Output Decline," *World Oil Market Update* (January 18, 2007).

Reassessing the Potential for Oil Production in Mexico (Continued)

attributed to the redirection of company profits by the Mexican Congress to support government programs.

Mexico's Congress annually approves the funding for and taxation of Pemex, incorporating the expenses and revenues into the national budget. Although Pemex typically has shown a net profit before taxes in recent years, the government has not returned sufficient revenues to the company for it to book a net profit after taxes. Between 2001 and 2005, taxes on Pemex operations averaged $3.8 billion more than its pre-tax income. As a result, Pemex has been unable independently to increase investment in exploration.

IEO2007 assumes that the trend of heavy taxation and minimal government financial support for expanding exploration activities will continue in the near term. Thus, over the period from 2006 to 2015, the reference case projects an annual decline in Mexico's oil production. After 2015, it is assumed that changes in current oil industry regulations, whether they concern taxation rates or rules about foreign investment in the sector, will be made when the country suffers a significant loss of profits from declining oil production. The current assumptions incorporate several different time lags for the implementation of new investment policies and the impact of increased funding for exploration and development. A 4-year delay, based on the world average, is incorporated into the long-term outlook for production increases after a significant increase in funding for exploration and development funding.

period, to 3.9 million barrels per day of conventional production and 0.5 million barrels per day of unconventional production in 2030. Colombia's current economic downturn and civil unrest have delayed development of its oil production infrastructure, but its output is expected to reach 700,000 barrels per day in 2015, with continued modest increases over the remainder of the projection period. Although the current political situation in Ecuador is in transition, there is still optimism that Ecuador will increase production volumes over the projection period.

OPEC Production

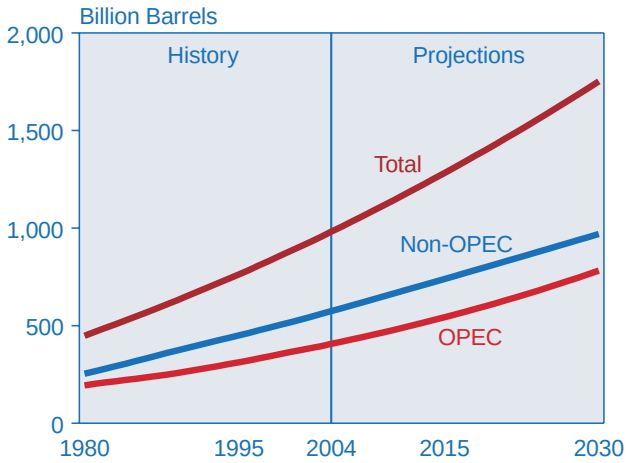
It is generally acknowledged that OPEC members with large reserves and relatively low costs for expanding production capacity can accommodate sizable increases in the world's petroleum consumption. In the *IEO2007* reference case, the production call on OPEC suppliers grows at an annual rate of 2.0 percent through 2030 (Figure 37).

Amidst enormous uncertainty, Iraq's role in OPEC in the next several years will be of particular interest. In 1999, Iraq expanded its production capacity to 2.8 million barrels per day in order to reach the maximum export revenue (slightly more than $5.2 billion) allowed under United Nations Security Council resolutions. Iraq's oil production capacity in 2007 is assumed to be 2.0 million barrels per day [2]. Iraq has indicated a desire to expand production aggressively, to more than 6 million barrels per day, once the security and political situation in the country has stabilized. Preliminary discussions of exploration projects have already been held with a number of potential outside investors. In the *IEO2007* reference case, Iraq's oil production is projected to reach 3.3 million barrels per day in 2015 and 5.3 million barrels per day in 2030.

Oil production in Iran is projected to increase only slightly in the early years of the reference case, from 4.1 million barrels per day in 2004 to 4.3 million barrels per day in 2015, despite the country's sizable resource base. In the long run, Iran's oil production is projected to reach 5.0 million barrels per day in 2030.

Kuwait and the United Arab Emirates (UAE) are expected to follow similar growth paths in their oil production sectors. In 2004, levels of production from the two countries were 2.5 and 2.8 million barrels per day, respectively; in 2015, they are projected to be 3.2 and 3.8 million barrels per day, respectively; and in 2030 they

Figure 37. Cumulative World Production of Crude Oil and Lease Condensates in the Reference Case, 1980-2030



Sources: **1980-2004:** Energy Information Administration (EIA), *Short-Term Energy Outlook* (October 2006), and *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

are projected to be 4.1 and 4.9 million barrels per day, respectively. Qatar's production is projected to grow from 1.0 million barrels per day in 2004 to 2.9 million barrels per day in 2030, with liquids other than crude oil expected to provide more than half the increase.

In the past, Saudi Arabia—with its very low development and production costs per barrel of output—has maintained 1 to 5 million barrels per day of spare production capacity, which has given it considerable market power. It is expected to maintain average spare capacity of 1 to 2 million barrels per day in the future. In the reference case, Saudi Arabia's production is projected to be 9.4 million barrels per day in 2015 and 16.4 million barrels per day in 2030.

Angola became a 1.1 million barrel per day producer in 2004, and the results of deepwater exploration indicate that its production could increase to as much as 4.0 million barrels per day by 2030. The rapid increase in Angola's production demonstrates the importance of political stability, international investment, and technology advances. Angola's oil production languished for the most part during a 20-year civil war, which ended in 2003. It was not until the late 1990s, when prospects for a peaceful resolution were taking shape, that the foreign investment needed to support offshore production began to materialize. Angola's decision to join OPEC in January 2007 is not expected to slow the increase in its oil production, given that other OPEC members were granted some flexibility while they were rapidly expanding their production.

In the *IEO2007* reference case, OPEC members outside the Persian Gulf (excluding Angola) are projected to increase their production capacity only moderately, in part because of the relatively high cost of capacity expansion in most of the member countries. There is some optimism surrounding Nigeria's potential for offshore production. For Algeria and Libya, the reference case projects an increase of 1.2 million barrels per day in their combined liquids production from 2004 to 2015, but after 2015 it is projected to remain fairly flat. Indonesia's production is expected to decline over the projection period, and Venezuela is expected to see some increase in production after 2015. Tables G1-G9 in Appendix G show the ranges of production potential for both OPEC and non-OPEC producers.

Geopolitical issues in a number of the OPEC countries, including Iraq, Iran, Venezuela, and Nigeria, make it difficult to estimate future production levels. As a result, there is a high level of uncertainty associated with the reference case assumptions and projections for OPEC production through 2030.

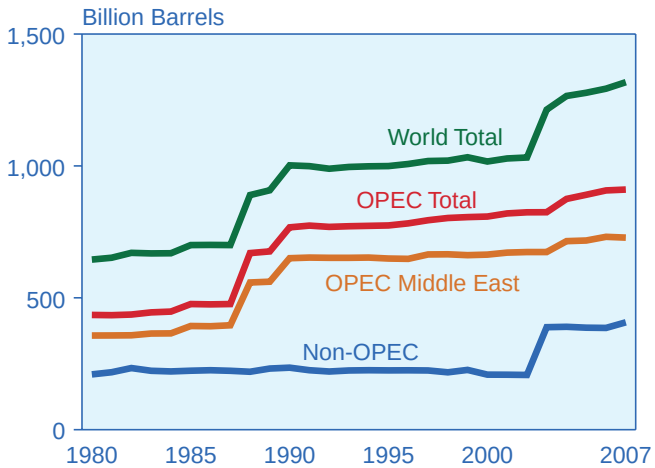
The *IEO2007* high price case provides one scenario in which OPEC limits production. Assuming lower availability of non-OPEC conventional resources, OPEC would be able to exercise greater influence on oil prices. Production of both OPEC and non-OPEC conventional liquids is projected to increase in the high price case, but at a slower rate than projected in the reference case. Because higher prices would make more unconventional liquids production economically competitive, non-OPEC liquids production is projected to be nearly the same in the reference and high price cases, with unconventional liquids replacing most of the reduction in conventional production that is projected in the high world oil price case.

The *IEO2007* low price case assumes greater availability of non-OPEC conventional resources than in the reference case. Oil prices fall as non-OPEC production expands, and OPEC producers must increase production to meet their revenue requirements. As a result, OPEC's options for influencing the market are limited. In the low price case, OPEC production is projected to be about the same as in the reference case, but with lower total revenues.

Oil Reserves and Resources

Historically, estimates of world oil reserves have generally trended upward (Figure 38) [3]. As of January 1, 2007, proved world oil reserves, as reported by *Oil & Gas Journal*,[7] were estimated at 1,317 billion barrels—24 billion barrels (about 2 percent) higher than the estimate

Figure 38. World Crude Oil Reserves, 1980-2007



Note: Reserves include crude oil (including lease condensates) and natural gas plant liquids.

Sources: **1980-1993:** "Worldwide Oil and Gas at a Glance," *International Petroleum Encyclopedia* (Tulsa, OK: PennWell Publishing, various issues). **1994-2007:** *Oil & Gas Journal* (various issues).

[7]Proved reserves, as reported by the *Oil & Gas Journal*, are estimated quantities that can be recovered under present technology and prices. Oil reserves reported by the *Oil & Gas Journal* are compiled from voluntary survey responses and do not always reflect the most recent changes. Changes made to individual countries' reserves during 2006 are not likely to be reflected in the reserves reported here.

for 2006 [*4*] (Table 3). In addition to growth in remaining oil reserves, production from conventional crude oil and condensate reserves, natural gas plant liquids, Canadian oil sands, and Venezuelan ultra-heavy oil during 2006 were estimated to be 30 billion barrels. Taken together, the reserve increases and production imply that 54 billion barrels of reserve discoveries and growth occurred during 2006, or an increase of about 4 percent.

Reserve estimates for oil, natural gas, and coal are difficult to develop. EIA develops estimates of reserves for the United States but not for foreign countries. As a convenience to the public, EIA makes available global reserve estimates from the *Oil & Gas Journal*, *World Oil*, and BP's *Statistical Review of World Energy*, and uses the data in its analyses.

Proved reserves of crude oil are the estimated quantities that geological and engineering data demonstrate with reasonable certainty can be recovered in future years from known reservoirs, assuming existing economic and operating conditions. Companies whose stocks are publicly traded on U.S. stock markets are required by the Securities and Exchange Commission (SEC) to report their holdings of domestic and international proved reserves, following specific guidelines. Country-level estimates of proved reserves are developed from the data reported to the SEC, from foreign government reports, and from international geologic assessments. Estimates are not always updated annually, and some countries invest in exploration only to maintain a target level of proved reserves. Thus, historical data series may be relatively flat over some periods, with sudden jumps in others.

Since 2000, the largest net increase in estimated proved oil reserves has been made in Canada, with the addition of 174 billion barrels of Canadian oil sands as a conventional reserve.[8] Iranian oil reserves have increased by 46.6 billion barrels, or 52 percent, since 2000. Kazakhstan has had the third-largest increase, 24.6 billion barrels, since 2000. The 10 countries with the largest net increases in reserves between 2000 and 2007 are listed in Table 4. According to *Oil & Gas Journal*, 56 percent of the world's total proved oil reserves are located in the Middle East (Figure 39). Among the top 20 reserve holders in 2007, 11 are OPEC member countries that, together, account for 65 percent of the world's total reserves

Table 3. World Oil Reserves by Country as of January 1, 2007
(Billion Barrels)

Country	Oil Reserves
Saudi Arabia	262.3
Canada	179.2
Iran	136.3
Iraq	115.0
Kuwait	101.5
United Arab Emirates	97.8
Venezuela	80.0
Russia	60.0
Libya	41.5
Nigeria	36.2
Kazakhstan	30.0
United States	21.8
China	16.0
Qatar	15.2
Mexico	12.4
Algeria	12.3
Brazil	11.8
Angola	8.0
Norway	7.8
Azerbaijan	7.0
Rest of World	65.5
World Total	**1,317.4**

"Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 24-25.

Table 4. World Oil Reserves: Ten Largest Gains and Losses, 2000-2007, by Country
(Billion Barrels)

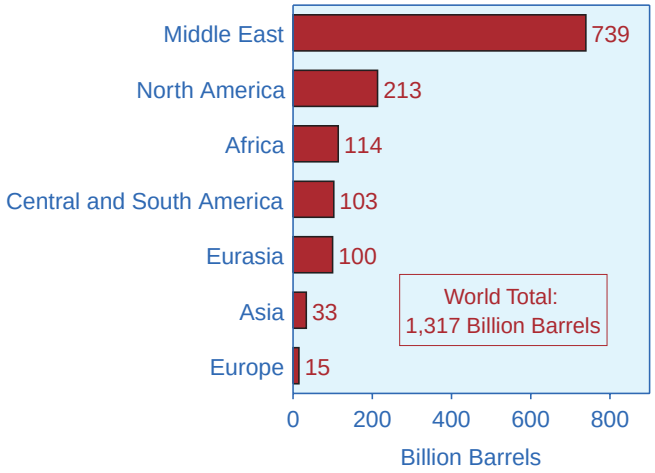
Country	Change in Oil Reserves
Canada	174.3
Iran	46.6
Kazakhstan	24.6
Nigeria	13.7
Libya	12.0
Qatar	11.5
Russia	11.4
Venezuela	7.4
Azerbaijan	5.8
Kuwait	5.0
Romania	-0.8
Malaysia	-0.9
Yemen	-1.0
Colombia	-1.1
Saudi Arabia	-1.2
United Kingdom	-1.3
Australia	-1.3
Norway	-2.9
China	-8.0
Mexico	-16.0

"Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 24-25.

[8] As reported by the Canadian Association of Petroleum Producers. BP's *Statistical Review of World Energy* classifies roughly 12 billion barrels of oil sands as reserves, based on the amount that is "under active development."

(Table 3). The largest declines in oil reserves between 2000 and 2007 were reported in Mexico (16.0 billion barrels), China (8.0 billion barrels), Norway (2.9 billion barrels), Australia (1.3 billion barrels), and the United Kingdom (1.3 billion barrels).

Figure 39. World Proved Oil Reserves by Geographic Region as of January 1, 2007



Source: "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 24-25.

The most common measure of the adequacy of proved reserves relative to annual production is the reserve-to-production (r/p) ratio, which describes the number of years of remaining production from current proved reserves at current production rates. For the past 25 years, the U.S. r/p ratio has been between 9 and 12 years, and the top 40 countries in conventional crude oil production rarely have reported r/p ratios below 8 years. The major oil-producing countries of OPEC have maintained r/p ratios of 20 to 100 years (Table 5).

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2. International Energy Agency, *Oil Market Report* (Paris, France, May 2006), p. 14, web site http://omrpublic.iea.org.
3. Energy Information Administration, "International Petroleum (Oil) Reserves and Resources," web site www.eia.doe.gov/emeu/international/oilreserves.html.
4. "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 24-25.

Table 5. World Crude Oil and Lease Condensate Production and Reserve-To-Production Ratios by Country, 2005

Country	2005 Production (Million Barrels per Day)	2005 Share of World Production (Percent)	Reserve-to-Production Ratio (Years)
Saudi Arabia	9.55	13.3	75
Russia	9.04	12.6	18
United States	5.18	7.2	11
Iran	4.14	5.7	83
China	3.61	5.0	14
Mexico	3.33	4.6	12
Norway	2.70	3.7	9
Nigeria	2.63	3.6	37
United Arab Emirates	2.54	3.5	106
Kuwait	2.53	3.5	110
Venezuela	1.98	2.7	107
Iraq	1.88	2.6	168
Algeria	1.80	2.5	18
United Kingdom	1.65	2.3	7
Brazil	1.63	2.3	18
Libya	1.63	2.3	65
Canada	1.28	1.8	10
Angola	1.26	1.7	12
Indonesia	1.07	1.5	12
Kazakhstan	1.05	1.5	23
Qatar	0.84	1.2	50
Oman	0.77	1.1	19
Malaysia	0.75	1.0	11
Argentina	0.70	1.0	10
India	0.66	0.9	22

Sources: **2005 Production:** Energy Information Administration, *Short-Term Energy Outlook* (October 2006). **Reserves:** "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 24-25.

Chapter 4

Natural Gas

In the IEO2007 reference case, natural gas consumption in the non-OECD countries grows more than twice as fast as in the OECD countries. Production increases in the non-OECD region account for more than 90 percent of the growth in world production from 2004 to 2030.

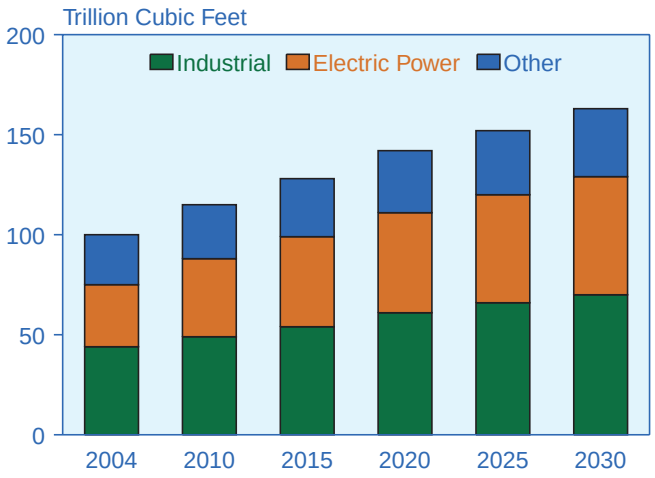
Consumption of natural gas worldwide increases from 100 trillion cubic feet in 2004 to 163 trillion cubic feet in 2030 in the *IEO2007* reference case (Figure 40). By energy source, the projected increase in natural gas consumption is second only to coal. Natural gas remains a key fuel in the electric power and industrial sectors. In the power sector, natural gas is an attractive choice for new generating plants because of its relative fuel efficiency. Natural gas also burns more cleanly than coal or petroleum products, and as more governments begin implementing national or regional plans to reduce carbon dioxide emissions, they may encourage the use of natural gas to displace liquids and coal.

Much of the world's natural gas use is for industrial sector processes. The industrial sector accounted for 44 percent of world natural gas consumption in 2004 and is projected to account for 43 percent in 2030. With world oil prices expected to remain high relative to historical levels throughout the projection period, natural gas is projected to displace liquids in the industrial sector to some extent. Industrial use of natural gas is projected to increase at an average annual rate of 1.9 percent from 2004 to 2030, as compared with an average increase of 1.1 percent per year for liquids consumption in the industrial sector.

In 2004, OECD member countries accounted for just over one-half of the world's total natural gas use, non-OECD Europe and Eurasia accounted for one-quarter, and the other non-OECD countries accounted for the remainder (Figure 41). In the *IEO2007* reference case, natural gas consumption in the non-OECD countries grows more than twice as fast as consumption in the OECD countries, with 2.6-percent average annual growth from 2004 to 2030 for non-OECD countries, compared with an average of 1.2 percent for the OECD countries. Natural gas demand in the non-OECD countries accounts for 71 percent of the total world increment in natural gas consumption over the projection period. In the non-OECD countries (excluding non-OECD Europe and Eurasia) natural gas use increases from less than one-quarter of the world total in 2004 to 35 percent in 2030.

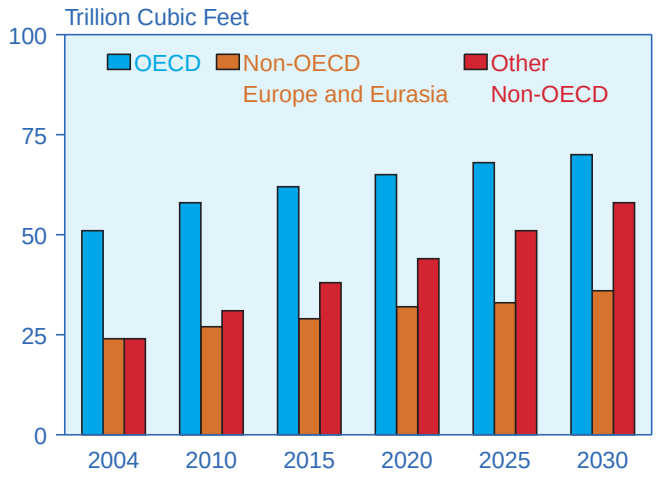
The OECD countries accounted for 40 percent of the world's total natural gas production and 52 percent of total natural gas consumption in 2004; in 2030, they are projected to account for only 27 percent of production and 43 percent of consumption. Natural gas production in the OECD nations increases by an average of only 0.4 percent per year in the *IEO2007* reference case, whereas their demand increases by 1.2 percent per year. As a

Figure 40. World Natural Gas Consumption by End-Use Sector, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 41. World Natural Gas Consumption by Region, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

result, the OECD countries are projected to rely increasingly on imports to meet natural gas demand, with a growing percentage of traded natural gas coming in the form of LNG. In 2030, more than one-third of the natural gas consumed in OECD countries is projected to come from other parts of the world, up from 22 percent in 2004.

Reserves and Resources

Historically, world natural gas reserves have, for the most part, trended upward (Figure 42). As of January 1, 2007, proved world natural gas reserves, as reported by *Oil & Gas Journal*,[9] were estimated at 6,183 trillion cubic feet—71 trillion cubic feet (about 1 percent) higher than the estimate for 2006 [*1*].

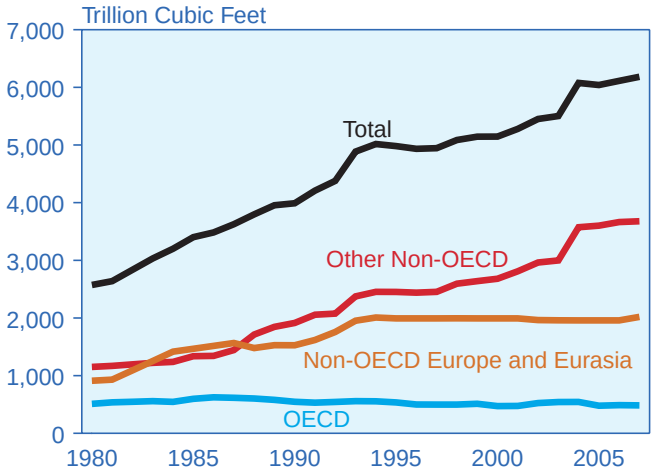
The largest revisions to natural gas reserve estimates were reported for Kazakhstan, Turkmenistan, and China. Kazakhstan added an estimated 35 trillion cubic feet (a 54-percent increase over 2006 proved reserves), Turkmenistan 29 trillion cubic feet (41 percent), and China 27 trillion cubic feet (50 percent). The United States also reported an increase of 12 trillion cubic feet over its 2006 reserves—a 6-percent increase and the largest increment in U.S. annual reserves since 1970. Declines in natural gas reserves were reported for the Netherlands (a decrease of 12 trillion cubic feet), Trinidad and Tobago (7 trillion cubic feet), Argentina (3 trillion cubic feet), Nigeria (3 trillion cubic feet), and Italy, Norway, the United Kingdom, and Saudi Arabia (about 2 trillion cubic feet each).

Almost three-quarters of the world's natural gas reserves are located in the Middle East and Eurasia (Figure 43). Russia, Iran, and Qatar combined accounted for about 58 percent of the world's natural gas reserves as of January 1, 2007 (Table 6). Reserves in the rest of the world are fairly evenly distributed on a regional basis.

Despite high rates of increase in natural gas consumption, particularly over the past decade, most regional reserves-to-production ratios are substantial. Worldwide, the reserves-to-production ratio is estimated at 65 years [*2*]. Central and South America has a reserves-to-production ratio of about 52 years, Russia 80 years, and Africa 88 years. The Middle East's reserves-to-production ratio exceeds 100 years.

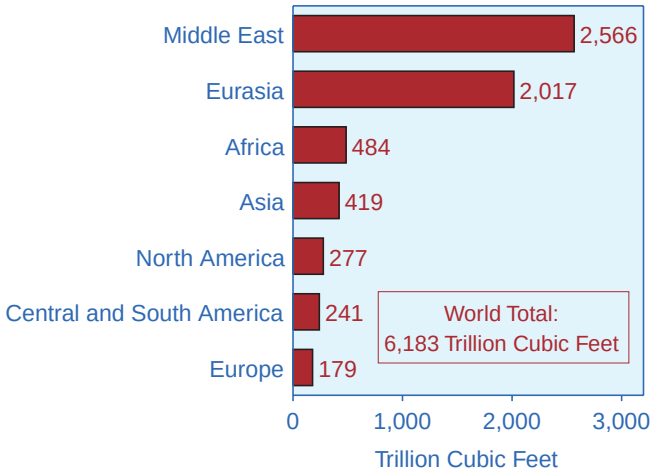
The U.S. Geological Survey (USGS) periodically assesses the long-term production potential of worldwide petroleum resources (oil, natural gas, and natural gas liquids). According to the most recent USGS estimates, released in the *World Petroleum Assessment 2000* and adjusted to reflect current proved reserves, a significant volume of natural gas remains to be discovered. Worldwide undiscovered natural gas is estimated at 4,136 trillion cubic feet (Figure 44). Within the total natural gas resource base, an estimated 3,000 trillion cubic feet is in "stranded" reserves, usually located too far away from

Figure 42. World Natural Gas Reserves by Region, 1980-2007



Sources: **1980-1993:** "Worldwide Oil and Gas at a Glance," *International Petroleum Encyclopedia* (Tulsa, OK: PennWell Publishing, various issues). **1994-2007:** *Oil & Gas Journal* (various issues).

Figure 43. World Natural Gas Reserves by Geographic Region as of January 1, 2007



Source: "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23.

[9]Proved reserves, as reported by the *Oil & Gas Journal*, are estimated quantities that can be recovered under present technology and prices. Natural gas reserves reported by the *Oil & Gas Journal* are compiled from voluntary survey responses and do not always reflect the most recent changes. U.S. proved reserves of natural gas are reported by the Energy Information Administration and are defined as the estimated quantities of natural gas reserves as of December 31, 2006, which analysis of geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Significant natural gas discoveries made in 2006 are not likely to be reflected in the reported reserves.

pipeline infrastructure or population centers for its transportation to be economical. Of the new natural gas resources expected to be added through 2025, reserve growth accounts for 2,347 trillion cubic feet.

World Natural Gas Supply

Production increases in the non-OECD countries are projected to account for more than 90 percent of the world's total growth in production from 2004 to 2030 (Figure 45). In the non-OECD countries, production is projected to grow by an average 2.6 percent per year, from 59 trillion cubic feet in 2004 to 119 trillion cubic feet in 2030. In particular, Russia and the Middle East each account for around 20 percent of the increase in annual production over the projection period. Both regions are expected to provide connections to natural gas markets in the Atlantic and Pacific basins, with Russia exporting mainly by pipeline and most Middle East exports being shipped as LNG.

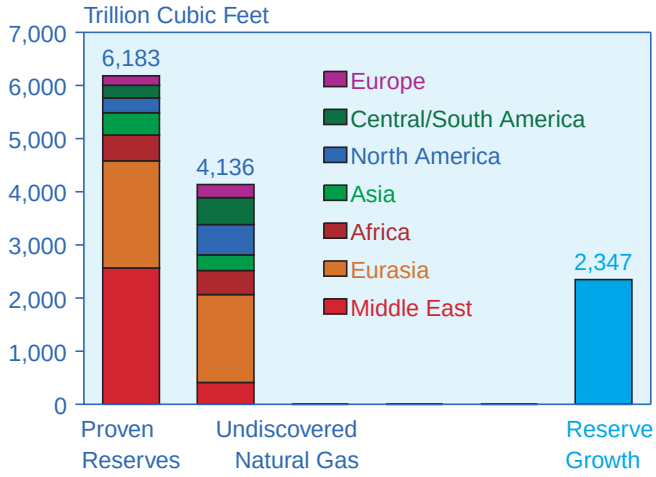
Russia has an extensive pipeline network reaching into Europe and has proposed the construction of pipelines to China and South Korea. In addition, Russia is beginning to enter LNG markets. It has traded pipeline gas for Atlantic LNG cargos, has plans to develop LNG export facilities to serve the Atlantic market, and soon will start exporting LNG from its Pacific coast. The Middle East already exports significant quantities of LNG to customers in both the Atlantic and Pacific basins. In 2005, 15 percent of the LNG exports from the region went to North America and Europe and 85 percent to Asia. Qatar has several LNG export projects under construction that are targeted for sales to North

Table 6. World Natural Gas Reserves by Country as of January 1, 2007

Country	Reserves (Trillion Cubic Feet)	Percent of World Total
World	**6,183**	**100.0**
Top 20 Countries	**5,602**	**90.6**
Russia	1,680	27.2
Iran	974	15.8
Qatar	911	14.7
Saudi Arabia	240	3.9
United Arab Emirates	214	3.5
United States	204	3.3
Nigeria	182	2.9
Algeria	162	2.6
Venezuela	152	2.5
Iraq	112	1.8
Turkmenistan	100	1.6
Kazakhstan	100	1.6
Indonesia	98	1.6
Norway	82	1.3
China	80	1.3
Malaysia	75	1.2
Uzbekistan	65	1.1
Egypt	59	0.9
Canada	58	0.9
Kuwait	55	0.9
Rest of World	**581**	**9.4**

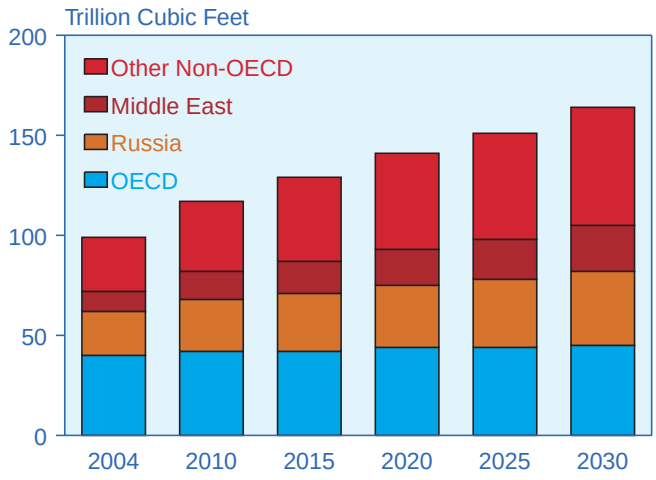
Source: "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23.

Figure 44. World Natural Gas Resources by Geographic Region, 2006-2025



Source: U.S. Geological Survey, *World Petroleum Assessment 2000*, web site http://greenwood.cr.usgs.gov/energy/WorldEnergy/DDS-60; "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23; and Energy Information Administration estimates.

Figure 45. World Natural Gas Production by Region, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

America and Europe. In December 2006, however, Qatar announced that the LNG from one project originally targeted for Atlantic buyers had been sold to Asian buyers in the Pacific basin.

Africa and non-OECD Asia (excluding China and India) are expected to be important sources of natural gas production in the future. For each of the two regions, natural gas production in 2030 is projected to be some 10 trillion cubic feet above 2004 production levels. The two regions combined accounted for 14 percent of the world's natural gas production in 2004; in 2030, their combined share is projected to be 21 percent. A significant portion of the production from both regions is exported. In 2004, 26 percent of the natural gas production from the countries of non-OECD Asia (primarily from Brunei, Indonesia, Malaysia, and Myanmar [formerly Burma]) and 50 percent of the production from African countries was for export. In 2030, the export share of production from non-OECD Asia is projected to fall to 10 percent, as domestic consumption takes precedence over exports, whereas the export share of Africa's production is projected to increase. Several pipelines from North Africa to Europe are under consideration, and LNG export capacity in West Africa continues to expand.

Historically, the United States has been both the largest producer and the largest consumer of natural gas in North America, and Canada has been the primary source of U.S. natural gas imports. In 2004, Canada provided 85 percent of gross U.S. imports of natural gas. Although Canada's unconventional and Arctic production both are expected to increase over the projection period, and LNG imports into Eastern Canada are expected to begin by the end of the decade, those supply increases are not expected to be sufficient to offset a decline in conventional production in Canada's largest producing basin, the Western Sedimentary Basin. Gross U.S. imports of LNG are projected to exceed gross pipeline imports from Canada after 2015, and Canada's share of gross U.S. imports is projected to decline to 25 percent in 2030.

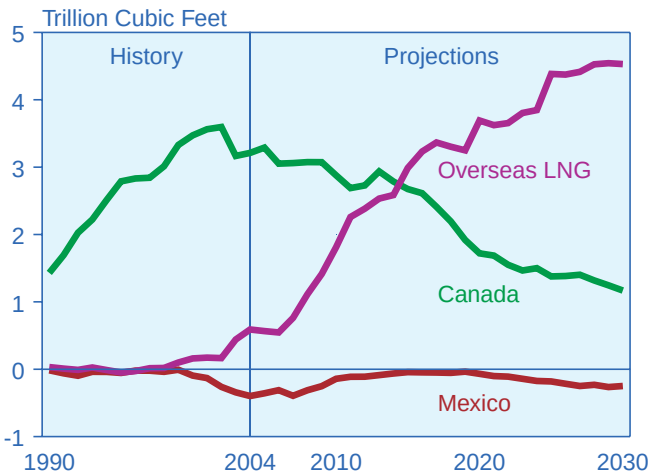
Rising natural gas prices are expected to make it economical for two major North American pipelines that have long been in the planning stages to come online. The first, a Canadian pipeline to transport natural gas from the MacKenzie Delta, is expected to become operational in 2012. The second, an Alaska pipeline, is expected to begin transporting natural gas from Alaska to the lower 48 States in 2018, contributing significantly to U.S. domestic supply. Alaska's natural gas production accounts for all of the projected growth in domestic U.S. conventional natural gas production from 2004 to 2030, with flows on the Alaska pipeline increasing to 2.2 trillion cubic feet in 2030. As a result, Alaskan production is projected to account for 22 percent of the increase in U.S. natural gas supply in 2030 relative to the 2004 total.

A large portion of North America's remaining technically recoverable resource base of natural gas consists of unconventional sources, which include tight sands, shale, and coalbed methane. With most of the large onshore conventional fields in the United States already having been discovered, the United States, like Canada, must look to these costlier sources of supply to make up for declines in conventional production. Unconventional production, especially from tight sands formations, is expected to be a significant source of U.S. incremental supply, increasing from 40 percent of total domestic production in 2004 to 50 percent in 2030 and accounting for 28 percent of the increase in U.S. natural gas supply in 2030 relative to the 2004 total.

By far the largest source of U.S. incremental natural gas supply (50 percent of the increase in 2030 relative to 2004) is expected to be LNG. Currently, the United States has five LNG import facilities in operation with a total peak capacity slightly above 5.8 billion cubic feet per day. Four additional facilities are under construction in the Gulf of Mexico. When completed, the four new terminals will more than double U.S. LNG import capacity. Peak annual U.S. LNG import capacity in 2030 is projected to reach 6.5 trillion cubic feet, with actual imports of 4.5 trillion cubic feet (Figure 46).

The growth of U.S. LNG imports is expected to be strong through most of the projection period. The significant

Figure 46. U.S. Net Imports of Natural Gas by Source, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *Annual Energy Review 2005*, DOE/EIA-0384(2005) (Washington, DC, August 2006), web site www.eia.doe.gov/emeu/aer. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), web site www.eia.doe.gov/oiaf/aeo.

growth in U.S. LNG imports is indicative of the country's growing dependence on imports and the increasing globalization of natural gas markets. The emerging LNG markets in Canada and Mexico, both of which have facilities either in operation (in Altamira, Mexico) or under construction, also highlight this trend.

Mexico has significant untapped reserves of natural gas, but the Mexican government does not have the resources needed to develop them and to date has been relatively unsuccessful in attracting foreign capital. Currently, only the state oil and natural gas company, Pemex, is allowed to have any ownership interest in Mexico's oil and natural gas reserves, which makes participation in the development of Mexico's oil and gas resources unattractive to foreign investors.

Outside North America, the Australia/New Zealand OECD region is projected to see the most rapid expansion of natural gas production among all the world regions (but starting from a much lower point than many other producing regions). Production in Australia/New Zealand is projected to grow by an average of 4.3 percent per year from 2004 to 2030 (Table 7), and most of the increase is expected to be used for LNG exports. Australia currently has 0.75 trillion cubic feet of LNG export capacity from five liquefaction trains, including four at the Northwest Shelf project and one at the Darwin project that began operation in February 2006. More than 2.5 trillion cubic feet per year of additional LNG liquefaction capacity has been proposed. The Australia/New Zealand region is projected to account for 5 percent of the growth in world natural gas

Table 7. World Natural Gas Production by Region and Country, 2004-2030
(Trillion Cubic Feet)

Region/Country	2004	2010	2015	2020	2025	2030	Average Annual Percent Change, 2004-2030
OECD North America	**26.9**	**28.1**	**28.2**	**29.3**	**29.2**	**29.6**	**0.4**
United States[a]	19.0	19.5	19.7	20.9	20.7	20.7	0.3
Canada	6.5	6.8	6.4	6.0	5.9	6.0	-0.3
Mexico	1.5	1.8	2.0	2.4	2.6	3.0	2.7
OECD Europe	**11.4**	**11.7**	**11.2**	**10.7**	**10.5**	**10.1**	**-0.4**
OECD Asia	**1.6**	**2.2**	**3.1**	**3.8**	**4.3**	**4.7**	**4.2**
Japan	0.1	0.1	0.1	0.1	0.1	0.1	0.4
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	—
Australia/New Zealand	1.5	2.1	3.0	3.7	4.2	4.6	4.3
Total OECD	**39.9**	**42.0**	**42.5**	**43.8**	**44.1**	**44.5**	**0.4**
Non-OECD Europe and Eurasia	**28.6**	**33.2**	**36.4**	**39.5**	**42.4**	**45.2**	**1.7**
Russia	22.4	24.9	27.4	30.0	32.6	35.2	1.7
Other	6.3	8.3	9.1	9.5	9.8	10.0	1.8
Non-OECD Asia	**10.5**	**13.6**	**16.4**	**19.1**	**22.2**	**25.2**	**3.3**
China	1.4	2.5	3.1	3.5	4.0	4.3	4.1
India	1.0	1.5	1.7	2.1	2.4	2.5	3.5
Other non-OECD Asia	8.1	9.6	11.5	13.5	15.8	18.4	3.1
Middle East	**9.9**	**13.8**	**17.4**	**20.1**	**21.8**	**24.1**	**3.3**
Africa	**5.3**	**7.8**	**9.5**	**11.1**	**13.0**	**15.1**	**4.0**
Central and South America	**4.5**	**5.8**	**7.0**	**7.7**	**8.4**	**9.2**	**2.7**
Brazil	0.3	0.6	0.7	0.8	0.9	1.0	4.1
Other Central /South America	4.2	5.3	6.3	6.9	7.6	8.2	2.5
Total Non-OECD	**58.9**	**74.3**	**86.7**	**97.4**	**107.8**	**118.8**	**2.6**
Total World	**98.9**	**116.3**	**129.2**	**141.2**	**151.9**	**163.3**	**1.9**

[a]Includes supplemental production or forecast discrepancy. For details, see Energy Information Administration (EIA), *Annual Energy Outlook 2007*, p. 159, Table A13, "Natural Gas Supply, Disposition, and Prices."

Note: Totals may not equal sum of components due to independent rounding.

Sources: **2004:** EIA, *International Energy Annual 2004* (May-July 2006), web site www.eia. doe.gov/iea. **2010-2030: United States:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), web site www.eia.doe.gov/oiaf/aeo. **Others:** EIA, System for the Analysis of Global Energy Markets (2007).

production from 2004 to 2030 and 3 percent of total production in 2030.

Investment in Australia's natural gas sector projects has been helped by the country's reputation as a stable political environment that takes no state equity in reserves or LNG assets. Even in Australia, however, state involvement has a bearing on project economics. The Gorgon LNG project to develop reserves off Australia's northwest coast faces not only stringent environmental requirements but also, in an agreement with the Western Australia state government, a requirement that the project must allocate 15 percent of Gorgon reserves for domestic consumption. The Western Australia government negotiated a similar agreement with the Northwest Shelf LNG developers, reserving 4.7 trillion cubic feet of Northwest Shelf natural gas for the domestic market. The requirement for domestic sales has kept natural gas prices in Western Australia below the LNG netback equivalent; however, all of the reserved natural gas has been consumed or allocated, and the Western Australia government is now looking at options for applying domestic reservation requirements to all future liquefaction projects that would process offshore gas in Western Australia [*3*].

Increasing state involvement in the upstream natural gas activities of several large reserve holders throughout the world is threatening to delay or discourage investments in new production and export capacity. In May 2006, Bolivia nationalized its energy resources, prompting investors to suspend further investment, including suspending plans to expand export pipelines. In January 2006, Venezuelan President Hugo Chavez proposed changing the constitution to make both natural gas and petroleum assets subject to state control. And in October 2006, Russia announced that there would be no foreign ownership in the giant Shtokman natural gas reserves, although it may bring foreign firms in as contractors to help with the development. Also in Russia, the majority state-owned firm Gazprom has gained a controlling share in the Sakhalin-2 LNG project, owned by a consortium led by Royal Dutch/Shell, ending disputes with authorities about environmental issues that had plagued the project [*4*].

World Natural Gas Demand

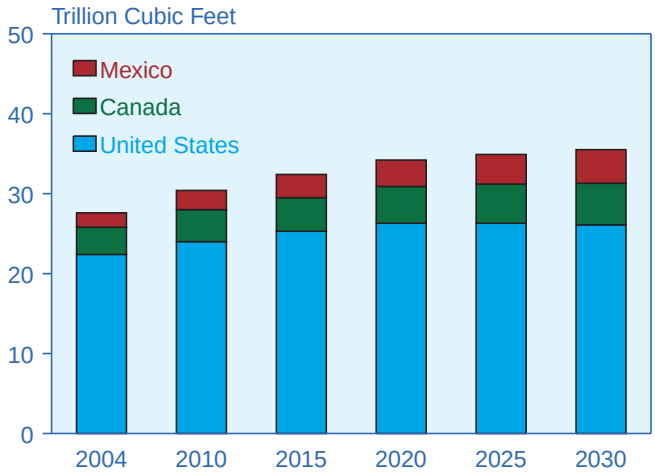
OECD North America

Natural gas consumption in North America (Figure 47) is projected to increase at an average annual rate of 1.0 percent from 2004 to 2030. The average annual growth rate for natural gas demand in the United States is projected to be 0.6 percent, significantly less than in Canada and Mexico, largely because of the impact of higher natural gas prices and supply concerns in U.S. natural gas markets. As North America's largest consumer, the United States accounted for more than 80 percent of the 27.6 trillion cubic feet of natural gas consumed in North America in 2004. As a result of the relatively slow growth in U.S. demand and robust growth in Canada and Mexico, the U.S. share of North America's total natural gas consumption in 2030 falls to 74 percent.

In 2004, natural-gas-fired plants accounted for less than 20 percent of electricity generation in the United States, while coal-fired plants accounted for about 50 percent. The natural gas share of generation is projected to rise to 22 percent in 2015. After 2015, higher natural gas prices, along with tax incentives for clean coal technologies, are expected to discourage the construction of new natural-gas-fired plants in favor of coal-fired plants, leading to a decline in the natural gas share to 16 percent and an increase in the coal share to 57 percent in 2030. U.S. natural gas consumption for electricity generation is projected to peak in 2020 at 7.2 trillion cubic feet, followed by a decline to 5.9 trillion cubic feet in 2030.

In Canada, natural gas consumption in the residential and commercial sectors is expected to increase steadily at rates of 0.5 and 0.7 percent per year, respectively. Strong growth rates of 2.2 percent per year in Canada's consumption of natural gas for electricity generation and 2.1 percent per year for industrial uses—including vast quantities of natural gas consumed in the mining of the country's oil sands deposits—are the main contributors to Canada's projected consumption growth. The expected growth in domestic consumption, coupled with a projected production decline of 0.3 percent per year, would leave less Canadian natural gas available for export. In 2004, Canada consumed 52 percent of its

Figure 47. Natural Gas Consumption in North America by Country, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

own natural gas production. In 2030, it is expected to consume 87 percent of its production domestically.

In Mexico, strong growth in natural gas consumption is expected in all sectors, with total consumption more than doubling between 2004 and 2030. Although the absolute quantities are small, average annual growth of 3.8 percent and 3.7 percent are expected for natural gas consumption in the residential and commercial sectors, respectively. Industrial consumption is projected to almost double, and consumption for electricity generation is expected to almost triple. Mexico's natural gas production is expected to double between 2004 and 2030, from 1.5 trillion cubic feet to 3.0 trillion cubic feet, but the projected growth in consumption over the period (2.4 trillion cubic feet) far exceeds the production growth, leaving Mexico dependent on LNG-exporting countries and on pipeline imports from the United States for needed supplies. Mexico remains a net importer of natural gas from the United States throughout the projection period.

OECD Europe

Natural gas is expected to be the fastest growing fuel source in OECD Europe, with demand increasing at an annual average rate of 1.4 percent, from 18.8 trillion cubic feet in 2004 to 23.0 trillion cubic feet in 2015 and 26.9 trillion cubic feet in 2030 (Figure 48). Growth in natural gas use for power generation is projected to account for the majority of total incremental gas use to 2030. Natural-gas-fired generation is less carbon-intensive than oil- or coal-fired generation and is expected to remain more cost-competitive than renewable energy, making natural gas the fuel of choice for new generating capacity in OECD Europe.

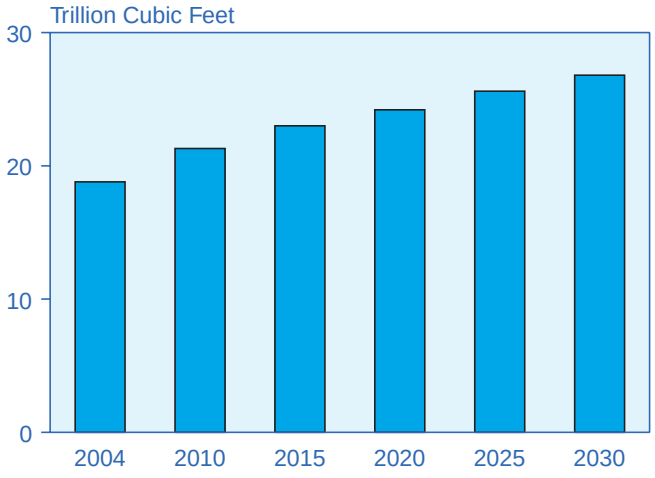
OECD Asia

In Japan, natural gas consumption is projected to grow on average by 1.4 percent per year over the projection period, from 3.0 trillion cubic in 2004 to 4.3 trillion cubic feet in 2030 (Figure 49). The strongest growth in consumption is projected for the electric power sector, averaging 1.7 percent annually from 2004 to 2030.

Total natural gas consumption in South Korea is projected to grow at an average annual rate of 1.6 percent from 2004 to 2030. In 2004, the residential sector was the country's predominant source of demand for natural gas, accounting for 39 percent of the total. The electric power sector was a close second at 33 percent of total natural gas use, followed by the industrial sector at 20 percent of the total.

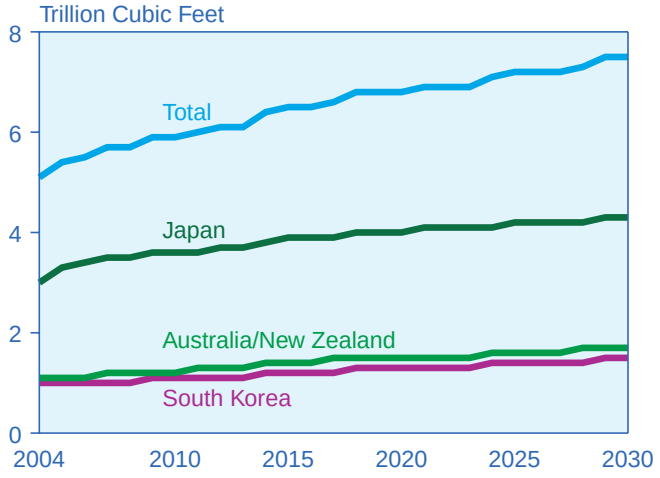
South Korea has large seasonal swings in demand for natural gas, importing more than twice as much LNG at its annual winter peak as at its lowest point during the summer—primarily to meet demand for heating in the residential sector. For a country that imports all its natural gas supplies as LNG and has no underground storage facilities, this can be an expensive undertaking. Korea Gas Corporation paid as much as $26 per million Btu for LNG on the spot market in 2005 and 2006, when it faced steep competition for winter cargoes [**5**]. In the reference case projection, however, with nearly flat population growth, South Korea is expected to see the growth of natural gas consumption in its electric power and industrial sectors outpace growth in the residential sector, potentially moderating seasonal swings in overall demand.

Figure 48. Natural Gas Consumption in OECD Europe, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 49. Natural Gas Consumption in OECD Asia by Country, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

In Australia and New Zealand, the industrial sector currently is the predominant consumer of natural gas and is projected to account for more than 50 percent of all natural gas consumption in the region throughout the projection period. Natural gas is the fastest growing fuel in Australia and New Zealand in the *IEO2007* reference case, accounting for 30 percent of the projected growth in the region's total energy consumption from 2004 to 2030. It is also the fastest growing fuel in the region's electric power sector. Although Australia has not ratified the Kyoto Protocol, several of the government's environmental policies have been put in place to help stimulate increases in natural gas use for electric power generation and to moderate growth in the use of coal, of which Australia has large reserves.

In January 2003, the government of New South Wales instituted a greenhouse gas abatement scheme that applies to electricity retailers [*6*]. Also, starting in January 2005, the Queensland government's "13 percent Gas Scheme" requires all electricity retailers to source at least 13 percent of their electricity from natural-gas-fired generation. The scheme allows certificates from qualified generation to be traded independently of the electricity generated. Electricity retailers are then required to acquire and turn in certificates representing their 13-percent minimum. The scheme aims to reduce greenhouse gas emissions and boost the natural gas industry in Queensland [*7*].

Non-OECD Europe and Eurasia

The non-OECD Europe and Eurasia region is more reliant on natural gas than any other region in the world. Russia is second only to the United States in total natural gas consumption, with demand totaling 16.0 trillion cubic feet in 2004 and representing 55 percent of Russia's total energy consumption (Figure 50). The other countries of non-OECD Europe and Eurasia met 44 percent of their combined total energy needs with natural gas in 2004, consuming 8.4 trillion cubic feet.

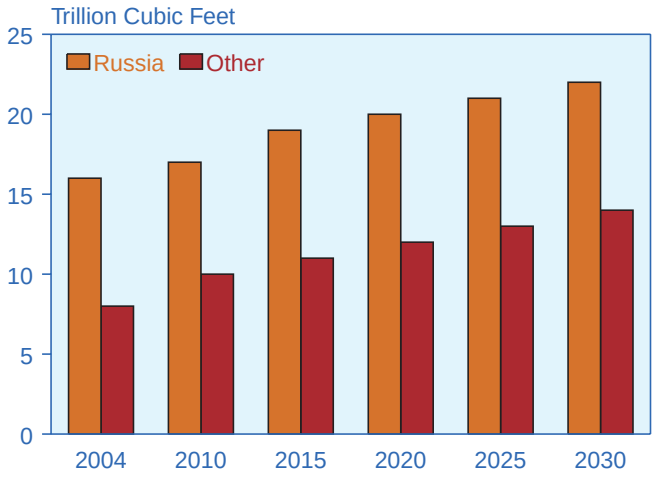
Natural gas intensity (defined as the amount consumed per dollar of GDP) in non-OECD Europe and Eurasia is greater than in any other region of the world, although it has improved in recent years from 9.7 thousand Btu per dollar of GDP in 1996 to 7.5 thousand Btu per dollar in 2004. In the *IEO2007* reference case, natural gas intensity in the region is projected to continue improving (decreasing) at an average rate of 2.8 percent per year from 2004 to 2030. Even at that rate, however, natural gas intensity in non-OECD Europe and Eurasia is not projected to equal the 2004 level of North America's natural gas intensity until after 2030.

Non-OECD Asia

The fastest growth in natural gas consumption among all regions is projected for non-OECD Asia, which accounted for only 8.5 percent of the world total in 2004 but is projected to account for almost 30 percent of the increase in total natural gas consumption from 2004 to 2030. Natural gas consumption in non-OECD Asia more than triples in the *IEO2007* reference case, from 8.5 trillion cubic feet in 2004 to 27.4 trillion cubic feet in 2030 (Figure 51).

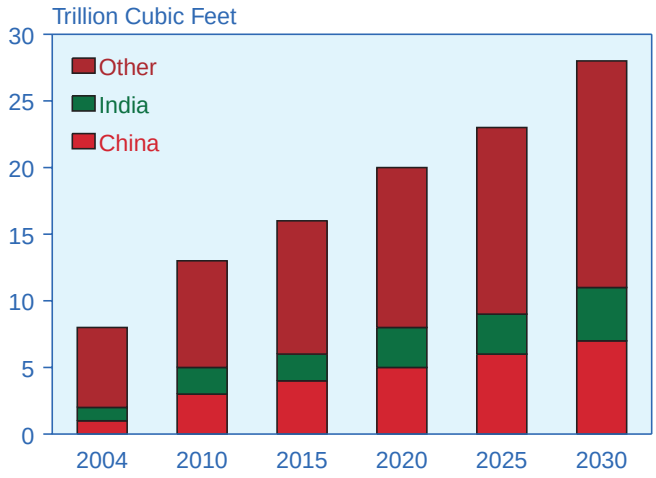
Led by demand in China and India, natural gas consumption in non-OECD Asia is projected to expand by 4.6 percent per year on average from 2004 to 2030. In both China and India, natural gas currently is a minor fuel in the overall energy mix, representing only

Figure 50. Natural Gas Consumption in Non-OECD Europe and Eurasia, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 51. Natural Gas Consumption in Non-OECD Asia, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

3 percent and 8 percent, respectively, of total primary energy consumption in 2004; however, both countries are rapidly expanding infrastructure to serve demand. China received it first-ever LNG cargo in mid-2006 under a long-term contract with Australia.

India increased its spot and short-term LNG purchases in 2006, reportedly paying more than $9 per million Btu for one cargo (a year earlier, Royal Dutch/Shell could not find customers for LNG from its Hazira regasification terminal at a price of about $8 per million Btu). Natural gas shortages in India have reportedly left natural-gas-fired electric power plants and fertilizer plants underutilized in the past few years. In the *IEO2007* reference case, India's natural gas consumption is projected to rise rapidly in the mid-term, growing by 6.2 percent per year on average from 2004 to 2015. As international natural gas prices gain acceptance in India, and as supplies from the Krishna-Godavari basin come on line around 2010, domestic natural gas supply is expected to catch up with currently underserved demand and also expand to serve new demand.

Natural gas supplies have also been tight in other parts of non-OECD Asia. LNG exports from Indonesia's Arun and Bontang liquefaction plants have been declining steadily, as dwindling production from the aging fields has been diverted to satisfy local demand. Startup of the Tangguh liquefaction plant, scheduled for 2009, should boost Indonesia's exports for a time, but it is expected that the country will soon lose its place (to Qatar) as the world's largest exporter of LNG.

Growth in natural gas consumption is projected to outstrip production growth in the non-OECD Asia region over the projection period. In 2004, net exports from the region were equal to 19 percent of its total production. In the *IEO2007* reference case, its net exports fall to 4 percent of production in 2015, and in 2020 the non-OECD Asia region is projected to be a net importer, with importing exceeding production by 9 percent.

Other Non-OECD

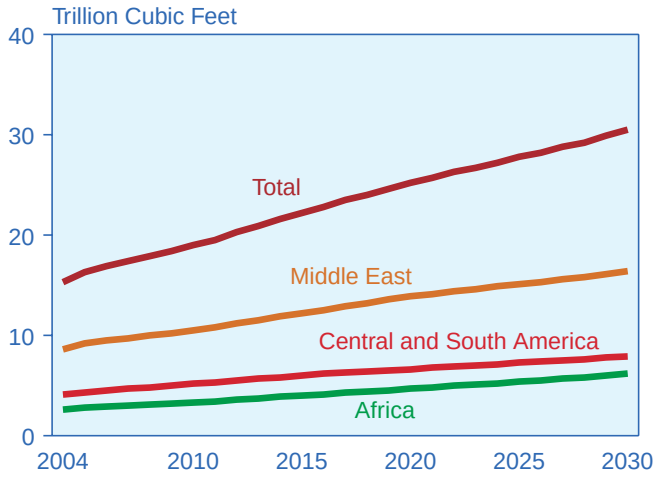
In the *IEO2007* reference case, natural gas consumption grows at average annual rates of 2.5 percent in the Middle East and 3.3 percent in Africa from 2004 to 2030. Natural gas consumption in the Middle East almost doubles over the projection period, and consumption in Africa more than doubles (Figure 52). Before 2015, most of the increase in natural gas production in both regions is projected to be for export projects. As a result, the export share of production increases from 2004 to 2015 in both regions (Figure 53). After 2015, production increases in the two regions are expected to be directed more toward domestic consumption, and their export shares of production show only slight increases from 2015 to 2030.

In Central and South America, natural gas is the fastest growing fuel source, with demand increasing on average by 2.6 percent per year, from 4.1 trillion cubic feet in 2004 to 7.9 trillion cubic feet in 2030. Brazil accounts for more than 20 percent of the projected increase in the region's consumption of natural gas in 2030 relative to total consumption in 2004.

References

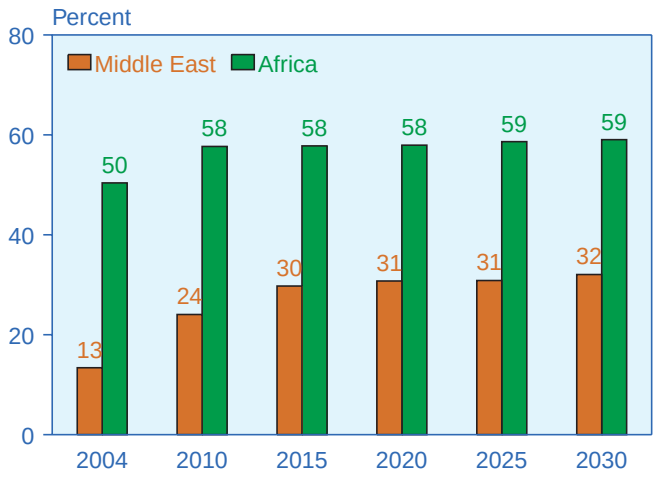
1. "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23.

Figure 52. Natural Gas Consumption in Central and South America, Africa, and the Middle East, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 53. Export Share of Natural Gas Production in the Middle East and Africa, 2004-2030



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2. *BP Statistical Review of World Energy 2006* (London, UK, June 2006), p. 22.
3. State of Western Australia, Department of Industry and Resources, "WA Government Policy on Securing Domestic Gas Supplies, Consultation Paper" (February 2006).
4. A. Neff, "Gazprom Secures Controlling Stake in Sakhalin02 Project in US$7.45-bil. Deal," Global Insight, Inc., Energy: Sector Analysis, web site www.globalinsight.com (December 22, 2006).
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Chapter 5
Coal

In the IEO2007 reference case, world coal consumption increases by 74 percent from 2004 to 2030, international coal trade increases by 44 percent from 2005 to 2030, and coal's share of world energy consumption increases from 26 percent in 2004 to 28 percent in 2030.

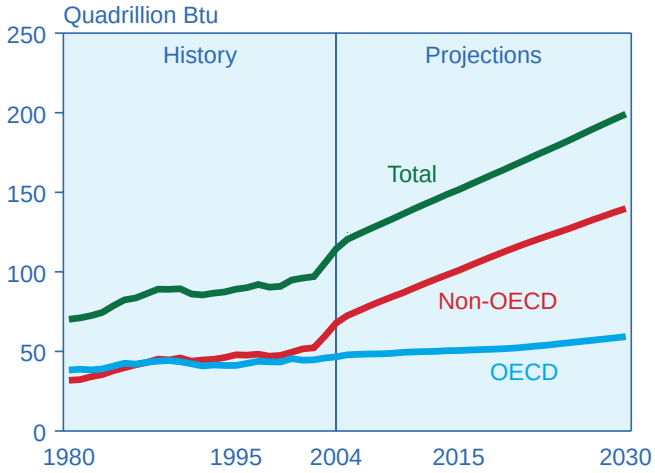
In the *IEO2007* reference case, world coal consumption increases by 74 percent over the projection period, from 114.4 quadrillion Btu in 2004 to 199.0 quadrillion Btu in 2030 (Figure 54). Coal consumption increases by 2.6 percent per year on average from 2004 to 2015, then slows to an average increase of 1.8 percent annually from 2015 to 2030. World GDP and primary energy consumption also grow more rapidly in the first half than in the second half of the projections, reflecting a gradual slowdown of economic growth in non-OECD Asia. Regionally, increased use of coal in non-OECD countries accounts for 85 percent of the total growth in world coal consumption projected over the entire *IEO2007* projection horizon.

In 2004, coal accounted for 26 percent of total world energy consumption (Figure 55). Of the coal produced worldwide in 2004, 65 percent was shipped to electricity producers, 31 percent to industrial consumers, and most of the remaining 4 percent to coal consumers in the residential and commercial sectors. Coal's share of total world energy consumption is projected to increase to 28 percent in 2030, and in the electric power sector its share is projected to rise from 43 percent in 2004 to 45 percent in 2030.

Although coal currently is the second-largest fuel source of energy-related carbon dioxide emissions (behind oil), accounting for 39 percent of the world total in 2004, it is projected to become the largest source by 2010. The two key factors underlying the increase are a more rapid projected growth rate for world coal consumption than for oil consumption and the fact that carbon dioxide emissions per unit of energy output are higher for coal than for oil or natural gas. In 2030, coal's share of energy-related carbon dioxide emissions is projected to be 43 percent, compared with 36 percent for oil and 21 percent for natural gas.

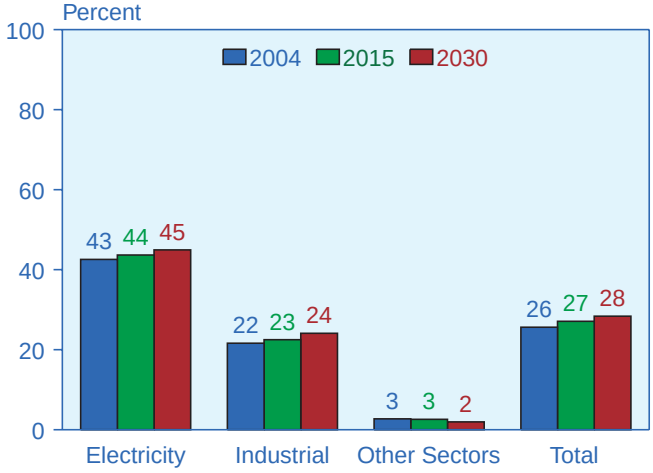
International coal trade increases in the reference case from 18.4 quadrillion Btu in 2005 to 26.5 quadrillion Btu in 2030—an increase of 44 percent. Because the largest increase in consumption is projected for coal that is both produced and consumed domestically in China, the share of total world coal consumption accounted for by internationally traded coal falls from 15 percent in 2004 to 13 percent in 2030.

Figure 54. World Coal Consumption by Region, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 55. Coal Share of World Energy Consumption by Sector, 2004, 2015, and 2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2015 and 2030:** EIA, System for the Analysis of Global Energy Markets (2007).

World Coal Reserves

Total recoverable reserves of coal[10] around the world are estimated at 998 billion tons[11]—reflecting a current reserves-to-production ratio of 164[12] (Table 8) [*1*]. Historically, estimates of world recoverable coal reserves, although relatively stable, have declined gradually from 1,174 billion tons in 1990 to 1,083 billion tons in 2000 and 998 billion tons in 2003 [*2*]. The most recent assessment of world coal reserves includes a substantial downward adjustment for Germany, from 73 billion tons of recoverable coal reserves to 7 billion tons. The reassessment primarily reflects more restrictive criteria for the depth and thickness parameters associated with both underground and surface minable seams of coal [*3*].

Although coal deposits are widely distributed, 67 percent of the world's recoverable reserves are located in four countries: the United States (27 percent), Russia (17 percent), China (13 percent), and India (10 percent). In 2004, these four countries, taken together, accounted for 66 percent of total world coal production [*4*]. By rank, anthracite and bituminous coal account for 53 percent of the world's estimated recoverable coal reserves (on a tonnage basis), subbituminous coal accounts for 30 percent, and lignite accounts for 17 percent.

Quality and geological characteristics of coal deposits are important parameters for coal reserves. Coal is a heterogeneous source of energy, with quality (e.g., characteristics such as heat, sulfur, and ash content) varying significantly by region and even within individual coal seams. At the top end of the quality spectrum are premium-grade bituminous coals, or coking coals, used to manufacture coke for the steelmaking process. Coking coals produced in the United States have an estimated heat content of 27.4 million Btu per ton and relatively low sulfur content of approximately 0.8 percent by weight [*5*]. At the other end of the spectrum are reserves of low-Btu lignite. On a Btu basis, lignite reserves show considerable variation. Estimates published by the International Energy Agency for 2004 indicate that the average heat content of lignite in major producing countries varies from a low of 4.4 million Btu per ton in Greece to a high of 12.3 million Btu per ton in Canada [*6*].

World Coal Production

From 2004 to 2030, coal production in China, the United States, and India, driven by growing coal consumption, is projected to increase by 50.4 quadrillion Btu, 11.1 quadrillion Btu, and 5.7 quadrillion Btu, respectively (Table 9). It is assumed that most of the demand for coal in

Table 8. World Recoverable Coal Reserves as of January 1, 2003
(Billion Short Tons)

Region/Country	Bituminous and Anthracite	Subbituminous	Lignite	Total
World Total	**528.8**	**298.1**	**170.9**	**997.7**
United States[a]	123.7	110.3	33.5	267.6
Russia	54.1	107.4	11.5	173.1
China	68.6	37.1	20.5	126.2
India	99.3	0.0	2.6	101.9
Other Non-OECD Europe and Eurasia	50.1	18.7	31.3	100.1
Australia and New Zealand	42.6	2.7	41.9	87.2
Africa	55.3	0.2	*	55.5
OECD Europe	19.5	5.0	18.8	43.3
Other Non-OECD Asia	1.4	2.0	8.1	11.5
Brazil	0.0	11.1	0.0	11.1
Other Central and South America	8.5	2.2	0.1	10.8
Canada	3.8	1.0	2.5	7.3
Other[b]	1.8	0.4	0.1	2.3

[a]Data for the United States represent recoverable coal estimates as of January 1, 2006.
[b]Includes Mexico, Middle East, Japan, and South Korea.
*Less than 0.05 billion short tons.
Sources: **United States:** Energy Information Administration, unpublished data from the Coal Reserves Database (April 2007). **All Other Countries:** World Energy Council, *2004 Survey of Energy Resources*, Eds. J. Trinnaman and A. Clarke (London, UK: Elsevier, December 2004).

[10]Recoverable reserves are those quantities of coal which geological and engineering information indicates with reasonable certainty can be extracted in the future under existing economic and operating conditions.
[11]Throughout this chapter, tons refer to short tons (2,000 pounds).
[12]Ratio based on reserves data supplied in Table 8 and data on world coal production for 2004.

China, the United States, and India will continue to be met by domestic production. The projected increases in coal production for the three countries dominate the overall trends in the OECD and non-OECD regions, accounting for 71 percent of the increase in production for the entire OECD region and 79 percent of the increase in the non-OECD region. Increased demand for international trade is expected to support production increases in Australia/New Zealand, Russia, other non-OECD Asia, Africa, and Central and South America (excluding Brazil).

World Coal Consumption

OECD Countries

Coal consumption in the OECD countries rises at a relatively even pace in the reference case, from 46.6 quadrillion Btu in 2004 to 50.7 quadrillion Btu in 2015 and 59.3 quadrillion Btu in 2030 (Figure 56). The increases represent average growth of 0.9 percent per year over the entire period and a slightly higher rate of 1.1 percent per year from 2015 to 2030.

Table 9. World Coal Production by Region, 2004-2030
(Quadrillion Btu)

Region	2004	2010	2015	2020	2025	2030	Average Annual Percent Change, 2004-2030
OECD North America	**24.6**	**27.0**	**28.3**	**29.4**	**33.3**	**37.0**	**1.6%**
United States	22.8	24.6	25.8	26.7	30.4	33.9	1.5%
Canada	1.5	1.9	2.1	2.2	2.4	2.5	2.0%
Mexico	0.2	0.4	0.4	0.4	0.5	0.5	3.3%
OECD Europe	**7.9**	**8.0**	**7.7**	**7.1**	**6.6**	**6.6**	**-0.7%**
OECD Asia	**8.1**	**9.7**	**10.4**	**11.2**	**11.9**	**12.7**	**1.7%**
Japan	0.0	0.0	0.0	0.0	0.0	0.0	—
South Korea	0.1	0.1	0.1	0.1	0.1	0.1	0.9%
Australia/New Zealand	8.1	9.6	10.2	11.1	11.9	12.6	1.7%
Total OECD	**40.6**	**44.7**	**46.4**	**47.7**	**51.9**	**56.2**	**1.3%**
Non-OECD Europe and Eurasia	**10.0**	**11.5**	**12.5**	**13.3**	**13.6**	**13.7**	**1.2%**
Russia	5.9	7.1	7.5	7.9	8.2	8.5	1.4%
Other	4.1	4.4	5.0	5.3	5.4	5.3	0.9%
Non-OECD Asia	**55.2**	**70.6**	**82.4**	**94.7**	**105.4**	**116.7**	**2.9%**
China	43.0	55.4	64.6	74.3	83.4	93.4	3.0%
India	7.3	8.1	9.5	10.8	12.0	13.0	2.3%
Other	4.9	7.1	8.3	9.6	10.0	10.3	2.9%
Middle East	*	*	*	*	*	*	**-1.2%**
Africa	**5.9**	**7.1**	**7.7**	**8.0**	**8.6**	**8.9**	**1.6%**
Central and South America	**1.8**	**2.7**	**3.1**	**4.0**	**4.3**	**4.3**	**3.4%**
Brazil	0.1	0.1	0.2	0.2	0.2	0.2	3.3%
Other	1.7	2.5	2.9	3.8	4.1	4.1	3.4%
Total Non-OECD	**72.8**	**91.9**	**105.7**	**120.1**	**131.9**	**143.7**	**2.6%**
Total World	**113.4**	**136.6**	**152.1**	**167.7**	**183.8**	**199.9**	**2.2%**

*Less than 0.05 quadrillion Btu

Note: With the exception of North America, non-seaborne coal trade is not represented in the *IEO2007* cases. As a result, the projected levels of production assume that net non-seaborne coal trade will balance out across the world regions. Currently, a significant amount of non-seaborne coal trade takes place in Eurasia, represented by exports of steam coal from Kazikhstan to Russia and exports of coking coal from Russia to Ukraine.

Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007) and National Energy Modeling System run IEO2007.D032707B.

Much of the increase in coal consumption projected for the OECD countries from 2004 to 2030 is the result of expected strong growth in U.S. coal demand, under the assumption that existing laws and policies remain in effect indefinitely. Moderate increases in coal consumption are projected for most of the OECD countries, including South Korea, Canada, Australia/New Zealand, and Mexico. In OECD Europe, natural gas is expected to capture an increasing share of the region's total energy mix, primarily displacing coal and liquids and, to a lesser extent, nuclear energy. Slow economic growth in Japan is projected to result in sluggish growth in overall energy demand, and as a result, the projection for Japan's coal consumption in 2030 is only slightly lower than its 2004 total.

North America

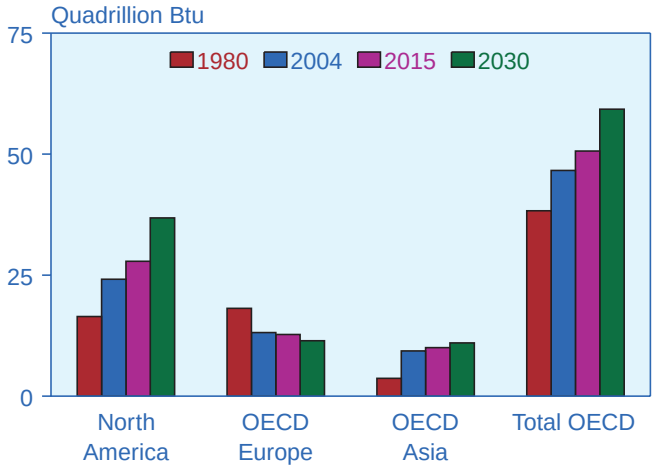
In 2004, the United States consumed 22.6 quadrillion Btu of energy from coal, accounting for 94 percent of total coal consumption in North America and 48 percent of the OECD total. U.S. coal consumption rises to 34.1 quadrillion Btu in 2030 in the reference case. The United States has substantial coal reserves and has come to rely heavily on coal for electricity generation, a trend that continues in the projections. Coal's share of total electricity generation in the United States (including electricity produced at combined heat and power plants in the industrial and commercial sectors) declines slightly, from 50 percent in 2004 to 49 percent in 2015, then rises to 57 percent in 2030.

Much of the projected growth in U.S. coal consumption occurs after 2015. Between 2005 and 2015, natural gas prices are projected to decline, remaining competitive with coal prices for electricity generation. Although some new natural-gas-fired capacity is projected to come on line during the period, much of the growth in electricity generation from natural gas is based on increasing utilization of the nearly 200 gigawatts of new natural-gas-fired capacity that came on line from 1999 through 2004. After 2015, rising natural gas prices gradually tilt economic decisions toward new coal-fired power plants. From 2015 to 2030, 140 gigawatts of new coal-fired capacity is projected to be built, representing 89 percent of the total coal builds projected for the years 2005 through 2030. These projections could change significantly if existing laws and policies, particularly those related to greenhouse gas emissions, were to change.

Canada's coal consumption is projected to increase from 1.2 quadrillion Btu in 2004 to 1.8 quadrillion Btu in 2030. In the short term, Canada's coal consumption remains near current levels, as the Ontario government moves ahead with plans to shut down the Province's 6.5 gigawatts of remaining coal-fired generating capacity by 2014 [7]. The government has indicated, however, that the shutdown will not be completed until generation from alternative sources can be secured. The decision to close the plants is based primarily on the premise that the adverse health and environmental impacts of the plants' operation are unacceptable. In western Canada, where most of the country's coal resources are located, increasing demand for electricity is expected to result in the need for additional coal-fired generating capacity.

In Mexico, relatively strong growth in overall energy demand leads to an increase in total coal consumption of 0.5 quadrillion Btu from 2004 to 2030. Mexico is projected to use more coal in 2030 both in the electric power sector and in the industrial sector.

Figure 56. OECD Coal Consumption by Region, 1980, 2004, 2015, and 2030



Sources: **1980 and 2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2015 and 2030:** EIA, System for the Analysis of Global Energy Markets (2007).

OECD Europe

Coal consumption in OECD Europe declines by 1.7 quadrillion Btu (13 percent) from 2004 to 2030 in the *IEO2007* reference case; however, the region is and will continue to be a major market for coal. Coal consumption in OECD Europe, at 13.1 quadrillion Btu in 2004, represented 28 percent of total OECD coal use. It is projected to drop to 11.5 quadrillion Btu in 2030, or 19 percent of total OECD coal use.

The major coal-consuming countries of the region, all with consumption of 0.7 quadrillion Btu or more in 2004, include Germany, Poland, the United Kingdom, Spain, Turkey, and the Czech Republic. Although OECD Europe relies heavily on imports of hard coal,[13] low-Btu lignite represents an important domestically produced source of energy. In 2004, lignite accounted for 47 percent of the region's total coal consumption on a tonnage basis and 23 percent on a Btu basis [8].

[13]Internationally, the term "hard coal" is used to describe anthracite and bituminous coal. In data published by the International Energy Agency, coal of subbituminous rank is classified as hard coal for some countries and as brown coal (with lignite) for others.

Plans to replace or refurbish existing coal-fired capacity in a number of the countries of OECD Europe are an indication that coal will continue to play an important role in the region's overall energy mix. In addition to some recent additions of coal-fired capacity (primarily in Turkey), electricity producers in Germany, Spain, France, Italy, Poland, the Czech Republic, and Slovakia have revealed plans to upgrade or replace existing coal-fired generating facilities over the next two decades. Power producers in Germany plan to build nearly 11 gigawatts of new coal-fired generating capacity by 2012, primarily to replace existing, less efficient, coal-fired capacity [***9***]. A key incentive for the new coal builds in Germany is a provision guaranteeing carbon dioxide emission rights for the new capacity during the first 14 years of its operation.

Among the most important factors that keep coal consumption in OECD Europe from increasing in the projections is the region's relatively slow growth in overall energy consumption (0.4 percent per year). Contributing factors include continued penetration of natural gas in both the electricity and industrial sectors, growing use of renewable fuels in the region, and continuing pressure on members of the European Union to reduce subsidies that support domestic production of hard coal.

OECD Asia

In 2004, the countries of OECD Asia (Australia, New Zealand, Japan, and South Korea) consumed 9.3 quadrillion Btu of coal, representing 20 percent of total OECD coal consumption. In addition to being an important coal-consuming region, OECD Asia also plays an important role in international coal trade. In 2004, Australia was the world's leading coal exporter, supplying 5.6 quadrillion Btu of coal to the international market, while Japan and South Korea were the world's leading importers, receiving 4.6 and 2.0 quadrillion Btu of coal, respectively, from other countries [***10***].

In the *IEO2007* reference case, coal consumption in OECD Asia increases by 1.7 quadrillion Btu, to 11.0 quadrillion Btu in 2030. With little change projected for Japan's coal consumption, South Korea and Australia/New Zealand account for virtually all of the increase in the region.

Coal consumption in Australia and New Zealand is projected to increase by an average of 1.2 percent per year, from 2.4 quadrillion Btu in 2004 to 3.3 quadrillion Btu in 2030. With substantial coal reserves, the Australia/New Zealand region continues to rely heavily on coal for electricity generation; however, coal's share of total generation in the region is projected to decline gradually, as more natural gas is used for power generation. Coal-fired power plants in the two countries supplied 73 percent of their total electricity generation in 2004. That share declines gradually in the reference case, to 63 percent in 2030.

South Korea's total annual coal consumption is projected to increase by 0.9 quadrillion Btu from 2004 to 2030, primarily to fuel electric power plants. Construction plans that have been announced by South Korea's generating companies indicate additional builds of 7.3 gigawatts of coal-fired capacity at existing sites over the next few years, including two 500-megawatt units that came on line at Korea East-West Power Company's Dangjin plant in 2005 and 2006 [***11***].

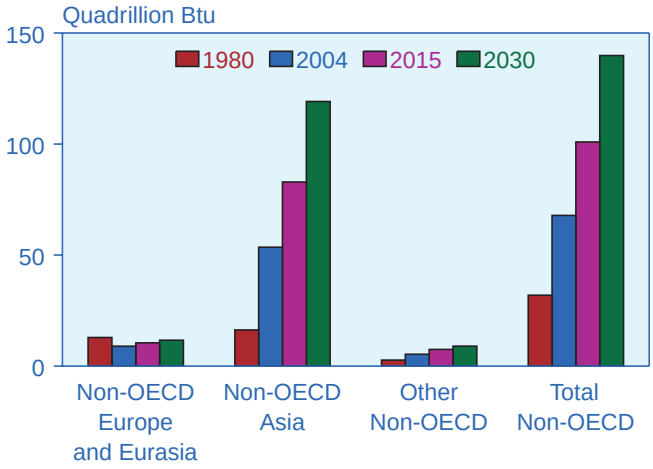
Non-OECD Countries

Led by strong economic growth and rising demand for energy in China and India, non-OECD coal consumption is projected to rise to 139.8 quadrillion Btu in 2030, more than double the quantity consumed in 2004 (Figure 57). The increase of 71.9 quadrillion Btu represents 85 percent of the projected increase in total world coal consumption. Coal's share of total energy consumption in the non-OECD region is projected to increase from 33 percent in 2004 to 35 percent in 2030. Total coal consumption in the non-OECD countries is projected to grow at an average annual rate of 3.7 percent from 2004 to 2015 and at a slower rate of 2.2 percent per year from 2015 to 2030, as the region's overall rate of economic growth begins to slow in the later years of the projection period.

Non-OECD Asia

China and India together account for 72 percent of the projected increase in world coal consumption from 2004 to 2030. Strong economic growth (averaging 6.5 percent

Figure 57. Non-OECD Coal Consumption by Region, 1980, 2004, 2015, and 2030



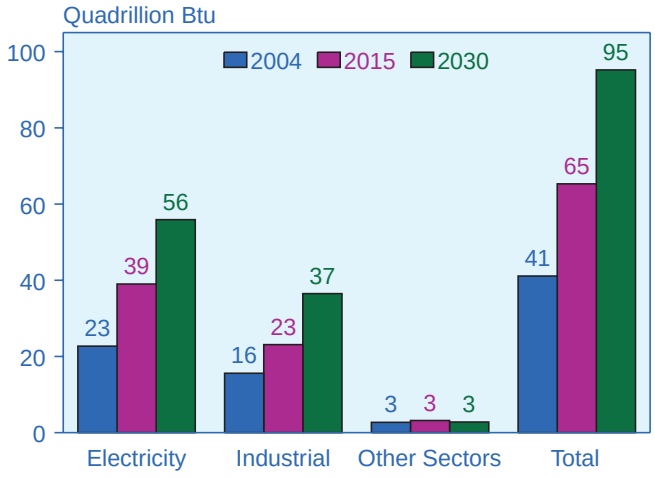
Sources: **1980 and 2004:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea. **2015 and 2030:** EIA, System for the Analysis of Global Energy Markets (2007).

per year in China and 5.7 percent per year in India from 2004 to 2030) is projected for both countries, and much of the increase in their demand for energy, particularly in the industrial and electricity sectors, is expected to be met by coal.

Coal use in China's electricity sector is projected to increase from 22.7 quadrillion Btu in 2004 to 55.9 quadrillion Btu in 2030, at an average rate of 3.5 percent per year (Figure 58). In comparison, coal consumption in the U.S. electricity sector is projected to grow by 1.7 percent annually, from 20.3 quadrillion Btu in 2004 to 31.1 quadrillion Btu in 2030. At the end of 2004, China had an estimated 271 gigawatts of coal-fired capacity in operation. To meet the demand for electricity that is expected to accompany its rapid economic growth, an additional 497 gigawatts of coal-fired capacity (net of retirements) is projected to be brought on line in China by 2030, requiring large financial investments in new coal-fired power plants and associated transmission and distribution systems.

Nearly one-half (45 percent) of China's coal use in 2004 was in the non-electricity sectors, primarily in the industrial sector. China was the world's leading producer of both steel and pig iron in 2004 [***12***]. Over the projection period, coal demand in China's non-electricity sectors is expected to more than double, increasing by 20.9 quadrillion Btu. Despite such substantial growth, however, the non-electricity share of total coal demand is projected to decline slightly, to 41 percent of total coal demand in 2030. Coal remains the primary source of energy in China's industrial sector, primarily because the country has only limited reserves of oil and natural gas.

Figure 58. Coal Consumption in China by Sector, 2004, 2015, and 2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea. **2015 and 2030:** EIA, System for the Analysis of Global Energy Markets (2006).

With a substantial portion of the increase in China's demand for both liquids and natural gas projected to be met by imports, the Chinese government is actively promoting the development of a large coal-to-liquids industry. Initial production of coal-based synthetic liquids in China is scheduled to commence in late 2007 with the completion of the country's first coal-to-liquids plant, located in the Inner Mongolia Autonomous Region [***13***]. It is being built by the Shenhua Coal Liquefaction Corporation and will have an initial capacity of approximately 20,000 barrels per day, tentatively scheduled to be increased to 100,000 barrels per day by 2010.

In another development, China's Shenhua and Ningxia Industry Groups are proceeding with feasibility studies for the construction of two 80,000 barrel per day coal-to-liquids plants to be sited in the Ningxia Autonomous Region and the Shaanxi Province. Although China's government and industry have proposed to build as much as 1.0 million barrels of daily coal-to-liquids capacity by 2020, considerable uncertainty and risks are associated with the emergence of such a massive coal-to-liquids industry, including potential strains on water resources and the general financial risks associated with the technological uncertainties and huge capital investments.

Nearly 70 percent of the growth in India's coal consumption is expected to be in the electric power sector and most of the remainder in the industrial sector. In 2004, India's coal-fired power plants consumed 5.6 quadrillion Btu of coal, representing 69 percent of the country's total coal demand. Coal use for electricity generation in India is projected to grow by 2.4 percent per year, to 10.5 quadrillion Btu in 2030, as an additional 104 gigawatts of coal-fired capacity (net of retirements) is brought on line. As a result, India's coal-fired generating capacity more than doubles in the *IEO2007* projections, from 82 gigawatts in 2004 to 186 gigawatts in 2030.

Currently, India's government indicates that 11 gigawatts of new coal-fired generating capacity will be completed during its tenth power plan period (a 5-year period ending in March 2007), and it is planning to complete more than 50 gigawatts of new coal-fired capacity during its eleventh plan period (ending in March 2012) [***14***]. In addition, India's government is also pursuing the development of between five and seven large coal-fired power projects that would have between 20 and 28 gigawatts of combined generating capability [***15***].

In other non-OECD Asia, coal consumption is projected to grow by an average of 2.8 percent per year, from 4.3 quadrillion Btu in 2004 to 8.8 quadrillion Btu in 2030, with increases in both the industrial and electric power sectors. In the electric power sector, significant growth in coal consumption is expected in Taiwan, Vietnam, Indonesia, and Malaysia, where considerable amounts

of new coal-fired generating capacity are either planned or under construction.

Non-OECD Europe and Eurasia

Coal consumption in non-OECD Europe and Eurasia is projected to increase at an average rate of 1.0 percent per year, from 9.0 quadrillion Btu in 2004 to 11.7 quadrillion Btu in 2030. The region has substantial coal reserves: Russia alone has an estimated 173 billion tons of recoverable reserves (17 percent of the world total), and the other countries in the region have an additional 100 billion tons (10 percent of the world total).

Russia is the largest coal consumer in the region, with total consumption of 4.8 quadrillion Btu in 2004, corresponding to 54 percent of total coal consumption in non-OECD Europe and Eurasia. In 2030, Russia's coal use is projected to total 6.1 quadrillion Btu. Coal supplied 16 percent of Russia's total energy requirements in 2004, and coal-fired power plants provided 20 percent of its electricity. In the *IEO2007* reference case, coal's share of Russia's total energy consumption is projected to drop slightly, to 15 percent in 2030, and its share of electricity generation is projected to decline to 16 percent in 2030. In most cases, natural gas is expected to be the most economical option for new generating capacity in Russia, although nuclear generation also is expected to increase substantially though 2030. The natural gas share of Russia's total electricity generation is projected to rise from 44 percent in 2004 to 48 percent in 2030.

Although Russia's long-term energy strategy calls for considerable new nuclear generating capacity, the government maintains that fossil-fuel-fired plants will continue in their role as the primary source for electric power generation through 2020 [***16***]. For new fossil-fired generating capacity, Russia's energy strategy promotes the construction of advanced coal-fired capacity in the coal-rich Siberian region (central Russia) and recommends a focus on efficient natural-gas-fired capacity for the western and far eastern areas of the country.

In other non-OECD Europe and Eurasia, coal consumption is projected to increase from 4.2 quadrillion Btu in 2004 to 5.6 quadrillion Btu by 2030, growing by 1.1 percent per year on average. Plans for both new coal-fired capacity and the refurbishment of existing capacity in a number of countries, including Bosnia and Herzegovina, Serbia and Montenegro, Bulgaria, Romania, and Ukraine, are a significant indication that coal will continue to be an important source of energy for the region [***17***].

Africa

Africa's coal consumption is projected to increase by 2.6 quadrillion Btu from 2004 to 2030. South Africa currently accounts for 94 percent of the coal consumed on the continent and is expected to continue to account for much of the increase in Africa's total coal consumption over the projection period in both the electricity and industrial sectors.

In South Africa, increasing demand for electricity in recent years has led to a decision by Eskom, the country's state-owned electricity supplier, to restart three large coal-fired plants (Camden, Grootvlei, and Komati) that have been closed for more than a decade [***18***]. The plants, with a combined generating capacity of 3.8 gigawatts, are scheduled to return to service in 2007. Recent power shortages and the general lack of spare generating capacity in southern Africa have led to increased interest in new coal-fired power projects not only in South Africa but also in Mozambique, Zimbabwe, Tanzania, and Botswana [***19***].

In the industrial sector, increasing use of coal in Africa is expected for several purposes, including the production of steam and process heat for industrial applications, production of coke for the steel industry, and production of coal-based synthetic liquids. Currently, two commercial-sized coal-to-liquids plants in South Africa (Sasol II and Sasol III) supply about 28 percent of the country's total liquid fuel requirements [***20***]. The two plants together are capable of producing 150,000 barrels of synthetic liquids per day.

Central and South America

The countries of Central and South America consumed 0.8 quadrillion Btu of coal in 2004. Brazil, with the world's eighth-largest steel industry in 2004, accounted for 56 percent of the region's coal demand. Chile, Colombia, Puerto Rico, Peru, and Argentina accounted for most of the remainder [***21***].

In the projections, coal consumption in Central and South America increases by 0.9 quadrillion Btu from 2004 to 2030, with 72 percent of the increase in Brazil, primarily for coke manufacture and electricity generation. Brazil's steel companies currently plan to expand production capacity by a substantial amount over the next few years to meet increasing domestic and international demand for steel [***22***]. In addition, Brazil's three southernmost states, Rio Grande do Sul, Santa Catarina, and Parana, which contain most of the country's coal reserves, are actively promoting the construction of several new coal-fired power plants [***23***]. The new projects being promoted by the government of Rio Grande do Sul represent a key component of its plan to become more self-sufficient in electricity supply.

Middle East

Countries of the Middle East consumed 0.4 quadrillion Btu of coal in 2004. Israel accounted for 86 percent of the total and Iran most of the remainder. The region's coal consumption increases only slightly in the projections, to 0.6 quadrillion Btu in 2030.

World Coal Trade

In addition to overall energy demand and the price of coal, many factors have the potential to influence different countries' ability and interest in exporting and importing coal. They include mine productivity, inland transportation infrastructure, and the port capacity of both importing and exporting countries. Shifts in public policy, as well as environmental concerns related to either coal production or coal consumption, can affect the amounts of coal traded. Uncertainty in the outlook for international coal trade includes potential changes in each of those factors.

Internationally traded coal made up 15 percent of total world consumption in 2004. In the *IEO2007* reference case, world coal trade is projected to grow at an average annual rate of 1.5 percent, from about 18.4 quadrillion Btu in 2005 to 26.5 quadrillion Btu in 2030 (Table 10). Because the largest increases in coal consumption through 2030 are projected for non-OECD Asia—particularly China, which is expected to satisfy most of the increase in its coal demand from domestic mines rather than imports—the share of coal trade as a percentage of global coal consumption is projected to fall to 13 percent in 2030. Australia and Indonesia are geographically well situated to continue as the leading suppliers of internationally traded coal (particularly to Asia) over the period.

Both steam and metallurgical coal are traded internationally, but most of the trade is in steam coal, which is projected to continue to represent most (70 percent) of the coal traded in 2030. In 2005, 55 percent of the world's exports of steam coal was imported by Asian countries, and their share is projected to rise to 61 percent in 2030. The share of metallurgical coal imports destined for Asian countries is projected to increase from 61 percent in 2005 to 68 percent in 2030.

Coal Exporters

Coal-exporting countries typically have large reserves of high-quality coal and production capacity exceeding their own domestic demand requirements. The top four exporters of steam coal in 2005 were Australia, Indonesia, China, and South Africa. In the projections, Indonesia is expected to surpass Australia as the largest exporter of steam coal in most years, and China is only the sixth-largest exporter of steam coal in 2030. For coking coal, Australia, Canada, and the United States continue to be ranked among the top three exporters over the projection period. Countries projected to expand their contributions to international trade include Australia, Indonesia, and Russia. China and Vietnam are projected to constrain their export expansion.

Already the world's leading exporter of coal, Australia is projected to dominate future international coal trade. Australia continues to improve its inland transportation and port infrastructure to expedite coal shipments to international markets. It has plans to expand coal terminals at Abbot Point, Dalrymple Bay, Hay Point, RG Tanna, Barney Point, and Fisherman Islands by about 55 million tons by 2010 and to expand rail transportation capacity in Queensland, where most of Australia's metallurgical coal is mined, to about 280 million tons (6.8 quadrillion Btu[14]) [***24***]. Australia also is projected to remain the primary exporter of metallurgical coal to Asian markets, supplying 73 percent of Asia's demand for coking coal.

In the international market for steam coal, Indonesia is expected to play a growing role, surpassing Australia as the largest exporter of steam coal in most years of the *IEO2007* projections. Indonesia has low-cost reserves of low-sulfur coal; many ports, some with the capability to take capesize ships; and proximity to the expanding markets of Asia. Indonesia's export trade grew by 125 percent (79 million tons or 1.6 quadrillion Btu) from 2000 to 2005 [***25***]. For 2006, Indonesia is expected to beat its 2005 export volume by 0.7 quadrillion Btu. From 2005 to 2030, its annual exports are projected to increase by 1.7 quadrillion Btu, depending on its investment in resource exploration and the development of new mines over the period. Other areas of uncertainty for Indonesian exports include the potential for domestic coal demand to compete with coal exports, the adequacy of its internal transportation infrastructure, and domestic environmental concerns.

In the period following the breakup of the Soviet Union in 1991, exports of steam coal from Eurasia (the countries of the former Soviet Union) fell from 11 million tons (0.2 quadrillion Btu) in 1991 to 3 million tons (0.08 quadrillion Btu) in 1998 [***26***]. Russia, the region's largest exporter, was largely dismissed as a growing coal exporter because of its low mine productivity, relatively poor coal quality, and long distances between mines and markets. Since then, however, the productivity of its coal mines has improved, lowering mining costs and compensating in part for the expense of transporting the coal to ports.

Europe, particularly the United Kingdom, has increasingly sought Russia's low-sulfur coal as its own mines have closed. From 1998 to 2005, Eurasia's annual coal exports increased by 56 million tons (1.2 quadrillion Btu) [***27***], and Russia is continuing to increase the capacity of its coal ports. Current plans call for an additional increase in export capacity from about 72 million tons (1.6 quadrillion Btu) in 2005 to 97 million tons (2.1

[14]Throughout this section, British thermal units appearing in parentheses are estimates by Energy Information Administration, Office of Integrated Analysis and Forecasting.

Table 10. World Coal Flows by Importing and Exporting Regions, Reference Case, 2005, 2015, and 2030
(Quadrillion Btu)

Exporters	Importers											
	Steam				Coking				Total			
	Europe[a]	Asia	Americas	Total[b]	Europe[a]	Asia[c]	Americas	Total[b]	Europe[a]	Asia	Americas	Total[b]
2005												
Australia	0.08	2.57	0.15	**2.81**	0.79	2.26	0.22	**3.27**	0.86	4.83	0.37	**6.07**
United States	0.08	0.03	0.36	**0.47**	0.44	0.10	0.22	**0.77**	0.52	0.13	0.58	**1.23**
South Africa	1.54	0.10	0.03	**1.70**	0.02	0.00	0.00	**0.03**	1.56	0.10	0.03	**1.73**
Eurasia	0.92	0.29	0.00	**1.22**	0.08	0.10	0.00	**0.18**	1.00	0.40	0.00	**1.40**
Poland	0.33	0.00	0.00	**0.34**	0.04	0.00	0.00	**0.04**	0.37	0.00	0.00	**0.37**
Canada	0.00	0.02	0.01	**0.04**	0.24	0.38	0.11	**0.72**	0.24	0.41	0.12	**0.76**
China	0.07	1.62	0.01	**1.70**	0.00	0.14	0.00	**0.14**	0.07	1.76	0.01	**1.84**
South America[d]	0.86	0.00	0.77	**1.63**	0.00	0.00	0.00	**0.00**	0.86	0.00	0.77	**1.63**
Vietnam	0.00	0.28	0.00	**0.28**	0.00	0.00	0.00	**0.00**	0.00	0.28	0.00	**0.28**
Indonesia/Other[e]	0.42	2.06	0.08	**2.57**	0.00	0.46	0.00	**0.46**	0.42	2.52	0.08	**3.03**
Total	**4.30**	**6.98**	**1.41**	**12.75**	**1.61**	**3.44**	**0.56**	**5.60**	**5.91**	**10.41**	**1.97**	**18.35**
2015												
Australia	0.00	3.33	0.00	**3.33**	0.64	3.20	0.27	**4.10**	0.64	6.53	0.27	**7.43**
United States	0.07	0.03	0.19	**0.29**	0.33	0.03	0.35	**0.71**	0.41	0.06	0.54	**1.00**
South Africa	1.69	0.31	0.13	**2.13**	0.02	0.00	0.02	**0.04**	1.71	0.31	0.15	**2.17**
Eurasia	1.35	0.54	0.00	**1.89**	0.08	0.23	0.00	**0.31**	1.43	0.77	0.00	**2.20**
Poland	0.13	0.00	0.02	**0.15**	0.03	0.00	0.00	**0.03**	0.16	0.00	0.02	**0.18**
Canada	0.00	0.00	0.00	**0.00**	0.29	0.54	0.13	**0.96**	0.29	0.54	0.13	**0.96**
China	0.00	1.07	0.00	**1.07**	0.00	0.03	0.00	**0.03**	0.00	1.10	0.00	**1.10**
South America[d]	1.42	0.00	1.25	**2.66**	0.00	0.00	0.00	**0.00**	1.42	0.00	1.25	**2.66**
Vietnam	0.00	0.16	0.00	**0.16**	0.00	0.01	0.00	**0.01**	0.00	0.16	0.00	**0.16**
Indonesia/Other[e]	0.00	3.66	0.13	**3.79**	0.00	0.43	0.00	**0.43**	0.00	4.09	0.13	**4.22**
Total	**4.67**	**9.10**	**1.70**	**15.48**	**1.39**	**4.46**	**0.76**	**6.61**	**6.06**	**13.56**	**2.47**	**22.09**
2030												
Australia	0.00	4.17	0.00	**4.17**	0.84	3.88	0.41	**5.13**	0.84	8.05	0.42	**9.31**
United States	0.00	0.01	0.16	**0.17**	0.26	0.04	0.46	**0.76**	0.26	0.05	0.62	**0.93**
South Africa	1.44	0.73	0.18	**2.36**	0.00	0.00	0.02	**0.02**	1.44	0.73	0.21	**2.38**
Eurasia	1.25	0.66	0.00	**1.90**	0.16	0.27	0.00	**0.43**	1.41	0.93	0.00	**2.33**
Poland	0.07	0.00	0.03	**0.10**	0.01	0.00	0.00	**0.01**	0.08	0.00	0.03	**0.11**
Canada	0.00	0.00	0.00	**0.00**	0.28	0.66	0.11	**1.04**	0.28	0.66	0.11	**1.04**
China	0.00	1.07	0.00	**1.07**	0.00	0.03	0.00	**0.03**	0.00	1.10	0.00	**1.10**
South America[d]	1.58	0.00	2.19	**3.77**	0.00	0.00	0.00	**0.00**	1.58	0.00	2.19	**3.77**
Vietnam	0.00	0.80	0.00	**0.80**	0.00	0.01	0.00	**0.01**	0.00	0.80	0.00	**0.80**
Indonesia/Other[e]	0.00	3.90	0.35	**4.26**	0.00	0.43	0.00	**0.43**	0.00	4.33	0.35	**4.68**
Total	**4.33**	**11.35**	**2.93**	**18.61**	**1.55**	**5.31**	**1.00**	**7.86**	**5.88**	**16.65**	**3.93**	**26.47**

[a]Europe/Mediterranean, including coal shipments to the Middle East and Africa.

[b]In 2005, total world coal flows include a balancing item used to reconcile discrepancies between reported exports and imports. The 2005 balancing items by coal type were 1.062 quadrillion Btu (steam coal), 0.003 quadrillion Btu (coking coal), and 0.065 quadrillion Btu (total).

[c]Includes 0.37 quadrillion Btu of coal for pulverized coal injection at blast furnaces shipped to Japanese steelmakers in 2005.

[d]Coal exports from South America are projected to originate from mines in Colombia and Venezuela.

[e]Includes shipments from other countries not modeled for the projection period. The 2005 exports from other countries by coal type were 0.08 quadrillion Btu (steam coal), 0.03 quadrillion Btu (coking coal), and 0.11 quadrillion Btu (total).

Notes: Data exclude non-seaborne shipments of coal to Europe and Asia. Totals may not equal sum of components due to independent rounding.

Sources: **2005:** SSY Consultancy and Research, Ltd., *SSY's Coal Trade Forecast*, Vol. 15, No. 2 (London, UK, August 2006); and Energy Information Administration, *Quarterly Coal Report*, October-December 2005, DOE/EIA-0121(2005/4Q) (Washington, DC, March 2006). **2015 and 2030:** Energy Information Administration, National Energy Modeling System, run IEO2007.D032707B.

quadrillion Btu) by 2008 [*28*]. In 2030, Eurasia's coal exports are projected to be 0.93 quadrillion Btu, or 67 percent, higher than the 2005 level.

In non-OECD Asia, China and Vietnam are examples of countries that have the potential to export more coal but are focused instead on meeting domestic coal demand. Whereas China in the past had offered an export tax rebate of 8 percent to encourage exports, it has now imposed a 5-percent export tax on coking coal and may apply an export tax on steam coal in the future [*29*]. China has also lowered its export cap to 46 million tons (1.1 quadrillion Btu) for 2007 [*30*], equivalent to about one-half of China's steam coal exports in 2003. Australia, Indonesia, and other suppliers are projected to compensate for the shortfalls in China's coal exports, as occurred in 2005 when China reduced its exports by 16 million tons (0.4 quadrillion Btu) from their 2004 level [*31*].

Vietnam's coal exports have risen quickly in recent years, from 7 million tons (0.1 quadrillion Btu) in 2003 to 14 million tons (0.3 quadrillion Btu) in 2005, and are projected to increase to 19 million tons (0.4 quadrillion Btu) in 2006. More recently, however, despite previous indications of plans to expand its export capacity, Vietnam has moved to restrict exports. In 2006, the Vietnamese government sanctioned a tariff of 10 percent on exported coal, where previously there had been none; and in late 2006, the Prime Minister approved a plan to restrict coal exports through 2010 in favor of preserving coal production for domestic uses [*32*]. In the *IEO2007* reference case, Vietnam's coal exports are projected to decline to 0.2 quadrillion Btu in 2010 but increase thereafter, to 0.8 quadrillion Btu in 2030.

Coal Imports

Asia

Asia poses a large area of uncertainty for world coal trade projections. In particular, China has the potential to influence the market either as an importer or an exporter. If China's imports increase significantly, it may be difficult for some other countries to find adequate coal supplies at affordable prices. Likewise, if China opts to export significantly less coal, other exporting countries may divert supplies to countries such as Japan, Taiwan, and Korea, which are accustomed to receiving coal from China. In *IEO2007*, in line with the projection of continued strong growth in its coal consumption, China's coal imports are projected to total 3.2 quadrillion Btu in 2030, while its exports are projected to total 1.1 quadrillion Btu. Most of the coal consumed in China is expected to come from its own coal mines.

In India, demand for coal imports in 2030 is projected to be almost double the demand in 2005, as the country continues to encounter problems with coal production and transportation within its borders. Japan, lacking coal resources of its own, is expected to remain the world's largest importer of coal in 2030. Historically, Japan has relied on China for coal imports, but recently it has initiated investments in coal production in other countries (including Russia) in order to improve the security of its coal supply [*33*]. South Korea also is projected to continue importing most of the coal it consumes. With planned increases in coal-fired capacity, South Korea and Taiwan together are projected to maintain their share of world steam coal imports at about 21 percent in 2030.

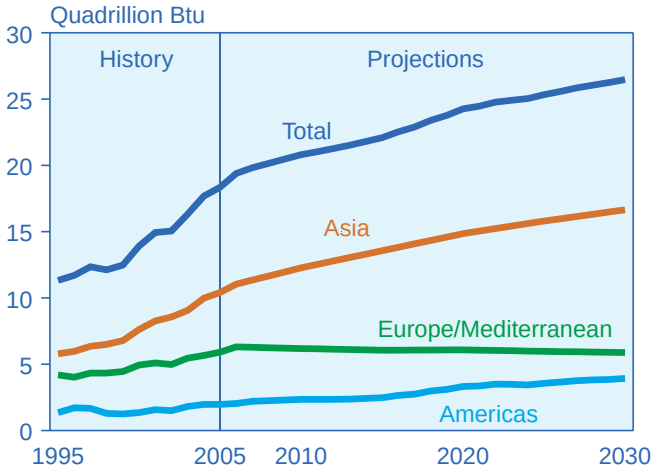
Europe, Middle East, and Africa

Total coal imports to the Europe/Mediterranean market (including the Middle East and Africa) will remain fairly flat at their 2005 levels throughout the projection period (Figure 59). For most European countries with increasing emphasis on natural gas in the power sector, coal becomes a less significant component of the fuel mix for electricity generation. In Turkey, however, economic expansion and steel industry growth partially offset the decline in Europe's coal imports. The initial increase in coal trade to Europe in the projections also is the result of the phaseout of European mining subsidies and higher demand for lower sulfur coal. The demand for lower sulfur coal causes an increase in the projected share of Europe's coal imports that originates from South America and Eurasia.

The Americas

The United States is projected to import 2.1 quadrillion Btu of coal in 2030, 1.3 quadrillion Btu more than in 2005.

Figure 59. Coal Imports by Major Importing Region, 1995-2030



Sources: **History:** SSY Consultancy and Research, Ltd., *SSY's Coal Trade Forecast*, Vol. 15, No. 3 (London, UK, November 2006); International Energy Agency, *Coal Information 2006* (Paris, France, August 2006), and previous issues; and Energy Information Administration (EIA), *Quarterly Coal Report*, October-December 2005, DOE/EIA-0121(2005/4Q) (Washington, DC, March 2006), and previous issues; Btu conversions from short tons are estimates by EIA's Office of Integrated Analysis and Forecasting. **Projections:** EIA, National Energy Modeling System run IEO2007.D032707B.

Although still a small share of U.S. consumption, at 6.1 percent, that would represent a shift for the United States from being a net exporter to being a net importer. With declining productivity and mining difficulties in Central Appalachia, and with rising demand for coal in the Southeast, imports are expected to become increasingly competitive with domestic U.S. coal production. Already, plans are being made to expand U.S. ports to accommodate coal imports. For example, Kinder Morgan Energy Partners LP is adding 9 million tons (roughly 0.2 quadrillion Btu) of coal import capacity at its Virginia port facilities in early 2008 [***34***].

South America is expected to be an important source of coal imports to the United States and the third-largest exporter of coal worldwide in 2030. In recent years, Canada has been the largest importer of U.S. coal. Although Ontario's revised plan to close its four remaining coal-fired generation plants by 2014 could be delayed, exports of U.S. steam coal to Canada in 2030 are projected to be about 10 million tons (0.2 quadrillion Btu) below their 2005 level [***35***].

Brazil is planning a 39-percent increase in steelmaking capacity by 2010 [***36***]. With rich reserves of iron ore but no coking-grade coal, Brazil's steel industry will require an increase in imports of coking coal from Australia, South Africa, Canada, and the United States. Its total imports of coking coal are projected to grow from about 0.3 quadrillion Btu in 2005 to 0.7 quadrillion Btu in 2030. Much of the steam coal imported by the countries of Central and South America is expected to come from producers in South Africa and also from Colombia.

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Chapter 6
Electricity

World electricity generation nearly doubles in the IEO2007 reference case from 2004 to 2030. In 2030, generation in the non-OECD countries is projected to exceed generation in the OECD countries by 30 percent.

In the *IEO2007* reference case, world demand for electricity advances strongly from 2004 to 2030. Global electricity generation increases by 2.4 percent per year over the projection period, from 16,424 billion kilowatthours in 2004 to 30,364 billion kilowatthours in 2030 (Figure 60). Much of the growth in electric power demand is projected for nations outside the OECD. Although the non-OECD nations consumed 26 percent less electricity than the OECD nations in 2004, total electricity generation in the non-OECD region in 2030 is projected to exceed generation in the OECD by 30 percent (Figure 61).

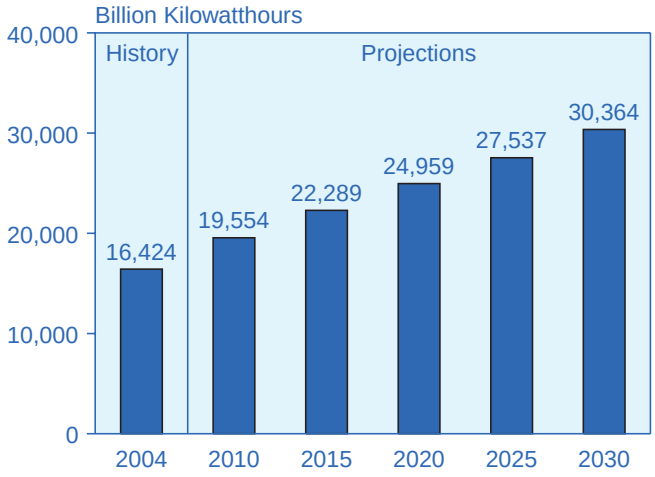
Total electricity demand in the non-OECD nations is expected to grow from 2004 to 2030 at an annual rate that is nearly triple the rate of growth for electricity demand in the OECD. The difference reflects the relative maturity of electricity infrastructure in the more developed OECD region, as well as the expectation that populations in the OECD countries generally will grow slowly or decline over the next 25 years. In addition, fast-paced growth in the developing non-OECD economies translates to rising standards of living and robust growth in consumer demand for lighting and appliances. Total electricity generation in the non-OECD region increases by an average of 3.5 percent per year in the *IEO2007* reference case, as compared with a projected annual growth rate for OECD electricity generation that averages 1.3 percent per year from 2004 to 2030.

Among the energy end-use sectors, the most rapid growth in total world demand for electricity is projected for the buildings (residential and commercial) sectors. Worldwide, total electric power consumption on a Btu basis in the buildings sectors increases by an average of 2.6 percent per year in the *IEO2007* reference case, as compared with an average growth rate of 2.2 percent per year for total electricity consumption in the industrial and transportation sectors combined. The most rapid rate of increase in electricity demand is projected for the commercial sector, both worldwide and by region, reflecting the expected growth of service activities as strong economic growth, particularly among the non-OECD countries, increases the demand for office space, hospitals, hotels, and other institutions or organizations (Figure 62).

Electricity Supply by Energy Source

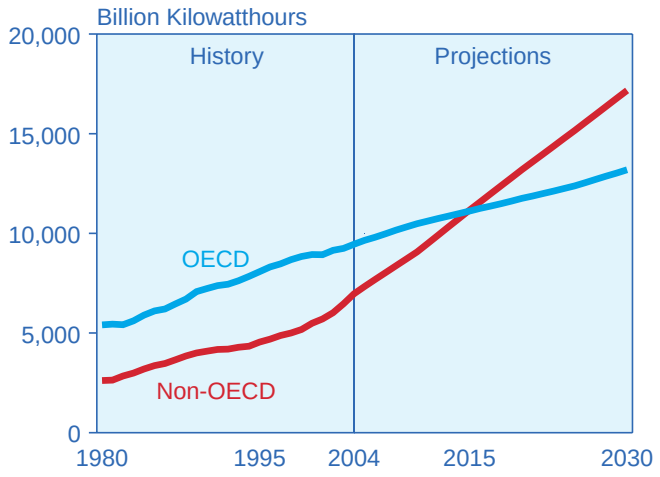
The mix of primary fuels used to generate electricity has changed a great deal over the past two decades on a

Figure 60. World Electric Power Generation, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 61. World Electric Power Generation by Region, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

worldwide basis. Coal has continued to be the fuel most widely used for electricity generation, although generation from nuclear power increased rapidly from the 1970s through the mid-1980s, and natural-gas-fired generation grew rapidly in the 1980s and 1990s. The use of oil for electricity generation has been declining since the mid-1970s, when the oil embargo by Arab producers in 1973-1974 and the Iranian Revolution in 1979 produced oil price shocks.

More recently, high world oil prices—which have been trending upward since 2003—have further eroded the role of petroleum in the power sector. Higher world oil prices have encouraged a shift from oil-fired generation to natural gas and nuclear power and have reinforced coal's important role as an energy source for electricity generation. Today, relatively high world oil prices in combination with concerns about the environmental consequences of greenhouse gas emissions are raising renewed interest in nuclear power and renewable energy sources as alternatives to the use of coal and natural gas for electric power generation. Projections of future coal use are particularly sensitive to assumptions about future policies that might be adopted to mitigate greenhouse gas emissions.

Coal

In the *IEO2007* reference case, while natural gas is the fastest-growing energy source for electricity generation worldwide, coal continues to provide the largest share of the energy used for electric power production (Figure 63). In 2004, coal-fired generation accounted for 41 percent of world electricity supply; in 2030, its share is projected to be 45 percent. Sustained high prices for oil and natural gas make coal-fired generation more attractive economically, particularly in nations that are rich in coal resources, which include China, India, and the United States. The 2.8-percent projected annual growth rate for coal-fired electricity generation worldwide is exceeded only by the 3.3-percent rate projected for natural-gas-fired generation.

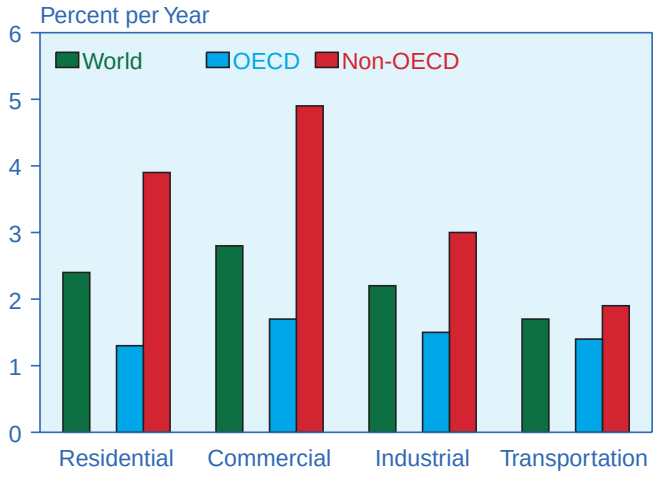
Natural Gas

Although natural gas is the fastest-growing energy source for electric power generation in the *IEO2007* reference case projection—increasing from 3,231 billion kilowatthours in 2004 to 7,423 billion kilowatthours in 2030—the total amount of electricity generated from natural gas continues to be only about one-half the total for coal, even in 2030. Natural-gas-fired combined-cycle capacity is an attractive choice for new power plants because of its fuel efficiency, operating flexibility (it can be brought on line in minutes rather than the hours it takes for coal-fired and other generating capacity), relatively short construction times (months instead of the years that coal-fired and nuclear power plants typically require), and investment costs that are lower than those for other technologies. Natural gas also burns more cleanly than coal or petroleum products, and as more governments begin implementing national or regional plans to reduce carbon dioxide emissions they may encourage the use of natural gas to displace oil and coal.

Oil

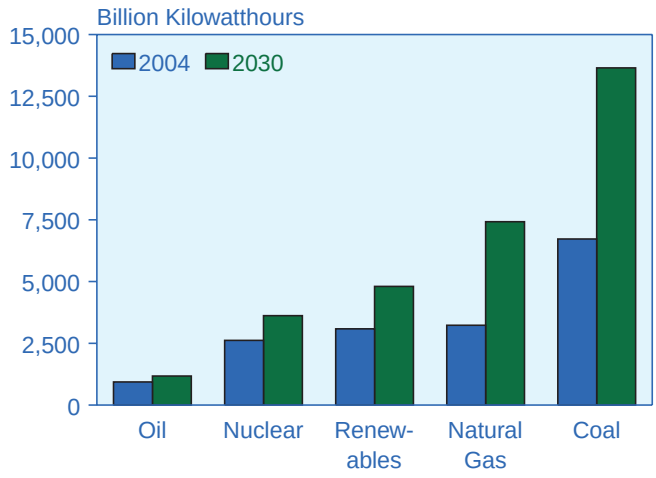
With world oil prices projected to reach $59 per barrel (in real 2005 dollars) at the end of the *IEO2007* projection in 2030, the expected rate of increase in oil use for electricity generation is the slowest among all energy sources. Worldwide, oil-fired generation is projected to increase by an average of 0.9 percent per year from 2004

Figure 62. Average Annual Change in End-Use Sector Electricity Demand, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 63. World Electricity Generation by Fuel, 2004 and 2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

to 2030; and in the OECD nations, it is projected to decline by 0.3 percent per year. Only the non-OECD Middle East region, with its ample oil reserves and a current one-third share of total electricity generation fueled by oil, is projected to continue relying heavily on oil to meet its electricity needs.

Nuclear Power

The prospects for nuclear power have improved in recent years. Higher capacity utilization rates have been reported for many existing nuclear facilities, and most of the existing plants in OECD countries and the countries of non-OECD Europe and Eurasia (including Russia) are expected to be granted extensions to their operating lives. In the *IEO2007* reference case, electricity generation from nuclear power plants worldwide is projected to increase at an average rate of 1.3 percent per year, from 2,619 billion kilowatthours in 2004 to 3,619 billion kilowatthours in 2030.

In past editions of the *IEO*, it was anticipated that nuclear generation would decline in the later years of the projections, as aging nuclear reactors (especially among the OECD nations) were expected to be taken out of operation and not to be replaced. The role of nuclear power in meeting future electricity demand has been reconsidered more recently, given concerns about rising fossil fuel prices, energy security, and greenhouse gas emissions. On the other hand, issues related to plant safety, radioactive waste disposal, and the proliferation of nuclear weapons, which continue to raise public concerns in many countries, may hinder the development of new nuclear power reactors.

The projection for total electricity generation from the world's nuclear power plants in 2030 in the *IEO2007* reference case is 14 percent higher than the corresponding projection in *IEO2006*. On a regional basis, only OECD Europe—where some national governments, including those of Germany and Belgium, still have plans in place to phase out nuclear programs entirely—is projected to see a decline in nuclear power generation after 2010. Non-OECD Asia, in contrast, is poised for a robust expansion of nuclear generation. For example, in China, electricity generation from nuclear power is projected to grow at an average annual rate of 7.7 percent from 2004 to 2030, and in India it is projected to increase by an average of 9.1 percent per year.

Hydroelectricity and Other Renewables

In the *IEO2007* reference case, electricity generation from hydroelectric and other renewable energy resources is projected to increase at an average annual rate of 1.7 percent from 2004 to 2030. High oil and natural gas prices, which are expected to persist in the mid-term, encourage the use of renewables. Like nuclear power, renewable energy sources are attractive for environmental reasons. Further, government policies and incentives to increase the use of renewable energy sources for electricity generation encourage the development of renewable energy even when it cannot compete economically with fossil fuels. Nonetheless, the renewable share of world electricity generation falls slightly in the projection, from 19 percent in 2004 to 16 percent in 2030, as growth in the consumption of both coal and natural gas in the electricity generation sector worldwide exceeds the growth in renewable energy consumption. The capital costs of new power plants using renewable fuels remain relatively high in comparison with those for plants fired with coal or natural gas.

The *IEO2007* projections for hydroelectricity and other renewable energy resources include only on-grid renewables. Non-marketed (noncommercial) biofuels from plant and animal sources are an important source of energy, particularly in non-OECD economies, and the International Energy Agency has estimated that some 2.5 billion people in developing countries depend on traditional biomass as their main fuel for cooking [***1***]. Non-marketed fuels and dispersed renewables (renewable energy consumed on the site of production, such as energy from solar panels used to heat water) are not included in the projections, however, because comprehensive data on their use are not available.

In combination, electricity generation from nuclear power and from renewable energy sources is projected to increase by 1.5 percent per year from 2004 to 2030. The development of non-fossil energy sources in electricity markets may be especially attractive to countries that are attempting to diversify away from fossil fuels, both to address energy security issues and to reduce carbon dioxide emissions.

Regional Electricity Markets

In the *IEO2007* reference case, the highest projected growth rates for electricity generation are for nations in the non-OECD region (Figure 64). Robust population growth and rising personal incomes in the non-OECD nations drive the projected growth in demand for electric power. In the OECD countries, where electric power infrastructures are relatively mature, national populations generally are expected to grow slowly or decline, and GDP growth is expected to be slower than in the developing nations, increases in demand for electricity are projected to be much slower than those in the non-OECD countries. For example, electricity demand in OECD North America is projected to grow by an annual average of 1.5 percent from 2004 to 2030, which is less than one-half the projected rates of increase in China and in India.

OECD Economies

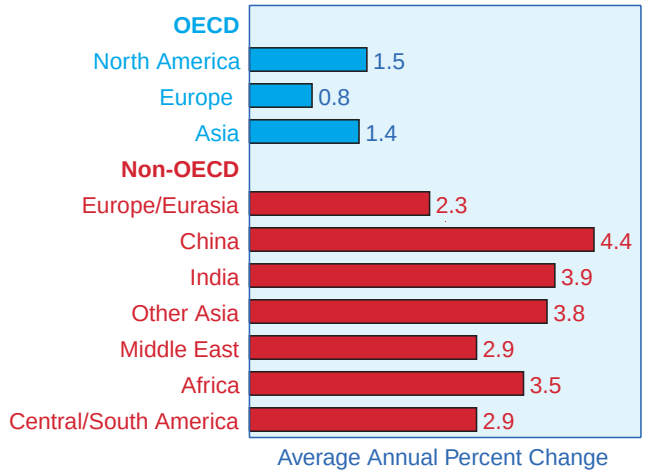
North America

In 2004, electricity generation in North America totaled 4,619 billion kilowatthours and accounted for 28 percent of the world's total generation. That share is projected to decline over the course of the projection period, as the non-OECD nations experience fast-paced growth in electric power demand. Still, North America is projected to account for 23 percent of the world's electric power generation in 2030.

The United States is the largest consumer of electricity in North America and is projected to remain in that position through 2030 (Figure 65). U.S. electricity generation—including both generation by electric power producers and on-site generation—is projected to increase steadily, at an average annual rate of 1.4 percent. Canada, like the United States, has a mature electricity market, and its generation is projected to increase by 1.5 percent per year from 2004 to 2030. Mexico's electricity generation grows at a faster rate—averaging 3.3 percent per year through 2030—reflecting the relatively undeveloped state of the country's electric power infrastructure.

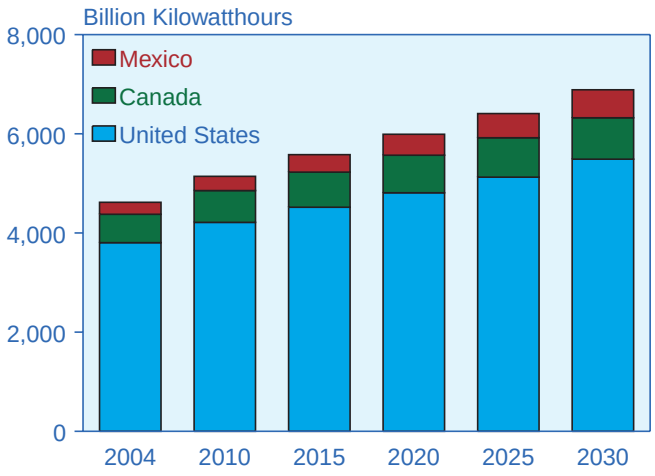
There are large differences in the mix of energy sources used to generate electricity in the three countries that make up OECD North America, and those differences are likely to become more pronounced in the future (Figure 66). In the United States, coal is the leading source of energy for power generation, accounting for 52 percent of the 2004 total; but in Canada, renewable energy sources (predominantly hydroelectricity) provided 60 percent of the nation's electricity generation in 2004. Most of Mexico's electricity generation currently is fueled by petroleum-based liquids and natural gas, which together accounted for 66 percent of its total electricity generation in 2004. In the reference case projections for 2030, U.S. reliance on coal is even greater than it was in 2004; Canada's hydropower resources (along with some generation from wind capacity scheduled to be built) continue to provide nearly 60 percent of its electricity; and the natural gas share of Mexico's total electricity generation increases to 54 percent (from 35 percent in 2004).

Figure 64. Annual Growth in Electricity Generation by Region, 2004-2030



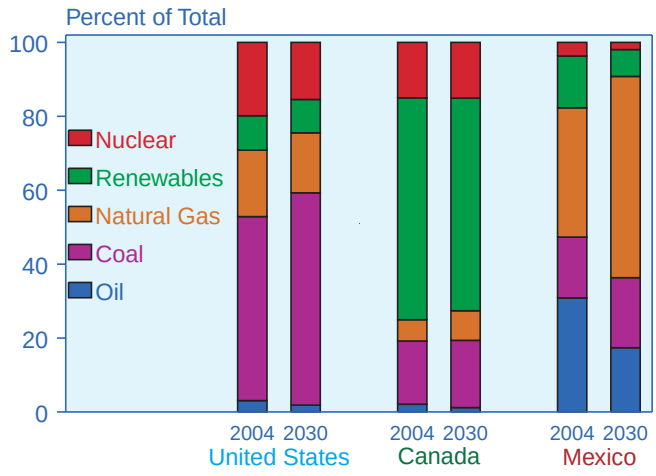
Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 65. Net Electricity Generation in OECD North America, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 66. Net Electricity Generation in OECD North America by Fuel, 2004 and 2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

In the United States, electricity generation from natural-gas-fired power plants is projected to increase through 2020, as recently constructed plants are utilized more fully to meet growing demand. After 2020, generation from new coal-fired and nuclear power plants is expected to meet most of the growth in electricity demand. Total generation from nuclear power plants is projected to increase, from 789 billion kilowatthours in 2004 to 896 billion kilowatthours in 2030, as the result of expected capacity increases that include 12,500 megawatts at newly built plants and 3,000 megawatts from uprates of existing plants (offset by 2,600 megawatts of retirements). Generation from renewable energy sources also is projected to expand, from 370 billion kilowatthours in 2004 to 522 billion kilowatthours in 2030, stimulated by technology improvements, higher fossil fuel prices, and the expansion and extension of the Federal production tax credit for renewable generation through December 31, 2007, enacted in the Energy Policy Act of 2005.[15]

In Canada, generation from natural gas and from coal is projected to increase, and oil-fired generation is projected to decline. The Province of Ontario had announced plans to close all its coal-fired plants by the end of 2007, but that date has since been pushed back to 2011. Further, in late 2006, the Ontario Power Authority recommended that the government consider maintaining 3,000 megawatts of coal-fired capacity until at least 2014 to ensure that no power shortages would occur as a result of possible delays in the addition of new generating capacity [*2*]. In the *IEO2007* reference case, Canada's coal use for electricity generation continues to increase throughout the projection period, by an average of 1.7 percent per year; natural-gas-fired generation increases by 2.8 percent per year; generation from nuclear power increases by 1.5 percent per year; and renewable generation increases by 1.3 percent per year.

Several large- and small-scale hydroelectric facilities currently are either planned or under construction in Canada. Hydro-Québec has announced plans to construct a 768-megawatt powerhouse near Eastman and a smaller 120-megawatt facility at Sarcelle in Québec, both of which are expected to be fully commissioned by 2011 [*3*]. Other planned hydroelectric projects include a 1,550-megawatt plant at La Romaine in Québec, a 2,000-megawatt project at the Lower Churchill River/Gull Island site in Newfoundland and Labrador, and a 1,500-megawatt project (the Conawapa Generating Station) on the Lower Nelson River in Manitoba [*4*]. The *IEO2007* reference case does not anticipate that all the planned projects will be constructed, but given Canada's historical experience with hydropower and the commitments for construction, new hydroelectric capacity accounts for more than one-half of the 16,000 megawatts of additional renewable capacity projected to be added in Canada between 2004 and 2030.

While hydropower plays a major role in Canada's renewable electricity generation, the country also has plans to expand wind-powered generating capacity in the future. In 2006, the country's installed wind capacity was doubled, to 1,460 megawatts, giving Canada the world's twelfth-largest national installed wind capacity [*5*]. In the Canadian government's 2005 budget, its Wind Power Production Incentive (WPPI) was expanded to support the development of 4,000 megawatts of wind power by 2010, with qualifying wind producers eligible to receive an incentive of $0.01 per kilowatthour (Canadian dollars) for the first 10 years of production from new installations [*6*]. In addition, several Provincial governments have instituted their own incentives to support the construction of new wind capacity. The incentives (along with sustained higher world oil and natural gas prices) are expected to support the projected increase in Canada's use of wind power for electricity generation.

OECD Europe

Electricity generation in the nations of OECD Europe is projected to grow slowly, as a result of their slow population growth and their already well-established electricity markets. The region's total generation increases by an average of 0.8 percent per year in the *IEO2007* reference case, from 3,250 billion kilowatthours in 2004 to 3,564 billion kilowatthours in 2015 and 4,044 billion kilowatthours in 2030. Natural gas is expected to be by far the fastest-growing fuel for electricity generation in OECD Europe, increasing at an average rate of 3.3 percent per year from 2004 to 2030, while high world oil prices and environmental concerns lead to decreases in the use of petroleum and coal (Figure 67).

Renewable electricity generation in OECD Europe is also projected to increase over the period from 2004 to 2030. The use of renewables (primarily nonhydropower) for electricity generation is projected to grow by 1.4 percent per year on average from 2004 to 2030. Although most of the economically feasible hydroelectric resources in Europe already have been developed, the countries of OECD Europe have installed substantial amounts of alternative renewable energy capacity—consisting mainly of wind turbines—over the past several years. At present, 7 of the world's 10 largest markets for wind-powered electricity generation are in Europe,[16] and the 27-member European Union accounted for 65 percent of the world's total installed wind capacity as of

[15]The U.S. projections, which are consistent with those in EIA's *Annual Energy Outlook 2007* reference case, assume that the production tax credit will expire at the end of 2007.

[16]According to the Global Wind Energy Council, the 10 countries with the largest installed wind capacity are Germany, Spain, the United States, India, Denmark, China, Italy, United Kingdom, Portugal, and France.

the end of 2006 [7]. With many European countries setting new goals to increase nonhydropower renewable electricity generation, the role of wind power in meeting OECD Europe's electricity demand is likely to grow in the future.

Several countries in OECD Europe have policies in effect to reduce their use of nuclear power in the future. As a result, nuclear electricity generation in the region is projected to decline through 2025. After 2025, however, modest growth is projected for the region's nuclear power capacity, and its total nuclear electricity generation begins to rise at the end of the projection. In the *IEO2007* reference case, nuclear capacity in OECD Europe is projected to fall from 134 gigawatts in 2004 to 114 gigawatts in 2030 (as compared with the larger decline projected in the *IEO2006* reference case, to 95 gigawatts in 2030). Many nations in the region are reassessing the potential role of nuclear power in meeting demand for electricity, particularly because it is an energy source that does not produce carbon dioxide emissions. As a result, the *IEO2007* reference case projection anticipates that more nuclear power plant operating lives will be extended and fewer plants will be retired in the mid-term, and that there will be some new builds of nuclear capacity in France, Finland, and possibly other countries in OECD Europe.

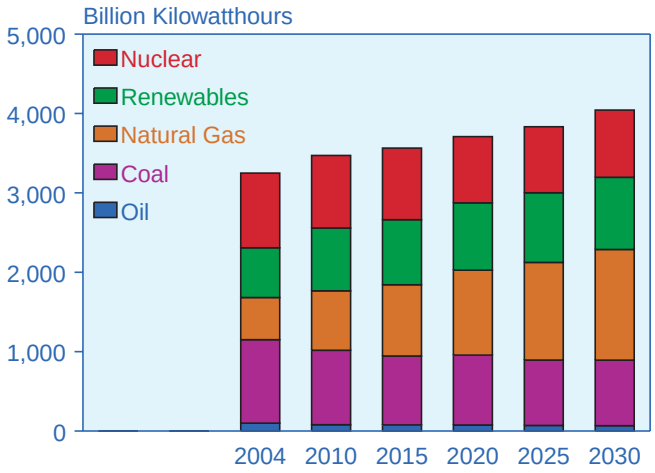
OECD Asia

Total electricity generation in OECD Asia is projected to increase by 1.4 percent per year on average, from 1,586 billion kilowatthours in 2004 to 2,259 billion kilowatthours in 2030. Japan accounts for the largest share of electricity generation in the region today and continues to do so in the mid-term projection, despite its having the slowest-growing electricity market in the region (Figure 68). Japan's electricity generation increases at a 1.0-percent average annual rate in the *IEO2007* reference case, as compared with projected rates of 1.4 percent per year in Australia/New Zealand and 2.3 percent per year in South Korea. Japan's electricity markets can be characterized as mature, and its aging population and relatively slow projected economic growth in the mid-term translate to slow growth in demand for electric power. In contrast, both Australia/New Zealand and South Korea are projected to have more robust income and population growth in the mid-term, leading to more rapid growth in demand for electricity.

The fuel mix for electricity generation varies widely among the three economies that make up the OECD Asia region (Figure 69). In Japan, natural gas, coal, and nuclear power make up the bulk of the current electric power mix, with natural gas and nuclear accounting for about 56 percent of total generation and coal another 25 percent. The remaining portion is split between renewables and petroleum-based liquids. In 2030, Japan is projected to rely on natural gas, nuclear power, and coal for about 83 percent of its electric power supply, with coal's share declining to 19 percent as both natural gas and nuclear power displace its use.

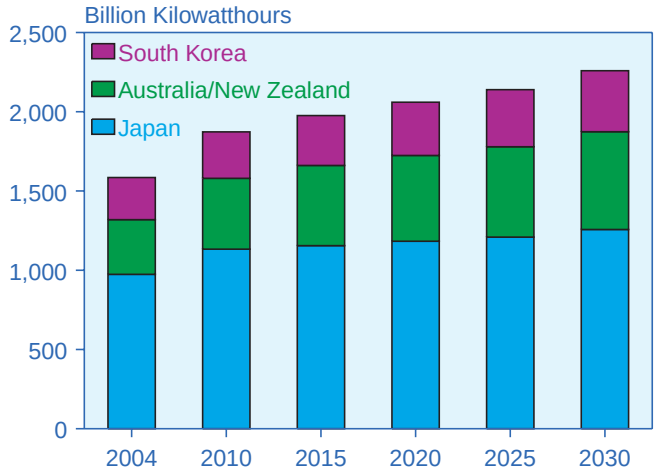
Australia and New Zealand, with their rich coal resources, rely on coal for nearly three-fourths of their combined electricity generation. Another 18 percent comes from renewable energy sources—primarily, hydropower. The Australia/New Zealand region uses negligible amounts of oil for electricity generation and no nuclear power, and that is not expected to change over the projection period. Natural-gas-fired generation

Figure 67. Net Electricity Generation in OECD Europe by Fuel, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 68. Net Electricity Generation in OECD Asia, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

is expected to grow strongly in the region, reducing coal's share in 2030.

In South Korea, coal and nuclear power currently provide 44 percent and 36 percent of total electricity generation, respectively. Strong expansion is projected for South Korea's nuclear power program: in 2030, nuclear electricity generation is projected to be nearly equal to coal-fired generation, with both providing about 41 percent of the country's total electricity.

Non-OECD Economies

Non-OECD Europe and Eurasia

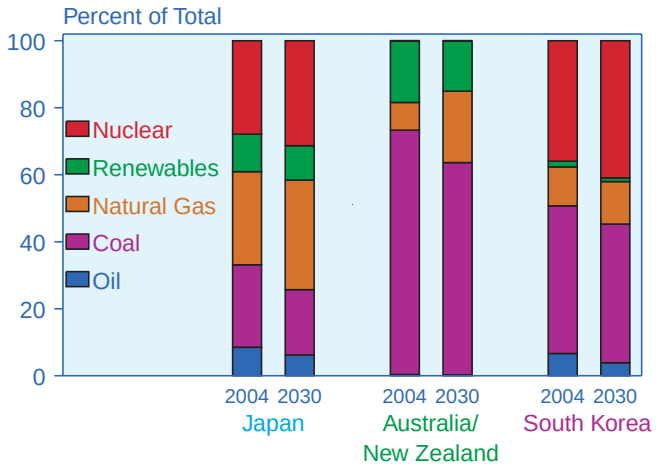
Total electricity generation in non-OECD Europe and Eurasia is projected to grow at an average rate of 2.3 percent per year in the *IEO2007* reference case, from 1,497 billion kilowatthours in 2004 to 2,036 billion kilowatthours in 2015 and 2,731 billion kilowatthours in 2030. Russia, the region's largest economy, accounted for 59 percent of its total generation in 2004 and is projected to account for 55 percent of the regional total in 2030 (Figure 70).

The non-OECD Europe and Eurasia region as a whole possesses ample natural gas resources. As a result, it is expected that much of its electricity supply will continue to be provided from natural-gas-fired power plants. Natural gas is the region's fastest-growing source of electric power in the *IEO2007* reference case, increasing by 3.2 percent per year from 2004 to 2030. Coal-fired and nuclear power plants also are important regional sources of electricity generation, with projected annual increases averaging 2.2 percent and 2.3 percent, respectively, over the same period. Renewable generation, largely from hydroelectric facilities, is projected to increase more slowly, at an average rate of 0.7 percent per year, largely as a result of repairs and expansions at existing hydroelectric projects rather than new hydropower or nonhydropower renewable generating facilities. Liquids play only a minor role in the electric power markets of non-OECD Europe and Eurasia, and their role is not expected to expand in the future.

Russia has announced plans to increase its nuclear power capacity over the mid-term, in order to lessen the reliance of its power sector on natural gas and preserve what is becoming one of its most valuable export commodities. As a result, electricity production from Russia's nuclear power plants is projected to grow by 3.2 percent per year on average in the reference case, while natural-gas-fired generation increases at the slower rate of 2.5 percent per year.

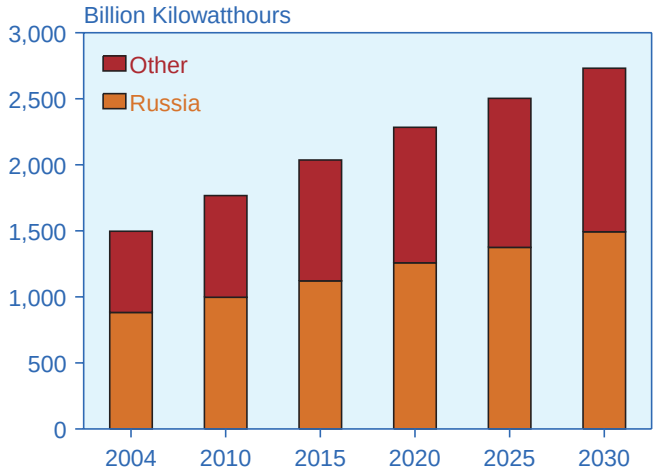
Only 3 gigawatts of new nuclear generating capacity has become operational in Russia since 1991. In 2006, Russian Prime Minister Mikhail Fradkov approved an ambitious plan to complete the construction of 10 new 1,000-megawatt reactors and begin construction on another 10 reactors by 2015 [*8*]. There is some question, however, as to whether the plan can be achieved within the announced time frame. One problem is that tariffs on nuclear power currently are much lower than those on thermal generation, and in the past the Russian nuclear power industry has not had sufficient funds to complete the construction on new reactors on schedule. The Russian government has acknowledged that raising nuclear tariffs to parity with the tariffs on thermal generation will be necessary to attract the private-sector capital investment needed for its nuclear power expansion plan to succeed, and the plan includes assumptions that both

Figure 69. Net Electricity Generation in OECD Asia by Fuel, 2004 and 2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 70. Net Electricity Generation in Non-OECD Europe and Eurasia, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

capital costs and operating costs will be reduced. Nevertheless, the *IEO2007* reference case projects some delay in meeting the current construction schedule. In the outlook, a net 5 gigawatts of nuclear capacity is added to Russia's existing 22 gigawatts by 2015. Thereafter, it is likely that another 15 gigawatts of nuclear capacity will be added by 2030.

Non-OECD Asia

Non-OECD Asia—led by China and India—is projected to be the region with the fastest growth in electric power generation worldwide, averaging 4.2 percent per year from 2004 to 2030. The nations of non-OECD Asia are expected to see continued robust economic growth, with corresponding increases in demand for electricity to power lighting, heating and cooling, household appliances, and other electronic devices associated with rising standards of living. Total electricity generation in the non-OECD Asia region nearly triples over the projection period, from 3,517 billion kilowatthours in 2004 to 10,185 billion kilowatthours in 2030 (Figure 71).

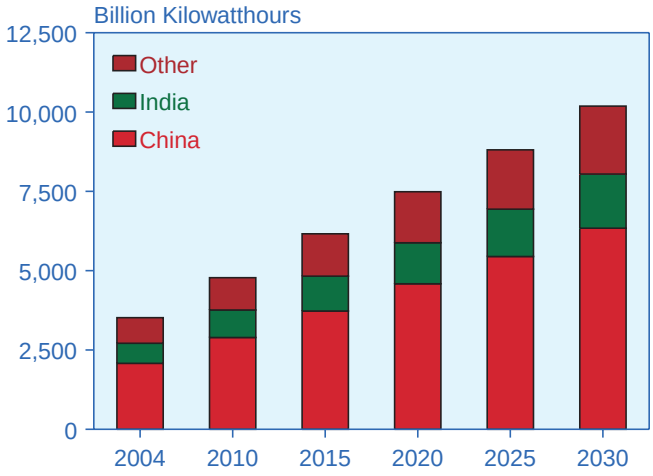
China and India account for the world's largest projected increases in national electric power demand over the 2004 to 2030 period. China already is the world's largest coal consumer, and India is the third largest (after the United States). In 2004, the combined coal use of China and India was equal to that of the entire OECD region, and in 2030 it is projected to exceed the OECD total by more than 85 percent. A sizable portion of the coal consumed in China and India is expected to be used for power generation. In China, the coal share of generation is projected to reach 84 percent in 2030, despite higher annual growth rates for natural-gas-fired and nuclear power generation (Figure 72). In India, coal's share is projected to decline to 69 percent of the country's total power generation in 2030.

In both China and India, consumption of petroleum liquids for electricity generation is projected to remain modest, as relatively high world oil prices make other fuels economically more attractive. Some increases in oil use for electricity generation are projected for other countries in the region, because many rural areas that currently do not have access to transmission lines are expected to replace noncommercial energy sources with electricity from diesel-fired generators until transmission infrastructure can be put into place. Nevertheless, the liquids share of electricity generation in non-OECD Asia is projected to fall from 4 percent in 2004 to 2 percent in 2030.

Non-OECD Asia is expected to lead the world in the installation of new nuclear capacity over the projection period, accounting for 51 percent of the projected net increment in nuclear capacity worldwide. China is projected to add 36 gigawatts of nuclear capacity by 2030, India 17 gigawatts, and the other countries of non-OECD Asia a combined 6 gigawatts. Strong growth in nuclear capacity in China and India will help both countries improve fuel diversification in their power sectors, although thermal generation will continue to dominate in both countries. In China, the nuclear share of total electricity generation is projected to rise from 2 percent in 2004 to 5 percent in 2030, and in India it is projected to rise from 2 percent to 8 percent.

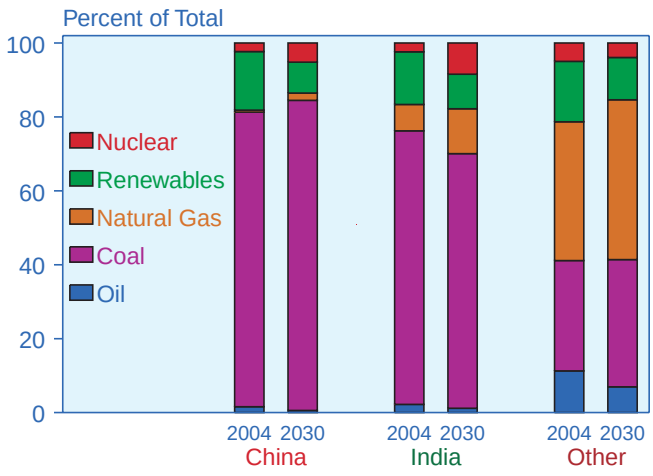
Although electricity generation from renewable energy sources is projected to grow at an average annual rate of 2.0 percent, the renewable share of total generation declines as the shares if fossil fuels and nuclear power

Figure 71. Net Electricity Generation in Non-OECD Asia, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 72. Net Electricity Generation in Non-OECD Asia by Fuel, 2004 and 2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

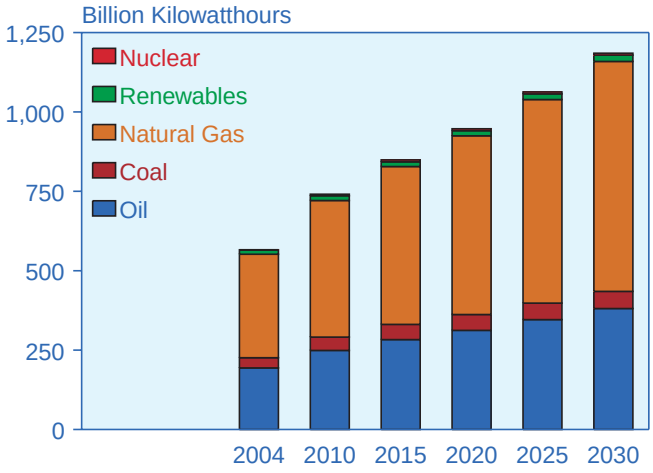
grow more strongly in the region. The renewable share of non-OECD Asian generation falls from 16 percent in 2004 to 9 percent in 2030. Much of the growth in non-OECD Asia's renewable energy consumption is projected to come from mid- to large-scale hydroelectric facilities. Several countries in the region have hydropower facilities either planned or under construction. In India, for instance, about 12,020 megawatts of hydroelectric capacity is under construction, and letters of award have been issued for the 1,000-megawatt Tehri Pass project (scheduled for completion by 2012) and the 1,200-megawatt Kotlibhel-IA project [***9***]. China also has a number of large-scale hydroelectric projects under construction, including the 18,200-megawatt Three Gorges Dam project (expected to be fully operational by 2009) and the 12,600-megawatt Xiluodu project on the Jisha River (scheduled for completion in 2020, as part of a 14-facility hydropower development plan) [***10***].

Middle East

Electric power generation in the Middle East region is projected to grow by 2.9 percent per year, from 567 billion kilowatthours in 2004 to 1,185 billion kilowatthours in 2030 (Figure 73). Most of the countries in the Middle East region have well-established electricity infrastructures, with electrification rates above 90 percent [***11***]. (Yemen, the region's poorest economy, is the exception, with only an estimated 50 percent of the population having access to electric power in 2002.) Nevertheless, population and income growth in the region are expected to result in growing demand for electric power in the future.

Natural gas is the largest source of energy for electricity generation in the Middle East, and it is expected to continue in that role. In 2004, natural-gas-fired generation accounted for 58 percent of the region's total power supply. In 2030, the natural gas share is projected to be 61 percent, as the petroleum share of generation decreases slightly over the projection period. Petroleum is a valuable export commodity for many nations of the Middle East, and there is increasing interest in the use of domestic natural gas for electricity generation in order to make more oil assets available for export.

Figure 73. Net Electricity Generation in the Middle East by Fuel, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

The Middle East is the only region in the world where petroleum liquids are expected to continue accounting for a sizable portion of the fuel mix for electricity generation throughout the projection period. The Middle East region as a whole relied on oil-fired capacity to meet 34 percent of its total generation needs in 2004, and that share is projected to fall only slightly, to 32 percent, in 2030. The rich petroleum resources in the Middle East are expected to allow nations of the region to continue using oil for electricity generation, even as high world oil prices result in the displacement of oil in other regions. Oil-fired generation in the Middle East is projected to increase by an average of 2.6 percent per year from 2004 to 2030.

Other energy sources make only minor contributions to the Middle East region's electricity supply. Israel is the only country in the region that uses significant amounts of coal to generate electric power [***12***], and Iran is the only one projected to add nuclear capacity, with completion of its Bushehr 1 reactor expected by 2010. Finally, because there is little incentive for countries in the Middle East to increase their use of renewable energy sources, renewables are projected to account for a modest 2 percent of the region's total electricity generation throughout the projection period.

Africa

In Africa, demand for electricity is projected to grow at an average annual rate of 3.5 percent in the *IEO2007* reference case. Thermal generation accounted for most of the region's total electricity supply in 2004 and is expected to be in the same position through 2030. Coal-fired power plants, which were the region's largest source of electricity in 2004, accounting for 45 percent of total generation, are projected to provide a 46-percent share in 2030, as natural-gas-fired generation expands strongly from 25 percent of the total in 2004 to 38 percent in 2030 (Figure 74).

At present, South Africa's two nuclear reactors are the only ones operating in the region, accounting for about 3 percent of Africa's total electricity generation. In the *IEO2007* reference case, 1,000 megawatts of new nuclear capacity (net) is projected to become operational in Africa over the 2004 to 2030 period; however, the nuclear share of total generation is expected to fall to 2 percent in 2030.

Hydroelectricity and other marketed renewable energy sources are expected to grow slowly in Africa. As they have in the past, non-marketed renewables can be expected to continue providing energy to Africa's rural areas; however, it is often difficult for African nations to find funding or international support for larger commercial projects. Still, plans for several hydroelectric projects in the region have been advanced recently, and they may help boost supplies of marketed renewable energy in the mid-term. Several (although not all) of the announced projects are expected to be completed in the mid-term outlook, allowing the region's consumption of marketed renewable energy to grow by 0.7 percent per year from 2004 to 2030.

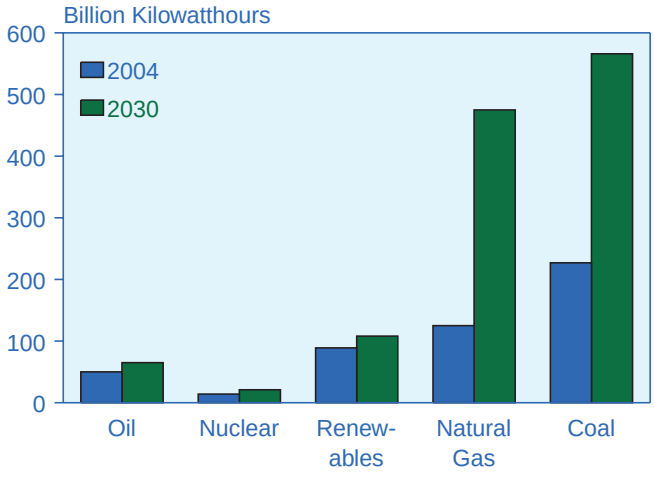
In 2006, the Export-Import Bank of China signed a memorandum of understanding with the government of Mozambique to provide a $2.3 billion loan package that would include construction of the 1,300-megawatt Mphanda Nkuwa hydroelectric dam on the Zambezi River [***13***]. In addition, there are plans to expand the existing hydroelectric facility at Cahora Bassa and to construct a new North Bank Cahora Bassa dam. The African Development Fund has estimated that the additions could increase Mozambique's installed generating capacity by 2,000 megawatts and raise its national electrification rate from 6 percent in 2006 to 20 percent in 2020 [***14***]. In Angola, there are plans to refurbish existing hydropower facilities at Capanda and Cambambe and increase their capacity to 520 megawatts and 700 megawatts, respectively in the near term [***15***]. Nigeria has plans to expand its renewable generating capacity by 3,500 megawatts in the mid-term, mostly in the form of small hydroelectric projects, in an attempt to diversify the country's energy mix away from oil and natural gas [***16***].

Central and South America

Electricity generation in Central and South America is projected to increase steadily in the *IEO2007* reference case, from 882 billion kilowatthours in 2004 to 1,838 billion kilowatthours in 2030 (Figure 75). Brazil, the region's largest economy, is expected to remain its largest electricity producer as well, accounting for 54 percent of total projected electricity generation in the Central and South America region in 2030.

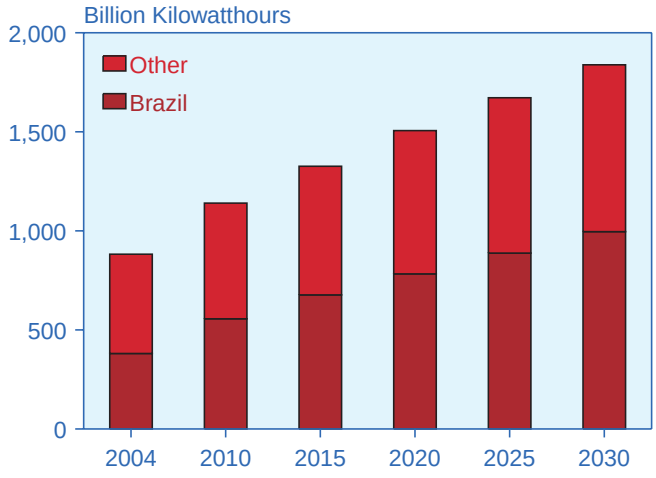
Throughout Central and South America, significant shares of national electric power supplies are derived from renewable energy sources—primarily, hydropower. In times of drought, such heavy reliance on hydroelectricity has been problematic, resulting in widespread power shortages. Hydroelectric generation accounted for 83 percent of Brazil's total electricity supply in 2004, and despite ongoing efforts to diversify the fuel mix for the country's electricity generation, hydropower is projected to remain Brazil's predominant source of electricity through 2030 (Figure 76). In combination, the other nations of Central and South America rely on hydropower for a smaller percentage of their electricity supply (51 percent in 2004); and in 2030, the share of hydropower and other renewable energy sources in their combined fuel use for electricity generation is projected to be 47 percent. Robust growth in the use of natural gas and nuclear power is projected to lessen the region's overall reliance on hydropower in the mid-term.

Figure 74. Net Electricity Generation in Africa by Fuel, 2004 and 2030



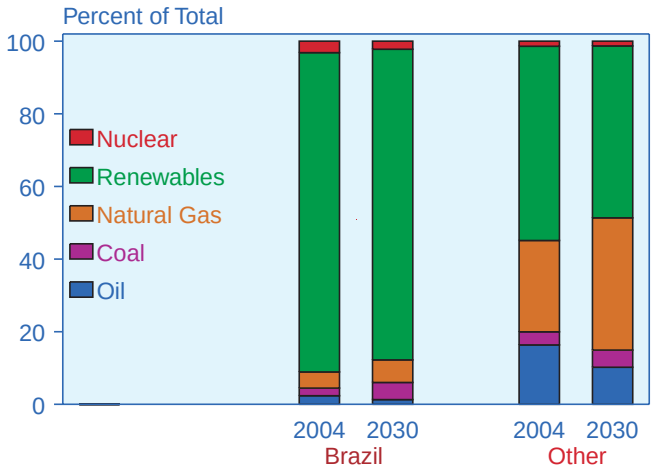
Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 75. Net Electricity Generation in Central and South America, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 76. Net Electricity Generation in Central and South America by Fuel, 2004 and 2030



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Chapter 7

Energy-Related Carbon Dioxide Emissions

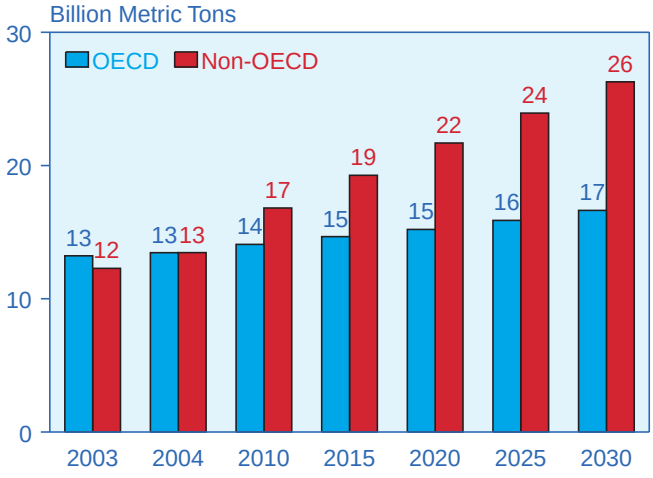
In 2004, non-OECD emissions of carbon dioxide were greater than OECD emissions for the first time. In 2030, carbon dioxide emissions from the non-OECD countries are projected to exceed those from the OECD countries by 57 percent.

Carbon dioxide is the most abundant anthropogenic (human-caused) greenhouse gas in the atmosphere. In recent years, atmospheric concentrations of carbon dioxide have been rising at a rate of about 0.5 percent per year, and because anthropogenic emissions of carbon dioxide result primarily from the combustion of fossil fuels for energy, world energy use has emerged at the center of the climate change debate. In the *IEO2007* reference case, world carbon dioxide emissions are projected to rise from 26.9 billion metric tons in 2004 to 33.9 billion metric tons in 2015 and 42.9 billion metric tons in 2030.[17]

From 2003 to 2004, carbon dioxide emissions from the non-OECD countries grew by almost 10 percent, largely because of a 17-percent increase in coal-related emissions in non-OECD Asia, while emissions from the OECD countries grew by less than 2 percent. The result of the large increase in non-OECD emissions was that 2004 marked the first time in history that energy-related carbon dioxide emissions from the non-OECD countries exceeded those from the OECD countries (Figure 77). Further, because the projected average annual increase in emissions from 2004 to 2030 in the non-OECD countries (2.6 percent) is more than three times the increase projected for the OECD countries (0.8 percent), carbon dioxide emissions from the non-OECD countries in 2030, at 26.2 billion metric tons, are projected to exceed those from the OECD countries by 57 percent.

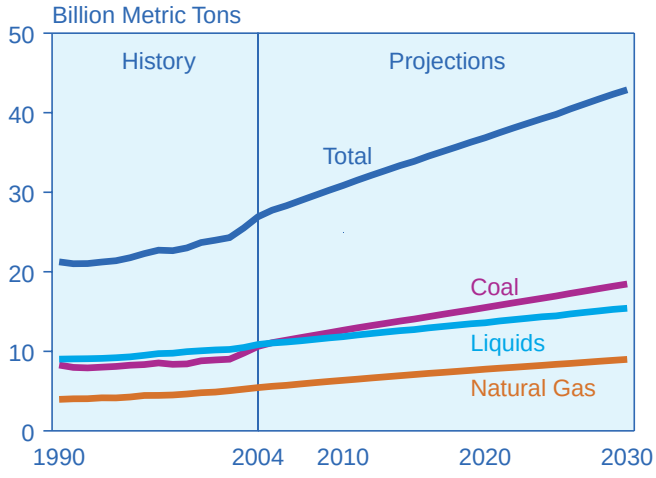
The relative contributions of different fossil fuels to total energy-related carbon dioxide emissions have changed over time. In 1990, emissions from petroleum and other liquids combustion made up an estimated 42 percent of the world total. In 2004, the petroleum share was 40 percent, and in 2030 its share is projected to be 36 percent, of the world total (Figure 78). Carbon dioxide emissions from natural gas combustion, which accounted for 19 percent of the total in 1990, increased to 20 percent of the 2004 total. That share is projected to rise to 21 percent in 2030. Coal's share in 2004 was the same as its share in 1990, at 39 percent; however, its share is projected to increase to 43 percent in 2030. Coal is the most carbon-intensive of the fossil fuels, and it is the fastest-growing energy source in the *IEO2007* reference case projection.

Figure 77. World Energy-Related Carbon Dioxide Emissions by Region, 2003-2030



Sources: **2003 and 2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 78. World Energy-Related Carbon Dioxide Emissions by Fuel Type, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

[17] In keeping with current international practice, *IEO2007* presents data on greenhouse gas emissions in billion metric tons carbon dioxide equivalent. The figures can be converted to carbon equivalent units by multiplying by 12/44.

The increasing share of coal is reflective of its important role in the energy mix of non-OECD countries—especially China and India. In 1990, China and India combined for 13 percent of world emissions, but by 2004 that share had risen to 22 percent—largely because of a strong increase in coal use in these two countries. This trend is projected to continue; and by 2030, carbon dioxide emissions from China and India combined are projected to account for 31 percent of total world emissions, with China alone responsible for 26 percent of the world total. As both economies expand, coal will become a greater part of the world energy mix and play a correspondingly larger role in the composition of world carbon dioxide emissions.

The Kyoto Protocol, which requires participating "Annex I" countries to reduce their greenhouse gas emissions collectively to an annual average of about 5 percent below their 1990 level over the 2008-2012 period, entered into force on February 16, 2005. Annex I countries include the 24 original OECD countries, the European Union, and 14 countries that are considered "economies in transition." Although the Protocol is technically "in force," it would have an effect on only one year of the *IEO2007* forecast—2010. The *IEO2007* projections do not explicitly include the impacts of the Kyoto Protocol, because the treaty does not indicate the methods by which ratifying parties will implement their obligations. Moreover, the participants have been unable to agree on a second commitment period, nor on any actions that might occur after 2012. Until those issues are resolved, it will be difficult to project the effects of the Kyoto Protocol through 2030.[18]

There are some signs that concerns about global climate change are beginning to affect the world fuel mix. In recent years, many countries have begun to express new interest in expanding their use of non-carbon-emitting nuclear power, in part to stem the growth of greenhouse gas emissions. The *IEO2007* reference case projection for electricity generation from nuclear power in 2030 is up by almost 10 percent from the *IEO2006* projection, reflecting a generally more favorable perception of nuclear power as an alternative to carbon-producing fossil fuels for electric power production. Many of the industrialized nations of OECD Europe have ratified the Kyoto Protocol, and in the *IEO2007* reference case the projected rate of decline in the region's nuclear electricity generation is considerably slower, at 0.4 percent per year, than the rate of 1.0 percent per year that was projected in the *IEO2006* reference case.

Reference Case

Carbon Dioxide Emissions

In the *IEO2007* reference case, world energy-related carbon dioxide emissions are projected to grow by an average of 1.8 percent per year from 2004 to 2030 (Table 11). For the OECD countries, total emissions are projected to average 0.8-percent annual growth, from 13.5 billion metric tons in 2004 to 14.7 billion metric tons in 2015 and 16.7 billion metric tons in 2030. The highest rate of increase among the OECD countries is projected for Mexico, at 2.3 percent per year (Figure 79). Mexico is less developed than most of the OECD countries, and it is projected to have the highest GDP growth rate in the OECD region. Much of that GDP growth is expected to

Table 11. World Carbon Dioxide Emissions by Region, 1990-2030
(Billion Metric Tons)

Region	History		Projections					Average Annual Percent Change	
	1990	2004	2010	2015	2020	2025	2030	1990-2004	2004-2030
OECD	**11.4**	**13.5**	**14.1**	**14.7**	**15.2**	**15.9**	**16.7**	**1.2%**	**0.8%**
North America	5.8	6.9	7.3	7.8	8.2	8.8	9.4	1.3%	1.2%
Europe	4.1	4.4	4.5	4.6	4.6	4.6	4.7	0.5%	0.3%
Asia	1.5	2.2	2.3	2.4	2.4	2.5	2.6	2.5%	0.6%
Non-OECD	**9.8**	**13.5**	**16.8**	**19.2**	**21.6**	**23.9**	**26.2**	**2.3%**	**2.6%**
Europe and Eurasia	4.2	2.8	3.1	3.3	3.5	3.7	3.9	-2.8%	1.2%
Asia	3.6	7.4	9.7	11.4	13.1	14.8	16.5	5.2%	3.1%
Middle East	0.7	1.3	1.6	1.8	2.0	2.1	2.3	4.4%	2.3%
Africa	0.6	0.9	1.1	1.3	1.4	1.5	1.7	2.5%	2.3%
Central and South America	0.7	1.0	1.2	1.4	1.6	1.7	1.9	3.1%	2.3%
Total World	**21.2**	**26.9**	**30.9**	**33.9**	**36.9**	**39.8**	**42.9**	**1.7%**	**1.8%**

Sources: **1990 and 2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2010-2030:** EIA, System for the Analysis of Global Energy Markets (2007).

[18]For a modeling analysis of the effects of the Kyoto Protocol, see Energy Information Administration, *International Energy Outlook 2006*, DOE/EIA-0484(2006) (Washington, DC, June 2006), "Kyoto Protocol Case," pp. 75-79, web site www.eia.doe.gov/oiaf/ieo.

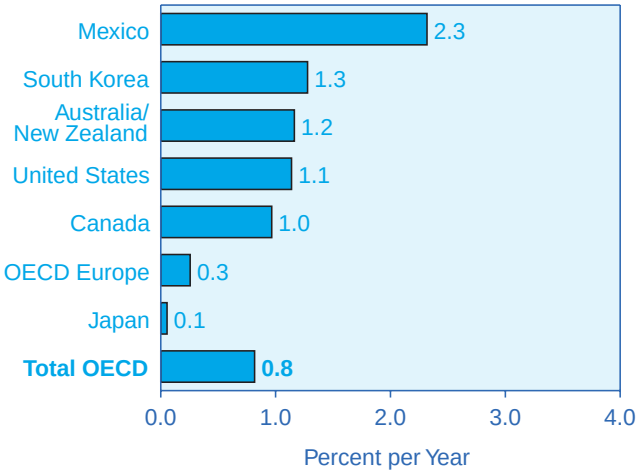
come from energy-intensive industries. For all the other OECD countries, annual increases in carbon dioxide emissions are projected to average less than 1.5 percent, reflecting the overall maturity of their energy infrastructures. In Japan, emissions are projected to increase by 0.1 percent per year from 2004 to 2030, and the average for OECD Europe is 0.3 percent per year.

For the non-OECD countries, total carbon dioxide emissions are projected to average 2.6-percent annual growth (Figure 80). The highest growth rate in the non-OECD regions is projected for China, at 3.4 percent annually from 2004 to 2030, reflecting the country's continued heavy reliance on fossil fuels, especially coal, over the projection period. China's energy-related emissions of carbon dioxide are projected to exceed U.S. emissions by about 5 percent in 2010 and by 41 percent in 2030. The lowest growth rate in the non-OECD region is projected for Russia, at 1.0 percent per year. Over the projection period, Russia is expected to expand its reliance on indigenous natural gas resources and nuclear power to fuel electricity generation, and a decline in its population growth rate is expected to slow the overall rate of increase in energy demand.

By fuel, world carbon dioxide emissions from the consumption of oil and other liquids are projected to grow at an average annual rate of 1.4 percent from 2004 to 2030. The average growth rates for the OECD and non-OECD regions are projected to be 0.6 percent and 2.3 percent per year, respectively (Figure 81). The highest rate of growth in petroleum-related carbon dioxide emissions is projected for China, at 3.5 percent per year, as its demand for liquid fuels increases to meet growing demand in the transportation and industrial sectors. The United States is expected to remain the largest source of petroleum-related carbon dioxide emissions throughout the period, with projected emissions of 3.3 billion metric tons in 2030—still 66 percent above the corresponding projection for China.

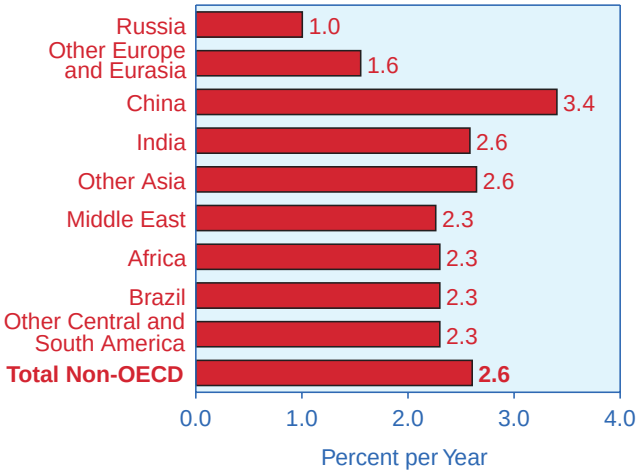
Carbon dioxide emissions from natural gas combustion worldwide are projected to increase on average by 1.9 percent per year, to 9.0 billion metric tons in 2030, with

Figure 79. Average Annual Growth in Energy-Related Carbon Dioxide Emissions in the OECD Economies, 2004-2030



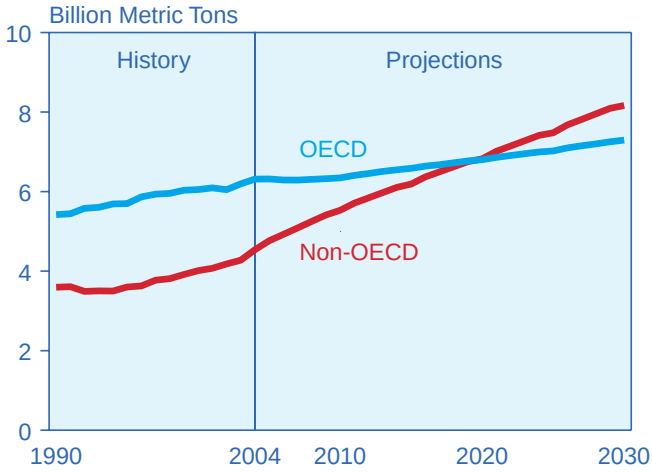
Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 80. Average Annual Growth in Energy-Related Carbon Dioxide Emissions in the Non-OECD Economies, 2004-2030



Sources: **2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 81. World Carbon Dioxide Emissions from Liquids Combustion by Region, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

the OECD countries averaging 1.2 percent and the non-OECD countries 2.6 percent (Figure 82). Again, China is projected to see the most rapid growth in emissions, averaging 6.5 percent annually; however, China's emissions from natural gas combustion amounted to only 0.1 billion metric tons in 2004, and in 2030 they are projected to total only 0.4 billion metric tons, or less than 5 percent of the world total. In contrast, the growth in U.S. emissions is projected to average 0.6 percent per year, but the projected level of 1.4 billion metric tons in 2030 is more than triple the projection for China.

Total carbon dioxide emissions from the combustion of coal throughout the world are projected to increase by 2.2 percent per year, from 10.6 billion metric tons in 2004 to 18.5 billion metric tons in 2030. Total coal-related emissions from the non-OECD countries have been greater than those from the OECD countries since 1987, and in 2030 they are projected to be more than double the OECD total (Figure 83), in large part because of the increase in coal use projected for China and India. Together, China and India account for 72 percent of the projected world increment in coal-related carbon dioxide emissions. For China alone, coal-related emissions are projected to grow by an average of 3.3 percent annually, from 3.8 billion metric tons in 2004 to 8.8 billion metric tons (48 percent of the world total) in 2030. India's carbon dioxide emissions from coal combustion are projected to total 1.4 billion metric tons in 2030, accounting for 8 percent of the world total.

Carbon Dioxide Intensity Measures

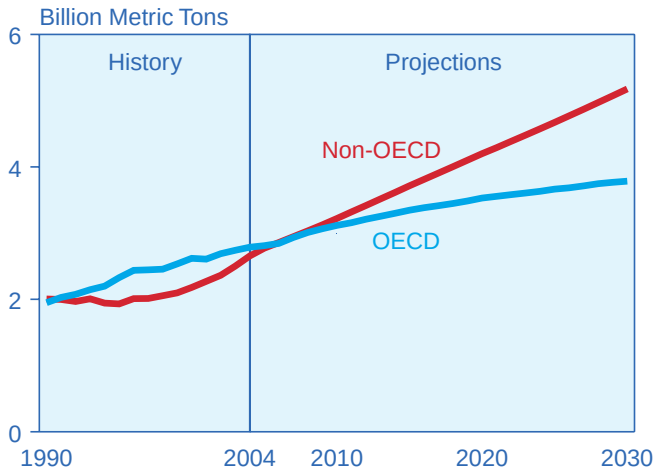
Emissions per Dollar of GDP

In all countries and regions, carbon dioxide intensity—expressed in emissions per unit of economic output—are projected to improve (decline) over the projection period as the world economy moves into a post-industrial phase. In 2004, estimated carbon dioxide intensity was 470 metric tons per million dollars of GDP in the OECD region and 516 metric tons per million dollars in the non-OECD region (Table 12).[19]

Because of the high rate of economic growth projected for the non-OECD countries, their carbon dioxide intensity in 2030 is projected to be about 263 metric tons per million dollars. In the OECD countries, carbon dioxide intensity in 2030 is projected to be 306 metric tons per million dollars. China, with a relatively high projected rate of growth in emissions (3.4 percent per year), has an even higher projected growth rate for GDP (6.5 percent).

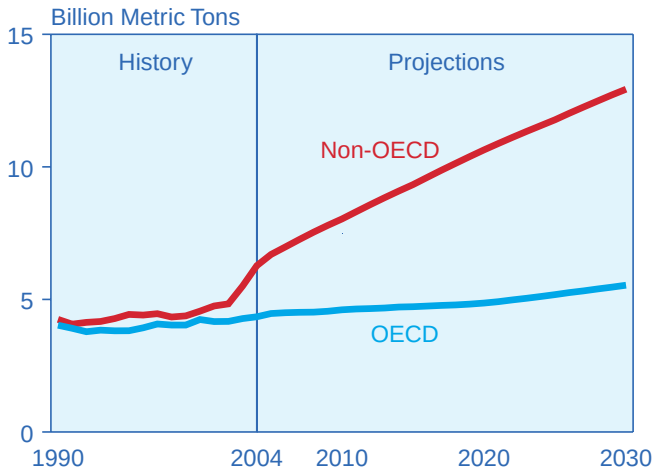
In 2030, OECD Europe is projected to have the lowest carbon dioxide intensity among the OECD regions, at 235 metric tons per million dollars, followed by Mexico at 273 metric tons per million dollars and Japan at 292 metric tons per million dollars. Without carbon dioxide constraints, Canada is projected to have the highest carbon dioxide intensity in the OECD region in 2030, at 410 metric tons per million dollars, followed by Australia/New Zealand at 400 metric tons per million dollars. U.S.

Figure 82. World Carbon Dioxide Emissions from Natural Gas Combustion by Region, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 83. World Carbon Dioxide Emissions from Coal Combustion by Region, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

[19]GDP is measured in chain-weighted 2000 dollars converted to the currency of the relevant country or region, based on purchasing power parity.

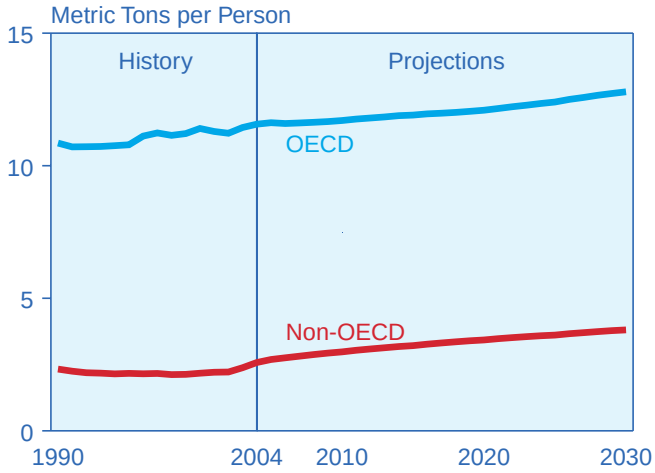
carbon dioxide intensity in 2030 is projected to be 353 metric tons per million dollars of GDP.

Emissions per Capita

Another measure of carbon dioxide intensity is emissions per person. Carbon dioxide emissions per capita in the OECD region are significantly higher than in the non-OECD region (Figure 84). If non-OECD countries consumed as much energy per capita as the OECD countries, the projection for world carbon dioxide emissions in 2030 would be much larger, because the non-OECD countries would consume about 3.5 times more energy than the current reference case estimate of 404 quadrillion Btu. And, given the expectation that non-OECD countries will rely heavily on fossil fuels to meet their energy needs, the increase in carbon dioxide emissions would be even greater.

Among the countries of the non-OECD region, Russia has the highest projected increase in carbon dioxide emissions per capita in the *IEO2007* reference case, from

Figure 84. World Carbon Dioxide Emissions per Capita by Region, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table 12. Carbon Dioxide Intensity by Region and Country, 1980-2030
(Metric Tons per Million 2000 U.S. Dollars of Gross Domestic Product)

Region	History			Projections					Average Annual Percent Change	
	1980	1990	2004	2010	2015	2020	2025	2030	1990-2004	2004-2030
OECD	**731**	**565**	**470**	**419**	**385**	**353**	**328**	**306**	**-1.3%**	**-1.6%**
United States	917	701	553	486	448	407	378	353	-1.7%	-1.7%
Canada	867	693	581	545	490	465	437	410	-1.3%	-1.3%
Mexico	395	441	379	380	353	329	300	273	-1.1%	-1.3%
Europe	672	507	394	349	316	284	258	235	-1.8%	-2.0%
Japan	483	355	375	336	319	307	299	292	0.4%	-1.0%
South Korea	883	719	694	543	488	451	418	392	-0.3%	-2.2%
Australia/New Zealand	693	678	621	590	529	480	443	400	-0.6%	-1.7%
Non-OECD	**687**	**701**	**516**	**434**	**383**	**338**	**298**	**263**	**-2.2%**	**-2.6%**
Europe/Eurasia	1,018	1,164	846	643	562	504	446	392	-2.3%	-2.9%
Russia	882	1,042	883	689	606	548	494	441	-1.2%	-2.6%
Other	1,242	1,366	796	587	511	454	396	344	-3.8%	-3.2%
Asia	738	605	468	393	346	305	269	238	-1.8%	-2.6%
China	1,766	1,120	610	500	425	367	321	284	-4.2%	-2.9%
India	305	340	298	227	202	178	158	138	-0.9%	-2.9%
Other	400	352	363	319	302	276	248	220	0.2%	-1.9%
Middle East	454	860	887	821	743	677	609	545	0.2%	-1.9%
Africa	398	448	425	388	344	301	261	223	-0.4%	-2.4%
Central and South America	314	307	311	288	273	252	230	209	0.1%	-1.5%
Brazil	214	215	231	227	216	201	186	174	0.5%	-1.1%
Other	393	388	374	332	313	285	259	230	-0.3%	-1.8%
Total World	**713**	**621**	**492**	**427**	**384**	**344**	**309**	**278**	**-1.6%**	**-2.1%**

Note: GDP is expressed in terms of purchasing power parity.
Sources: **1980-2004:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2010-2030:** EIA, System for the Analysis of Global Energy Markets (2007).

12 metric tons per person in 2004 to 17 metric tons per person in 2030. Russia continues to be a fairly inefficient energy consumer. With Soviet-era capital equipment that has not yet been replaced and a wealth of relatively inexpensive fossil fuel resources, there has been little incentive for Russia to introduce energy conservation or efficiency measures. The lowest levels of per capita emissions in the non-OECD region, and in the world, are in India and Africa, where they are projected to remain at about 1 metric ton per person through 2030.

The OECD countries have higher levels of carbon dioxide emissions per capita, in proportion to their higher per capita incomes. In the United States, emissions per capita are projected to rise from 20 metric tons in 2004 to 22 metric tons in 2030. In both Canada and Australia/New Zealand, emissions per capita are projected to rise from 18 metric tons in 2004 to 19 metric tons in 2030. In Mexico, with the lowest level of per capita emissions among the OECD countries, an increase from 4 metric tons in 2004 to 5 metric tons in 2030 is projected.

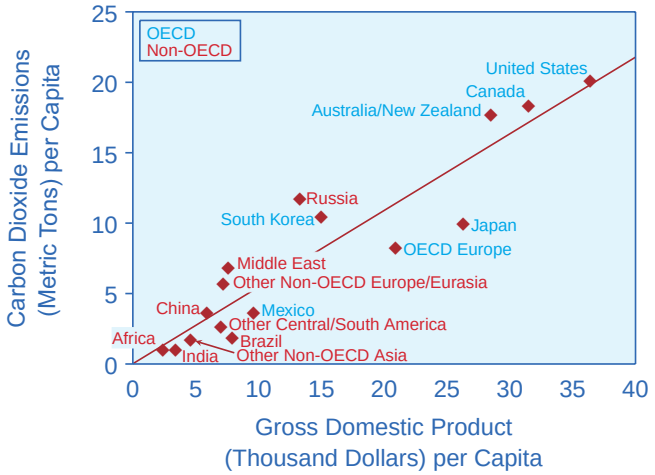
As shown in Figures 85 and 86, there is a strong correlation between income and emissions per capita. In the figures, countries and regions that are plotted on the trend line produce roughly the average amount of carbon dioxide emissions per capita relative to income per capita. Countries and regions that appear above the trend line are more carbon-intensive than average, and those below the trend line are less carbon-intensive than average.

Of the OECD countries and regions shown in Figure 85, two (Canada and the United States) are situated slightly above the trend line for 2004. Two (South Korea and Australia/New Zealand) are above the trend line, and three (Mexico, OECD Europe, and Japan) are below the trend line. Factors that can influence the position of a country or region relative to the trend line include level of industrialization, climate, population density, energy efficiency, and fuel mix. For example, South Korea, which is above the trend line, is still in the process of industrialization. Australia has a low population density and relies heavily on coal for its electricity generation, having no nuclear power capacity. Both Europe and Japan have relatively dense populations, and both have nuclear power generation capacity. Also, the economies of both Europe and Japan have entered the post-industrial phase. The United States benefits from post-industrialization and nuclear power but has relatively low population density in comparison with Europe and Japan.

Of the non-OECD countries shown in Figure 85, Brazil is the farthest below the trend line. Factors contributing to Brazil's position include a relatively warm climate, a high rate of ethanol use for transportation, and ample hydropower capacity for electricity generation. Africa, India, other non-OECD Asia, and Central and South America (excluding Brazil) are slightly below the trend line. China is slightly above the trend line. Russia is well above the trend line. The other countries of non-OECD Europe and Eurasia are above the trend line, as is the Middle East.

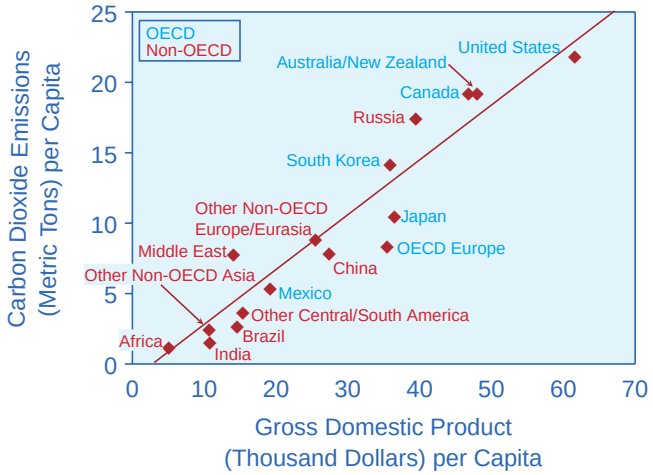
In the 2030 projections, most countries and regions have roughly the same positions relative to the trend line (Figure 86) that they did in 2004; however, there are

Figure 85. Carbon Dioxide Emissions and Gross Domestic Product per Capita by Region, 2004



Source: Derived from Energy Information Administration, *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea.

Figure 86. Carbon Dioxide Emissions and Gross Domestic Product per Capita by Region, 2030



Source: Energy Information Administration, System for the Analysis of Global Energy Markets (2007).

some exceptions. China moves from slightly above the trend for 2004 to slightly below the trend for 2030, mainly as a result of its projected rapid economic growth and movement toward a post-industrial economy. China's GDP is projected to increase by 6.5 percent per year from 2004 to 2030, while its carbon dioxide emissions increase by 3.4 percent per year. In addition, China's projected population growth rate is lower than the rates projected for most of the other non-OECD nations (excluding non-OECD Europe and Eurasia). Among the other non-OECD countries, India is projected to be the farthest below the trend line for 2030—surpassing Brazil—indicating that its projected economic growth is less carbon-intensive than in other countries, as it moves more toward service industries rather than energy-intensive manufacturing. Per capita GDP in India is projected to grow by 4.5 percent per year from 2004 to 2030, while its carbon dioxide emissions per capita are projected to increase by only 1.5 percent per year.

Alternative Macroeconomic Growth Cases

Economic growth is the most significant factor underlying the projections for growth in carbon dioxide emissions in the mid-term, as the world continues to rely on fossil fuels for most of its energy use. Accordingly, projections of world carbon dioxide emissions are lower in the *IEO2007* low economic growth case and higher in the high economic growth case.

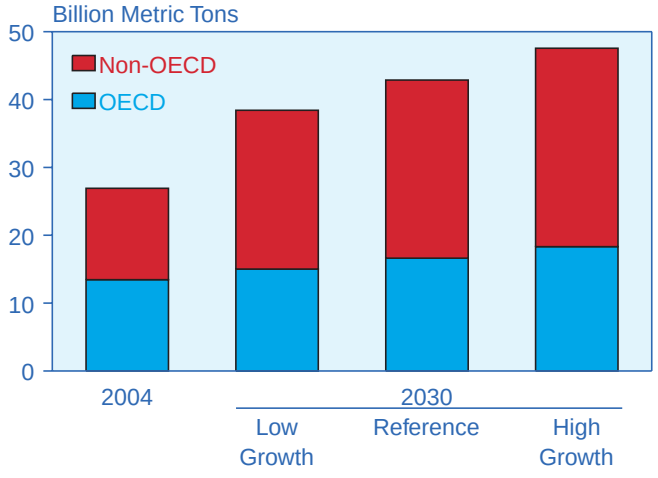
In the high growth case, world carbon dioxide emissions are projected to increase at an average rate of 2.2 percent annually from 2004 to 2030, as compared with 1.8 percent in the reference case. For the OECD countries, the projected average increase is 1.2 percent per year; for the non-OECD countries, the projected average increase is 3.0 percent per year. In the low growth case, world carbon dioxide emissions are projected to increase by 1.4 percent per year, with averages of 0.4 percent per year in the OECD countries and 2.1 percent per year in the non-OECD countries (compared with 0.8 percent and 2.6 percent, respectively, in the reference case). Total emissions worldwide are projected to be 38.4 billion metric tons in 2030 in the low growth case and 47.6 billion metric tons in the high growth case—24 percent higher than projected in the low growth case (Figure 87). The projections for emissions by fuel show similar variations across the cases.

Alternative World Oil Price Cases

The projections for carbon dioxide emissions in the *IEO2007* low and high world oil price cases (Figure 88) show smaller variations from the reference case than do those in the macroeconomic growth cases. In 2030, as compared with the reference case projection (42.9 billion metric tons), total carbon dioxide emissions are projected to be higher in the low price case (43.9 billion metric tons) and lower in the high price case (41.8 billion metric tons). Thus, there is a 5-percent difference between the projections in the two alternative world oil price cases, as compared with a 24-percent difference between the alternative macroeconomic growth cases.

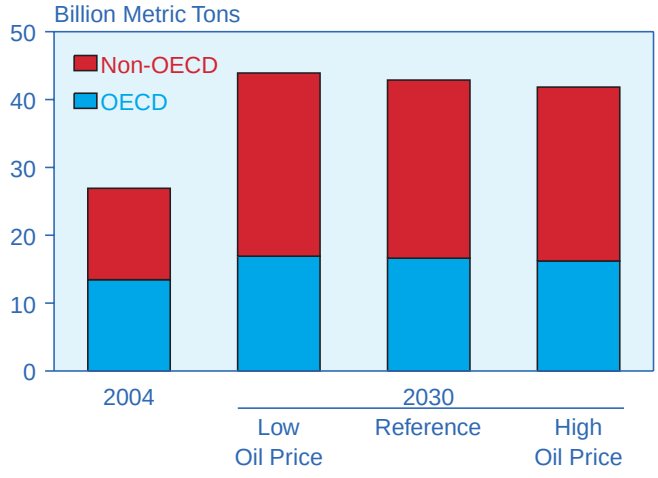
In the world oil price cases, natural gas prices are affected more strongly than coal prices. Because natural

Figure 87. Carbon Dioxide Emissions by Region in Three Economic Growth Cases, 2004 and 2030



Sources: **2004:** Energy Information Administration, *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** Energy Information Administration, System for the Analysis of Global Energy Markets (2007).

Figure 88. Carbon Dioxide Emissions by Region in Three World Oil Price Cases, 2004 and 2030



Sources: **2004:** Energy Information Administration, *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2030:** Energy Information Administration, System for the Analysis of Global Energy Markets (2007).

gas prices are projected to rise with oil prices in the high price case, both oil and natural gas lose market share to coal. In the *IEO2007* reference case, coal's share of total energy use is projected to increase to 28 percent; in the high price case, its share increases to 31 percent. As a result, in the high price case, carbon dioxide emissions from natural gas combustion in 2030 are projected to total 8.7 billion metric tons worldwide, down from 9.0 billion metric tons in the reference case. In the low oil price case, coal's share of total energy use drops to 26 percent in 2030.

Appendix A

Reference Case Projections:

- World Energy Consumption
- Gross Domestic Product
- Carbon Dioxide Emissions
- World Population

Table A1. World Total Primary Energy Consumption by Region, Reference Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**100.8**	**118.3**	**120.9**	**130.3**	**137.4**	**145.1**	**153.0**	**161.6**	**1.1**
United States[a]	84.7	98.3	100.7	106.5	112.3	118.2	124.4	131.2	1.0
Canada	11.1	13.5	13.6	15.5	15.9	16.7	17.5	18.4	1.2
Mexico	5.0	6.5	6.6	8.3	9.2	10.2	11.1	12.1	2.3
OECD Europe	**69.9**	**79.5**	**81.1**	**84.1**	**85.8**	**86.1**	**87.5**	**89.2**	**0.4**
OECD Asia	**26.6**	**36.9**	**37.8**	**39.9**	**42.1**	**43.9**	**45.4**	**47.2**	**0.9**
Japan	18.4	22.2	22.6	23.5	24.1	24.6	25.0	25.4	0.5
South Korea	3.8	8.7	9.0	9.6	10.8	11.8	12.5	13.4	1.6
Australia/New Zealand	4.4	6.0	6.2	6.8	7.2	7.6	8.0	8.4	1.2
Total OECD	**197.4**	**234.7**	**239.8**	**254.4**	**265.2**	**275.1**	**285.9**	**298.0**	**0.8**
Non-OECD									
Non-OECD Europe and Eurasia	**67.2**	**47.9**	**49.7**	**54.7**	**59.4**	**64.4**	**68.7**	**71.5**	**1.4**
Russia	39.0	28.8	30.1	32.9	35.3	37.6	40.1	41.6	1.3
Other	28.3	19.2	19.6	21.9	24.1	26.8	28.6	29.9	1.6
Non-OECD Asia	**47.5**	**88.2**	**99.9**	**131.0**	**154.7**	**178.8**	**202.5**	**227.6**	**3.2**
China	27.0	49.7	59.6	82.6	97.1	112.8	128.3	145.4	3.5
India	8.0	14.4	15.4	18.2	21.7	25.1	28.6	31.9	2.8
Other Non-OECD Asia	12.5	24.0	24.9	30.3	35.9	40.9	45.6	50.2	2.7
Middle East	**11.3**	**19.9**	**21.1**	**26.3**	**29.5**	**32.6**	**35.5**	**38.2**	**2.3**
Africa	**9.5**	**13.3**	**13.7**	**16.9**	**19.2**	**21.2**	**23.1**	**24.9**	**2.3**
Central and South America	**14.5**	**21.7**	**22.5**	**27.7**	**31.5**	**34.8**	**38.0**	**41.4**	**2.4**
Brazil	5.8	8.7	9.1	11.2	12.7	14.1	15.5	17.1	2.5
Other Central and South America	8.8	13.0	13.5	16.5	18.8	20.7	22.6	24.2	2.3
Total Non-OECD	**150.0**	**191.0**	**206.9**	**256.6**	**294.2**	**331.9**	**367.8**	**403.5**	**2.6**
Total World	**347.3**	**425.7**	**446.7**	**511.1**	**559.4**	**607.0**	**653.7**	**701.6**	**1.8**

[a]Includes the 50 States and the District of Columbia.

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A2. World Total Energy Consumption by Region and Fuel, Reference Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America									
Liquids	40.5	47.2	49.2	50.6	53.5	56.2	59.1	62.7	0.9
Natural Gas	23.2	28.5	28.5	31.5	33.5	35.3	36.1	36.8	1.0
Coal	20.7	24.1	24.1	26.4	27.9	29.7	33.2	36.8	1.6
Nuclear	6.9	8.9	9.3	9.7	9.9	10.7	10.8	11.0	0.6
Other	9.5	9.8	9.9	12.2	12.6	13.1	13.8	14.4	1.5
Total	**100.8**	**118.3**	**120.9**	**130.3**	**137.4**	**145.1**	**153.0**	**161.6**	**1.1**
OECD Europe									
Liquids	28.4	31.9	32.4	32.0	32.2	32.4	32.6	32.7	0.0
Natural Gas	11.2	18.6	19.3	21.8	23.6	24.8	26.3	27.6	1.4
Coal	17.6	13.2	13.1	13.2	12.8	12.2	11.6	11.5	-0.5
Nuclear	7.9	9.8	9.9	10.2	10.0	9.3	9.3	9.4	-0.2
Other	4.8	5.9	6.3	6.9	7.2	7.5	7.7	8.0	0.9
Total	**69.9**	**79.5**	**81.1**	**84.1**	**85.8**	**86.1**	**87.5**	**89.2**	**0.4**
OECD Asia									
Liquids	14.5	17.7	17.4	17.3	17.9	18.2	18.6	19.0	0.4
Natural Gas	2.9	5.3	5.3	6.3	6.9	7.3	7.6	8.0	1.5
Coal	5.2	8.6	9.3	9.8	10.0	10.3	10.7	11.0	0.6
Nuclear	2.5	3.5	4.0	4.6	5.3	6.0	6.3	6.9	2.1
Other	1.6	1.8	1.7	1.9	2.0	2.1	2.2	2.3	1.2
Total	**26.6**	**36.9**	**37.8**	**39.9**	**42.1**	**43.9**	**45.4**	**47.2**	**0.9**
Total OECD									
Liquids	83.4	96.7	98.9	99.9	103.5	106.8	110.3	114.4	0.6
Natural Gas	37.2	52.4	53.1	59.6	64.0	67.5	70.0	72.3	1.2
Coal	43.5	45.9	46.6	49.4	50.7	52.1	55.5	59.3	0.9
Nuclear	17.3	22.2	23.2	24.5	25.3	26.0	26.4	27.3	0.6
Other	15.9	17.5	17.9	21.1	21.8	22.7	23.7	24.7	1.2
Total	**197.4**	**234.7**	**239.8**	**254.4**	**265.2**	**275.1**	**285.9**	**298.0**	**0.8**
Non-OECD									
Non-OECD Europe and Eurasia									
Liquids	19.5	9.4	9.9	10.6	11.2	11.8	12.4	12.9	1.0
Natural Gas	27.5	24.2	25.1	27.6	29.9	32.3	34.5	36.6	1.5
Coal	15.1	8.7	9.0	9.7	10.5	11.3	11.7	11.7	1.0
Nuclear	2.5	2.9	2.9	3.2	3.7	4.7	5.5	5.5	2.5
Other	2.8	2.8	2.9	3.6	4.1	4.3	4.6	4.9	2.0
Total	**67.2**	**47.9**	**49.7**	**54.7**	**59.4**	**64.4**	**68.7**	**71.5**	**1.4**
Non-OECD Asia									
Liquids	13.9	28.1	30.6	38.7	44.0	49.1	54.9	61.5	2.7
Natural Gas	3.0	8.1	8.9	13.3	16.9	20.5	24.7	29.3	4.7
Coal	27.2	45.8	53.6	70.4	82.9	95.8	107.2	119.2	3.1
Nuclear	0.4	1.0	1.1	1.6	3.0	4.3	5.5	6.2	7.0
Other	3.0	5.2	5.7	7.0	7.9	9.1	10.2	11.3	2.7
Total	**47.5**	**88.2**	**99.9**	**131.0**	**154.7**	**178.8**	**202.5**	**227.6**	**3.2**

See notes at end of table.

Table A2. World Total Energy Consumption by Region and Fuel, Reference Case, 1990-2030 (Continued)
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
Non-OECD (Continued)									
Middle East									
Liquids	7.3	11.0	11.6	14.6	15.9	17.2	18.7	20.1	2.1
Natural Gas	3.8	8.4	9.0	11.0	12.8	14.6	15.8	17.1	2.5
Coal	0.1	0.4	0.4	0.5	0.5	0.5	0.6	0.6	1.6
Nuclear	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
Other	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	2.7
Total	**11.3**	**19.9**	**21.1**	**26.3**	**29.5**	**32.6**	**35.5**	**38.2**	**2.3**
Africa									
Liquids	4.3	5.6	5.7	6.9	7.9	8.9	9.4	10.1	2.2
Natural Gas	1.5	2.7	2.8	3.5	4.3	5.0	5.8	6.6	3.3
Coal	3.0	4.0	4.1	5.3	5.7	6.0	6.5	6.7	1.9
Nuclear	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	1.7
Other	0.6	0.9	0.9	1.1	1.1	1.2	1.3	1.3	1.5
Total	**9.5**	**13.3**	**13.7**	**16.9**	**19.2**	**21.2**	**23.1**	**24.9**	**2.3**
Central and South America									
Liquids	7.8	11.1	11.5	13.4	15.2	16.8	18.4	19.9	2.1
Natural Gas	2.2	4.0	4.4	5.5	6.5	7.1	7.8	8.5	2.6
Coal	0.6	0.8	0.8	1.1	1.3	1.5	1.5	1.7	2.8
Nuclear	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.4	2.3
Other	3.9	5.6	5.6	7.4	8.2	9.1	9.9	11.0	2.6
Total	**14.5**	**21.7**	**22.5**	**27.7**	**31.5**	**34.8**	**38.0**	**41.4**	**2.4**
Total Non-OECD									
Liquids	52.7	65.2	69.3	84.1	94.1	103.8	113.8	124.4	2.3
Natural Gas	38.0	47.4	50.3	61.0	70.4	79.5	88.5	98.1	2.6
Coal	45.9	59.7	67.9	86.9	100.9	115.1	127.4	139.8	2.8
Nuclear	3.1	4.2	4.3	5.3	7.2	9.6	11.7	12.4	4.2
Other	10.3	14.5	15.3	19.3	21.6	23.9	26.3	28.8	2.5
Total	**150.0**	**191.1**	**206.9**	**256.6**	**294.2**	**331.9**	**367.8**	**403.5**	**2.6**
Total World									
Liquids	136.2	161.9	168.2	183.9	197.6	210.6	224.1	238.9	1.4
Natural Gas	75.2	99.8	103.4	120.6	134.3	147.0	158.5	170.4	1.9
Coal	89.4	105.6	114.5	136.4	151.6	167.2	182.9	199.1	2.2
Nuclear	20.4	26.4	27.5	29.8	32.5	35.7	38.1	39.7	1.4
Other	26.2	32.1	33.2	40.4	43.4	46.5	50.1	53.5	1.9
Total	**347.3**	**425.7**	**446.7**	**511.1**	**559.4**	**607.0**	**653.7**	**701.6**	**1.8**

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A3. World Gross Domestic Product (GDP) by Region Expressed in Purchasing Power Parity, Reference Case, 1990-2030
(Billion 2000 Dollars)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**8,477**	**12,250**	**12,725**	**15,246**	**17,549**	**20,370**	**23,468**	**26,884**	**2.9**
United States[a]	7,113	10,301	10,704	12,790	14,698	17,077	19,666	22,494	2.9
Canada	684	973	1,005	1,189	1,343	1,491	1,652	1,829	2.3
Mexico	680	975	1,016	1,266	1,508	1,802	2,150	2,560	3.6
OECD Europe	**8,067**	**10,850**	**11,132**	**12,890**	**14,428**	**16,108**	**17,902**	**19,913**	**2.3**
OECD Asia	**3,621**	**4,630**	**4,761**	**5,551**	**6,144**	**6,645**	**7,130**	**7,669**	**1.9**
Japan	2,862	3,289	3,363	3,789	4,042	4,211	4,339	4,473	1.1
South Korea	331	683	715	963	1,175	1,361	1,551	1,764	3.5
Australia/New Zealand	429	658	682	799	926	1,074	1,240	1,433	2.9
Total OECD	**20,165**	**27,730**	**28,619**	**33,687**	**38,120**	**43,123**	**48,500**	**54,465**	**2.5**
Non-OECD									
Non-OECD Europe and Eurasia	**3,601**	**3,081**	**3,332**	**4,769**	**5,877**	**7,041**	**8,356**	**9,881**	**4.3**
Russia	2,241	1,780	1,907	2,624	3,148	3,680	4,281	4,954	3.7
Other	1,360	1,301	1,425	2,144	2,728	3,361	4,075	4,928	4.9
Non-OECD Asia	**5,995**	**14,573**	**15,841**	**24,693**	**32,948**	**43,049**	**54,908**	**69,460**	**5.8**
China	2,002	7,013	7,722	12,994	17,912	23,981	31,023	39,594	6.5
India	1,703	3,434	3,727	5,649	7,460	9,646	12,287	15,607	5.7
Other Non-OECD Asia	2,291	4,125	4,393	6,050	7,576	9,422	11,598	14,259	4.6
Middle East	**820**	**1,364**	**1,453**	**1,951**	**2,407**	**2,920**	**3,517**	**4,230**	**4.2**
Africa	**1,450**	**2,056**	**2,161**	**2,942**	**3,749**	**4,727**	**5,923**	**7,408**	**4.9**
Central and South America	**2,191**	**3,110**	**3,297**	**4,281**	**5,168**	**6,207**	**7,427**	**8,869**	**3.9**
Brazil	1,022	1,378	1,446	1,778	2,106	2,485	2,922	3,429	3.4
Other Central and South America	1,169	1,733	1,852	2,502	3,061	3,722	4,505	5,440	4.2
Total Non-OECD	**14,057**	**24,184**	**26,085**	**38,636**	**50,148**	**63,943**	**80,130**	**99,848**	**5.3**
Total World	**34,222**	**51,914**	**54,704**	**72,323**	**88,268**	**107,066**	**128,631**	**154,313**	**4.1**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. GDP growth rates for China and India were adjusted, based on the analyst's judgment.

Sources: **History:** Global Insight, Inc., *World Overview* (Lexington, MA, various issues). **Projections:** Global Insight, Inc., *World Overview*, Fourth Quarter 2006 (Lexington, MA, January 2007); and Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington DC, February 2007), Table A19.

Table A4. World Gross Domestic Product (GDP) by Region Expressed in Market Exchange Rates, Reference Case, 1990-2030
(Billion 2000 Dollars)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**8,070**	**11,667**	**12,120**	**14,505**	**16,682**	**19,357**	**22,286**	**25,504**	**2.9**
United States[a]	7,113	10,301	10,704	12,790	14,698	17,077	19,666	22,494	2.9
Canada	543	773	799	945	1,067	1,185	1,312	1,453	2.3
Mexico	414	593	618	770	917	1,096	1,307	1,557	3.6
OECD Europe	**6,896**	**9,189**	**9,402**	**10,755**	**11,918**	**13,165**	**14,474**	**15,914**	**2.0**
OECD Asia	**4,740**	**5,829**	**5,982**	**6,896**	**7,539**	**8,050**	**8,522**	**9,040**	**1.6**
Japan	4,141	4,759	4,867	5,483	5,850	6,094	6,280	6,473	1.1
South Korea	284	586	614	826	1,008	1,167	1,330	1,513	3.5
Australia/New Zealand	315	484	501	587	680	789	912	1,054	2.9
Total OECD	**19,706**	**26,685**	**27,505**	**32,156**	**36,138**	**40,573**	**45,282**	**50,458**	**2.4**
Non-OECD									
Non-OECD Europe and Eurasia	**695**	**606**	**654**	**931**	**1,145**	**1,372**	**1,629**	**1,926**	**4.2**
Russia	386	307	329	452	542	634	738	853	3.7
Other	309	299	325	479	602	738	891	1,073	4.7
Non-OECD Asia	**1,474**	**3,472**	**3,768**	**5,762**	**7,620**	**9,868**	**12,483**	**15,672**	**5.6**
China	443	1,550	1,707	2,872	3,959	5,301	6,858	8,752	6.5
India	275	554	601	911	1,204	1,556	1,982	2,518	5.7
Other Non-OECD Asia	757	1,367	1,459	1,978	2,457	3,011	3,643	4,402	4.3
Middle East	**397**	**671**	**713**	**965**	**1,190**	**1,439**	**1,724**	**2,061**	**4.2**
Africa	**484**	**671**	**704**	**960**	**1,223**	**1,542**	**1,930**	**2,412**	**4.8**
Central and South America	**1,063**	**1,496**	**1,593**	**2,083**	**2,515**	**3,021**	**3,616**	**4,321**	**3.9**
Brazil	463	625	656	807	955	1,127	1,325	1,555	3.4
Other Central and South America	600	872	937	1,276	1,560	1,894	2,291	2,766	4.2
Total Non-OECD	**4,114**	**6,915**	**7,432**	**10,701**	**13,693**	**17,242**	**21,382**	**26,393**	**5.0**
Total World	**23,820**	**33,601**	**34,937**	**42,857**	**49,831**	**57,815**	**66,664**	**76,850**	**3.1**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding. GDP growth rates for China and India were adjusted, based on the analyst's judgment.

Sources: **History:** Global Insight, Inc., *World Overview* (Lexington, MA, various issues). **Projections:** Global Insight, Inc., *World Overview*, Fourth Quarter 2006 (Lexington, MA, January 2007); and Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington DC, February 2007), Table A19.

Table A5. World Liquids Consumption by Region, Reference Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.5**	**24.2**	**25.0**	**25.9**	**27.3**	**28.7**	**30.1**	**32.0**	**1.0**
United States[a]	17.0	20.0	20.7	21.4	22.6	23.8	25.0	26.6	1.0
Canada	1.7	2.2	2.3	2.3	2.3	2.4	2.4	2.4	0.2
Mexico	1.8	1.9	2.0	2.2	2.3	2.6	2.7	2.9	1.6
OECD Europe	**13.7**	**15.4**	**15.6**	**15.4**	**15.5**	**15.6**	**15.7**	**15.8**	**0.0**
OECD Asia	**7.1**	**8.7**	**8.5**	**8.5**	**8.8**	**8.9**	**9.1**	**9.3**	**0.3**
Japan	5.2	5.5	5.4	5.2	5.2	5.2	5.2	5.2	-0.1
South Korea	1.0	2.2	2.1	2.2	2.5	2.6	2.7	2.8	1.0
Australia/New Zealand	0.8	1.0	1.0	1.1	1.1	1.2	1.2	1.3	0.8
Total OECD	**41.3**	**48.3**	**49.1**	**49.8**	**51.6**	**53.3**	**55.0**	**57.1**	**0.6**
Non-OECD									
Non-OECD Europe and Eurasia	**9.3**	**4.6**	**4.8**	**5.1**	**5.4**	**5.7**	**6.0**	**6.3**	**1.0**
Russia	5.4	2.7	2.8	2.9	3.0	3.1	3.2	3.3	0.7
Other	3.9	1.9	2.0	2.3	2.4	2.6	2.8	2.9	1.5
Non-OECD Asia	**6.6**	**13.6**	**14.8**	**18.8**	**21.3**	**23.8**	**26.6**	**29.8**	**2.7**
China	2.3	5.6	6.4	9.4	10.5	11.9	13.6	15.7	3.5
India	1.2	2.3	2.5	2.7	3.2	3.6	4.0	4.4	2.2
Other Non-OECD Asia	3.1	5.7	6.0	6.7	7.6	8.3	9.0	9.8	1.9
Middle East	**3.5**	**5.4**	**5.7**	**7.1**	**7.8**	**8.4**	**9.1**	**9.8**	**2.1**
Africa	**2.1**	**2.7**	**2.8**	**3.3**	**3.9**	**4.3**	**4.6**	**4.9**	**2.2**
Central and South America	**3.8**	**5.2**	**5.4**	**6.5**	**7.4**	**8.2**	**9.0**	**9.7**	**2.3**
Brazil	1.5	2.1	2.1	2.6	2.9	3.1	3.4	3.7	2.1
Other Central and South America	2.3	3.2	3.3	4.0	4.5	5.0	5.6	6.0	2.4
Total Non-OECD	**25.3**	**31.5**	**33.4**	**40.9**	**45.8**	**50.5**	**55.4**	**60.5**	**2.3**
Total World	**66.5**	**79.8**	**82.5**	**90.7**	**97.3**	**103.7**	**110.4**	**117.6**	**1.4**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A6. World Natural Gas Consumption by Region, Reference Case, 1990-2030
(Trillion Cubic Feet)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**22.5**	**27.4**	**27.6**	**30.5**	**32.4**	**34.2**	**34.9**	**35.5**	**1.0**
United States[a]	19.2	22.3	22.4	24.0	25.3	26.3	26.3	26.1	0.6
Canada	2.4	3.4	3.4	4.0	4.2	4.6	4.9	5.2	1.7
Mexico	0.9	1.7	1.8	2.4	2.9	3.3	3.7	4.2	3.4
OECD Europe	**11.6**	**18.2**	**18.8**	**21.3**	**23.0**	**24.2**	**25.7**	**26.9**	**1.4**
OECD Asia	**2.8**	**5.0**	**5.0**	**5.9**	**6.5**	**6.9**	**7.1**	**7.5**	**1.5**
Japan	1.9	3.0	3.0	3.6	3.9	4.0	4.2	4.3	1.4
South Korea	0.1	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
Australia/New Zealand	0.8	1.1	1.1	1.2	1.4	1.5	1.6	1.7	1.8
Total OECD	**36.8**	**50.5**	**51.4**	**57.6**	**61.8**	**65.2**	**67.7**	**69.9**	**1.2**
Non-OECD									
Non-OECD Europe and Eurasia	**26.7**	**23.6**	**24.4**	**26.9**	**29.1**	**31.4**	**33.5**	**35.5**	**1.4**
Russia	17.3	15.3	16.0	17.5	18.7	19.7	20.7	21.6	1.2
Other	9.5	8.3	8.4	9.4	10.4	11.6	12.8	13.9	1.9
Non-OECD Asia	**2.9**	**7.7**	**8.5**	**12.5**	**15.8**	**19.2**	**23.1**	**27.4**	**4.6**
China	0.5	1.1	1.4	2.8	3.7	4.6	5.7	7.0	6.5
India	0.4	1.0	1.1	1.8	2.1	2.6	3.2	3.9	5.0
Other Non-OECD Asia	2.0	5.6	6.0	7.9	10.0	12.0	14.1	16.5	4.0
Middle East	**3.6**	**8.0**	**8.6**	**10.5**	**12.2**	**13.9**	**15.1**	**16.4**	**2.5**
Africa	**1.4**	**2.5**	**2.6**	**3.3**	**4.0**	**4.7**	**5.4**	**6.2**	**3.3**
Central and South America	**2.0**	**3.7**	**4.1**	**5.2**	**6.0**	**6.6**	**7.3**	**7.9**	**2.6**
Brazil	0.1	0.5	0.6	0.8	1.0	1.1	1.2	1.4	3.3
Other Central and South America	1.9	3.2	3.5	4.3	5.1	5.5	6.0	6.5	2.4
Total Non-OECD	**36.5**	**45.5**	**48.2**	**58.3**	**67.2**	**75.8**	**84.3**	**93.3**	**2.6**
Total World	**73.4**	**96.0**	**99.6**	**115.9**	**129.0**	**141.1**	**152.0**	**163.2**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A7. World Coal Consumption by Region, Reference Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.7**	**24.1**	**24.1**	**26.4**	**27.9**	**29.7**	**33.2**	**36.8**	**1.6**
United States[a]	19.2	22.3	22.6	24.2	25.6	27.3	30.6	34.1	1.6
Canada	1.3	1.4	1.2	1.5	1.5	1.6	1.7	1.8	1.6
Mexico	0.2	0.4	0.3	0.7	0.7	0.8	0.9	0.9	3.8
OECD Europe	**17.6**	**13.2**	**13.1**	**13.2**	**12.8**	**12.2**	**11.6**	**11.5**	**-0.5**
OECD Asia	**5.2**	**8.6**	**9.3**	**9.8**	**10.0**	**10.3**	**10.7**	**11.0**	**0.6**
Japan	2.7	4.3	4.8	4.8	4.8	4.7	4.6	4.6	-0.1
South Korea	0.9	1.9	2.1	2.2	2.5	2.7	2.9	3.1	1.5
Australia/New Zealand	1.5	2.3	2.4	2.8	2.8	2.9	3.2	3.3	1.2
Total OECD	**43.5**	**45.9**	**46.6**	**49.4**	**50.7**	**52.1**	**55.5**	**59.3**	**0.9**
Non-OECD									
Non-OECD Europe and Eurasia	**15.1**	**8.7**	**9.0**	**9.7**	**10.5**	**11.3**	**11.7**	**11.7**	**1.0**
Russia	6.8	4.5	4.8	5.1	5.3	5.7	6.0	6.1	0.9
Other	8.3	4.2	4.2	4.6	5.2	5.6	5.6	5.6	1.1
Non-OECD Asia	**27.2**	**45.8**	**53.6**	**70.4**	**82.9**	**95.8**	**107.2**	**119.2**	**3.1**
China	20.3	33.7	41.1	55.3	65.3	75.5	85.0	95.2	3.3
India	4.3	7.5	8.1	9.3	10.7	12.2	13.7	15.2	2.4
Other Non-OECD Asia	2.6	4.6	4.3	5.8	6.9	8.0	8.5	8.8	2.8
Middle East	**0.1**	**0.4**	**0.4**	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**	**1.6**
Africa	**3.0**	**4.0**	**4.1**	**5.3**	**5.7**	**6.0**	**6.5**	**6.7**	**1.9**
Central and South America	**0.6**	**0.8**	**0.8**	**1.1**	**1.3**	**1.5**	**1.5**	**1.7**	**2.8**
Brazil	0.4	0.5	0.5	0.7	0.8	0.9	0.9	1.1	3.3
Other Central and South America	0.2	0.4	0.4	0.4	0.5	0.6	0.6	0.6	2.0
Total Non-OECD	**45.9**	**59.7**	**67.9**	**86.9**	**100.9**	**115.1**	**127.4**	**139.8**	**2.8**
Total World	**89.4**	**105.6**	**114.5**	**136.4**	**151.6**	**167.2**	**182.9**	**199.1**	**2.2**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A8. World Nuclear Energy Consumption by Region, Reference Case, 1990-2030
(Billion Kilowatthours)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**649**	**845**	**883**	**910**	**936**	**1,012**	**1,015**	**1,033**	**0.6**
United States[a]	577	764	789	789	812	885	886	896	0.5
Canada	69	71	86	110	113	116	118	126	1.5
Mexico	3	10	9	11	11	11	11	11	0.9
OECD Europe	**743**	**931**	**941**	**914**	**902**	**835**	**831**	**847**	**-0.4**
OECD Asia	**242**	**351**	**396**	**433**	**497**	**559**	**592**	**646**	**1.9**
Japan	192	228	272	299	325	352	370	394	1.4
South Korea	50	123	124	134	172	207	222	252	2.8
Australia/New Zealand	0	0	0	0	0	0	0	0	—
Total OECD	**1,635**	**2,128**	**2,220**	**2,257**	**2,335**	**2,406**	**2,438**	**2,526**	**0.5**
Non-OECD									
Non-OECD Europe and Eurasia	**219**	**260**	**263**	**278**	**323**	**405**	**479**	**476**	**2.3**
Russia	115	141	137	149	190	236	299	315	3.2
Other	104	119	125	129	133	169	180	161	1.0
Non-OECD Asia	**38**	**97**	**103**	**148**	**265**	**389**	**495**	**557**	**6.7**
China	0	42	48	64	135	217	283	329	7.7
India	6	16	15	37	66	97	124	144	9.1
Other Non-OECD Asia	32	39	40	47	64	75	88	84	2.9
Middle East	**0**	**0**	**0**	**5**	**6**	**6**	**6**	**6**	**—**
Africa	**8**	**13**	**14**	**14**	**15**	**15**	**21**	**21**	**1.5**
Central and South America	**9**	**20**	**19**	**20**	**28**	**34**	**33**	**33**	**2.2**
Brazil	2	13	12	13	18	22	22	22	2.5
Other Central and South America	7	7	7	7	10	12	11	11	1.6
Total Non-OECD	**274**	**390**	**399**	**465**	**637**	**849**	**1,034**	**1,093**	**4.0**
Total World	**1,909**	**2,518**	**2,619**	**2,722**	**2,972**	**3,255**	**3,472**	**3,619**	**1.3**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A9. World Consumption of Hydroelectricity and Other Renewable Energy by Region, Reference Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**9.5**	**9.8**	**9.9**	**12.2**	**12.6**	**13.1**	**13.8**	**14.4**	**1.5**
United States[a]	6.1	6.0	6.0	7.5	7.8	8.1	8.4	8.6	1.4
Canada	3.1	3.5	3.5	4.0	4.1	4.3	4.7	5.0	1.4
Mexico	0.3	0.4	0.4	0.6	0.7	0.7	0.7	0.7	2.3
OECD Europe	**4.8**	**5.9**	**6.3**	**6.9**	**7.2**	**7.5**	**7.7**	**8.0**	**0.9**
OECD Asia	**1.6**	**1.8**	**1.7**	**1.9**	**2.0**	**2.1**	**2.2**	**2.3**	**1.2**
Japan	1.1	1.2	1.1	1.3	1.3	1.4	1.4	1.5	1.0
South Korea	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.2
Australia/New Zealand	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	1.3
Total OECD	**15.9**	**17.5**	**17.9**	**21.1**	**21.8**	**22.7**	**23.7**	**24.7**	**1.2**
Non-OECD									
Non-OECD Europe and Eurasia	**2.8**	**2.8**	**2.9**	**3.6**	**4.1**	**4.3**	**4.6**	**4.9**	**2.0**
Russia	1.8	1.6	1.7	2.2	2.5	2.5	2.7	2.8	2.0
Other	1.0	1.2	1.2	1.4	1.6	1.8	1.9	2.0	2.0
Non-OECD Asia	**3.0**	**5.2**	**5.7**	**7.0**	**7.9**	**9.1**	**10.2**	**11.3**	**2.7**
China	1.3	2.9	3.3	4.0	4.6	5.3	5.9	6.6	2.7
India	0.7	0.8	0.9	1.0	1.1	1.4	1.6	1.7	2.5
Other Non-OECD Asia	0.9	1.5	1.5	2.1	2.2	2.5	2.7	3.0	2.8
Middle East	**0.1**	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**2.7**
Africa	**0.6**	**0.9**	**0.9**	**1.1**	**1.1**	**1.2**	**1.3**	**1.3**	**1.5**
Central and South America	**3.9**	**5.6**	**5.6**	**7.4**	**8.2**	**9.1**	**9.9**	**11.0**	**2.6**
Brazil	2.2	3.0	3.1	4.2	4.8	5.4	6.1	6.8	3.1
Other Central and South America	1.7	2.5	2.5	3.2	3.4	3.6	3.9	4.1	1.9
Total Non-OECD	**10.3**	**14.5**	**15.3**	**19.3**	**21.6**	**23.9**	**26.3**	**28.8**	**2.5**
Total World	**26.2**	**32.1**	**33.2**	**40.4**	**43.4**	**46.5**	**50.1**	**53.5**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. U.S. totals include net electricity imports, methanol, and liquid hydrogen.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A10. World Carbon Dioxide Emissions by Region, Reference Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**5,763**	**6,775**	**6,893**	**7,343**	**7,780**	**8,230**	**8,791**	**9,400**	**1.2**
United States[a]	4,989	5,800	5,923	6,214	6,589	6,944	7,425	7,950	1.1
Canada	474	589	584	648	659	694	722	750	1.0
Mexico	300	385	385	481	532	592	644	699	2.3
OECD Europe	**4,092**	**4,321**	**4,381**	**4,493**	**4,558**	**4,579**	**4,621**	**4,684**	**0.3**
OECD Asia	**1,543**	**2,129**	**2,183**	**2,269**	**2,353**	**2,423**	**2,495**	**2,569**	**0.6**
Japan	1,015	1,244	1,262	1,274	1,290	1,294	1,297	1,306	0.1
South Korea	238	475	497	523	574	614	649	691	1.3
Australia/New Zealand	291	410	424	472	490	516	549	573	1.2
Total OECD	**11,399**	**13,225**	**13,457**	**14,105**	**14,692**	**15,232**	**15,907**	**16,654**	**0.8**
Non-OECD									
Non-OECD Europe and Eurasia	**4,193**	**2,717**	**2,819**	**3,067**	**3,301**	**3,545**	**3,729**	**3,878**	**1.2**
Russia	2,334	1,602	1,685	1,809	1,908	2,018	2,114	2,185	1.0
Other	1,859	1,115	1,134	1,258	1,393	1,527	1,615	1,693	1.6
Non-OECD Asia	**3,627**	**6,479**	**7,411**	**9,711**	**11,404**	**13,115**	**14,759**	**16,536**	**3.1**
China	2,241	3,898	4,707	6,497	7,607	8,795	9,947	11,239	3.4
India	578	1,040	1,111	1,283	1,507	1,720	1,940	2,156	2.6
Other Non-OECD Asia	807	1,542	1,593	1,930	2,289	2,600	2,871	3,141	2.6
Middle East	**705**	**1,211**	**1,289**	**1,602**	**1,788**	**1,976**	**2,143**	**2,306**	**2.3**
Africa	**649**	**895**	**919**	**1,140**	**1,291**	**1,423**	**1,543**	**1,655**	**2.3**
Central and South America	**673**	**981**	**1,027**	**1,235**	**1,413**	**1,562**	**1,708**	**1,851**	**2.3**
Brazil	220	317	334	403	454	500	544	597	2.3
Other Central and South America	453	664	693	831	959	1,062	1,165	1,254	2.3
Total Non-OECD	**9,847**	**12,283**	**13,465**	**16,755**	**19,197**	**21,622**	**23,882**	**26,226**	**2.6**
Total World	**21,246**	**25,508**	**26,922**	**30,860**	**33,889**	**36,854**	**39,789**	**42,880**	**1.8**

[a]Includes the 50 States and the District of Columbia.

Note: The U.S. numbers include carbon dioxide emissions attributable to renewable energy sources.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A11. World Carbon Dioxide Emissions from Liquids Use by Region, Reference Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**2,633**	**3,029**	**3,140**	**3,202**	**3,395**	**3,577**	**3,762**	**3,998**	**0.9**
United States[a]	2,178	2,500	2,598	2,629	2,799	2,947	3,112	3,318	0.9
Canada	224	279	290	293	294	297	299	302	0.2
Mexico	231	250	253	281	301	333	351	378	1.6
OECD Europe	**1,867**	**2,099**	**2,125**	**2,099**	**2,113**	**2,125**	**2,138**	**2,151**	**0.0**
OECD Asia	**921**	**1,068**	**1,048**	**1,042**	**1,075**	**1,097**	**1,120**	**1,144**	**0.3**
Japan	667	683	665	642	644	645	648	652	-0.1
South Korea	144	248	245	256	280	292	304	319	1.0
Australia/New Zealand	110	137	138	143	151	160	167	172	0.8
Total OECD	**5,420**	**6,196**	**6,314**	**6,343**	**6,583**	**6,799**	**7,021**	**7,293**	**0.6**
Non-OECD									
Non-OECD Europe and Eurasia	**1,350**	**636**	**663**	**712**	**751**	**796**	**833**	**868**	**1.0**
Russia	782	364	376	391	409	424	440	450	0.7
Other	568	271	287	320	342	373	394	418	1.5
Non-OECD Asia	**950**	**1,822**	**1,983**	**2,496**	**2,838**	**3,165**	**3,537**	**3,960**	**2.7**
China	325	711	816	1,200	1,338	1,516	1,730	1,995	3.5
India	160	293	306	334	403	449	501	545	2.2
Other Non-OECD Asia	464	818	861	962	1,098	1,200	1,306	1,420	1.9
Middle East	**493**	**735**	**778**	**978**	**1,065**	**1,157**	**1,257**	**1,348**	**2.1**
Africa	**298**	**387**	**395**	**474**	**547**	**613**	**651**	**696**	**2.2**
Central and South America	**503**	**696**	**720**	**838**	**952**	**1,052**	**1,156**	**1,247**	**2.1**
Brazil	180	248	258	293	327	358	390	420	1.9
Other Central and South America	323	449	462	545	625	694	766	827	2.3
Total Non-OECD	**3,594**	**4,276**	**4,538**	**5,498**	**6,153**	**6,783**	**7,434**	**8,118**	**2.3**
Total World	**9,014**	**10,472**	**10,852**	**11,842**	**12,735**	**13,582**	**14,455**	**15,411**	**1.4**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A12. World Carbon Dioxide Emissions from Natural Gas Use by Region, Reference Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,207**	**1,477**	**1,483**	**1,655**	**1,761**	**1,859**	**1,901**	**1,935**	**1.0**
United States[a]	1,026	1,197	1,198	1,298	1,369	1,420	1,422	1,412	0.6
Canada	127	183	183	216	227	248	265	281	1.7
Mexico	54	98	102	140	165	190	213	242	3.4
OECD Europe	**590**	**984**	**1,021**	**1,153**	**1,245**	**1,311**	**1,391**	**1,456**	**1.4**
OECD Asia	**152**	**279**	**282**	**332**	**363**	**385**	**399**	**420**	**1.5**
Japan	102	168	163	198	214	223	230	236	1.4
South Korea	6	50	58	64	71	77	82	88	1.6
Australia/New Zealand	44	61	61	69	79	85	88	96	1.8
Total OECD	**1,949**	**2,740**	**2,786**	**3,139**	**3,369**	**3,554**	**3,690**	**3,810**	**1.2**
Non-OECD									
Non-OECD Europe and Eurasia	**1,450**	**1,280**	**1,328**	**1,459**	**1,581**	**1,705**	**1,819**	**1,930**	**1.5**
Russia	928	828	868	945	1,014	1,069	1,123	1,172	1.2
Other	521	452	460	514	567	635	697	758	1.9
Non-OECD Asia	**160**	**428**	**471**	**702**	**891**	**1,085**	**1,302**	**1,546**	**4.7**
China	30	70	83	175	227	282	348	428	6.5
India	24	56	64	103	123	152	189	226	5.0
Other Non-OECD Asia	106	301	325	424	541	650	764	893	4.0
Middle East	**199**	**442**	**476**	**581**	**675**	**769**	**835**	**905**	**2.5**
Africa	**80**	**144**	**148**	**187**	**227**	**265**	**304**	**349**	**3.3**
Central and South America	**116**	**209**	**231**	**291**	**341**	**375**	**411**	**447**	**2.6**
Brazil	6	27	34	46	53	60	67	77	3.3
Other Central and South America	110	181	197	246	287	316	344	370	2.4
Total Non-OECD	**2,005**	**2,502**	**2,655**	**3,220**	**3,714**	**4,199**	**4,672**	**5,178**	**2.6**
Total World	**3,954**	**5,242**	**5,441**	**6,359**	**7,083**	**7,754**	**8,362**	**8,988**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A13. World Carbon Dioxide Emissions from Coal Use by Region, Reference Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,923**	**2,258**	**2,258**	**2,474**	**2,611**	**2,781**	**3,114**	**3,453**	**1.6**
United States[a]	1,784	2,093	2,115	2,275	2,407	2,563	2,877	3,206	1.6
Canada	123	128	112	140	138	148	159	168	1.6
Mexico	15	37	30	60	66	69	79	79	3.8
OECD Europe	**1,635**	**1,237**	**1,235**	**1,241**	**1,200**	**1,143**	**1,092**	**1,078**	**-0.5**
OECD Asia	**471**	**782**	**853**	**896**	**916**	**941**	**976**	**1,006**	**0.6**
Japan	245	393	434	434	432	425	419	417	-0.1
South Korea	88	177	194	203	224	245	263	284	1.5
Australia/New Zealand	137	212	225	259	260	272	294	305	1.2
Total OECD	**4,028**	**4,277**	**4,345**	**4,611**	**4,727**	**4,865**	**5,183**	**5,536**	**0.9**
Non-OECD									
Non-OECD Europe and Eurasia	**1,393**	**801**	**828**	**897**	**970**	**1,044**	**1,076**	**1,079**	**1.0**
Russia	624	410	441	472	486	525	551	562	0.9
Other	770	392	387	425	484	520	524	517	1.1
Non-OECD Asia	**2,517**	**4,229**	**4,957**	**6,513**	**7,675**	**8,865**	**9,919**	**11,030**	**3.1**
China	1,886	3,117	3,809	5,122	6,043	6,996	7,868	8,816	3.3
India	394	690	741	846	981	1,119	1,250	1,386	2.4
Other Non-OECD Asia	237	422	407	544	651	750	801	828	2.8
Middle East	**14**	**34**	**35**	**43**	**48**	**50**	**52**	**54**	**1.6**
Africa	**271**	**364**	**376**	**478**	**517**	**545**	**588**	**610**	**1.9**
Central and South America	**54**	**76**	**77**	**105**	**120**	**134**	**141**	**157**	**2.8**
Brazil	34	42	43	64	74	82	87	101	3.3
Other Central and South America	20	34	34	41	46	53	54	56	2.0
Total Non-OECD	**4,248**	**5,505**	**6,272**	**8,037**	**9,330**	**10,639**	**11,776**	**12,930**	**2.8**
Total World	**8,277**	**9,782**	**10,617**	**12,647**	**14,057**	**15,505**	**16,958**	**18,466**	**2.2**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table A14. World Population by Region, Reference Case, 1990-2030
(Millions)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**366**	**427**	**432**	**457**	**478**	**498**	**518**	**537**	**0.8**
United States[a]	254	291	294	310	324	337	351	365	0.8
Canada	28	32	32	34	35	36	38	39	0.8
Mexico	84	104	106	113	119	125	129	133	0.9
OECD Europe	**497**	**530**	**532**	**543**	**550**	**555**	**559**	**562**	**0.2**
OECD Asia	**187**	**199**	**199**	**202**	**204**	**204**	**203**	**202**	**0.0**
Japan	124	128	128	128	128	127	125	123	-0.2
South Korea	43	47	48	49	49	49	49	49	0.1
Australia/New Zealand	20	24	24	25	27	28	29	30	0.9
Total OECD	**1,050**	**1,156**	**1,163**	**1,203**	**1,232**	**1,257**	**1,280**	**1,300**	**0.4**
Non-OECD									
Non-OECD Europe and Eurasia	**348**	**343**	**342**	**338**	**334**	**330**	**325**	**319**	**-0.3**
Russia	148	145	144	140	137	133	129	125	-0.5
Other	200	198	198	198	198	197	196	193	-0.1
Non-OECD Asia	**2,748**	**3,316**	**3,356**	**3,592**	**3,783**	**3,958**	**4,108**	**4,231**	**0.9**
China	1,155	1,299	1,307	1,355	1,393	1,424	1,441	1,446	0.4
India	849	1,070	1,087	1,183	1,260	1,332	1,395	1,449	1.1
Other Non-OECD Asia	743	946	962	1,054	1,129	1,202	1,271	1,335	1.3
Middle East	**137**	**187**	**191**	**216**	**238**	**260**	**281**	**301**	**1.8**
Africa	**636**	**869**	**887**	**1,007**	**1,115**	**1,228**	**1,344**	**1,463**	**1.9**
Central and South America	**360**	**442**	**448**	**486**	**515**	**542**	**567**	**589**	**1.1**
Brazil	149	181	184	198	209	219	228	236	1.0
Other Central and South America	210	260	264	287	306	323	339	354	1.1
Total Non-OECD	**4,228**	**5,156**	**5,224**	**5,638**	**5,986**	**6,319**	**6,626**	**6,903**	**1.1**
Total World	**5,278**	**6,312**	**6,388**	**6,841**	**7,217**	**7,577**	**7,906**	**8,203**	**1.0**

[a]Includes the 50 States and the District of Columbia.

Sources: **United States:** *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo. **Other Countries:** United Nations, Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2004 Revision and World Urbanization Prospects (February 25, 2005), web site http://esa.un.org/unpp.

Appendix B

High Economic Growth Case Projections:

- **World Energy Consumption**
- **Gross Domestic Product**
- **Carbon Dioxide Emissions**

Table B1. World Total Primary Energy Consumption by Region, High Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**100.8**	**118.3**	**120.9**	**132.4**	**142.0**	**152.4**	**164.5**	**177.7**	**1.5**
United States[a]	84.7	98.3	100.7	108.2	116.2	124.1	133.9	144.4	1.4
Canada	11.1	13.5	13.6	15.7	16.3	17.4	18.6	19.9	1.5
Mexico	5.0	6.5	6.6	8.5	9.5	10.8	12.0	13.4	2.7
OECD Europe	**69.9**	**79.5**	**81.1**	**85.1**	**88.1**	**89.9**	**93.0**	**96.7**	**0.7**
OECD Asia	**26.6**	**36.9**	**37.8**	**40.5**	**43.4**	**46.1**	**48.6**	**51.7**	**1.2**
Japan	18.4	22.2	22.6	23.8	24.8	25.7	26.6	27.6	0.8
South Korea	3.8	8.7	9.0	9.8	11.2	12.5	13.5	14.9	2.0
Australia/New Zealand	4.4	6.0	6.2	6.9	7.4	7.9	8.5	9.1	1.5
Total OECD	**197.4**	**234.7**	**239.8**	**257.9**	**273.5**	**288.4**	**306.2**	**326.0**	**1.2**
Non-OECD									
Non-OECD Europe and Eurasia	**67.2**	**47.9**	**49.7**	**55.6**	**61.6**	**68.3**	**74.6**	**79.6**	**1.8**
Russia	39.0	28.8	30.1	33.4	36.7	39.9	43.5	46.3	1.7
Other	28.3	19.2	19.6	22.2	25.0	28.4	31.0	33.3	2.1
Non-OECD Asia	**47.5**	**88.2**	**99.9**	**133.1**	**160.3**	**189.3**	**219.1**	**252.0**	**3.6**
China	27.0	49.7	59.6	83.9	100.7	119.5	138.8	160.9	3.9
India	8.0	14.4	15.4	18.4	22.4	26.5	30.9	35.3	3.2
Other Non-OECD Asia	12.5	24.0	24.9	30.8	37.2	43.3	49.4	55.7	3.2
Middle East	**11.3**	**19.9**	**21.1**	**26.7**	**30.5**	**34.6**	**38.4**	**42.3**	**2.7**
Africa	**9.5**	**13.3**	**13.7**	**17.1**	**19.8**	**22.4**	**25.0**	**27.6**	**2.7**
Central and South America	**14.5**	**21.7**	**22.5**	**28.1**	**32.6**	**36.8**	**41.2**	**45.8**	**2.8**
Brazil	5.8	8.7	9.1	11.4	13.2	14.9	16.8	19.0	2.9
Other Central and South America	8.8	13.0	13.5	16.7	19.5	21.9	24.4	26.8	2.7
Total Non-OECD	**150.0**	**191.0**	**206.9**	**260.7**	**304.9**	**351.4**	**398.2**	**447.2**	**3.0**
Total World	**347.3**	**425.7**	**446.7**	**518.6**	**578.4**	**639.8**	**704.4**	**773.3**	**2.1**

[a]Includes the 50 States and the District of Columbia.

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B2. World Total Energy Consumption by Region and Fuel, High Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America									
Liquids	40.5	47.2	49.2	51.8	55.6	59.7	64.3	69.5	1.3
Natural Gas	23.2	28.5	28.5	32.1	34.8	36.8	37.9	40.2	1.3
Coal	20.7	24.1	24.1	26.6	28.6	31.5	36.2	40.4	2.0
Nuclear	6.9	8.9	9.3	9.7	10.2	10.8	11.5	12.1	1.0
Other	9.5	9.8	9.9	12.3	12.9	13.6	14.6	15.4	1.7
Total	**100.8**	**118.3**	**120.9**	**132.4**	**142.0**	**152.4**	**164.5**	**177.7**	**1.5**
OECD Europe									
Liquids	28.4	31.9	32.4	32.4	33.2	34.0	34.8	35.7	0.4
Natural Gas	11.2	18.6	19.3	22.1	24.3	26.0	28.2	30.3	1.7
Coal	17.6	13.2	13.1	13.4	13.2	12.9	12.6	12.7	-0.1
Nuclear	7.9	9.8	9.9	10.2	10.0	9.3	9.3	9.4	-0.2
Other	4.8	5.9	6.3	7.0	7.4	7.7	8.1	8.5	1.2
Total	**69.9**	**79.5**	**81.1**	**85.1**	**88.1**	**89.9**	**93.0**	**96.7**	**0.7**
OECD Asia									
Liquids	14.5	17.7	17.4	17.6	18.5	19.3	20.1	21.1	0.7
Natural Gas	2.9	5.3	5.3	6.4	7.1	7.7	8.2	8.9	2.0
Coal	5.2	8.6	9.3	9.9	10.4	10.9	11.6	12.3	1.1
Nuclear	2.5	3.5	4.0	4.6	5.3	6.0	6.3	6.9	2.1
Other	1.6	1.8	1.7	1.9	2.1	2.2	2.3	2.5	1.5
Total	**26.6**	**36.9**	**37.8**	**40.5**	**43.4**	**46.1**	**48.6**	**51.7**	**1.2**
Total OECD									
Liquids	83.4	96.7	98.9	101.7	107.2	113.0	119.3	126.3	0.9
Natural Gas	37.2	52.4	53.1	60.5	66.2	70.6	74.4	79.4	1.6
Coal	43.5	45.9	46.6	49.9	52.2	55.3	60.4	65.4	1.3
Nuclear	17.3	22.2	23.2	24.5	25.6	26.1	27.1	28.5	0.8
Other	15.9	17.5	17.9	21.3	22.4	23.5	25.0	26.5	1.5
Total	**197.4**	**234.7**	**239.8**	**257.9**	**273.5**	**288.4**	**306.2**	**326.0**	**1.2**
Non-OECD									
Non-OECD Europe and Eurasia									
Liquids	19.5	9.4	9.9	10.8	11.7	12.7	13.6	14.5	1.5
Natural Gas	27.5	24.2	25.1	28.1	31.1	34.4	37.7	41.2	1.9
Coal	15.1	8.7	9.0	9.9	10.9	12.1	12.8	13.1	1.5
Nuclear	2.5	2.9	2.9	3.2	3.7	4.7	5.5	5.5	2.5
Other	2.8	2.8	2.9	3.6	4.2	4.5	4.9	5.2	2.3
Total	**67.2**	**47.9**	**49.7**	**55.6**	**61.6**	**68.3**	**74.6**	**79.6**	**1.8**
Non-OECD Asia									
Liquids	13.9	28.1	30.6	39.4	45.8	52.4	60.0	68.9	3.2
Natural Gas	3.0	8.1	8.9	13.5	17.5	21.8	26.8	32.6	5.1
Coal	27.2	45.8	53.6	71.5	85.9	101.4	116.1	132.1	3.5
Nuclear	0.4	1.0	1.1	1.6	3.0	4.3	5.5	6.2	7.0
Other	3.0	5.2	5.7	7.1	8.1	9.4	10.7	12.1	2.9
Total	**47.5**	**88.2**	**99.9**	**133.1**	**160.3**	**189.3**	**219.1**	**252.0**	**3.6**

See notes at end of table.

Table B2. World Total Energy Consumption by Region and Fuel, High Economic Growth Case, 1990-2030 (Continued)
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
Non-OECD (Continued)									
Middle East									
Liquids	7.3	11.0	11.6	14.8	16.5	18.3	20.4	22.4	2.6
Natural Gas	3.8	8.4	9.0	11.2	13.2	15.4	17.0	18.9	2.9
Coal	0.1	0.4	0.4	0.5	0.5	0.6	0.6	0.6	2.0
Nuclear	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
Other	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	2.9
Total	**11.3**	**19.9**	**21.1**	**26.7**	**30.5**	**34.6**	**38.4**	**42.3**	**2.7**
Africa									
Liquids	4.3	5.6	5.7	7.0	8.2	9.4	10.2	11.2	2.6
Natural Gas	1.5	2.7	2.8	3.6	4.5	5.3	6.3	7.4	3.8
Coal	3.0	4.0	4.1	5.3	5.9	6.3	7.0	7.4	2.3
Nuclear	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	1.7
Other	0.6	0.9	0.9	1.1	1.1	1.2	1.3	1.4	1.7
Total	**9.5**	**13.3**	**13.7**	**17.1**	**19.8**	**22.4**	**25.0**	**27.6**	**2.7**
Central and South America									
Liquids	7.8	11.1	11.5	13.6	15.8	17.8	20.1	22.2	2.6
Natural Gas	2.2	4.0	4.4	5.6	6.7	7.6	8.5	9.6	3.1
Coal	0.6	0.8	0.8	1.2	1.4	1.6	1.7	1.9	3.3
Nuclear	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.4	2.3
Other	3.9	5.6	5.6	7.5	8.4	9.4	10.5	11.7	2.9
Total	**14.5**	**21.7**	**22.5**	**28.1**	**32.6**	**36.8**	**41.2**	**45.8**	**2.8**
Total Non-OECD									
Liquids	52.7	65.2	69.3	85.6	97.9	110.6	124.3	139.2	2.7
Natural Gas	38.0	47.4	50.3	62.0	73.0	84.4	96.4	109.7	3.0
Coal	45.9	59.7	67.9	88.3	104.6	121.9	138.1	155.2	3.2
Nuclear	3.1	4.2	4.3	5.3	7.2	9.6	11.7	12.4	4.2
Other	10.3	14.5	15.3	19.5	22.1	24.8	27.7	30.7	2.7
Total	**150.0**	**191.1**	**206.9**	**260.7**	**304.9**	**351.4**	**398.2**	**447.2**	**3.0**
Total World									
Liquids	136.2	161.9	168.2	187.3	205.2	223.5	243.5	265.5	1.8
Natural Gas	75.2	99.8	103.4	122.5	139.1	155.0	170.8	189.0	2.3
Coal	89.4	105.6	114.5	138.2	156.8	177.2	198.5	220.6	2.6
Nuclear	20.4	26.4	27.5	29.8	32.8	35.7	38.8	40.9	1.5
Other	26.2	32.1	33.2	40.8	44.5	48.3	52.8	57.2	2.1
Total	**347.3**	**425.7**	**446.7**	**518.6**	**578.4**	**639.8**	**704.4**	**773.3**	**2.1**

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B3. World Gross Domestic Product (GDP) by Region Expressed in Purchasing Power Parity, High Economic Growth Case, 1990-2030
(Billion 2000 Dollars)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**8,477**	**12,250**	**12,725**	**15,722**	**18,597**	**22,014**	**26,133**	**30,687**	**3.4**
United States[a]	7,113	10,301	10,704	13,219	15,619	18,490	21,965	25,757	3.4
Canada	684	973	1,005	1,213	1,403	1,596	1,812	2,057	2.8
Mexico	680	975	1,016	1,291	1,575	1,928	2,356	2,874	4.1
OECD Europe	**8,067**	**10,850**	**11,132**	**13,143**	**15,074**	**17,246**	**19,641**	**22,386**	**2.7**
OECD Asia	**3,621**	**4,630**	**4,761**	**5,660**	**6,419**	**7,115**	**7,825**	**8,625**	**2.3**
Japan	2,862	3,289	3,363	3,864	4,225	4,511	4,766	5,036	1.6
South Korea	331	683	715	982	1,227	1,455	1,699	1,980	4.0
Australia/New Zealand	429	658	682	815	967	1,149	1,360	1,609	3.4
Total OECD	**20,165**	**27,730**	**28,619**	**34,526**	**40,091**	**46,375**	**53,599**	**61,698**	**3.0**
Non-OECD									
Non-OECD Europe and Eurasia	**3,601**	**3,081**	**3,332**	**4,860**	**6,133**	**7,527**	**9,152**	**11,086**	**4.7**
Russia	2,241	1,780	1,907	2,675	3,287	3,935	4,691	5,561	4.2
Other	1,360	1,301	1,425	2,185	2,847	3,592	4,461	5,525	5.4
Non-OECD Asia	**5,995**	**14,573**	**15,841**	**25,157**	**34,366**	**45,975**	**60,049**	**77,793**	**6.3**
China	2,002	7,013	7,722	13,235	18,676	25,600	33,910	44,319	7.0
India	1,703	3,434	3,727	5,756	7,782	10,304	13,441	17,484	6.1
Other Non-OECD Asia	2,291	4,125	4,393	6,166	7,907	10,072	12,698	15,989	5.1
Middle East	**820**	**1,364**	**1,453**	**1,989**	**2,513**	**3,122**	**3,852**	**4,745**	**4.7**
Africa	**1,450**	**2,056**	**2,161**	**2,998**	**3,912**	**5,052**	**6,483**	**8,304**	**5.3**
Central and South America	**2,191**	**3,110**	**3,297**	**4,363**	**5,396**	**6,638**	**8,136**	**9,953**	**4.3**
Brazil	1,022	1,378	1,446	1,813	2,199	2,658	3,202	3,850	3.8
Other Central and South America	1,169	1,733	1,852	2,551	3,196	3,980	4,934	6,103	4.7
Total Non-OECD	**14,057**	**24,184**	**26,085**	**39,367**	**52,320**	**68,314**	**87,671**	**111,881**	**5.8**
Total World	**34,222**	**51,914**	**54,704**	**73,893**	**92,410**	**114,689**	**141,270**	**173,579**	**4.5**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. GDP growth rates for China and India were adjusted, based on the analyst's judgment.

Sources: **History:** Global Insight, Inc., *World Overview* (Lexington, MA, various issues). **Projections:** Global Insight, Inc., *World Overview*, Fourth Quarter 2006 (Lexington, MA, January 2007); and Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington DC, February 2007), Table B4.

Table B4. World Liquids Consumption by Region, High Economic Growth Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.5**	**24.2**	**25.0**	**26.4**	**28.4**	**30.5**	**32.9**	**35.5**	**1.4**
United States[a]	17.0	20.0	20.7	21.9	23.5	25.3	27.4	29.7	1.4
Canada	1.7	2.2	2.3	2.4	2.4	2.5	2.5	2.6	0.5
Mexico	1.8	1.9	2.0	2.2	2.4	2.7	3.0	3.3	2.0
OECD Europe	**13.7**	**15.4**	**15.6**	**15.7**	**16.0**	**16.4**	**16.8**	**17.3**	**0.4**
OECD Asia	**7.1**	**8.7**	**8.5**	**8.6**	**9.1**	**9.5**	**9.9**	**10.3**	**0.7**
Japan	5.2	5.5	5.4	5.2	5.4	5.5	5.6	5.8	0.3
South Korea	1.0	2.2	2.1	2.3	2.6	2.7	2.9	3.2	1.5
Australia/New Zealand	0.8	1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.2
Total OECD	**41.3**	**48.3**	**49.1**	**50.7**	**53.5**	**56.4**	**59.6**	**63.1**	**1.0**
Non-OECD									
Non-OECD Europe and Eurasia	**9.3**	**4.6**	**4.8**	**5.2**	**5.7**	**6.2**	**6.6**	**7.1**	**1.5**
Russia	5.4	2.7	2.8	2.9	3.1	3.3	3.6	3.7	1.2
Other	3.9	1.9	2.0	2.3	2.5	2.8	3.0	3.3	1.9
Non-OECD Asia	**6.6**	**13.6**	**14.8**	**19.1**	**22.2**	**25.4**	**29.1**	**33.4**	**3.2**
China	2.3	5.6	6.4	9.6	10.9	12.7	14.8	17.5	4.0
India	1.2	2.3	2.5	2.7	3.4	3.8	4.4	4.9	2.7
Other Non-OECD Asia	3.1	5.7	6.0	6.8	7.9	8.8	9.9	11.0	2.4
Middle East	**3.5**	**5.4**	**5.7**	**7.2**	**8.0**	**8.9**	**9.9**	**10.9**	**2.6**
Africa	**2.1**	**2.7**	**2.8**	**3.4**	**4.0**	**4.6**	**5.0**	**5.4**	**2.6**
Central and South America	**3.8**	**5.2**	**5.4**	**6.6**	**7.7**	**8.7**	**9.8**	**10.8**	**2.7**
Brazil	1.5	2.1	2.1	2.6	3.0	3.3	3.7	4.1	2.6
Other Central and South America	2.3	3.2	3.3	4.0	4.7	5.4	6.1	6.7	2.8
Total Non-OECD	**25.3**	**31.5**	**33.4**	**41.6**	**47.6**	**53.8**	**60.4**	**67.7**	**2.7**
Total World	**66.5**	**79.8**	**82.5**	**92.3**	**101.1**	**110.1**	**120.0**	**130.8**	**1.8**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B5. World Natural Gas Consumption by Region, High Economic Growth Case, 1990-2030
(Trillion Cubic Feet)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**22.5**	**27.4**	**27.6**	**31.0**	**33.6**	**35.6**	**36.7**	**38.8**	**1.3**
United States[a]	19.2	22.3	22.4	24.5	26.4	27.3	27.4	28.4	0.9
Canada	2.4	3.4	3.4	4.0	4.3	4.8	5.2	5.7	2.0
Mexico	0.9	1.7	1.8	2.5	3.0	3.5	4.0	4.7	3.8
OECD Europe	**11.6**	**18.2**	**18.8**	**21.5**	**23.6**	**25.3**	**27.5**	**29.5**	**1.7**
OECD Asia	**2.8**	**5.0**	**5.0**	**6.0**	**6.7**	**7.3**	**7.7**	**8.4**	**2.0**
Japan	1.9	3.0	3.0	3.6	4.0	4.3	4.5	4.8	1.9
South Korea	0.1	0.9	1.0	1.1	1.2	1.4	1.5	1.7	2.1
Australia/New Zealand	0.8	1.1	1.1	1.3	1.4	1.6	1.7	1.9	2.1
Total OECD	**36.8**	**50.5**	**51.4**	**58.5**	**64.0**	**68.2**	**71.9**	**76.6**	**1.5**
Non-OECD									
Non-OECD Europe and Eurasia	**26.7**	**23.6**	**24.4**	**27.3**	**30.3**	**33.4**	**36.7**	**40.0**	**1.9**
Russia	17.3	15.3	16.0	17.7	19.5	21.1	22.7	24.4	1.6
Other	9.5	8.3	8.4	9.6	10.8	12.4	14.0	15.6	2.4
Non-OECD Asia	**2.9**	**7.7**	**8.5**	**12.6**	**16.4**	**20.4**	**25.0**	**30.5**	**5.1**
China	0.5	1.1	1.4	2.9	3.8	4.8	6.1	7.6	6.9
India	0.4	1.0	1.1	1.8	2.2	2.8	3.5	4.3	5.5
Other Non-OECD Asia	2.0	5.6	6.0	8.0	10.4	12.8	15.4	18.5	4.4
Middle East	**3.6**	**8.0**	**8.6**	**10.6**	**12.6**	**14.7**	**16.3**	**18.0**	**2.9**
Africa	**1.4**	**2.5**	**2.6**	**3.4**	**4.2**	**5.0**	**5.9**	**6.9**	**3.8**
Central and South America	**2.0**	**3.7**	**4.1**	**5.2**	**6.3**	**7.1**	**8.0**	**8.9**	**3.1**
Brazil	0.1	0.5	0.6	0.9	1.0	1.2	1.4	1.7	4.0
Other Central and South America	1.9	3.2	3.5	4.4	5.2	5.9	6.6	7.2	2.9
Total Non-OECD	**36.5**	**45.5**	**48.2**	**59.2**	**69.7**	**80.5**	**91.8**	**104.4**	**3.0**
Total World	**73.4**	**96.0**	**99.6**	**117.7**	**133.6**	**148.8**	**163.7**	**181.0**	**2.3**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B6. World Coal Consumption by Region, High Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.7**	**24.1**	**24.1**	**26.6**	**28.6**	**31.5**	**36.2**	**40.4**	**2.0**
United States[a]	19.2	22.3	22.6	24.4	26.3	29.0	33.3	37.3	1.9
Canada	1.3	1.4	1.2	1.5	1.6	1.7	1.9	2.1	2.2
Mexico	0.2	0.4	0.3	0.7	0.8	0.8	0.9	1.0	4.2
OECD Europe	**17.6**	**13.2**	**13.1**	**13.4**	**13.2**	**12.9**	**12.6**	**12.7**	**-0.1**
OECD Asia	**5.2**	**8.6**	**9.3**	**9.9**	**10.4**	**10.9**	**11.6**	**12.3**	**1.1**
Japan	2.7	4.3	4.8	4.8	4.9	4.9	5.0	5.0	0.2
South Korea	0.9	1.9	2.1	2.3	2.6	2.9	3.2	3.6	2.1
Australia/New Zealand	1.5	2.3	2.4	2.8	2.9	3.1	3.4	3.6	1.5
Total OECD	**43.5**	**45.9**	**46.6**	**49.9**	**52.2**	**55.3**	**60.4**	**65.4**	**1.3**
Non-OECD									
Non-OECD Europe and Eurasia	**15.1**	**8.7**	**9.0**	**9.9**	**10.9**	**12.1**	**12.8**	**13.1**	**1.5**
Russia	6.8	4.5	4.8	5.2	5.5	6.1	6.6	6.9	1.4
Other	8.3	4.2	4.2	4.6	5.4	6.0	6.2	6.2	1.6
Non-OECD Asia	**27.2**	**45.8**	**53.6**	**71.5**	**85.9**	**101.4**	**116.1**	**132.1**	**3.5**
China	20.3	33.7	41.1	56.2	67.7	80.1	92.1	105.6	3.7
India	4.3	7.5	8.1	9.4	11.1	12.9	14.8	16.8	2.8
Other Non-OECD Asia	2.6	4.6	4.3	5.9	7.2	8.4	9.2	9.7	3.2
Middle East	**0.1**	**0.4**	**0.4**	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**	**2.0**
Africa	**3.0**	**4.0**	**4.1**	**5.3**	**5.9**	**6.3**	**7.0**	**7.4**	**2.3**
Central and South America	**0.6**	**0.8**	**0.8**	**1.2**	**1.4**	**1.6**	**1.7**	**1.9**	**3.3**
Brazil	0.4	0.5	0.5	0.7	0.8	1.0	1.0	1.3	4.0
Other Central and South America	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	2.4
Total Non-OECD	**45.9**	**59.7**	**67.9**	**88.3**	**104.6**	**121.9**	**138.1**	**155.2**	**3.2**
Total World	**89.4**	**105.6**	**114.5**	**138.2**	**156.8**	**177.2**	**198.5**	**220.6**	**2.6**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B7. World Nuclear Energy Consumption by Region, High Economic Growth Case, 1990-2030
(Billion Kilowatthours)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**649**	**845**	**883**	**910**	**961**	**1,017**	**1,087**	**1,147**	**1.0**
United States[a]	577	764	789	789	837	890	958	1,010	1.0
Canada	69	71	86	110	113	116	118	126	1.5
Mexico	3	10	9	11	11	11	11	11	0.9
OECD Europe	**743**	**931**	**941**	**914**	**902**	**835**	**831**	**847**	**-0.4**
OECD Asia	**242**	**351**	**396**	**433**	**497**	**559**	**592**	**646**	**1.9**
Japan	192	228	272	299	325	352	370	394	1.4
South Korea	50	123	124	134	172	207	222	252	2.8
Australia/New Zealand	0	0	0	0	0	0	0	0	—
Total OECD	**1,635**	**2,128**	**2,220**	**2,257**	**2,360**	**2,411**	**2,510**	**2,640**	**0.7**
Non-OECD									
Non-OECD Europe and Eurasia	**219**	**260**	**263**	**278**	**323**	**405**	**479**	**476**	**2.3**
Russia	115	141	137	149	190	236	299	315	3.2
Other	104	119	125	129	133	169	180	161	1.0
Non-OECD Asia	**38**	**97**	**103**	**148**	**265**	**389**	**495**	**557**	**6.7**
China	0	42	48	64	135	217	283	329	7.7
India	6	16	15	37	66	97	124	144	9.1
Other Non-OECD Asia	32	39	40	47	64	75	88	84	2.9
Middle East	**0**	**0**	**0**	**5**	**6**	**6**	**6**	**6**	**—**
Africa	**8**	**13**	**14**	**14**	**15**	**15**	**21**	**21**	**1.5**
Central and South America	**9**	**20**	**19**	**20**	**28**	**34**	**33**	**33**	**2.2**
Brazil	2	13	12	13	18	22	22	22	2.5
Other Central and South America	7	7	7	7	10	12	11	11	1.6
Total Non-OECD	**274**	**390**	**399**	**465**	**637**	**849**	**1,034**	**1,093**	**4.0**
Total World	**1,909**	**2,518**	**2,619**	**2,722**	**2,997**	**3,260**	**3,544**	**3,733**	**1.4**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B8. World Consumption of Hydroelectricity and Other Renewable Energy by Region, High Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**9.5**	**9.8**	**9.9**	**12.3**	**12.9**	**13.6**	**14.6**	**15.4**	**1.7**
United States[a]	6.1	6.0	6.0	7.6	8.0	8.4	8.9	9.3	1.7
Canada	3.1	3.5	3.5	4.1	4.2	4.5	4.9	5.3	1.7
Mexico	0.3	0.4	0.4	0.6	0.7	0.7	0.7	0.8	2.6
OECD Europe	**4.8**	**5.9**	**6.3**	**7.0**	**7.4**	**7.7**	**8.1**	**8.5**	**1.2**
OECD Asia	**1.6**	**1.8**	**1.7**	**1.9**	**2.1**	**2.2**	**2.3**	**2.5**	**1.5**
Japan	1.1	1.2	1.1	1.3	1.3	1.4	1.5	1.6	1.3
South Korea	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.5
Australia/New Zealand	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	1.6
Total OECD	**15.9**	**17.5**	**17.9**	**21.3**	**22.4**	**23.5**	**25.0**	**26.5**	**1.5**
Non-OECD									
Non-OECD Europe and Eurasia	**2.8**	**2.8**	**2.9**	**3.6**	**4.2**	**4.5**	**4.9**	**5.2**	**2.3**
Russia	1.8	1.6	1.7	2.2	2.5	2.6	2.9	3.0	2.3
Other	1.0	1.2	1.2	1.5	1.7	1.9	2.0	2.2	2.2
Non-OECD Asia	**3.0**	**5.2**	**5.7**	**7.1**	**8.1**	**9.4**	**10.7**	**12.1**	**2.9**
China	1.3	2.9	3.3	4.0	4.7	5.5	6.2	7.0	2.9
India	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.9	2.8
Other Non-OECD Asia	0.9	1.5	1.5	2.1	2.2	2.6	2.9	3.2	3.0
Middle East	**0.1**	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**2.9**
Africa	**0.6**	**0.9**	**0.9**	**1.1**	**1.1**	**1.2**	**1.3**	**1.4**	**1.7**
Central and South America	**3.9**	**5.6**	**5.6**	**7.5**	**8.4**	**9.4**	**10.5**	**11.7**	**2.9**
Brazil	2.2	3.0	3.1	4.3	5.0	5.6	6.4	7.3	3.3
Other Central and South America	1.7	2.5	2.5	3.2	3.5	3.8	4.1	4.4	2.2
Total Non-OECD	**10.3**	**14.5**	**15.3**	**19.5**	**22.1**	**24.8**	**27.7**	**30.7**	**2.7**
Total World	**26.2**	**32.1**	**33.2**	**40.8**	**44.5**	**48.3**	**52.8**	**57.2**	**2.1**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. U.S. totals include net electricity imports, methanol, and liquid hydrogen.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B9. World Carbon Dioxide Emissions by Region, High Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**5,763**	**6,775**	**6,893**	**7,450**	**8,034**	**8,683**	**9,477**	**10,322**	**1.6**
United States[a]	4,989	5,800	5,923	6,304	6,801	7,322	7,997	8,711	1.5
Canada	474	589	584	657	680	732	781	833	1.4
Mexico	300	385	385	489	553	628	700	778	2.7
OECD Europe	**4,092**	**4,321**	**4,381**	**4,553**	**4,703**	**4,814**	**4,958**	**5,138**	**0.6**
OECD Asia	**1,543**	**2,129**	**2,183**	**2,302**	**2,435**	**2,564**	**2,704**	**2,858**	**1.0**
Japan	1,015	1,244	1,262	1,292	1,332	1,363	1,398	1,440	0.5
South Korea	238	475	497	533	599	660	719	793	1.8
Australia/New Zealand	291	410	424	478	504	540	587	625	1.5
Total OECD	**11,399**	**13,225**	**13,457**	**14,305**	**15,172**	**16,060**	**17,139**	**18,318**	**1.2**
Non-OECD									
Non-OECD Europe and Eurasia	**4,193**	**2,717**	**2,819**	**3,121**	**3,437**	**3,784**	**4,087**	**4,365**	**1.7**
Russia	2,334	1,602	1,685	1,841	1,988	2,154	2,319	2,462	1.5
Other	1,859	1,115	1,134	1,280	1,449	1,629	1,768	1,903	2.0
Non-OECD Asia	**3,627**	**6,479**	**7,411**	**9,878**	**11,843**	**13,925**	**16,037**	**18,401**	**3.6**
China	2,241	3,898	4,707	6,615	7,908	9,344	10,810	12,500	3.8
India	578	1,040	1,111	1,302	1,560	1,821	2,105	2,403	3.0
Other Non-OECD Asia	807	1,542	1,593	1,961	2,375	2,760	3,122	3,499	3.1
Middle East	**705**	**1,211**	**1,289**	**1,627**	**1,852**	**2,093**	**2,322**	**2,559**	**2.7**
Africa	**649**	**895**	**919**	**1,158**	**1,337**	**1,505**	**1,670**	**1,834**	**2.7**
Central and South America	**673**	**981**	**1,027**	**1,256**	**1,470**	**1,665**	**1,868**	**2,081**	**2.8**
Brazil	220	317	334	411	474	536	601	682	2.8
Other Central and South America	453	664	693	845	996	1,128	1,267	1,398	2.7
Total Non-OECD	**9,847**	**12,283**	**13,465**	**17,040**	**19,940**	**22,971**	**25,984**	**29,240**	**3.0**
Total World	**21,246**	**25,508**	**26,922**	**31,346**	**35,112**	**39,031**	**43,123**	**47,558**	**2.2**

[a]Includes the 50 States and the District of Columbia.

Note: The U.S. numbers include carbon dioxide emissions attributable to renewable energy sources.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B10. World Carbon Dioxide Emissions from Liquids Use by Region, High Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**2,633**	**3,029**	**3,140**	**3,264**	**3,513**	**3,778**	**4,073**	**4,409**	**1.3**
United States[a]	2,178	2,500	2,598	2,682	2,896	3,112	3,371	3,659	1.3
Canada	224	279	290	297	304	312	321	331	0.5
Mexico	231	250	253	285	313	353	380	419	2.0
OECD Europe	**1,867**	**2,099**	**2,125**	**2,127**	**2,179**	**2,231**	**2,287**	**2,346**	**0.4**
OECD Asia	**921**	**1,068**	**1,048**	**1,058**	**1,113**	**1,160**	**1,211**	**1,265**	**0.7**
Japan	667	683	665	651	665	680	697	716	0.3
South Korea	144	248	245	261	292	312	335	361	1.5
Australia/New Zealand	110	137	138	146	156	168	179	188	1.2
Total OECD	**5,420**	**6,196**	**6,314**	**6,449**	**6,804**	**7,168**	**7,571**	**8,020**	**0.9**
Non-OECD									
Non-OECD Europe and Eurasia	**1,350**	**636**	**663**	**725**	**785**	**853**	**916**	**980**	**1.5**
Russia	782	364	376	399	428	455	485	509	1.2
Other	568	271	287	326	357	398	432	470	1.9
Non-OECD Asia	**950**	**1,822**	**1,983**	**2,540**	**2,955**	**3,375**	**3,864**	**4,433**	**3.1**
China	325	711	816	1,223	1,395	1,619	1,892	2,236	4.0
India	160	293	306	339	419	479	547	611	2.7
Other Non-OECD Asia	464	818	861	978	1,142	1,277	1,424	1,587	2.4
Middle East	**493**	**735**	**778**	**994**	**1,106**	**1,229**	**1,367**	**1,502**	**2.6**
Africa	**298**	**387**	**395**	**482**	**567**	**649**	**706**	**772**	**2.6**
Central and South America	**503**	**696**	**720**	**853**	**990**	**1,120**	**1,261**	**1,395**	**2.6**
Brazil	180	248	258	299	340	382	426	471	2.3
Other Central and South America	323	449	462	554	650	738	835	924	2.7
Total Non-OECD	**3,594**	**4,276**	**4,538**	**5,595**	**6,403**	**7,226**	**8,113**	**9,081**	**2.7**
Total World	**9,014**	**10,472**	**10,852**	**12,044**	**13,207**	**14,395**	**15,684**	**17,101**	**1.8**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B11. World Carbon Dioxide Emissions from Natural Gas Use by Region, High Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,207**	**1,477**	**1,483**	**1,685**	**1,829**	**1,937**	**1,995**	**2,113**	**1.4**
United States[a]	1,026	1,197	1,198	1,324	1,425	1,475	1,480	1,537	1.0
Canada	127	183	183	218	233	260	282	305	2.0
Mexico	54	98	102	143	171	202	233	271	3.8
OECD Europe	**590**	**984**	**1,021**	**1,166**	**1,281**	**1,374**	**1,490**	**1,597**	**1.7**
OECD Asia	**152**	**279**	**282**	**336**	**375**	**407**	**433**	**470**	**2.0**
Japan	102	168	163	201	221	237	250	266	1.9
South Korea	6	50	58	65	73	82	90	100	2.1
Australia/New Zealand	44	61	61	70	81	88	93	104	2.1
Total OECD	**1,949**	**2,740**	**2,786**	**3,187**	**3,485**	**3,718**	**3,918**	**4,180**	**1.6**
Non-OECD									
Non-OECD Europe and Eurasia	**1,450**	**1,280**	**1,328**	**1,483**	**1,643**	**1,817**	**1,993**	**2,174**	**1.9**
Russia	928	828	868	961	1,055	1,140	1,230	1,320	1.6
Other	521	452	460	522	588	676	763	854	2.4
Non-OECD Asia	**160**	**428**	**471**	**712**	**922**	**1,149**	**1,413**	**1,722**	**5.1**
China	30	70	83	177	233	296	373	469	6.9
India	24	56	64	105	128	162	207	254	5.5
Other Non-OECD Asia	106	301	325	431	561	691	833	999	4.4
Middle East	**199**	**442**	**476**	**589**	**697**	**811**	**899**	**998**	**2.9**
Africa	**80**	**144**	**148**	**190**	**236**	**281**	**331**	**391**	**3.8**
Central and South America	**116**	**209**	**231**	**296**	**354**	**400**	**451**	**506**	**3.1**
Brazil	6	27	34	47	56	66	78	94	4.0
Other Central and South America	110	181	197	249	298	334	373	412	2.9
Total Non-OECD	**2,005**	**2,502**	**2,655**	**3,271**	**3,853**	**4,458**	**5,088**	**5,791**	**3.0**
Total World	**3,954**	**5,242**	**5,441**	**6,458**	**7,338**	**8,176**	**9,006**	**9,971**	**2.4**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table B12. World Carbon Dioxide Emissions from Coal Use by Region, High Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,923**	**2,258**	**2,258**	**2,489**	**2,679**	**2,955**	**3,396**	**3,786**	**2.0**
United States[a]	1,784	2,093	2,115	2,286	2,466	2,721	3,132	3,501	2.0
Canada	123	128	112	142	144	160	177	197	2.2
Mexico	15	37	30	61	69	74	86	88	4.2
OECD Europe	**1,635**	**1,237**	**1,235**	**1,260**	**1,243**	**1,209**	**1,181**	**1,195**	**-0.1**
OECD Asia	**471**	**782**	**853**	**908**	**947**	**997**	**1,059**	**1,123**	**1.1**
Japan	245	393	434	439	446	447	450	459	0.2
South Korea	88	177	194	207	235	266	295	332	2.1
Australia/New Zealand	137	212	225	262	267	284	315	332	1.5
Total OECD	**4,028**	**4,277**	**4,345**	**4,657**	**4,869**	**5,160**	**5,637**	**6,104**	**1.3**
Non-OECD									
Non-OECD Europe and Eurasia	**1,393**	**801**	**828**	**912**	**1,009**	**1,114**	**1,178**	**1,212**	**1.5**
Russia	624	410	441	480	505	559	604	633	1.4
Other	770	392	387	432	504	554	574	579	1.6
Non-OECD Asia	**2,517**	**4,229**	**4,957**	**6,626**	**7,966**	**9,401**	**10,760**	**12,246**	**3.5**
China	1,886	3,117	3,809	5,215	6,280	7,428	8,544	9,795	3.7
India	394	690	741	858	1,013	1,180	1,351	1,538	2.8
Other Non-OECD Asia	237	422	407	552	673	792	865	913	3.2
Middle East	**14**	**34**	**35**	**44**	**49**	**53**	**56**	**59**	**2.0**
Africa	**271**	**364**	**376**	**485**	**534**	**574**	**633**	**672**	**2.3**
Central and South America	**54**	**76**	**77**	**107**	**126**	**144**	**156**	**180**	**3.3**
Brazil	34	42	43	65	78	89	97	117	4.0
Other Central and South America	20	34	34	42	48	56	59	62	2.4
Total Non-OECD	**4,248**	**5,505**	**6,272**	**8,174**	**9,684**	**11,286**	**12,783**	**14,368**	**3.2**
Total World	**8,277**	**9,782**	**10,617**	**12,831**	**14,553**	**16,446**	**18,419**	**20,472**	**2.6**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Appendix C

Low Economic Growth Case Projections:

- **World Energy Consumption**
- **Gross Domestic Product**
- **Carbon Dioxide Emissions**

Table C1. World Total Energy Consumption by Region, Low Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**100.8**	**118.3**	**120.9**	**128.4**	**132.9**	**137.8**	**142.0**	**146.3**	**0.7**
United States[a]	84.7	98.3	100.7	104.8	108.5	112.2	115.3	118.5	0.6
Canada	11.1	13.5	13.6	15.4	15.5	16.0	16.4	16.9	0.8
Mexico	5.0	6.5	6.6	8.2	8.9	9.7	10.2	10.9	1.9
OECD Europe	**69.9**	**79.5**	**81.1**	**83.2**	**83.5**	**82.5**	**82.4**	**82.4**	**0.1**
OECD Asia	**26.6**	**36.9**	**37.8**	**39.4**	**40.9**	**41.9**	**42.5**	**43.2**	**0.5**
Japan	18.4	22.2	22.6	23.2	23.5	23.6	23.5	23.5	0.1
South Korea	3.8	8.7	9.0	9.5	10.4	11.1	11.5	12.1	1.1
Australia/New Zealand	4.4	6.0	6.2	6.7	7.0	7.2	7.5	7.7	0.9
Total OECD	**197.4**	**234.7**	**239.8**	**251.0**	**257.3**	**262.1**	**266.8**	**271.9**	**0.5**
Non-OECD									
Non-OECD Europe and Eurasia	**67.2**	**47.9**	**49.7**	**53.6**	**56.5**	**59.3**	**61.2**	**61.6**	**0.8**
Russia	39.0	28.8	30.1	32.3	34.0	35.4	36.9	37.4	0.8
Other	28.3	19.2	19.6	21.2	22.4	23.9	24.3	24.2	0.8
Non-OECD Asia	**47.5**	**88.2**	**99.9**	**129.0**	**149.3**	**169.0**	**187.2**	**205.7**	**2.8**
China	27.0	49.7	59.6	81.2	93.6	106.6	118.7	131.6	3.1
India	8.0	14.4	15.4	17.9	21.0	23.8	26.5	28.9	2.4
Other Non-OECD Asia	12.5	24.0	24.9	29.8	34.7	38.6	42.0	45.2	2.3
Middle East	**11.3**	**19.9**	**21.1**	**25.9**	**28.4**	**30.9**	**32.8**	**34.4**	**1.9**
Africa	**9.5**	**13.3**	**13.7**	**16.6**	**18.5**	**20.1**	**21.4**	**22.6**	**1.9**
Central and South America	**14.5**	**21.7**	**22.5**	**27.2**	**30.4**	**32.9**	**35.2**	**37.3**	**2.0**
Brazil	5.8	8.7	9.1	11.0	12.2	13.3	14.3	15.4	2.1
Other Central and South America	8.8	13.0	13.5	16.2	18.1	19.6	20.9	21.9	1.9
Total Non-OECD	**150.0**	**191.0**	**206.9**	**252.3**	**283.1**	**312.2**	**337.8**	**361.7**	**2.2**
Total World	**347.3**	**425.7**	**446.7**	**503.3**	**540.4**	**574.3**	**604.6**	**633.6**	**1.4**

[a]Includes the 50 States and the District of Columbia.

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C2. World Total Energy Consumption by Region and Fuel, Low Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America									
Liquids	40.5	47.2	49.2	49.5	51.1	52.9	54.4	56.0	0.5
Natural Gas	23.2	28.5	28.5	30.8	32.4	33.7	33.9	33.9	0.7
Coal	20.7	24.1	24.1	26.3	27.0	28.0	30.1	32.5	1.1
Nuclear	6.9	8.9	9.3	9.7	9.9	10.4	10.5	10.4	0.4
Other	9.5	9.8	9.9	12.1	12.4	12.7	13.1	13.4	1.2
Total	**100.8**	**118.3**	**120.9**	**128.4**	**132.9**	**137.8**	**142.0**	**146.3**	**0.7**
OECD Europe									
Liquids	28.4	31.9	32.4	31.5	31.2	30.8	30.4	30.0	-0.3
Natural Gas	11.2	18.6	19.3	21.6	22.9	23.7	24.6	25.1	1.0
Coal	17.6	13.2	13.1	13.0	12.3	11.5	10.7	10.3	-0.9
Nuclear	7.9	9.8	9.9	10.2	10.0	9.3	9.3	9.4	-0.2
Other	4.8	5.9	6.3	6.9	7.0	7.2	7.3	7.5	0.7
Total	**69.9**	**79.5**	**81.1**	**83.2**	**83.5**	**82.5**	**82.4**	**82.4**	**0.1**
OECD Asia									
Liquids	14.5	17.7	17.4	17.0	17.2	17.2	17.2	17.2	0.0
Natural Gas	2.9	5.3	5.3	6.2	6.6	6.9	6.9	7.1	1.1
Coal	5.2	8.6	9.3	9.7	9.7	9.7	9.8	9.8	0.2
Nuclear	2.5	3.5	4.0	4.6	5.3	6.0	6.3	6.9	2.1
Other	1.6	1.8	1.7	1.9	2.0	2.0	2.1	2.2	1.0
Total	**26.6**	**36.9**	**37.8**	**39.4**	**40.9**	**41.9**	**42.5**	**43.2**	**0.5**
Total OECD									
Liquids	83.4	96.7	98.9	98.1	99.6	101.0	102.1	103.3	0.2
Natural Gas	37.2	52.4	53.1	58.6	62.0	64.3	65.4	66.1	0.8
Coal	43.5	45.9	46.6	48.9	49.1	49.2	50.6	52.6	0.5
Nuclear	17.3	22.2	23.2	24.5	25.3	25.7	26.1	26.8	0.6
Other	15.9	17.5	17.9	20.9	21.3	21.9	22.6	23.1	1.0
Total	**197.4**	**234.7**	**239.8**	**251.0**	**257.3**	**262.1**	**266.8**	**271.9**	**0.5**
Non-OECD									
Non-OECD Europe and Eurasia									
Liquids	19.5	9.4	9.9	10.3	10.5	10.7	10.8	10.8	0.4
Natural Gas	27.5	24.2	25.1	27.0	28.4	29.6	30.4	31.0	0.8
Coal	15.1	8.7	9.0	9.5	9.9	10.3	10.2	9.8	0.4
Nuclear	2.5	2.9	2.9	3.2	3.7	4.7	5.5	5.5	2.5
Other	2.8	2.8	2.9	3.6	3.9	4.1	4.3	4.4	1.6
Total	**67.2**	**47.9**	**49.7**	**53.6**	**56.5**	**59.3**	**61.2**	**61.6**	**0.8**
Non-OECD Asia									
Liquids	13.9	28.1	30.6	38.0	42.3	46.1	50.3	55.0	2.3
Natural Gas	3.0	8.1	8.9	13.1	16.3	19.4	22.7	26.3	4.2
Coal	27.2	45.8	53.6	69.3	80.0	90.5	99.0	107.6	2.7
Nuclear	0.4	1.0	1.1	1.6	3.0	4.3	5.5	6.2	7.0
Other	3.0	5.2	5.7	7.0	7.7	8.7	9.7	10.6	2.4
Total	**47.5**	**88.2**	**99.9**	**129.0**	**149.3**	**169.0**	**187.2**	**205.7**	**2.8**

See notes at end of table.

Table C2. World Total Energy Consumption by Region and Fuel, Low Economic Growth Case, 1990-2030 (Continued)
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
Non-OECD (Continued)									
Middle East									
Liquids	7.3	11.0	11.6	14.3	15.3	16.2	17.2	18.0	1.7
Natural Gas	3.8	8.4	9.0	10.9	12.4	13.8	14.7	15.5	2.1
Coal	0.1	0.4	0.4	0.5	0.5	0.5	0.5	0.5	1.3
Nuclear	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
Other	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	2.5
Total	**11.3**	**19.9**	**21.1**	**25.9**	**28.4**	**30.9**	**32.8**	**34.4**	**1.9**
Africa									
Liquids	4.3	5.6	5.7	6.8	7.6	8.4	8.7	9.1	1.8
Natural Gas	1.5	2.7	2.8	3.5	4.2	4.7	5.3	5.9	2.9
Coal	3.0	4.0	4.1	5.2	5.5	5.7	6.0	6.1	1.5
Nuclear	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	1.7
Other	0.6	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.2
Total	**9.5**	**13.3**	**13.7**	**16.6**	**18.5**	**20.1**	**21.4**	**22.6**	**1.9**
Central and South America									
Liquids	7.8	11.1	11.5	13.1	14.6	15.7	16.9	17.8	1.7
Natural Gas	2.2	4.0	4.4	5.4	6.2	6.7	7.1	7.5	2.1
Coal	0.6	0.8	0.8	1.1	1.2	1.4	1.4	1.5	2.2
Nuclear	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.4	2.3
Other	3.9	5.6	5.6	7.3	8.0	8.7	9.4	10.3	2.3
Total	**14.5**	**21.7**	**22.5**	**27.2**	**30.4**	**32.9**	**35.2**	**37.3**	**2.0**
Total Non-OECD									
Liquids	52.7	65.2	69.3	82.5	90.2	97.1	103.9	110.7	1.8
Natural Gas	38.0	47.4	50.3	59.9	67.5	74.2	80.2	86.3	2.1
Coal	45.9	59.7	67.9	85.5	97.2	108.3	117.1	125.5	2.4
Nuclear	3.1	4.2	4.3	5.3	7.2	9.6	11.7	12.4	4.2
Other	10.3	14.5	15.3	19.1	21.0	22.9	24.9	26.8	2.2
Total	**150.0**	**191.1**	**206.9**	**252.3**	**283.1**	**312.2**	**337.8**	**361.7**	**2.2**
Total World									
Liquids	136.2	161.9	168.2	180.6	189.8	198.1	206.0	214.0	0.9
Natural Gas	75.2	99.8	103.4	118.5	129.4	138.6	145.6	152.4	1.5
Coal	89.4	105.6	114.5	134.4	146.2	157.5	167.7	178.2	1.7
Nuclear	20.4	26.4	27.5	29.8	32.5	35.3	37.8	39.2	1.4
Other	26.2	32.1	33.2	40.0	42.4	44.8	47.5	49.9	1.6
Total	**347.3**	**425.7**	**446.7**	**503.3**	**540.4**	**574.3**	**604.6**	**633.6**	**1.4**

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C3. World Gross Domestic Product (GDP) by Region Expressed in Purchasing Power Parity, Low Economic Growth Case, 1990-2030
(Billion 2000 Dollars)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**8,477**	**12,250**	**12,725**	**14,767**	**16,506**	**18,762**	**20,865**	**23,155**	**2.3**
United States[a]	7,113	10,301	10,704	12,359	13,777	15,686	17,399	19,249	2.3
Canada	684	973	1,005	1,166	1,285	1,392	1,505	1,626	1.9
Mexico	680	975	1,016	1,242	1,444	1,684	1,961	2,279	3.2
OECD Europe	**8,067**	**10,850**	**11,132**	**12,640**	**13,806**	**15,040**	**16,310**	**17,702**	**1.8**
OECD Asia	**3,621**	**4,630**	**4,761**	**5,444**	**5,879**	**6,203**	**6,494**	**6,815**	**1.4**
Japan	2,862	3,289	3,363	3,539	3,612	3,679	3,736	3,789	0.5
South Korea	331	683	715	945	1,126	1,272	1,415	1,570	3.1
Australia/New Zealand	429	658	682	784	886	1,003	1,131	1,275	2.4
Total OECD	**20,165**	**27,730**	**28,619**	**32,851**	**36,190**	**40,006**	**43,669**	**47,672**	**2.0**
Non-OECD									
Non-OECD Europe and Eurasia	**3,601**	**3,081**	**3,332**	**4,640**	**5,520**	**6,380**	**7,302**	**8,324**	**3.6**
Russia	2,241	1,780	1,907	2,575	3,015	3,439	3,906	4,410	3.3
Other	1,360	1,301	1,425	2,065	2,505	2,941	3,397	3,913	4.0
Non-OECD Asia	**5,995**	**14,573**	**15,841**	**24,236**	**31,582**	**40,297**	**50,186**	**61,987**	**5.4**
China	2,002	7,013	7,722	12,756	17,176	22,458	28,369	35,353	6.0
India	1,703	3,434	3,727	5,544	7,150	9,027	11,227	13,925	5.2
Other Non-OECD Asia	2,291	4,125	4,393	5,936	7,257	8,812	10,589	12,709	4.2
Middle East	**820**	**1,364**	**1,453**	**1,915**	**2,305**	**2,730**	**3,210**	**3,768**	**3.7**
Africa	**1,450**	**2,056**	**2,161**	**2,887**	**3,591**	**4,421**	**5,409**	**6,605**	**4.4**
Central and South America	**2,191**	**3,110**	**3,297**	**4,199**	**4,948**	**5,802**	**6,776**	**7,899**	**3.4**
Brazil	1,022	1,378	1,446	1,744	2,017	2,322	2,665	3,053	2.9
Other Central and South America	1,169	1,733	1,852	2,455	2,932	3,479	4,111	4,846	3.8
Total Non-OECD	**14,057**	**24,184**	**26,085**	**37,876**	**47,947**	**59,629**	**72,882**	**88,582**	**4.8**
Total World	**34,222**	**51,914**	**54,704**	**70,727**	**84,138**	**99,635**	**116,552**	**136,254**	**3.6**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. GDP growth rates for China and India were adjusted, based on the analyst's judgment.

Sources: **History:** Global Insight, Inc., *World Overview* (Lexington, MA, various issues). **Projections:** Global Insight, Inc., *World Overview*, Fourth Quarter 2006 (Lexington, MA, January 2007); and Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington DC, February 2007), Table B4.

Table C4. World Liquids Consumption by Region, Low Economic Growth Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.5**	**24.2**	**25.0**	**25.3**	**26.1**	**27.0**	**27.7**	**28.5**	**0.5**
United States[a]	17.0	20.0	20.7	20.9	21.6	22.3	23.0	23.7	0.5
Canada	1.7	2.2	2.3	2.3	2.3	2.2	2.2	2.2	-0.2
Mexico	1.8	1.9	2.0	2.1	2.3	2.4	2.5	2.7	1.2
OECD Europe	**13.7**	**15.4**	**15.6**	**15.2**	**15.1**	**14.9**	**14.7**	**14.5**	**-0.3**
OECD Asia	**7.1**	**8.7**	**8.5**	**8.4**	**8.5**	**8.5**	**8.4**	**8.4**	**0.0**
Japan	5.2	5.5	5.4	5.1	5.0	4.9	4.9	4.8	-0.4
South Korea	1.0	2.2	2.1	2.2	2.4	2.4	2.4	2.5	0.6
Australia/New Zealand	0.8	1.0	1.0	1.1	1.1	1.1	1.2	1.2	0.5
Total OECD	**41.3**	**48.3**	**49.1**	**48.9**	**49.6**	**50.3**	**50.9**	**51.5**	**0.2**
Non-OECD									
Non-OECD Europe and Eurasia	**9.3**	**4.6**	**4.8**	**5.0**	**5.1**	**5.2**	**5.2**	**5.3**	**0.4**
Russia	5.4	2.7	2.8	2.8	2.9	2.9	2.9	2.9	0.2
Other	3.9	1.9	2.0	2.2	2.2	2.3	2.3	2.3	0.5
Non-OECD Asia	**6.6**	**13.6**	**14.8**	**18.4**	**20.5**	**22.3**	**24.4**	**26.7**	**2.3**
China	2.3	5.6	6.4	9.2	10.1	11.1	12.4	14.0	3.1
India	1.2	2.3	2.5	2.6	3.1	3.4	3.7	3.9	1.8
Other Non-OECD Asia	3.1	5.7	6.0	6.5	7.3	7.8	8.3	8.8	1.5
Middle East	**3.5**	**5.4**	**5.7**	**7.0**	**7.5**	**7.9**	**8.4**	**8.8**	**1.7**
Africa	**2.1**	**2.7**	**2.8**	**3.3**	**3.7**	**4.1**	**4.2**	**4.4**	**1.8**
Central and South America	**3.8**	**5.2**	**5.4**	**6.4**	**7.1**	**7.7**	**8.2**	**8.7**	**1.8**
Brazil	1.5	2.1	2.1	2.5	2.7	2.9	3.1	3.3	1.6
Other Central and South America	2.3	3.2	3.3	3.9	4.4	4.7	5.1	5.4	2.0
Total Non-OECD	**25.3**	**31.5**	**33.4**	**40.1**	**43.9**	**47.2**	**50.5**	**53.8**	**1.8**
Total World	**66.5**	**79.8**	**82.5**	**89.0**	**93.5**	**97.6**	**101.4**	**105.3**	**0.9**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C5. World Natural Gas Consumption by Region, Low Economic Growth Case, 1990-2030
(Trillion Cubic Feet)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**22.5**	**27.4**	**27.6**	**29.8**	**31.3**	**32.6**	**32.7**	**32.8**	**0.7**
United States[a]	19.2	22.3	22.4	23.5	24.5	25.1	24.7	24.2	0.3
Canada	2.4	3.4	3.4	4.0	4.1	4.4	4.6	4.8	1.3
Mexico	0.9	1.7	1.8	2.4	2.8	3.1	3.4	3.8	2.9
OECD Europe	**11.6**	**18.2**	**18.8**	**21.0**	**22.3**	**23.1**	**24.0**	**24.5**	**1.0**
OECD Asia	**2.8**	**5.0**	**5.0**	**5.8**	**6.3**	**6.5**	**6.5**	**6.7**	**1.1**
Japan	1.9	3.0	3.0	3.5	3.7	3.8	3.8	3.8	1.0
South Korea	0.1	0.9	1.0	1.1	1.2	1.2	1.3	1.3	1.1
Australia/New Zealand	0.8	1.1	1.1	1.2	1.4	1.4	1.5	1.6	1.5
Total OECD	**36.8**	**50.5**	**51.4**	**56.7**	**59.9**	**62.2**	**63.2**	**63.9**	**0.8**
Non-OECD									
Non-OECD Europe and Eurasia	**26.7**	**23.6**	**24.4**	**26.3**	**27.6**	**28.8**	**29.6**	**30.2**	**0.8**
Russia	17.3	15.3	16.0	17.2	18.0	18.5	18.9	19.2	0.7
Other	9.5	8.3	8.4	9.1	9.6	10.3	10.7	11.0	1.0
Non-OECD Asia	**2.9**	**7.7**	**8.5**	**12.3**	**15.3**	**18.2**	**21.3**	**24.6**	**4.2**
China	0.5	1.1	1.4	2.8	3.6	4.4	5.3	6.4	6.1
India	0.4	1.0	1.1	1.7	2.0	2.4	3.0	3.4	4.5
Other Non-OECD Asia	2.0	5.6	6.0	7.7	9.6	11.3	13.0	14.8	3.5
Middle East	**3.6**	**8.0**	**8.6**	**10.4**	**11.8**	**13.2**	**14.0**	**14.8**	**2.1**
Africa	**1.4**	**2.5**	**2.6**	**3.3**	**3.9**	**4.4**	**4.9**	**5.5**	**2.9**
Central and South America	**2.0**	**3.7**	**4.1**	**5.1**	**5.8**	**6.2**	**6.6**	**7.0**	**2.1**
Brazil	0.1	0.5	0.6	0.8	0.9	1.0	1.1	1.1	2.4
Other Central and South America	1.9	3.2	3.5	4.2	4.9	5.2	5.6	5.8	2.0
Total Non-OECD	**36.5**	**45.5**	**48.2**	**57.2**	**64.4**	**70.8**	**76.4**	**82.0**	**2.1**
Total World	**73.4**	**96.0**	**99.6**	**113.9**	**124.3**	**133.0**	**139.6**	**145.9**	**1.5**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C6. World Coal Consumption by Region, Low Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.7**	**24.1**	**24.1**	**26.3**	**27.0**	**28.0**	**30.1**	**32.5**	**1.1**
United States[a]	19.2	22.3	22.6	24.1	24.9	25.8	27.7	30.2	1.1
Canada	1.3	1.4	1.2	1.5	1.4	1.5	1.5	1.5	0.9
Mexico	0.2	0.4	0.3	0.6	0.7	0.7	0.8	0.8	3.4
OECD Europe	**17.6**	**13.2**	**13.1**	**13.0**	**12.3**	**11.5**	**10.7**	**10.3**	**-0.9**
OECD Asia	**5.2**	**8.6**	**9.3**	**9.7**	**9.7**	**9.7**	**9.8**	**9.8**	**0.2**
Japan	2.7	4.3	4.8	4.7	4.6	4.4	4.3	4.2	-0.5
South Korea	0.9	1.9	2.1	2.2	2.3	2.5	2.6	2.6	0.8
Australia/New Zealand	1.5	2.3	2.4	2.8	2.7	2.8	3.0	3.0	0.8
Total OECD	**43.5**	**45.9**	**46.6**	**48.9**	**49.1**	**49.2**	**50.6**	**52.6**	**0.5**
Non-OECD									
Non-OECD Europe and Eurasia	**15.1**	**8.7**	**9.0**	**9.5**	**9.9**	**10.3**	**10.2**	**9.8**	**0.4**
Russia	6.8	4.5	4.8	5.1	5.1	5.4	5.5	5.4	0.5
Other	8.3	4.2	4.2	4.4	4.8	4.9	4.7	4.4	0.2
Non-OECD Asia	**27.2**	**45.8**	**53.6**	**69.3**	**80.0**	**90.5**	**99.0**	**107.6**	**2.7**
China	20.3	33.7	41.1	54.4	62.9	71.3	78.4	85.9	2.9
India	4.3	7.5	8.1	9.1	10.4	11.6	12.6	13.7	2.0
Other Non-OECD Asia	2.6	4.6	4.3	5.7	6.7	7.6	7.9	8.0	2.4
Middle East	**0.1**	**0.4**	**0.4**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**1.3**
Africa	**3.0**	**4.0**	**4.1**	**5.2**	**5.5**	**5.7**	**6.0**	**6.1**	**1.5**
Central and South America	**0.6**	**0.8**	**0.8**	**1.1**	**1.2**	**1.4**	**1.4**	**1.5**	**2.2**
Brazil	0.4	0.5	0.5	0.7	0.8	0.8	0.8	0.9	2.7
Other Central and South America	0.2	0.4	0.4	0.4	0.5	0.5	0.5	0.6	1.6
Total Non-OECD	**45.9**	**59.7**	**67.9**	**85.5**	**97.2**	**108.3**	**117.1**	**125.5**	**2.4**
Total World	**89.4**	**105.6**	**114.5**	**134.4**	**146.2**	**157.5**	**167.7**	**178.2**	**1.7**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C7. World Nuclear Energy Consumption by Region, Low Economic Growth Case, 1990-2030
(Billion Kilowatthours)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**649**	**845**	**883**	**910**	**933**	**982**	**990**	**982**	**0.4**
United States[a]	577	764	789	789	809	855	861	845	0.3
Canada	69	71	86	110	113	116	118	126	1.5
Mexico	3	10	9	11	11	11	11	11	0.9
OECD Europe	**743**	**931**	**941**	**914**	**902**	**835**	**831**	**847**	**-0.4**
OECD Asia	**242**	**351**	**396**	**433**	**497**	**559**	**592**	**646**	**1.9**
Japan	192	228	272	299	325	352	370	394	1.4
South Korea	50	123	124	134	172	207	222	252	2.8
Australia/New Zealand	0	0	0	0	0	0	0	0	—
Total OECD	**1,635**	**2,128**	**2,220**	**2,257**	**2,332**	**2,376**	**2,413**	**2,475**	**0.4**
Non-OECD									
Non-OECD Europe and Eurasia	**219**	**260**	**263**	**278**	**323**	**405**	**479**	**476**	**2.3**
Russia	115	141	137	149	190	236	299	315	3.2
Other	104	119	125	129	133	169	180	161	1.0
Non-OECD Asia	**38**	**97**	**103**	**148**	**265**	**389**	**495**	**557**	**6.7**
China	0	42	48	64	135	217	283	329	7.7
India	6	16	15	37	66	97	124	144	9.1
Other Non-OECD Asia	32	39	40	47	64	75	88	84	2.9
Middle East	**0**	**0**	**0**	**5**	**6**	**6**	**6**	**6**	**—**
Africa	**8**	**13**	**14**	**14**	**15**	**15**	**21**	**21**	**1.5**
Central and South America	**9**	**20**	**19**	**20**	**28**	**34**	**33**	**33**	**2.2**
Brazil	2	13	12	13	18	22	22	22	2.5
Other Central and South America	7	7	7	7	10	12	11	11	1.6
Total Non-OECD	**274**	**390**	**399**	**465**	**637**	**849**	**1,034**	**1,093**	**4.0**
Total World	**1,909**	**2,518**	**2,619**	**2,722**	**2,969**	**3,225**	**3,447**	**3,568**	**1.2**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C8. World Consumption of Hydroelectricity and Other Renewable Energy by Region, Low Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**9.5**	**9.8**	**9.9**	**12.1**	**12.4**	**12.7**	**13.1**	**13.4**	**1.2**
United States[a]	6.1	6.0	6.0	7.5	7.7	7.9	8.0	8.1	1.1
Canada	3.1	3.5	3.5	4.0	4.0	4.2	4.4	4.7	1.2
Mexico	0.3	0.4	0.4	0.6	0.6	0.7	0.7	0.7	2.1
OECD Europe	**4.8**	**5.9**	**6.3**	**6.9**	**7.0**	**7.2**	**7.3**	**7.5**	**0.7**
OECD Asia	**1.6**	**1.8**	**1.7**	**1.9**	**2.0**	**2.0**	**2.1**	**2.2**	**1.0**
Japan	1.1	1.2	1.1	1.2	1.3	1.3	1.3	1.4	0.8
South Korea	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.0
Australia/New Zealand	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	1.1
Total OECD	**15.9**	**17.5**	**17.9**	**20.9**	**21.3**	**21.9**	**22.6**	**23.1**	**1.0**
Non-OECD									
Non-OECD Europe and Eurasia	**2.8**	**2.8**	**2.9**	**3.6**	**3.9**	**4.1**	**4.3**	**4.4**	**1.6**
Russia	1.8	1.6	1.7	2.1	2.4	2.4	2.6	2.6	1.7
Other	1.0	1.2	1.2	1.4	1.6	1.7	1.7	1.8	1.5
Non-OECD Asia	**3.0**	**5.2**	**5.7**	**7.0**	**7.7**	**8.7**	**9.7**	**10.6**	**2.4**
China	1.3	2.9	3.3	3.9	4.5	5.1	5.6	6.1	2.4
India	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.6	2.3
Other Non-OECD Asia	0.9	1.5	1.5	2.1	2.1	2.4	2.6	2.8	2.5
Middle East	**0.1**	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**2.5**
Africa	**0.6**	**0.9**	**0.9**	**1.0**	**1.1**	**1.1**	**1.2**	**1.2**	**1.2**
Central and South America	**3.9**	**5.6**	**5.6**	**7.3**	**8.0**	**8.7**	**9.4**	**10.3**	**2.3**
Brazil	2.2	3.0	3.1	4.2	4.7	5.2	5.7	6.4	2.8
Other Central and South America	1.7	2.5	2.5	3.1	3.3	3.5	3.7	3.9	1.7
Total Non-OECD	**10.3**	**14.5**	**15.3**	**19.1**	**21.0**	**22.9**	**24.9**	**26.8**	**2.2**
Total World	**26.2**	**32.1**	**33.2**	**40.0**	**42.4**	**44.8**	**47.5**	**49.9**	**1.6**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. U.S. totals include net electricity imports, methanol, and liquid hydrogen.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C9. World Carbon Dioxide Emissions by Region, Low Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**5,763**	**6,775**	**6,893**	**7,237**	**7,513**	**7,798**	**8,103**	**8,446**	**0.8**
United States[a]	4,989	5,800	5,923	6,125	6,363	6,583	6,842	7,141	0.7
Canada	474	589	584	639	638	657	668	676	0.6
Mexico	300	385	385	473	513	558	593	629	1.9
OECD Europe	**4,092**	**4,321**	**4,381**	**4,434**	**4,419**	**4,355**	**4,307**	**4,269**	**-0.1**
OECD Asia	**1,543**	**2,129**	**2,183**	**2,237**	**2,274**	**2,290**	**2,302**	**2,309**	**0.2**
Japan	1,015	1,244	1,262	1,257	1,249	1,228	1,204	1,183	-0.2
South Korea	238	475	497	514	549	570	584	601	0.7
Australia/New Zealand	291	410	424	466	476	492	514	525	0.8
Total OECD	**11,399**	**13,225**	**13,457**	**13,907**	**14,206**	**14,443**	**14,712**	**15,023**	**0.4**
Non-OECD									
Non-OECD Europe and Eurasia	**4,193**	**2,717**	**2,819**	**2,993**	**3,119**	**3,232**	**3,272**	**3,275**	**0.6**
Russia	2,334	1,602	1,685	1,777	1,832	1,890	1,926	1,937	0.5
Other	1,859	1,115	1,134	1,216	1,287	1,342	1,346	1,338	0.6
Non-OECD Asia	**3,627**	**6,479**	**7,411**	**9,564**	**11,004**	**12,381**	**13,616**	**14,899**	**2.7**
China	2,241	3,898	4,707	6,400	7,340	8,305	9,185	10,143	3.0
India	578	1,040	1,111	1,264	1,457	1,625	1,789	1,936	2.2
Other Non-OECD Asia	807	1,542	1,593	1,899	2,207	2,450	2,642	2,820	2.2
Middle East	**705**	**1,211**	**1,289**	**1,578**	**1,725**	**1,867**	**1,979**	**2,080**	**1.9**
Africa	**649**	**895**	**919**	**1,123**	**1,248**	**1,346**	**1,427**	**1,495**	**1.9**
Central and South America	**673**	**981**	**1,027**	**1,213**	**1,358**	**1,465**	**1,562**	**1,647**	**1.8**
Brazil	220	317	334	396	435	465	491	523	1.7
Other Central and South America	453	664	693	818	923	1,000	1,071	1,125	1.9
Total Non-OECD	**9,847**	**12,283**	**13,465**	**16,472**	**18,454**	**20,291**	**21,856**	**23,396**	**2.1**
Total World	**21,246**	**25,508**	**26,922**	**30,379**	**32,660**	**34,734**	**36,568**	**38,419**	**1.4**

[a]Includes the 50 States and the District of Columbia.

Note: The U.S. numbers include carbon dioxide emissions attributable to renewable energy sources.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C10. World Carbon Dioxide Emissions from Liquids Use by Region, Low Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**2,633**	**3,029**	**3,140**	**3,143**	**3,261**	**3,384**	**3,487**	**3,600**	**0.5**
United States[a]	2,178	2,500	2,598	2,578	2,686	2,787	2,884	2,983	0.5
Canada	224	279	290	289	285	282	279	276	-0.2
Mexico	231	250	253	276	291	315	325	341	1.2
OECD Europe	**1,867**	**2,099**	**2,125**	**2,072**	**2,049**	**2,024**	**1,999**	**1,972**	**-0.3**
OECD Asia	**921**	**1,068**	**1,048**	**1,026**	**1,038**	**1,037**	**1,036**	**1,035**	**0.0**
Japan	667	683	665	633	623	613	603	594	-0.4
South Korea	144	248	245	251	268	273	277	283	0.6
Australia/New Zealand	110	137	138	142	147	152	156	158	0.5
Total OECD	**5,420**	**6,196**	**6,314**	**6,240**	**6,348**	**6,445**	**6,523**	**6,607**	**0.2**
Non-OECD									
Non-OECD Europe and Eurasia	**1,350**	**636**	**663**	**692**	**705**	**720**	**726**	**728**	**0.4**
Russia	782	364	376	384	391	395	399	398	0.2
Other	568	271	287	308	314	326	327	330	0.5
Non-OECD Asia	**950**	**1,822**	**1,983**	**2,452**	**2,726**	**2,970**	**3,241**	**3,539**	**2.3**
China	325	711	816	1,179	1,283	1,421	1,583	1,781	3.1
India	160	293	306	328	388	422	459	486	1.8
Other Non-OECD Asia	464	818	861	945	1,056	1,128	1,198	1,272	1.5
Middle East	**493**	**735**	**778**	**963**	**1,026**	**1,089**	**1,156**	**1,211**	**1.7**
Africa	**298**	**387**	**395**	**467**	**528**	**579**	**602**	**628**	**1.8**
Central and South America	**503**	**696**	**720**	**824**	**915**	**988**	**1,060**	**1,116**	**1.7**
Brazil	180	248	258	288	314	336	356	374	1.4
Other Central and South America	323	449	462	535	601	652	703	741	1.8
Total Non-OECD	**3,594**	**4,276**	**4,538**	**5,398**	**5,899**	**6,347**	**6,784**	**7,222**	**1.8**
Total World	**9,014**	**10,472**	**10,852**	**11,638**	**12,248**	**12,792**	**13,307**	**13,829**	**0.9**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C11. World Carbon Dioxide Emissions from Natural Gas Use by Region, Low Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,207**	**1,477**	**1,483**	**1,620**	**1,704**	**1,775**	**1,781**	**1,785**	**0.7**
United States[a]	1,026	1,197	1,198	1,269	1,325	1,359	1,337	1,311	0.3
Canada	127	183	183	214	221	237	248	258	1.3
Mexico	54	98	102	138	158	178	196	216	2.9
OECD Europe	**590**	**984**	**1,021**	**1,140**	**1,211**	**1,251**	**1,299**	**1,326**	**1.0**
OECD Asia	**152**	**279**	**282**	**327**	**351**	**364**	**367**	**375**	**1.1**
Japan	102	168	163	196	206	211	210	209	1.0
South Korea	6	50	58	63	68	72	74	77	1.1
Australia/New Zealand	44	61	61	69	77	81	82	88	1.5
Total OECD	**1,949**	**2,740**	**2,786**	**3,088**	**3,266**	**3,389**	**3,447**	**3,486**	**0.9**
Non-OECD									
Non-OECD Europe and Eurasia	**1,450**	**1,280**	**1,328**	**1,427**	**1,500**	**1,563**	**1,606**	**1,638**	**0.8**
Russia	928	828	868	929	974	1,003	1,024	1,040	0.7
Other	521	452	460	498	526	561	581	598	1.0
Non-OECD Asia	**160**	**428**	**471**	**691**	**860**	**1,024**	**1,200**	**1,389**	**4.2**
China	30	70	83	172	220	269	325	391	6.1
India	24	56	64	101	119	143	173	201	4.5
Other Non-OECD Asia	106	301	325	418	521	612	702	798	3.5
Middle East	**199**	**442**	**476**	**573**	**653**	**730**	**774**	**820**	**2.1**
Africa	**80**	**144**	**148**	**184**	**219**	**250**	**280**	**312**	**2.9**
Central and South America	**116**	**209**	**231**	**287**	**328**	**352**	**375**	**395**	**2.1**
Brazil	6	27	34	45	50	54	58	63	2.4
Other Central and South America	110	181	197	242	277	298	317	332	2.0
Total Non-OECD	**2,005**	**2,502**	**2,655**	**3,163**	**3,561**	**3,920**	**4,235**	**4,554**	**2.1**
Total World	**3,954**	**5,242**	**5,441**	**6,250**	**6,827**	**7,309**	**7,682**	**8,040**	**1.5**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table C12. World Carbon Dioxide Emissions from Coal Use by Region, Low Economic Growth Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,923**	**2,258**	**2,258**	**2,461**	**2,535**	**2,626**	**2,821**	**3,048**	**1.2**
United States[a]	1,784	2,093	2,115	2,265	2,340	2,423	2,607	2,834	1.1
Canada	123	128	112	137	132	138	141	142	0.9
Mexico	15	37	30	59	64	65	73	71	3.4
OECD Europe	**1,635**	**1,237**	**1,235**	**1,222**	**1,158**	**1,080**	**1,008**	**970**	**-0.9**
OECD Asia	**471**	**782**	**853**	**883**	**885**	**889**	**899**	**899**	**0.2**
Japan	245	393	434	428	419	404	390	379	-0.5
South Korea	88	177	194	199	213	225	233	241	0.8
Australia/New Zealand	137	212	225	256	253	259	276	279	0.8
Total OECD	**4,028**	**4,277**	**4,345**	**4,566**	**4,579**	**4,595**	**4,728**	**4,917**	**0.5**
Non-OECD									
Non-OECD Europe and Eurasia	**1,393**	**801**	**828**	**874**	**914**	**948**	**940**	**909**	**0.4**
Russia	624	410	441	464	467	492	503	499	0.5
Other	770	392	387	410	447	456	437	410	0.2
Non-OECD Asia	**2,517**	**4,229**	**4,957**	**6,421**	**7,417**	**8,386**	**9,175**	**9,971**	**2.7**
China	1,886	3,117	3,809	5,049	5,837	6,615	7,276	7,971	2.9
India	394	690	741	835	950	1,060	1,157	1,250	2.0
Other Non-OECD Asia	237	422	407	537	629	710	742	751	2.4
Middle East	**14**	**34**	**35**	**43**	**46**	**48**	**48**	**49**	**1.3**
Africa	**271**	**364**	**376**	**472**	**501**	**518**	**546**	**554**	**1.5**
Central and South America	**54**	**76**	**77**	**103**	**115**	**125**	**127**	**137**	**2.2**
Brazil	34	42	43	63	71	75	77	86	2.7
Other Central and South America	20	34	34	40	45	50	50	51	1.6
Total Non-OECD	**4,248**	**5,505**	**6,272**	**7,912**	**8,993**	**10,025**	**10,837**	**11,620**	**2.4**
Total World	**8,277**	**9,782**	**10,617**	**12,478**	**13,572**	**14,620**	**15,565**	**16,536**	**1.7**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LM2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Appendix D

High World Oil Price Case Projections:

- **World Energy Consumption**
- **Gross Domestic Product**
- **Carbon Dioxide Emissions**

Table D1. World Total Primary Energy Consumption by Region, High World Oil Price Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**100.8**	**118.3**	**120.9**	**129.3**	**134.8**	**142.7**	**149.9**	**157.6**	**1.0**
United States[a]	84.7	98.3	100.7	105.5	109.9	115.8	121.6	127.7	0.9
Canada	11.1	13.5	13.6	15.6	16.0	17.0	17.6	18.3	1.1
Mexico	5.0	6.5	6.6	8.2	8.9	10.0	10.7	11.6	2.2
OECD Europe	**69.9**	**79.5**	**81.1**	**83.6**	**84.1**	**85.3**	**86.2**	**86.9**	**0.3**
OECD Asia	**26.6**	**36.9**	**37.8**	**39.4**	**40.5**	**42.4**	**43.8**	**45.3**	**0.7**
Japan	18.4	22.2	22.6	23.2	23.2	23.7	24.0	24.3	0.3
South Korea	3.8	8.7	9.0	9.4	10.2	11.2	11.9	12.8	1.4
Australia/New Zealand	4.4	6.0	6.2	6.8	7.1	7.6	8.0	8.2	1.1
Total OECD	**197.4**	**234.7**	**239.8**	**252.3**	**259.4**	**270.4**	**279.9**	**289.8**	**0.7**
Non-OECD									
Non-OECD Europe and Eurasia	**67.2**	**47.9**	**49.7**	**55.2**	**60.7**	**67.0**	**70.3**	**72.1**	**1.4**
Russia	39.0	28.8	30.1	33.2	36.3	39.4	41.3	42.2	1.3
Other	28.3	19.2	19.6	22.0	24.4	27.6	29.0	29.9	1.6
Non-OECD Asia	**47.5**	**88.2**	**99.9**	**129.4**	**149.6**	**174.2**	**197.0**	**219.7**	**3.1**
China	27.0	49.7	59.6	81.6	94.0	110.1	125.1	140.8	3.4
India	8.0	14.4	15.4	17.9	20.8	24.3	27.7	30.8	2.7
Other Non-OECD Asia	12.5	24.0	24.9	29.9	34.8	39.9	44.2	48.2	2.6
Middle East	**11.3**	**19.9**	**21.1**	**26.6**	**29.9**	**32.9**	**34.9**	**36.9**	**2.2**
Africa	**9.5**	**13.3**	**13.7**	**16.7**	**18.5**	**20.6**	**22.4**	**23.9**	**2.2**
Central and South America	**14.5**	**21.7**	**22.5**	**27.3**	**30.5**	**33.8**	**36.7**	**39.5**	**2.2**
Brazil	5.8	8.7	9.1	11.0	12.2	13.5	14.7	16.2	2.3
Other Central and South America	8.8	13.0	13.5	16.3	18.3	20.4	22.0	23.2	2.1
Total Non-OECD	**150.0**	**191.0**	**206.9**	**255.2**	**289.1**	**328.5**	**361.3**	**392.1**	**2.5**
Total World	**347.3**	**425.7**	**446.7**	**507.4**	**548.5**	**598.9**	**641.3**	**681.9**	**1.6**

[a]Includes the 50 States and the District of Columbia.

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D2. World Total Energy Consumption by Region and Fuel, High World Oil Price Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America									
Liquids	40.5	47.2	49.2	49.8	50.4	52.0	54.1	56.6	0.5
Natural Gas	23.2	28.5	28.5	30.7	32.3	33.8	34.2	34.8	0.8
Coal	20.7	24.1	24.1	26.7	29.1	32.2	35.7	39.4	1.9
Nuclear	6.9	8.9	9.3	9.7	10.0	10.9	11.6	11.9	1.0
Other	9.5	9.8	9.9	12.4	13.0	13.8	14.3	14.8	1.6
Total	**100.8**	**118.3**	**120.9**	**129.3**	**134.8**	**142.7**	**149.9**	**157.6**	**1.0**
OECD Europe									
Liquids	28.4	31.9	32.4	30.6	28.5	27.9	28.2	28.3	-0.5
Natural Gas	11.2	18.6	19.3	21.9	23.4	25.6	26.3	26.7	1.3
Coal	17.6	13.2	13.1	13.9	14.7	14.5	14.2	14.3	0.3
Nuclear	7.9	9.8	9.9	10.2	10.0	9.3	9.3	9.4	-0.2
Other	4.8	5.9	6.3	7.1	7.5	8.0	8.1	8.2	1.0
Total	**69.9**	**79.5**	**81.1**	**83.6**	**84.1**	**85.3**	**86.2**	**86.9**	**0.3**
OECD Asia									
Liquids	14.5	17.7	17.4	16.6	15.8	15.7	16.2	16.5	-0.2
Natural Gas	2.9	5.3	5.3	6.1	6.3	6.9	7.0	7.2	1.2
Coal	5.2	8.6	9.3	10.2	11.0	11.5	11.9	12.2	1.0
Nuclear	2.5	3.5	4.0	4.6	5.3	6.0	6.3	6.9	2.1
Other	1.6	1.8	1.7	1.9	2.1	2.3	2.3	2.4	1.3
Total	**26.6**	**36.9**	**37.8**	**39.4**	**40.5**	**42.4**	**43.8**	**45.3**	**0.7**
Total OECD									
Liquids	83.4	96.7	98.9	96.9	94.7	95.6	98.6	101.4	0.1
Natural Gas	37.2	52.4	53.1	58.7	62.0	66.4	67.6	68.8	1.0
Coal	43.5	45.9	46.6	50.8	54.8	58.3	61.8	66.0	1.3
Nuclear	17.3	22.2	23.2	24.5	25.3	26.2	27.2	28.3	0.8
Other	15.9	17.5	17.9	21.4	22.6	24.0	24.7	25.4	1.4
Total	**197.4**	**234.7**	**239.8**	**252.3**	**259.4**	**270.4**	**279.9**	**289.8**	**0.7**
Non-OECD									
Non-OECD Europe and Eurasia									
Liquids	19.5	9.4	9.9	10.2	10.1	10.3	10.9	11.3	0.5
Natural Gas	27.5	24.2	25.1	27.8	30.2	33.6	34.6	35.7	1.4
Coal	15.1	8.7	9.0	10.4	12.5	13.9	14.4	14.6	1.9
Nuclear	2.5	2.9	2.9	3.2	3.7	4.7	5.5	5.5	2.5
Other	2.8	2.8	2.9	3.7	4.2	4.6	4.8	5.0	2.1
Total	**67.2**	**47.9**	**49.7**	**55.2**	**60.7**	**67.0**	**70.3**	**72.1**	**1.4**
Non-OECD Asia									
Liquids	13.9	28.1	30.6	37.0	39.0	42.4	47.8	53.4	2.2
Natural Gas	3.0	8.1	8.9	13.1	16.4	20.9	24.4	28.1	4.5
Coal	27.2	45.8	53.6	70.5	83.0	97.0	108.7	120.4	3.2
Nuclear	0.4	1.0	1.1	1.6	3.0	4.3	5.5	6.2	7.0
Other	3.0	5.2	5.7	7.1	8.2	9.7	10.7	11.6	2.8
Total	**47.5**	**88.2**	**99.9**	**129.4**	**149.6**	**174.2**	**197.0**	**219.7**	**3.1**

See notes at end of table.

Table D2. World Total Energy Consumption by Region and Fuel, High World Oil Price Case, 1990-2030 (Continued)
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
Non-OECD (Continued)									
Middle East									
Liquids	7.3	11.0	11.6	14.4	15.0	15.4	16.8	18.1	1.7
Natural Gas	3.8	8.4	9.0	11.4	13.8	16.3	16.8	17.6	2.6
Coal	0.1	0.4	0.4	0.6	0.8	0.9	0.9	0.9	3.2
Nuclear	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
Other	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	2.8
Total	**11.3**	**19.9**	**21.1**	**26.6**	**29.9**	**32.9**	**34.9**	**36.9**	**2.2**
Africa									
Liquids	4.3	5.6	5.7	6.5	6.9	7.5	8.1	8.6	1.6
Natural Gas	1.5	2.7	2.8	3.5	4.0	4.8	5.5	6.1	3.0
Coal	3.0	4.0	4.1	5.5	6.3	6.8	7.3	7.6	2.4
Nuclear	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	1.7
Other	0.6	0.9	0.9	1.1	1.2	1.3	1.3	1.4	1.6
Total	**9.5**	**13.3**	**13.7**	**16.7**	**18.5**	**20.6**	**22.4**	**23.9**	**2.2**
Central and South America									
Liquids	7.8	11.1	11.5	12.8	13.4	14.4	16.0	17.2	1.6
Natural Gas	2.2	4.0	4.4	5.6	6.8	7.7	8.3	8.7	2.7
Coal	0.6	0.8	0.8	1.2	1.4	1.5	1.6	1.8	3.1
Nuclear	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.4	2.3
Other	3.9	5.6	5.6	7.5	8.6	9.7	10.5	11.3	2.7
Total	**14.5**	**21.7**	**22.5**	**27.3**	**30.5**	**33.8**	**36.7**	**39.5**	**2.2**
Total Non-OECD									
Liquids	52.7	65.2	69.3	80.9	84.4	90.1	99.6	108.7	1.7
Natural Gas	38.0	47.4	50.3	61.4	71.2	83.3	89.5	96.2	2.5
Coal	45.9	59.7	67.9	88.0	103.9	119.9	132.9	145.3	3.0
Nuclear	3.1	4.2	4.3	5.3	7.2	9.6	11.7	12.4	4.2
Other	10.3	14.5	15.3	19.6	22.4	25.5	27.6	29.5	2.6
Total	**150.0**	**191.1**	**206.9**	**255.2**	**289.1**	**328.5**	**361.3**	**392.1**	**2.5**
Total World									
Liquids	136.2	161.9	168.2	177.8	179.1	185.7	198.2	210.1	0.9
Natural Gas	75.2	99.8	103.4	120.1	133.2	149.6	157.1	165.0	1.8
Coal	89.4	105.6	114.5	138.8	158.7	178.2	194.7	211.3	2.4
Nuclear	20.4	26.4	27.5	29.8	32.6	35.8	38.9	40.7	1.5
Other	26.2	32.1	33.2	41.0	45.0	49.5	52.3	54.9	2.0
Total	**347.3**	**425.7**	**446.7**	**507.4**	**548.5**	**598.9**	**641.3**	**681.9**	**1.6**

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D3. World Gross Domestic Product (GDP) by Region Expressed in Purchasing Power Parity, High World Oil Price Case, 1990-2030
(Billion 2000 Dollars)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**8,477**	**12,250**	**12,725**	**15,160**	**17,372**	**20,309**	**23,458**	**26,862**	**2.9**
United States[a]	7,113	10,301	10,704	12,707	14,544	17,024	19,658	22,476	2.9
Canada	684	973	1,005	1,190	1,339	1,490	1,651	1,829	2.3
Mexico	680	975	1,016	1,262	1,489	1,795	2,149	2,557	3.6
OECD Europe	**8,067**	**10,850**	**11,132**	**12,832**	**14,251**	**16,049**	**17,894**	**19,894**	**2.3**
OECD Asia	**3,621**	**4,630**	**4,761**	**5,528**	**6,040**	**6,611**	**7,126**	**7,659**	**1.8**
Japan	2,862	3,289	3,363	3,774	3,977	4,190	4,337	4,467	1.1
South Korea	331	683	715	958	1,151	1,352	1,550	1,761	3.5
Australia/New Zealand	429	658	682	796	912	1,069	1,240	1,431	2.9
Total OECD	**20,165**	**27,730**	**28,619**	**33,520**	**37,663**	**42,969**	**48,478**	**54,415**	**2.5**
Non-OECD									
Non-OECD Europe and Eurasia	**3,601**	**3,081**	**3,332**	**4,762**	**5,866**	**7,037**	**8,356**	**9,880**	**4.3**
Russia	2,241	1,780	1,907	2,626	3,156	3,682	4,282	4,955	3.7
Other	1,360	1,301	1,425	2,136	2,709	3,354	4,074	4,925	4.9
Non-OECD Asia	**5,995**	**14,573**	**15,841**	**24,585**	**32,501**	**42,873**	**54,878**	**69,385**	**5.8**
China	2,002	7,013	7,722	12,928	17,638	23,872	31,004	39,547	6.5
India	1,703	3,434	3,727	5,629	7,339	9,599	12,279	15,587	5.7
Other Non-OECD Asia	2,291	4,125	4,393	6,028	7,523	9,402	11,595	14,251	4.6
Middle East	**820**	**1,364**	**1,453**	**1,989**	**2,483**	**2,947**	**3,521**	**4,240**	**4.2**
Africa	**1,450**	**2,056**	**2,161**	**2,927**	**3,699**	**4,708**	**5,920**	**7,400**	**4.8**
Central and South America	**2,191**	**3,110**	**3,297**	**4,262**	**5,103**	**6,183**	**7,423**	**8,860**	**3.9**
Brazil	1,022	1,378	1,446	1,774	2,092	2,480	2,921	3,427	3.4
Other Central and South America	1,169	1,733	1,852	2,488	3,011	3,703	4,502	5,433	4.2
Total Non-OECD	**14,057**	**24,184**	**26,085**	**38,524**	**49,652**	**63,749**	**80,098**	**99,766**	**5.3**
Total World	**34,222**	**51,914**	**54,704**	**72,044**	**87,315**	**106,718**	**128,575**	**154,181**	**4.1**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Global Insight, Inc., Global Scenario Model (February 2007). **Projections:** Global Insight, Inc., *World Overview*, Fourth Quarter 2006 (Lexington, MA, January 2007); and Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington DC, February 2007), Table B4.

Table D4. World Liquids Consumption by Region, High World Oil Price Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.5**	**24.2**	**25.0**	**25.4**	**25.8**	**26.5**	**27.6**	**28.7**	**0.5**
United States[a]	17.0	20.0	20.7	21.1	21.6	22.3	23.2	24.1	0.6
Canada	1.7	2.2	2.3	2.2	2.1	2.0	2.1	2.1	-0.4
Mexico	1.8	1.9	2.0	2.1	2.1	2.2	2.4	2.5	1.0
OECD Europe	**13.7**	**15.4**	**15.6**	**14.8**	**13.8**	**13.5**	**13.6**	**13.7**	**-0.5**
OECD Asia	**7.1**	**8.7**	**8.5**	**8.1**	**7.7**	**7.7**	**8.0**	**8.1**	**-0.2**
Japan	5.2	5.5	5.4	5.0	4.6	4.5	4.6	4.6	-0.6
South Korea	1.0	2.2	2.1	2.1	2.2	2.2	2.3	2.4	0.5
Australia/New Zealand	0.8	1.0	1.0	1.0	1.0	1.0	1.1	1.1	0.3
Total OECD	**41.3**	**48.3**	**49.1**	**48.3**	**47.3**	**47.7**	**49.2**	**50.5**	**0.1**
Non-OECD									
Non-OECD Europe and Eurasia	**9.3**	**4.6**	**4.8**	**4.9**	**4.9**	**5.0**	**5.3**	**5.5**	**0.5**
Russia	5.4	2.7	2.8	2.8	2.7	2.7	2.9	2.9	0.2
Other	3.9	1.9	2.0	2.2	2.2	2.3	2.4	2.6	0.9
Non-OECD Asia	**6.6**	**13.6**	**14.8**	**18.0**	**18.9**	**20.5**	**23.2**	**25.9**	**2.2**
China	2.3	5.6	6.4	9.0	9.3	10.3	11.8	13.6	2.9
India	1.2	2.3	2.5	2.6	2.9	3.1	3.5	3.8	1.7
Other Non-OECD Asia	3.1	5.7	6.0	6.4	6.7	7.1	7.8	8.5	1.4
Middle East	**3.5**	**5.4**	**5.7**	**7.0**	**7.3**	**7.5**	**8.2**	**8.9**	**1.7**
Africa	**2.1**	**2.7**	**2.8**	**3.2**	**3.4**	**3.7**	**3.9**	**4.2**	**1.6**
Central and South America	**3.8**	**5.2**	**5.4**	**6.2**	**6.6**	**7.0**	**7.8**	**8.4**	**1.7**
Brazil	1.5	2.1	2.1	2.5	2.5	2.7	3.0	3.2	1.5
Other Central and South America	2.3	3.2	3.3	3.8	4.0	4.3	4.9	5.2	1.8
Total Non-OECD	**25.3**	**31.5**	**33.4**	**39.3**	**41.0**	**43.8**	**48.4**	**52.9**	**1.8**
Total World	**66.5**	**79.8**	**82.5**	**87.7**	**88.3**	**91.6**	**97.6**	**103.3**	**0.9**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D5. World Natural Gas Consumption by Region, High World Oil Price Case, 1990-2030
(Trillion Cubic Feet)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**22.5**	**27.4**	**27.6**	**29.8**	**31.2**	**32.9**	**33.3**	**33.8**	**0.8**
United States[a]	19.2	22.3	22.4	23.1	23.7	24.2	24.1	24.1	0.3
Canada	2.4	3.4	3.4	4.1	4.6	5.2	5.4	5.5	1.9
Mexico	0.9	1.7	1.8	2.5	2.9	3.5	3.8	4.2	3.3
OECD Europe	**11.6**	**18.2**	**18.8**	**21.3**	**22.8**	**25.0**	**25.6**	**26.0**	**1.3**
OECD Asia	**2.8**	**5.0**	**5.0**	**5.7**	**6.0**	**6.5**	**6.6**	**6.8**	**1.2**
Japan	1.9	3.0	3.0	3.4	3.5	3.7	3.7	3.8	1.0
South Korea	0.1	0.9	1.0	1.1	1.1	1.3	1.3	1.4	1.3
Australia/New Zealand	0.8	1.1	1.1	1.2	1.4	1.5	1.5	1.6	1.5
Total OECD	**36.8**	**50.5**	**51.4**	**56.8**	**59.9**	**64.3**	**65.5**	**66.6**	**1.0**
Non-OECD									
Non-OECD Europe and Eurasia	**26.7**	**23.6**	**24.4**	**27.0**	**29.3**	**32.6**	**33.7**	**34.7**	**1.4**
Russia	17.3	15.3	16.0	17.6	19.0	20.7	21.0	21.4	1.1
Other	9.5	8.3	8.4	9.4	10.3	11.9	12.6	13.4	1.8
Non-OECD Asia	**2.9**	**7.7**	**8.5**	**12.3**	**15.4**	**19.5**	**22.7**	**26.2**	**4.4**
China	0.5	1.1	1.4	2.9	4.0	5.3	6.2	7.3	6.7
India	0.4	1.0	1.1	1.7	1.8	2.3	2.8	3.3	4.4
Other Non-OECD Asia	2.0	5.6	6.0	7.7	9.6	11.9	13.7	15.6	3.7
Middle East	**3.6**	**8.0**	**8.6**	**10.9**	**13.2**	**15.5**	**16.0**	**16.8**	**2.6**
Africa	**1.4**	**2.5**	**2.6**	**3.2**	**3.8**	**4.5**	**5.1**	**5.7**	**3.0**
Central and South America	**2.0**	**3.7**	**4.1**	**5.2**	**6.3**	**7.2**	**7.7**	**8.2**	**2.7**
Brazil	0.1	0.5	0.6	0.8	0.9	1.0	1.2	1.3	3.1
Other Central and South America	1.9	3.2	3.5	4.4	5.4	6.2	6.5	6.8	2.6
Total Non-OECD	**36.5**	**45.5**	**48.2**	**58.6**	**67.9**	**79.4**	**85.2**	**91.5**	**2.5**
Total World	**73.4**	**96.0**	**99.6**	**115.4**	**127.8**	**143.7**	**150.8**	**158.1**	**1.8**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D6. World Coal Consumption by Region, High World Oil Price Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.7**	**24.1**	**24.1**	**26.7**	**29.1**	**32.2**	**35.7**	**39.4**	**1.9**
United States[a]	19.2	22.3	22.6	24.4	26.6	29.6	32.8	36.4	1.8
Canada	1.3	1.4	1.2	1.5	1.5	1.6	1.8	1.9	1.8
Mexico	0.2	0.4	0.3	0.7	0.9	1.0	1.1	1.1	4.9
OECD Europe	**17.6**	**13.2**	**13.1**	**13.9**	**14.7**	**14.5**	**14.2**	**14.3**	**0.3**
OECD Asia	**5.2**	**8.6**	**9.3**	**10.2**	**11.0**	**11.5**	**11.9**	**12.2**	**1.0**
Japan	2.7	4.3	4.8	5.0	5.4	5.4	5.3	5.3	0.4
South Korea	0.9	1.9	2.1	2.3	2.6	2.9	3.1	3.3	1.8
Australia/New Zealand	1.5	2.3	2.4	2.9	3.0	3.2	3.5	3.6	1.5
Total OECD	**43.5**	**45.9**	**46.6**	**50.8**	**54.8**	**58.3**	**61.8**	**66.0**	**1.3**
Non-OECD									
Non-OECD Europe and Eurasia	**15.1**	**8.7**	**9.0**	**10.4**	**12.5**	**13.9**	**14.4**	**14.6**	**1.9**
Russia	6.8	4.5	4.8	5.5	6.5	7.2	7.6	7.7	1.9
Other	8.3	4.2	4.2	4.8	6.1	6.7	6.8	6.8	1.9
Non-OECD Asia	**27.2**	**45.8**	**53.6**	**70.5**	**83.0**	**97.0**	**108.7**	**120.4**	**3.2**
China	20.3	33.7	41.1	55.0	64.1	74.9	84.5	94.3	3.2
India	4.3	7.5	8.1	9.4	11.0	12.7	14.3	15.8	2.6
Other Non-OECD Asia	2.6	4.6	4.3	6.1	7.9	9.3	10.0	10.3	3.4
Middle East	**0.1**	**0.4**	**0.4**	**0.6**	**0.8**	**0.9**	**0.9**	**0.9**	**3.2**
Africa	**3.0**	**4.0**	**4.1**	**5.5**	**6.3**	**6.8**	**7.3**	**7.6**	**2.4**
Central and South America	**0.6**	**0.8**	**0.8**	**1.2**	**1.4**	**1.5**	**1.6**	**1.8**	**3.1**
Brazil	0.4	0.5	0.5	0.7	0.8	0.8	0.9	1.1	3.3
Other Central and South America	0.2	0.4	0.4	0.5	0.6	0.7	0.7	0.8	2.8
Total Non-OECD	**45.9**	**59.7**	**67.9**	**88.0**	**103.9**	**119.9**	**132.9**	**145.3**	**3.0**
Total World	**89.4**	**105.6**	**114.5**	**138.8**	**158.7**	**178.2**	**194.7**	**211.3**	**2.4**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D7. World Nuclear Energy Consumption by Region, High World Oil Price Case, 1990-2030
(Billion Kilowatthours)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**649**	**845**	**883**	**910**	**938**	**1,028**	**1,095**	**1,127**	**0.9**
United States[a]	577	764	789	789	814	901	966	990	0.9
Canada	69	71	86	110	113	116	118	126	1.5
Mexico	3	10	9	11	11	11	11	11	0.9
OECD Europe	**743**	**931**	**941**	**914**	**902**	**835**	**831**	**847**	**-0.4**
OECD Asia	**242**	**351**	**396**	**433**	**497**	**559**	**592**	**646**	**1.9**
Japan	192	228	272	299	325	352	370	394	1.4
South Korea	50	123	124	134	172	207	222	252	2.8
Australia/New Zealand	0	0	0	0	0	0	0	0	—
Total OECD	**1,635**	**2,128**	**2,220**	**2,257**	**2,337**	**2,422**	**2,518**	**2,620**	**0.6**
Non-OECD									
Non-OECD Europe and Eurasia	**219**	**260**	**263**	**278**	**323**	**405**	**479**	**476**	**2.3**
Russia	115	141	137	149	190	236	299	315	3.2
Other	104	119	125	129	133	169	180	161	1.0
Non-OECD Asia	**38**	**97**	**103**	**148**	**265**	**389**	**495**	**557**	**6.7**
China	0	42	48	64	135	217	283	329	7.7
India	6	16	15	37	66	97	124	144	9.1
Other Non-OECD Asia	32	39	40	47	64	75	88	84	2.9
Middle East	**0**	**0**	**0**	**5**	**6**	**6**	**6**	**6**	**—**
Africa	**8**	**13**	**14**	**14**	**15**	**15**	**21**	**21**	**1.5**
Central and South America	**9**	**20**	**19**	**20**	**28**	**34**	**33**	**33**	**2.2**
Brazil	2	13	12	13	18	22	22	22	2.5
Other Central and South America	7	7	7	7	10	12	11	11	1.6
Total Non-OECD	**274**	**390**	**399**	**465**	**637**	**849**	**1,034**	**1,093**	**4.0**
Total World	**1,909**	**2,518**	**2,619**	**2,722**	**2,974**	**3,271**	**3,552**	**3,713**	**1.4**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D8. World Consumption of Hydroelectricity and Other Renewable Energy by Region, High Economic Growth Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**9.5**	**9.8**	**9.9**	**12.4**	**13.0**	**13.8**	**14.3**	**14.8**	**1.6**
United States[a]	6.1	6.0	6.0	7.6	8.1	8.4	8.6	8.9	1.5
Canada	3.1	3.5	3.5	4.1	4.3	4.6	4.9	5.1	1.5
Mexico	0.3	0.4	0.4	0.6	0.7	0.7	0.7	0.8	2.4
OECD Europe	**4.8**	**5.9**	**6.3**	**7.1**	**7.5**	**8.0**	**8.1**	**8.2**	**1.0**
OECD Asia	**1.6**	**1.8**	**1.7**	**1.9**	**2.1**	**2.3**	**2.3**	**2.4**	**1.3**
Japan	1.1	1.2	1.1	1.3	1.3	1.4	1.5	1.5	1.1
South Korea	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.3
Australia/New Zealand	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	1.4
Total OECD	**15.9**	**17.5**	**17.9**	**21.4**	**22.6**	**24.0**	**24.7**	**25.4**	**1.4**
Non-OECD									
Non-OECD Europe and Eurasia	**2.8**	**2.8**	**2.9**	**3.7**	**4.2**	**4.6**	**4.8**	**5.0**	**2.1**
Russia	1.8	1.6	1.7	2.2	2.5	2.6	2.8	2.9	2.1
Other	1.0	1.2	1.2	1.5	1.7	2.0	2.0	2.1	2.1
Non-OECD Asia	**3.0**	**5.2**	**5.7**	**7.1**	**8.2**	**9.7**	**10.7**	**11.6**	**2.8**
China	1.3	2.9	3.3	4.0	4.8	5.6	6.2	6.7	2.8
India	0.7	0.8	0.9	1.0	1.2	1.5	1.6	1.8	2.6
Other Non-OECD Asia	0.9	1.5	1.5	2.1	2.3	2.6	2.9	3.1	2.8
Middle East	**0.1**	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**2.8**
Africa	**0.6**	**0.9**	**0.9**	**1.1**	**1.2**	**1.3**	**1.3**	**1.4**	**1.6**
Central and South America	**3.9**	**5.6**	**5.6**	**7.5**	**8.6**	**9.7**	**10.5**	**11.3**	**2.7**
Brazil	2.2	3.0	3.1	4.3	5.1	5.8	6.4	7.0	3.2
Other Central and South America	1.7	2.5	2.5	3.2	3.5	3.9	4.1	4.3	2.1
Total Non-OECD	**10.3**	**14.5**	**15.3**	**19.6**	**22.4**	**25.5**	**27.6**	**29.5**	**2.6**
Total World	**26.2**	**32.1**	**33.2**	**41.0**	**45.0**	**49.5**	**52.3**	**54.9**	**2.0**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. U.S. totals include net electricity imports, methanol, and liquid hydrogen.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D9. World Carbon Dioxide Emissions by Region, High World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**5,763**	**6,775**	**6,893**	**7,278**	**7,626**	**8,091**	**8,575**	**9,108**	**1.1**
United States[a]	4,989	5,800	5,923	6,156	6,456	6,830	7,239	7,701	1.0
Canada	474	589	584	646	651	683	710	735	0.9
Mexico	300	385	385	477	519	577	626	672	2.2
OECD Europe	**4,092**	**4,321**	**4,381**	**4,468**	**4,491**	**4,550**	**4,584**	**4,610**	**0.2**
OECD Asia	**1,543**	**2,129**	**2,183**	**2,248**	**2,287**	**2,366**	**2,436**	**2,493**	**0.5**
Japan	1,015	1,244	1,262	1,260	1,249	1,255	1,258	1,258	0.0
South Korea	238	475	497	516	548	592	627	664	1.1
Australia/New Zealand	291	410	424	472	490	519	550	571	1.2
Total OECD	**11,399**	**13,225**	**13,457**	**13,994**	**14,404**	**15,007**	**15,594**	**16,210**	**0.7**
Non-OECD									
Non-OECD Europe and Eurasia	**4,193**	**2,717**	**2,819**	**3,110**	**3,426**	**3,746**	**3,890**	**3,994**	**1.3**
Russia	2,334	1,602	1,685	1,840	1,996	2,152	2,221	2,264	1.1
Other	1,859	1,115	1,134	1,270	1,430	1,594	1,669	1,729	1.6
Non-OECD Asia	**3,627**	**6,479**	**7,411**	**9,613**	**11,077**	**12,822**	**14,443**	**16,083**	**3.0**
China	2,241	3,898	4,707	6,432	7,376	8,588	9,727	10,924	3.3
India	578	1,040	1,111	1,274	1,467	1,683	1,905	2,110	2.5
Other Non-OECD Asia	807	1,542	1,593	1,907	2,234	2,551	2,811	3,049	2.5
Middle East	**705**	**1,211**	**1,289**	**1,617**	**1,807**	**1,973**	**2,095**	**2,224**	**2.1**
Africa	**649**	**895**	**919**	**1,131**	**1,260**	**1,393**	**1,512**	**1,611**	**2.2**
Central and South America	**673**	**981**	**1,027**	**1,206**	**1,326**	**1,453**	**1,591**	**1,712**	**2.0**
Brazil	220	317	334	389	411	438	483	534	1.8
Other Central and South America	453	664	693	817	915	1,015	1,108	1,177	2.1
Total Non-OECD	**9,847**	**12,283**	**13,465**	**16,676**	**18,894**	**21,387**	**23,531**	**25,623**	**2.5**
Total World	**21,246**	**25,508**	**26,922**	**30,670**	**33,299**	**36,395**	**39,125**	**41,833**	**1.7**

[a]Includes the 50 States and the District of Columbia.

Note: The U.S. numbers include carbon dioxide emissions attributable to renewable energy sources.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D10. World Carbon Dioxide Emissions from Liquids Use by Region, High World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**2,633**	**3,029**	**3,140**	**3,145**	**3,188**	**3,290**	**3,425**	**3,577**	**0.5**
United States[a]	2,178	2,500	2,598	2,597	2,661	2,750	2,862	2,989	0.5
Canada	224	279	290	280	261	255	259	260	-0.4
Mexico	231	250	253	269	266	285	304	327	1.0
OECD Europe	**1,867**	**2,099**	**2,125**	**2,007**	**1,873**	**1,831**	**1,855**	**1,857**	**-0.5**
OECD Asia	**921**	**1,068**	**1,048**	**997**	**951**	**948**	**976**	**993**	**-0.2**
Japan	667	683	665	615	571	558	566	567	-0.6
South Korea	144	248	245	245	245	251	265	277	0.5
Australia/New Zealand	110	137	138	137	134	138	145	149	0.3
Total OECD	**5,420**	**6,196**	**6,314**	**6,150**	**6,011**	**6,069**	**6,255**	**6,426**	**0.1**
Non-OECD									
Non-OECD Europe and Eurasia	**1,350**	**636**	**663**	**684**	**677**	**694**	**732**	**762**	**0.5**
Russia	782	364	376	378	373	372	388	397	0.2
Other	568	271	287	306	305	322	344	365	0.9
Non-OECD Asia	**950**	**1,822**	**1,983**	**2,390**	**2,514**	**2,731**	**3,078**	**3,436**	**2.1**
China	325	711	816	1,151	1,184	1,313	1,508	1,731	2.9
India	160	293	306	319	356	388	436	472	1.7
Other Non-OECD Asia	464	818	861	920	975	1,030	1,133	1,233	1.4
Middle East	**493**	**735**	**778**	**963**	**1,008**	**1,036**	**1,129**	**1,217**	**1.7**
Africa	**298**	**387**	**395**	**451**	**478**	**521**	**559**	**596**	**1.6**
Central and South America	**503**	**696**	**720**	**802**	**844**	**906**	**1,006**	**1,082**	**1.6**
Brazil	180	248	258	281	290	308	337	362	1.3
Other Central and South America	323	449	462	522	554	598	669	720	1.7
Total Non-OECD	**3,594**	**4,276**	**4,538**	**5,291**	**5,521**	**5,889**	**6,504**	**7,093**	**1.7**
Total World	**9,014**	**10,472**	**10,852**	**11,440**	**11,533**	**11,958**	**12,759**	**13,520**	**0.8**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D11. World Carbon Dioxide Emissions from Natural Gas Use by Region, High World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,207**	**1,477**	**1,483**	**1,616**	**1,698**	**1,770**	**1,793**	**1,821**	**0.8**
United States[a]	1,026	1,197	1,198	1,251	1,282	1,289	1,286	1,284	0.3
Canada	127	183	183	224	249	282	289	296	1.9
Mexico	54	98	102	142	167	199	218	241	3.3
OECD Europe	**590**	**984**	**1,021**	**1,154**	**1,233**	**1,353**	**1,390**	**1,412**	**1.3**
OECD Asia	**152**	**279**	**282**	**322**	**335**	**365**	**371**	**382**	**1.2**
Japan	102	168	163	191	191	203	207	210	1.0
South Korea	6	50	58	63	67	76	79	82	1.3
Australia/New Zealand	44	61	61	69	76	85	86	90	1.5
Total OECD	**1,949**	**2,740**	**2,786**	**3,092**	**3,266**	**3,489**	**3,555**	**3,615**	**1.0**
Non-OECD									
Non-OECD Europe and Eurasia	**1,450**	**1,280**	**1,328**	**1,468**	**1,592**	**1,772**	**1,829**	**1,886**	**1.4**
Russia	928	828	868	954	1,030	1,121	1,139	1,157	1.1
Other	521	452	460	514	562	651	690	729	1.8
Non-OECD Asia	**160**	**428**	**471**	**691**	**868**	**1,101**	**1,286**	**1,483**	**4.5**
China	30	70	83	178	246	325	381	445	6.7
India	24	56	64	97	104	133	165	194	4.4
Other Non-OECD Asia	106	301	325	415	518	644	740	844	3.7
Middle East	**199**	**442**	**476**	**603**	**728**	**858**	**888**	**927**	**2.6**
Africa	**80**	**144**	**148**	**182**	**213**	**255**	**288**	**322**	**3.0**
Central and South America	**116**	**209**	**231**	**297**	**357**	**409**	**436**	**461**	**2.7**
Brazil	6	27	34	45	51	57	64	74	3.1
Other Central and South America	110	181	197	251	305	352	372	388	2.6
Total Non-OECD	**2,005**	**2,502**	**2,655**	**3,241**	**3,757**	**4,396**	**4,727**	**5,080**	**2.5**
Total World	**3,954**	**5,242**	**5,441**	**6,333**	**7,022**	**7,885**	**8,281**	**8,694**	**1.8**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table D12. World Carbon Dioxide Emissions from Coal Use by Region, High World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,923**	**2,258**	**2,258**	**2,503**	**2,726**	**3,016**	**3,344**	**3,696**	**1.9**
United States[a]	1,784	2,093	2,115	2,295	2,499	2,778	3,077	3,414	1.9
Canada	123	128	112	142	142	146	162	178	1.8
Mexico	15	37	30	67	86	93	104	103	4.9
OECD Europe	**1,635**	**1,237**	**1,235**	**1,307**	**1,385**	**1,366**	**1,338**	**1,341**	**0.3**
OECD Asia	**471**	**782**	**853**	**928**	**1,002**	**1,054**	**1,089**	**1,119**	**1.0**
Japan	245	393	434	454	487	493	485	481	0.4
South Korea	88	177	194	208	236	265	284	305	1.8
Australia/New Zealand	137	212	225	266	280	296	319	332	1.5
Total OECD	**4,028**	**4,277**	**4,345**	**4,739**	**5,113**	**5,436**	**5,770**	**6,155**	**1.3**
Non-OECD									
Non-OECD Europe and Eurasia	**1,393**	**801**	**828**	**957**	**1,156**	**1,280**	**1,329**	**1,346**	**1.9**
Russia	624	410	441	507	593	659	694	711	1.9
Other	770	392	387	450	563	621	635	635	1.9
Non-OECD Asia	**2,517**	**4,229**	**4,957**	**6,532**	**7,695**	**8,990**	**10,079**	**11,163**	**3.2**
China	1,886	3,117	3,809	5,103	5,946	6,951	7,837	8,748	3.2
India	394	690	741	857	1,007	1,162	1,304	1,444	2.6
Other Non-OECD Asia	237	422	407	572	742	877	938	972	3.4
Middle East	**14**	**34**	**35**	**51**	**71**	**78**	**78**	**79**	**3.2**
Africa	**271**	**364**	**376**	**498**	**569**	**616**	**665**	**693**	**2.4**
Central and South America	**54**	**76**	**77**	**107**	**125**	**138**	**149**	**168**	**3.1**
Brazil	34	42	43	63	70	73	82	99	3.3
Other Central and South America	20	34	34	44	55	65	67	69	2.8
Total Non-OECD	**4,248**	**5,505**	**6,272**	**8,145**	**9,617**	**11,102**	**12,301**	**13,450**	**3.0**
Total World	**8,277**	**9,782**	**10,617**	**12,884**	**14,730**	**16,538**	**18,071**	**19,605**	**2.4**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run HP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Appendix E

Low World Oil Price Case Projections:

- **World Energy Consumption**
- **Gross Domestic Product**
- **Carbon Dioxide Emissions**

Table E1. World Total Energy Consumption by Region, Low World Oil Price Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**100.8**	**118.3**	**120.9**	**130.8**	**139.2**	**146.7**	**154.1**	**162.8**	**1.2**
United States[a]	84.7	98.3	100.7	106.9	113.6	119.3	125.0	131.7	1.0
Canada	11.1	13.5	13.6	15.5	16.0	16.9	17.6	18.4	1.2
Mexico	5.0	6.5	6.6	8.4	9.5	10.6	11.5	12.6	2.5
OECD Europe	**69.9**	**79.5**	**81.1**	**84.8**	**88.0**	**88.3**	**89.8**	**91.9**	**0.5**
OECD Asia	**26.6**	**36.9**	**37.8**	**40.4**	**43.5**	**45.5**	**47.3**	**49.5**	**1.0**
Japan	18.4	22.2	22.6	23.8	25.0	25.6	26.1	26.8	0.6
South Korea	3.8	8.7	9.0	9.8	11.3	12.3	13.1	14.2	1.8
Australia/New Zealand	4.4	6.0	6.2	6.8	7.2	7.7	8.1	8.5	1.3
Total OECD	**197.4**	**234.7**	**239.8**	**256.1**	**270.6**	**280.6**	**291.3**	**304.2**	**0.9**
Non-OECD									
Non-OECD Europe and Eurasia	**67.2**	**47.9**	**49.7**	**54.7**	**59.9**	**64.5**	**67.9**	**70.6**	**1.4**
Russia	39.0	28.8	30.1	32.8	35.5	37.5	39.4	40.8	1.2
Other	28.3	19.2	19.6	21.9	24.3	27.0	28.5	29.8	1.6
Non-OECD Asia	**47.5**	**88.2**	**99.9**	**132.5**	**159.4**	**184.5**	**209.1**	**235.9**	**3.4**
China	27.0	49.7	59.6	83.4	99.8	116.1	132.1	150.3	3.6
India	8.0	14.4	15.4	18.3	22.3	25.9	29.7	33.2	3.0
Other Non-OECD Asia	12.5	24.0	24.9	30.7	37.2	42.5	47.3	52.3	2.9
Middle East	**11.3**	**19.9**	**21.1**	**26.2**	**30.0**	**33.4**	**36.4**	**39.3**	**2.4**
Africa	**9.5**	**13.3**	**13.7**	**17.1**	**19.8**	**22.0**	**24.1**	**26.1**	**2.5**
Central and South America	**14.5**	**21.7**	**22.5**	**28.0**	**32.6**	**36.1**	**39.8**	**43.5**	**2.6**
Brazil	5.8	8.7	9.1	11.3	13.2	14.7	16.3	18.2	2.7
Other Central and South America	8.8	13.0	13.5	16.7	19.4	21.4	23.4	25.4	2.5
Total Non-OECD	**150.0**	**191.0**	**206.9**	**258.5**	**301.7**	**340.6**	**377.3**	**415.5**	**2.7**
Total World	**347.3**	**425.7**	**446.7**	**514.6**	**572.3**	**621.2**	**668.5**	**719.6**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E2. World Total Energy Consumption by Region and Fuel, Low World Oil Price Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America									
Liquids	40.5	47.2	49.2	51.4	55.9	59.8	63.6	68.4	1.3
Natural Gas	23.2	28.5	28.5	31.8	34.6	37.0	38.8	40.0	1.3
Coal	20.7	24.1	24.1	25.9	26.4	27.3	28.6	30.8	0.9
Nuclear	6.9	8.9	9.3	9.7	9.9	10.0	10.0	9.9	0.3
Other	9.5	9.8	9.9	12.1	12.3	12.7	13.1	13.6	1.2
Total	**100.8**	**118.3**	**120.9**	**130.8**	**139.2**	**146.7**	**154.1**	**162.8**	**1.1**
OECD Europe									
Liquids	28.4	31.9	32.4	33.1	34.9	35.8	37.1	38.0	0.6
Natural Gas	11.2	18.6	19.3	22.1	24.9	25.6	26.4	27.6	1.4
Coal	17.6	13.2	13.1	12.5	10.9	10.3	9.6	9.3	-1.3
Nuclear	7.9	9.8	9.9	10.2	10.0	9.3	9.3	9.4	-0.2
Other	4.8	5.9	6.3	6.9	7.2	7.4	7.4	7.6	0.7
Total	**69.9**	**79.5**	**81.1**	**84.8**	**88.0**	**88.3**	**89.8**	**91.9**	**0.5**
OECD Asia									
Liquids	14.5	17.7	17.4	17.9	19.4	20.1	21.2	22.0	0.9
Natural Gas	2.9	5.3	5.3	6.5	7.6	7.9	8.1	8.5	1.8
Coal	5.2	8.6	9.3	9.5	9.2	9.4	9.6	9.8	0.2
Nuclear	2.5	3.5	4.0	4.6	5.3	6.0	6.3	6.9	2.1
Other	1.6	1.8	1.7	1.9	2.0	2.1	2.1	2.2	1.0
Total	**26.6**	**36.9**	**37.8**	**40.4**	**43.5**	**45.5**	**47.3**	**49.5**	**1.0**
Total OECD									
Liquids	83.4	96.7	98.9	102.3	110.2	115.7	121.9	128.4	1.0
Natural Gas	37.2	52.4	53.1	60.4	67.1	70.4	73.3	76.1	1.4
Coal	43.5	45.9	46.6	48.0	46.5	47.0	47.8	49.9	0.3
Nuclear	17.3	22.2	23.2	24.5	25.3	25.3	25.6	26.3	0.5
Other	15.9	17.5	17.9	20.9	21.6	22.1	22.7	23.5	1.1
Total	**197.4**	**234.7**	**239.8**	**256.1**	**270.6**	**280.6**	**291.3**	**304.2**	**0.9**
Non-OECD									
Non-OECD Europe and Eurasia									
Liquids	19.5	9.4	9.9	10.9	11.9	12.9	13.9	14.7	1.6
Natural Gas	27.5	24.2	25.1	27.8	31.1	33.0	34.2	36.1	1.4
Coal	15.1	8.7	9.0	9.2	9.0	9.7	9.7	9.6	0.2
Nuclear	2.5	2.9	2.9	3.2	3.7	4.7	5.5	5.5	2.5
Other	2.8	2.8	2.9	3.6	4.1	4.3	4.5	4.7	1.8
Total	**67.2**	**47.9**	**49.7**	**54.7**	**59.9**	**64.5**	**67.9**	**70.6**	**1.4**
Non-OECD Asia									
Liquids	13.9	28.1	30.6	39.9	47.6	54.1	62.5	71.2	3.3
Natural Gas	3.0	8.1	8.9	13.7	18.3	21.8	25.4	30.0	4.8
Coal	27.2	45.8	53.6	70.2	82.5	95.2	105.9	117.6	3.1
Nuclear	0.4	1.0	1.1	1.6	3.0	4.3	5.5	6.2	7.0
Other	3.0	5.2	5.7	7.1	8.0	9.0	9.8	10.8	2.5
Total	**47.5**	**88.2**	**99.9**	**132.5**	**159.4**	**184.5**	**209.1**	**235.9**	**3.4**

See notes at end of table.

Table E2. World Total Energy Consumption by Region and Fuel, Low World Oil Price Case, 1990-2030 (Continued)
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
Non-OECD (Continued)									
Middle East									
Liquids	7.3	11.0	11.6	14.7	16.3	18.3	20.6	22.5	2.6
Natural Gas	3.8	8.4	9.0	10.9	13.0	14.5	15.0	16.1	2.2
Coal	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2
Nuclear	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
Other	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	2.6
Total	**11.3**	**19.9**	**21.1**	**26.2**	**30.0**	**33.4**	**36.4**	**39.3**	**2.4**
Africa									
Liquids	4.3	5.6	5.7	7.1	8.6	9.9	10.8	11.8	2.8
Natural Gas	1.5	2.7	2.8	3.7	4.8	5.4	6.1	7.0	3.6
Coal	3.0	4.0	4.1	5.1	5.2	5.4	5.7	5.8	1.3
Nuclear	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	1.7
Other	0.6	0.9	0.9	1.1	1.1	1.2	1.2	1.3	1.3
Total	**9.5**	**13.3**	**13.7**	**17.1**	**19.8**	**22.0**	**24.1**	**26.1**	**2.5**
Central and South America									
Liquids	7.8	11.1	11.5	13.8	16.4	18.5	20.9	23.0	2.7
Natural Gas	2.2	4.0	4.4	5.5	6.4	7.0	7.5	8.1	2.4
Coal	0.6	0.8	0.8	1.1	1.2	1.4	1.5	1.6	2.6
Nuclear	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.4	2.3
Other	3.9	5.6	5.6	7.4	8.2	8.9	9.5	10.4	2.4
Total	**14.5**	**21.7**	**22.5**	**28.0**	**32.6**	**36.1**	**39.8**	**43.5**	**2.6**
Total Non-OECD									
Liquids	52.7	65.2	69.3	86.4	100.9	113.6	128.8	143.2	2.8
Natural Gas	38.0	47.4	50.3	61.6	73.6	81.7	88.2	97.4	2.6
Coal	45.9	59.7	67.9	86.0	98.3	112.1	123.2	135.0	2.7
Nuclear	3.1	4.2	4.3	5.3	7.2	9.6	11.7	12.4	4.2
Other	10.3	14.5	15.3	19.3	21.6	23.6	25.3	27.5	2.3
Total	**150.0**	**191.1**	**206.9**	**258.5**	**301.7**	**340.6**	**377.3**	**415.5**	**2.7**
Total World									
Liquids	136.2	161.9	168.2	188.7	211.0	229.4	250.7	271.6	1.9
Natural Gas	75.2	99.8	103.4	122.0	140.7	152.1	161.5	173.5	2.0
Coal	89.4	105.6	114.5	133.9	144.8	159.1	171.0	184.9	1.9
Nuclear	20.4	26.4	27.5	29.8	32.5	34.9	37.3	38.7	1.3
Other	26.2	32.1	33.2	40.2	43.2	45.7	48.0	51.0	1.7
Total	**347.3**	**425.7**	**446.7**	**514.6**	**572.3**	**621.2**	**668.5**	**719.6**	**1.9**

Notes: Energy totals include net imports of coal coke and electricity generated from biomass in the United States. Totals may not equal sum of components due to independent rounding. The electricity portion of the national fuel consumption values consists of generation for domestic use plus an adjustment for electricity trade based on a fuel's share of total generation in the exporting country.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E3. World Gross Domestic Product (GDP) by Region Expressed in Purchasing Power Parity, Low World Oil Price Case, 1990-2030
(Billion 2000 Dollars)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**8,477**	**12,250**	**12,725**	**15,308**	**17,648**	**20,429**	**23,506**	**26,927**	**2.9**
United States[a]	7,113	10,301	10,704	12,850	14,786	17,129	19,700	22,532	2.9
Canada	684	973	1,005	1,189	1,344	1,492	1,652	1,830	2.3
Mexico	680	975	1,016	1,269	1,518	1,808	2,154	2,565	3.6
OECD Europe	**8,067**	**10,850**	**11,132**	**12,929**	**14,510**	**16,155**	**17,932**	**19,945**	**2.3**
OECD Asia	**3,621**	**4,630**	**4,761**	**5,567**	**6,188**	**6,670**	**7,145**	**7,685**	**1.9**
Japan	2,862	3,289	3,363	3,798	4,069	4,225	4,348	4,481	1.1
South Korea	331	683	715	967	1,187	1,367	1,555	1,768	3.5
Australia/New Zealand	429	658	682	802	932	1,077	1,243	1,435	2.9
Total OECD	**20,165**	**27,730**	**28,619**	**33,804**	**38,346**	**43,253**	**48,583**	**54,557**	**2.5**
Non-OECD									
Non-OECD Europe and Eurasia	**3,601**	**3,081**	**3,332**	**4,774**	**5,884**	**7,046**	**8,360**	**9,885**	**4.3**
Russia	2,241	1,780	1,907	2,623	3,145	3,677	4,280	4,952	3.7
Other	1,360	1,301	1,425	2,150	2,740	3,368	4,080	4,933	4.9
Non-OECD Asia	**5,995**	**14,573**	**15,841**	**24,770**	**33,173**	**43,200**	**55,017**	**69,597**	**5.9**
China	2,002	7,013	7,722	13,041	18,051	24,076	31,092	39,681	6.5
India	1,703	3,434	3,727	5,663	7,516	9,682	12,313	15,640	5.7
Other Non-OECD Asia	2,291	4,125	4,393	6,066	7,606	9,441	11,612	14,275	4.6
Middle East	**820**	**1,364**	**1,453**	**1,927**	**2,372**	**2,898**	**3,502**	**4,212**	**4.2**
Africa	**1,450**	**2,056**	**2,161**	**2,953**	**3,776**	**4,744**	**5,935**	**7,423**	**4.9**
Central and South America	**2,191**	**3,110**	**3,297**	**4,294**	**5,200**	**6,227**	**7,440**	**8,885**	**3.9**
Brazil	1,022	1,378	1,446	1,782	2,113	2,489	2,925	3,432	3.4
Other Central and South America	1,169	1,733	1,852	2,513	3,087	3,737	4,515	5,453	4.2
Total Non-OECD	**14,057**	**24,184**	**26,085**	**38,717**	**50,405**	**64,114**	**80,254**	**100,002**	**5.3**
Total World	**34,222**	**51,914**	**54,704**	**72,521**	**88,751**	**107,367**	**128,837**	**154,559**	**4.1**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Global Insight, Inc., *World Overview* (Lexington, MA, various issues). **Projections:** Global Insight, Inc., Global Scenario Model (February 2007); and Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington DC, February 2007), Table B4.

Table E4. World Liquids Consumption by Region, Low World Oil Price Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.5**	**24.2**	**25.0**	**26.2**	**28.5**	**30.5**	**32.4**	**34.8**	**1.3**
United States[a]	17.0	20.0	20.7	21.6	23.4	25.0	26.6	28.6	1.3
Canada	1.7	2.2	2.3	2.4	2.5	2.6	2.7	2.8	0.7
Mexico	1.8	1.9	2.0	2.3	2.5	2.9	3.1	3.4	2.1
OECD Europe	**13.7**	**15.4**	**15.6**	**16.0**	**16.9**	**17.3**	**17.9**	**18.4**	**0.6**
OECD Asia	**7.1**	**8.7**	**8.5**	**8.8**	**9.5**	**9.9**	**10.4**	**10.8**	**0.9**
Japan	5.2	5.5	5.4	5.3	5.6	5.7	5.9	6.0	0.5
South Korea	1.0	2.2	2.1	2.3	2.7	2.8	3.0	3.3	1.6
Australia/New Zealand	0.8	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.4
Total OECD	**41.3**	**48.3**	**49.1**	**51.0**	**54.8**	**57.6**	**60.7**	**64.0**	**1.0**
Non-OECD									
Non-OECD Europe and Eurasia	**9.3**	**4.6**	**4.8**	**5.3**	**5.8**	**6.3**	**6.8**	**7.2**	**1.6**
Russia	5.4	2.7	2.8	3.0	3.2	3.4	3.6	3.8	1.2
Other	3.9	1.9	2.0	2.3	2.6	2.9	3.1	3.4	2.0
Non-OECD Asia	**6.6**	**13.6**	**14.8**	**19.3**	**23.1**	**26.2**	**30.3**	**34.5**	**3.3**
China	2.3	5.6	6.4	9.7	11.4	13.1	15.5	18.1	4.1
India	1.2	2.3	2.5	2.8	3.5	4.0	4.6	5.1	2.8
Other Non-OECD Asia	3.1	5.7	6.0	6.9	8.2	9.1	10.3	11.4	2.5
Middle East	**3.5**	**5.4**	**5.7**	**7.2**	**8.0**	**8.9**	**10.1**	**11.0**	**2.6**
Africa	**2.1**	**2.7**	**2.8**	**3.5**	**4.2**	**4.8**	**5.3**	**5.7**	**2.8**
Central and South America	**3.8**	**5.2**	**5.4**	**6.7**	**8.0**	**9.0**	**10.2**	**11.2**	**2.9**
Brazil	1.5	2.1	2.1	2.7	3.1	3.5	3.9	4.3	2.7
Other Central and South America	2.3	3.2	3.3	4.1	4.9	5.5	6.3	7.0	3.0
Total Non-OECD	**25.3**	**31.5**	**33.4**	**42.0**	**49.0**	**55.3**	**62.6**	**69.6**	**2.9**
Total World	**66.5**	**79.8**	**82.5**	**93.0**	**103.9**	**112.9**	**123.4**	**133.6**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E5. World Natural Gas Consumption by Region, Low World Oil Price Case, 1990-2030
(Trillion Cubic Feet)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**22.5**	**27.4**	**27.6**	**30.8**	**33.5**	**35.8**	**37.5**	**38.7**	**1.3**
United States[a]	19.2	22.3	22.4	24.4	26.4	28.0	29.3	29.7	1.1
Canada	2.4	3.4	3.4	3.9	4.1	4.5	4.6	4.8	1.4
Mexico	0.9	1.7	1.8	2.5	2.9	3.3	3.6	4.1	3.2
OECD Europe	**11.6**	**18.2**	**18.8**	**21.5**	**24.2**	**24.9**	**25.7**	**26.9**	**1.4**
OECD Asia	**2.8**	**5.0**	**5.0**	**6.1**	**7.2**	**7.4**	**7.6**	**8.0**	**1.8**
Japan	1.9	3.0	3.0	3.7	4.3	4.4	4.5	4.6	1.7
South Korea	0.1	0.9	1.0	1.1	1.3	1.4	1.5	1.6	1.9
Australia/New Zealand	0.8	1.1	1.1	1.3	1.6	1.6	1.7	1.8	2.0
Total OECD	**36.8**	**50.5**	**51.4**	**58.4**	**64.8**	**68.1**	**70.8**	**73.5**	**1.4**
Non-OECD									
Non-OECD Europe and Eurasia	**26.7**	**23.6**	**24.4**	**27.0**	**30.3**	**32.1**	**33.3**	**35.1**	**1.4**
Russia	17.3	15.3	16.0	17.5	19.3	20.0	20.4	21.2	1.1
Other	9.5	8.3	8.4	9.5	10.9	12.0	12.9	14.0	2.0
Non-OECD Asia	**2.9**	**7.7**	**8.5**	**12.8**	**17.2**	**20.4**	**23.8**	**28.1**	**4.7**
China	0.5	1.1	1.4	2.9	3.7	4.5	5.4	6.7	6.3
India	0.4	1.0	1.1	1.9	2.6	3.1	3.8	4.6	5.7
Other Non-OECD Asia	2.0	5.6	6.0	8.1	10.8	12.8	14.6	16.9	4.0
Middle East	**3.6**	**8.0**	**8.6**	**10.4**	**12.4**	**13.8**	**14.3**	**15.4**	**2.2**
Africa	**1.4**	**2.5**	**2.6**	**3.4**	**4.4**	**5.1**	**5.7**	**6.5**	**3.6**
Central and South America	**2.0**	**3.7**	**4.1**	**5.1**	**6.0**	**6.5**	**7.0**	**7.6**	**2.4**
Brazil	0.1	0.5	0.6	0.9	1.0	1.1	1.3	1.5	3.6
Other Central and South America	1.9	3.2	3.5	4.3	5.0	5.4	5.7	6.0	2.2
Total Non-OECD	**36.5**	**45.5**	**48.2**	**58.8**	**70.3**	**77.9**	**84.0**	**92.6**	**2.5**
Total World	**73.4**	**96.0**	**99.6**	**117.3**	**135.1**	**146.0**	**154.9**	**166.2**	**2.0**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E6. World Coal Consumption by Region, Low World Oil Price Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**20.7**	**24.1**	**24.1**	**25.9**	**26.4**	**27.3**	**28.6**	**30.8**	**0.9**
United States[a]	19.2	22.3	22.6	23.9	24.5	25.2	26.3	28.4	0.9
Canada	1.3	1.4	1.2	1.5	1.3	1.5	1.6	1.7	1.3
Mexico	0.2	0.4	0.3	0.6	0.6	0.6	0.7	0.7	2.8
OECD Europe	**17.6**	**13.2**	**13.1**	**12.5**	**10.9**	**10.3**	**9.6**	**9.3**	**-1.3**
OECD Asia	**5.2**	**8.6**	**9.3**	**9.5**	**9.2**	**9.4**	**9.6**	**9.8**	**0.2**
Japan	2.7	4.3	4.8	4.6	4.3	4.2	4.1	4.0	-0.6
South Korea	0.9	1.9	2.1	2.2	2.3	2.5	2.6	2.8	1.1
Australia/New Zealand	1.5	2.3	2.4	2.7	2.5	2.7	2.9	3.0	0.7
Total OECD	**43.5**	**45.9**	**46.6**	**48.0**	**46.5**	**47.0**	**47.8**	**49.9**	**0.3**
Non-OECD									
Non-OECD Europe and Eurasia	**15.1**	**8.7**	**9.0**	**9.2**	**9.0**	**9.7**	**9.7**	**9.6**	**0.2**
Russia	6.8	4.5	4.8	4.8	4.5	4.8	5.0	5.0	0.1
Other	8.3	4.2	4.2	4.3	4.5	4.8	4.8	4.6	0.4
Non-OECD Asia	**27.2**	**45.8**	**53.6**	**70.2**	**82.5**	**95.2**	**105.9**	**117.6**	**3.1**
China	20.3	33.7	41.1	55.6	66.1	76.4	85.5	95.7	3.3
India	4.3	7.5	8.1	9.1	10.3	11.7	13.0	14.3	2.2
Other Non-OECD Asia	2.6	4.6	4.3	5.5	6.2	7.1	7.4	7.5	2.2
Middle East	**0.1**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.2**
Africa	**3.0**	**4.0**	**4.1**	**5.1**	**5.2**	**5.4**	**5.7**	**5.8**	**1.3**
Central and South America	**0.6**	**0.8**	**0.8**	**1.1**	**1.2**	**1.4**	**1.5**	**1.6**	**2.6**
Brazil	0.4	0.5	0.5	0.7	0.8	0.9	0.9	1.1	3.4
Other Central and South America	0.2	0.4	0.4	0.4	0.4	0.5	0.5	0.5	1.4
Total Non-OECD	**45.9**	**59.7**	**67.9**	**86.0**	**98.3**	**112.1**	**123.2**	**135.0**	**2.7**
Total World	**89.4**	**105.6**	**114.5**	**133.9**	**144.8**	**159.1**	**171.0**	**184.9**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E7. World Nuclear Energy Consumption by Region, Low World Oil Price Case, 1990-2030
(Billion Kilowatthours)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**649**	**845**	**883**	**910**	**933**	**942**	**944**	**936**	**0.2**
United States[a]	577	764	789	789	809	815	815	799	0.0
Canada	69	71	86	110	113	116	118	126	1.5
Mexico	3	10	9	11	11	11	11	11	0.9
OECD Europe	**743**	**931**	**941**	**914**	**902**	**835**	**831**	**847**	**-0.4**
OECD Asia	**242**	**351**	**396**	**433**	**497**	**559**	**592**	**646**	**1.9**
Japan	192	228	272	299	325	352	370	394	1.4
South Korea	50	123	124	134	172	207	222	252	2.8
Australia/New Zealand	0	0	0	0	0	0	0	0	—
Total OECD	**1,635**	**2,128**	**2,220**	**2,257**	**2,332**	**2,336**	**2,367**	**2,429**	**0.3**
Non-OECD									
Non-OECD Europe and Eurasia	**219**	**260**	**263**	**278**	**323**	**405**	**479**	**476**	**2.3**
Russia	115	141	137	149	190	236	299	315	3.2
Other	104	119	125	129	133	169	180	161	1.0
Non-OECD Asia	**38**	**97**	**103**	**148**	**265**	**389**	**495**	**557**	**6.7**
China	0	42	48	64	135	217	283	329	7.7
India	6	16	15	37	66	97	124	144	9.1
Other Non-OECD Asia	32	39	40	47	64	75	88	84	2.9
Middle East	**0**	**0**	**0**	**5**	**6**	**6**	**6**	**6**	**—**
Africa	**8**	**13**	**14**	**14**	**15**	**15**	**21**	**21**	**1.5**
Central and South America	**9**	**20**	**19**	**20**	**28**	**34**	**33**	**33**	**2.2**
Brazil	2	13	12	13	18	22	22	22	2.5
Other Central and South America	7	7	7	7	10	12	11	11	1.6
Total Non-OECD	**274**	**390**	**399**	**465**	**637**	**849**	**1,034**	**1,093**	**4.0**
Total World	**1,909**	**2,518**	**2,619**	**2,722**	**2,969**	**3,185**	**3,401**	**3,522**	**1.1**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E8. World Consumption of Hydroelectricity and Other Renewable Energy by Region, Low World Oil Price Case, 1990-2030
(Quadrillion Btu)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**9.5**	**9.8**	**9.9**	**12.1**	**12.3**	**12.7**	**13.1**	**13.6**	**1.2**
United States[a]	6.1	6.0	6.0	7.5	7.6	7.7	7.9	8.2	1.2
Canada	3.1	3.5	3.5	4.0	4.1	4.3	4.5	4.7	1.2
Mexico	0.3	0.4	0.4	0.6	0.7	0.7	0.7	0.7	2.1
OECD Europe	**4.8**	**5.9**	**6.3**	**6.9**	**7.2**	**7.4**	**7.4**	**7.6**	**0.7**
OECD Asia	**1.6**	**1.8**	**1.7**	**1.9**	**2.0**	**2.1**	**2.1**	**2.2**	**1.0**
Japan	1.1	1.2	1.1	1.2	1.3	1.3	1.4	1.4	0.8
South Korea	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.1
Australia/New Zealand	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	1.2
Total OECD	**15.9**	**17.5**	**17.9**	**20.9**	**21.6**	**22.1**	**22.7**	**23.5**	**1.1**
Non-OECD									
Non-OECD Europe and Eurasia	**2.8**	**2.8**	**2.9**	**3.6**	**4.1**	**4.3**	**4.5**	**4.7**	**1.8**
Russia	1.8	1.6	1.7	2.2	2.5	2.5	2.6	2.7	1.9
Other	1.0	1.2	1.2	1.4	1.6	1.8	1.9	2.0	1.8
Non-OECD Asia	**3.0**	**5.2**	**5.7**	**7.1**	**8.0**	**9.0**	**9.8**	**10.8**	**2.5**
China	1.3	2.9	3.3	4.0	4.6	5.2	5.7	6.3	2.5
India	0.7	0.8	0.9	1.0	1.2	1.4	1.5	1.7	2.4
Other Non-OECD Asia	0.9	1.5	1.5	2.1	2.2	2.4	2.6	2.9	2.6
Middle East	**0.1**	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.3**	**2.6**
Africa	**0.6**	**0.9**	**0.9**	**1.1**	**1.1**	**1.2**	**1.2**	**1.3**	**1.3**
Central and South America	**3.9**	**5.6**	**5.6**	**7.4**	**8.2**	**8.9**	**9.5**	**10.4**	**2.4**
Brazil	2.2	3.0	3.1	4.2	4.8	5.3	5.8	6.5	2.9
Other Central and South America	1.7	2.5	2.5	3.2	3.4	3.6	3.7	3.9	1.7
Total Non-OECD	**10.3**	**14.5**	**15.3**	**19.3**	**21.6**	**23.6**	**25.3**	**27.5**	**2.3**
Total World	**26.2**	**32.1**	**33.2**	**40.2**	**43.2**	**45.7**	**48.0**	**51.0**	**1.7**

[a]Includes the 50 States and the District of Columbia.

Notes: Totals may not equal sum of components due to independent rounding. U.S. totals include net electricity imports, methanol, and liquid hydrogen.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E9. World Carbon Dioxide Emissions by Region, Low World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**5,763**	**6,775**	**6,893**	**7,375**	**7,886**	**8,361**	**8,836**	**9,434**	**1.2**
United States[a]	4,989	5,800	5,923	6,241	6,673	7,040	7,424	7,929	1.1
Canada	474	589	584	650	666	707	740	770	1.1
Mexico	300	385	385	485	548	614	672	736	2.5
OECD Europe	**4,092**	**4,321**	**4,381**	**4,518**	**4,635**	**4,671**	**4,733**	**4,823**	**0.4**
OECD Asia	**1,543**	**2,129**	**2,183**	**2,286**	**2,402**	**2,487**	**2,578**	**2,668**	**0.8**
Japan	1,015	1,244	1,262	1,286	1,324	1,338	1,354	1,372	0.3
South Korea	238	475	497	529	593	635	675	723	1.5
Australia/New Zealand	291	410	424	471	485	514	549	574	1.2
Total OECD	**11,399**	**13,225**	**13,457**	**14,179**	**14,923**	**15,520**	**16,148**	**16,926**	**0.9**
Non-OECD									
Non-OECD Europe and Eurasia	**4,193**	**2,717**	**2,819**	**3,046**	**3,275**	**3,503**	**3,643**	**3,784**	**1.1**
Russia	2,334	1,602	1,685	1,794	1,891	1,988	2,053	2,116	0.9
Other	1,859	1,115	1,134	1,252	1,384	1,514	1,589	1,668	1.5
Non-OECD Asia	**3,627**	**6,479**	**7,411**	**9,807**	**11,688**	**13,466**	**15,182**	**17,062**	**3.3**
China	2,241	3,898	4,707	6,567	7,810	9,041	10,237	11,597	3.5
India	578	1,040	1,111	1,290	1,531	1,751	1,981	2,206	2.7
Other Non-OECD Asia	807	1,542	1,593	1,950	2,347	2,674	2,964	3,259	2.8
Middle East	**705**	**1,211**	**1,289**	**1,599**	**1,817**	**2,028**	**2,212**	**2,396**	**2.4**
Africa	**649**	**895**	**919**	**1,148**	**1,318**	**1,460**	**1,591**	**1,714**	**2.4**
Central and South America	**673**	**981**	**1,027**	**1,257**	**1,482**	**1,656**	**1,844**	**2,023**	**2.6**
Brazil	220	317	334	413	482	541	606	674	2.7
Other Central and South America	453	664	693	843	999	1,115	1,238	1,349	2.6
Total Non-OECD	**9,847**	**12,283**	**13,465**	**16,857**	**19,579**	**22,112**	**24,472**	**26,980**	**2.7**
Total World	**21,246**	**25,508**	**26,922**	**31,036**	**34,503**	**37,632**	**40,619**	**43,906**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Note: The U.S. numbers include carbon dioxide emissions attributable to renewable energy sources.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E10. World Carbon Dioxide Emissions from Liquids Use by Region, Low World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**2,633**	**3,029**	**3,140**	**3,263**	**3,576**	**3,844**	**4,096**	**4,422**	**1.3**
United States[a]	2,178	2,500	2,598	2,672	2,932	3,148	3,353	3,633	1.3
Canada	224	279	290	302	319	329	342	351	0.7
Mexico	231	250	253	289	325	367	401	439	2.1
OECD Europe	**1,867**	**2,099**	**2,125**	**2,171**	**2,294**	**2,351**	**2,439**	**2,497**	**0.6**
OECD Asia	**921**	**1,068**	**1,048**	**1,076**	**1,165**	**1,210**	**1,273**	**1,322**	**0.9**
Japan	667	683	665	663	696	710	735	752	0.5
South Korea	144	248	245	265	305	323	347	371	1.6
Australia/New Zealand	110	137	138	148	164	176	190	200	1.4
Total OECD	**5,420**	**6,196**	**6,314**	**6,510**	**7,035**	**7,404**	**7,808**	**8,241**	**1.0**
Non-OECD									
Non-OECD Europe and Eurasia	**1,350**	**636**	**663**	**732**	**799**	**866**	**937**	**993**	**1.6**
Russia	782	364	376	401	433	459	492	513	1.2
Other	568	271	287	330	367	408	445	480	2.0
Non-OECD Asia	**950**	**1,822**	**1,983**	**2,574**	**3,072**	**3,490**	**4,026**	**4,580**	**3.3**
China	325	711	816	1,237	1,454	1,675	1,972	2,309	4.1
India	160	293	306	345	438	496	571	631	2.8
Other Non-OECD Asia	464	818	861	992	1,181	1,318	1,483	1,640	2.5
Middle East	**493**	**735**	**778**	**987**	**1,096**	**1,227**	**1,384**	**1,509**	**2.6**
Africa	**298**	**387**	**395**	**492**	**596**	**682**	**749**	**814**	**2.8**
Central and South America	**503**	**696**	**720**	**864**	**1,029**	**1,160**	**1,315**	**1,445**	**2.7**
Brazil	180	248	258	303	355	397	445	488	2.5
Other Central and South America	323	449	462	561	674	763	870	957	2.8
Total Non-OECD	**3,594**	**4,276**	**4,538**	**5,649**	**6,593**	**7,425**	**8,411**	**9,341**	**2.8**
Total World	**9,014**	**10,472**	**10,852**	**12,158**	**13,627**	**14,829**	**16,219**	**17,583**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E11. World Carbon Dioxide Emissions from Natural Gas Use by Region, Low World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,207**	**1,477**	**1,483**	**1,672**	**1,820**	**1,945**	**2,041**	**2,105**	**1.4**
United States[a]	1,026	1,197	1,198	1,318	1,428	1,512	1,583	1,609	1.1
Canada	127	183	183	213	223	242	249	261	1.4
Mexico	54	98	102	141	169	190	208	235	3.2
OECD Europe	**590**	**984**	**1,021**	**1,168**	**1,313**	**1,349**	**1,395**	**1,457**	**1.4**
OECD Asia	**152**	**279**	**282**	**344**	**402**	**418**	**426**	**450**	**1.8**
Japan	102	168	163	207	237	243	247	254	1.7
South Korea	6	50	58	66	78	83	87	94	1.9
Australia/New Zealand	44	61	61	71	87	91	92	102	2.0
Total OECD	**1,949**	**2,740**	**2,786**	**3,183**	**3,534**	**3,711**	**3,862**	**4,012**	**1.4**
Non-OECD									
Non-OECD Europe and Eurasia	**1,450**	**1,280**	**1,328**	**1,468**	**1,644**	**1,742**	**1,808**	**1,908**	**1.4**
Russia	928	828	868	949	1,048	1,086	1,106	1,146	1.1
Other	521	452	460	519	596	656	702	762	2.0
Non-OECD Asia	**160**	**428**	**471**	**723**	**966**	**1,150**	**1,341**	**1,586**	**4.8**
China	30	70	83	176	228	277	329	408	6.3
India	24	56	64	110	152	183	225	266	5.7
Other Non-OECD Asia	106	301	325	437	586	690	788	911	4.0
Middle East	**199**	**442**	**476**	**574**	**686**	**764**	**791**	**849**	**2.2**
Africa	**80**	**144**	**148**	**194**	**251**	**287**	**323**	**369**	**3.6**
Central and South America	**116**	**209**	**231**	**290**	**341**	**369**	**395**	**428**	**2.4**
Brazil	6	27	34	47	56	63	73	84	3.6
Other Central and South America	110	181	197	244	285	306	322	344	2.2
Total Non-OECD	**2,005**	**2,502**	**2,655**	**3,249**	**3,888**	**4,311**	**4,657**	**5,140**	**2.6**
Total World	**3,954**	**5,242**	**5,441**	**6,433**	**7,422**	**8,023**	**8,520**	**9,151**	**2.0**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table E12. World Carbon Dioxide Emissions from Coal Use by Region, Low World Oil Price Case, 1990-2030
(Million Metric Tons Carbon Dioxide)

Region/Country	History			Projections					Average Annual Percent Change, 2004-2030
	1990	2003	2004	2010	2015	2020	2025	2030	
OECD									
OECD North America	**1,923**	**2,258**	**2,258**	**2,428**	**2,478**	**2,560**	**2,685**	**2,893**	**1.0**
United States[a]	1,784	2,093	2,115	2,239	2,301	2,368	2,474	2,673	0.9
Canada	123	128	112	135	123	136	148	158	1.3
Mexico	15	37	30	55	54	56	63	62	2.8
OECD Europe	**1,635**	**1,237**	**1,235**	**1,179**	**1,028**	**972**	**899**	**870**	**-1.3**
OECD Asia	**471**	**782**	**853**	**867**	**836**	**859**	**879**	**897**	**0.2**
Japan	245	393	434	417	392	384	372	366	-0.6
South Korea	88	177	194	199	210	229	241	258	1.1
Australia/New Zealand	137	212	225	251	234	246	267	272	0.7
Total OECD	**4,028**	**4,277**	**4,345**	**4,474**	**4,342**	**4,391**	**4,464**	**4,659**	**0.3**
Non-OECD									
Non-OECD Europe and Eurasia	**1,393**	**801**	**828**	**847**	**832**	**894**	**898**	**884**	**0.3**
Russia	624	410	441	444	411	444	456	457	0.1
Other	770	392	387	403	421	450	442	426	0.4
Non-OECD Asia	**2,517**	**4,229**	**4,957**	**6,510**	**7,649**	**8,825**	**9,815**	**10,897**	**3.1**
China	1,886	3,117	3,809	5,154	6,129	7,089	7,936	8,880	3.3
India	394	690	741	835	941	1,072	1,186	1,308	2.2
Other Non-OECD Asia	237	422	407	521	580	665	693	708	2.2
Middle East	**14**	**34**	**35**	**38**	**36**	**38**	**37**	**38**	**0.2**
Africa	**271**	**364**	**376**	**461**	**470**	**492**	**519**	**531**	**1.3**
Central and South America	**54**	**76**	**77**	**102**	**112**	**127**	**135**	**150**	**2.6**
Brazil	34	42	43	64	72	81	88	102	3.4
Other Central and South America	20	34	34	39	40	46	47	48	1.4
Total Non-OECD	**4,248**	**5,505**	**6,272**	**7,959**	**9,099**	**10,376**	**11,403**	**12,499**	**2.7**
Total World	**8,277**	**9,782**	**10,617**	**12,433**	**13,441**	**14,767**	**15,867**	**17,158**	**1.9**

[a]Includes the 50 States and the District of Columbia.

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run LP2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Appendix F

Reference Case Projections by End-Use Sector and Region

Table F1. Total World Delivered Energy Consumption by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	10.9	11.5	12.2	12.7	12.9	13.0	0.7
Natural Gas	18.4	20.2	21.7	22.8	23.7	24.9	1.2
Coal	3.5	3.7	4.0	4.0	3.9	3.8	0.3
Electricity	14.3	17.8	20.4	22.6	24.6	26.6	2.4
Renewables	0.5	0.7	0.7	0.7	0.7	0.7	1.2
Total	**47.7**	**53.9**	**59.0**	**62.7**	**65.8**	**69.0**	**1.4**
Commercial							
Liquids	5.3	5.5	5.8	5.9	6.0	6.2	0.6
Natural Gas	6.7	7.2	7.8	8.3	8.8	9.3	1.2
Coal	0.7	0.8	0.9	1.0	1.0	1.0	1.2
Electricity	11.7	14.6	17.0	19.2	21.5	24.0	2.8
Renewables	0.1	0.2	0.2	0.2	0.2	0.2	1.8
Total	**24.5**	**28.3**	**31.7**	**34.6**	**37.5**	**40.7**	**2.0**
Industrial							
Liquids	55.5	61.0	64.5	67.9	70.9	74.2	1.1
Natural Gas	45.2	51.5	56.6	63.1	68.3	73.3	1.9
Coal	35.4	39.5	45.3	50.4	55.9	62.0	2.2
Electricity	25.3	28.6	32.2	36.1	39.9	44.3	2.2
Renewables	2.2	2.6	2.8	2.9	3.1	3.3	1.6
Total	**163.6**	**183.1**	**201.4**	**220.5**	**238.1**	**257.1**	**1.8**
Transportation							
Liquids	85.9	95.4	104.1	112.9	122.7	133.8	1.7
Natural Gas	0.8	1.0	1.1	1.2	1.3	1.3	1.8
Coal	0.2	0.2	0.2	0.2	0.2	0.1	-2.4
Electricity	0.8	0.9	1.0	1.1	1.2	1.2	1.7
Total	**87.7**	**97.5**	**106.3**	**115.4**	**125.3**	**136.5**	**1.7**
All End-Use Sectors							
Liquids	157.6	173.4	186.5	199.3	212.5	227.2	1.4
Natural Gas	71.3	79.9	87.2	95.4	102.0	108.8	1.6
Coal	39.7	44.2	50.4	55.6	60.9	66.8	2.0
Electricity	52.1	61.9	70.6	79.0	87.2	96.1	2.4
Renewables	2.9	3.5	3.7	3.9	4.1	4.3	1.5
Delivered Energy	**323.5**	**362.9**	**398.4**	**433.2**	**466.7**	**503.3**	**1.7**
Electricity-Related Losses	123.2	148.2	161.0	173.8	187.0	198.3	1.8
Total	**446.7**	**511.1**	**559.4**	**607.0**	**653.7**	**701.6**	**1.8**
Electric Power[a]							
Liquids	10.6	10.5	11.0	11.3	11.6	11.6	0.4
Natural Gas	32.2	40.7	47.1	51.6	56.5	61.6	2.5
Coal	74.7	92.2	101.2	111.6	122.0	132.4	2.2
Nuclear	27.5	29.8	32.5	35.7	38.1	39.7	1.4
Renewables	30.3	36.9	39.8	42.7	46.0	49.2	1.9
Total	**175.2**	**210.1**	**231.6**	**252.9**	**274.2**	**294.5**	**2.0**
Total Energy Consumption							
Liquids	168.2	183.9	197.6	210.6	224.1	238.9	1.4
Natural Gas	103.4	120.6	134.3	147.0	158.5	170.4	1.9
Coal	114.5	136.4	151.6	167.2	182.9	199.1	2.2
Nuclear	27.5	29.8	32.5	35.7	38.1	39.7	1.4
Renewables	33.2	40.4	43.4	46.5	50.1	53.5	1.9
Total	**446.7**	**511.1**	**559.4**	**607.0**	**653.7**	**701.6**	**1.8**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table F2. Total OECD Delivered Energy Consumption by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	5.7	5.4	5.5	5.5	5.5	5.5	-0.1
Natural Gas	12.4	12.7	13.0	13.2	13.3	13.4	0.3
Coal	0.4	0.3	0.3	0.3	0.3	0.3	-1.4
Electricity	9.2	10.5	11.1	11.6	12.2	12.9	1.3
Renewables	0.5	0.6	0.6	0.6	0.6	0.7	0.9
Total	**28.2**	**29.6**	**30.5**	**31.3**	**32.0**	**32.8**	**0.6**
Commercial							
Liquids	3.7	3.5	3.6	3.6	3.6	3.7	0.0
Natural Gas	5.7	5.8	6.2	6.5	6.8	7.1	0.9
Coal	0.2	0.2	0.2	0.2	0.2	0.2	-0.6
Electricity	8.6	10.0	10.8	11.6	12.5	13.5	1.7
Renewables	0.1	0.2	0.2	0.2	0.2	0.2	1.2
Total	**18.3**	**19.7**	**21.0**	**22.1**	**23.2**	**24.6**	**1.2**
Industrial							
Liquids	28.4	27.9	28.4	28.7	29.2	30.0	0.2
Natural Gas	20.6	22.1	22.8	24.5	25.7	26.6	1.0
Coal	9.5	9.4	9.6	9.5	9.9	10.2	0.3
Electricity	11.8	12.4	13.0	13.6	14.1	15.0	0.9
Renewables	2.1	2.5	2.7	2.8	3.0	3.2	1.5
Total	**72.4**	**74.4**	**76.5**	**79.1**	**81.9**	**84.9**	**0.6**
Transportation							
Liquids	56.9	59.4	62.4	65.5	68.4	71.9	0.9
Natural Gas	0.6	0.8	0.8	0.9	1.0	1.0	1.6
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.4	0.4	0.4	0.5	0.5	0.5	1.4
Total	**57.9**	**60.5**	**63.7**	**66.9**	**69.9**	**73.4**	**0.9**
All End-Use Sectors							
Liquids	94.6	96.2	99.9	103.3	106.8	111.1	0.6
Natural Gas	39.3	41.4	42.9	45.2	46.7	48.1	0.8
Coal	10.1	9.9	10.0	9.9	10.3	10.6	0.2
Electricity	30.0	33.3	35.3	37.4	39.3	41.9	1.3
Renewables	2.8	3.3	3.5	3.6	3.8	4.0	1.4
Delivered Energy	**176.8**	**184.1**	**191.5**	**199.4**	**207.0**	**215.7**	**0.8**
Electricity-Related Losses	62.9	70.3	73.7	75.7	78.9	82.3	1.0
Total	**239.8**	**254.4**	**265.2**	**275.1**	**285.9**	**298.0**	**0.8**
Electric Power[a]							
Liquids	4.3	3.6	3.6	3.5	3.4	3.4	-0.9
Natural Gas	13.8	18.2	21.1	22.3	23.3	24.2	2.2
Coal	36.6	39.5	40.6	42.2	45.2	48.7	1.1
Nuclear	23.2	24.5	25.3	26.0	26.4	27.3	0.6
Renewables	15.1	17.8	18.4	19.0	19.9	20.7	1.2
Total	**92.9**	**103.6**	**109.0**	**113.1**	**118.2**	**124.2**	**1.1**
Total Energy Consumption							
Liquids	98.9	99.9	103.5	106.8	110.3	114.4	0.6
Natural Gas	53.1	59.6	64.0	67.5	70.0	72.3	1.2
Coal	46.6	49.4	50.7	52.1	55.5	59.3	0.9
Nuclear	23.2	24.5	25.3	26.0	26.4	27.3	0.6
Renewables	17.9	21.1	21.8	22.7	23.7	24.7	1.2
Total	**239.8**	**254.4**	**265.2**	**275.1**	**285.9**	**298.0**	**0.8**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table F3. Delivered Energy Consumption in the United States by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	1.6	1.5	1.5	1.5	1.5	1.5	-0.2
Natural Gas	5.0	5.2	5.3	5.4	5.4	5.5	0.3
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-1.1
Electricity	4.4	5.1	5.4	5.8	6.1	6.5	1.5
Renewables	0.4	0.4	0.4	0.4	0.4	0.4	0.0
Total	**11.4**	**12.2**	**12.7**	**13.2**	**13.5**	**13.8**	**0.7**
Commercial							
Liquids	0.8	0.8	0.8	0.8	0.8	0.8	0.3
Natural Gas	3.2	3.3	3.6	3.9	4.1	4.4	1.2
Coal	0.1	0.1	0.1	0.1	0.1	0.1	-0.1
Electricity	4.2	4.8	5.3	5.8	6.4	7.0	2.0
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Total	**8.4**	**9.1**	**9.9**	**10.7**	**11.5**	**12.4**	**1.5**
Industrial							
Liquids	10.1	9.5	9.7	9.8	10.1	10.6	0.2
Natural Gas	8.6	9.0	9.0	9.5	9.8	10.1	0.6
Coal	2.2	2.0	2.1	2.1	2.6	2.9	1.1
Electricity	3.5	3.6	3.8	3.8	3.9	4.1	0.6
Renewables	1.9	2.3	2.4	2.6	2.8	2.9	1.7
Total	**26.2**	**26.3**	**27.0**	**27.8**	**29.2**	**30.5**	**0.6**
Transportation							
Liquids	27.2	29.1	31.3	33.4	35.7	38.3	1.3
Natural Gas	0.6	0.7	0.8	0.9	0.9	0.9	1.5
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	1.9
Total	**27.9**	**29.9**	**32.1**	**34.3**	**36.6**	**39.3**	**1.3**
All End-Use Sectors							
Liquids	39.7	40.9	43.3	45.5	48.0	51.1	1.0
Natural Gas	17.4	18.2	18.8	19.6	20.3	20.8	0.7
Coal	2.3	2.1	2.2	2.2	2.7	3.0	1.0
Electricity	12.1	13.5	14.5	15.4	16.5	17.6	1.5
Renewables	2.4	2.8	3.0	3.1	3.3	3.5	1.4
Delivered Energy	**73.9**	**77.5**	**81.7**	**86.0**	**90.8**	**96.0**	**1.0**
Electricity-Related Losses	26.8	29.0	30.6	32.2	33.6	35.1	1.1
Total	**100.7**	**106.5**	**112.3**	**118.2**	**124.4**	**131.2**	**1.0**
Electric Power[a]							
Liquids	1.1	0.9	1.0	1.0	1.0	1.0	-0.5
Natural Gas	5.6	6.6	7.3	7.4	6.8	6.1	0.3
Coal	20.3	22.1	23.5	25.1	27.9	31.1	1.7
Nuclear	8.2	8.2	8.5	9.2	9.2	9.3	0.5
Renewables	3.6	4.7	4.9	5.0	5.1	5.2	1.4
Total	**38.9**	**42.5**	**45.1**	**47.6**	**50.0**	**52.8**	**1.2**
Total Energy Consumption							
Liquids	40.8	41.8	44.3	46.5	49.0	52.1	0.9
Natural Gas	23.1	24.7	26.1	27.0	27.1	26.9	0.6
Coal	22.6	24.2	25.6	27.3	30.6	34.1	1.6
Nuclear	8.2	8.2	8.5	9.2	9.2	9.3	0.5
Renewables	6.0	7.5	7.8	8.1	8.4	8.7	1.4
Total	**100.7**	**106.5**	**112.3**	**118.2**	**124.4**	**131.2**	**1.0**

[a]Fuel inputs used in the production of electricity and heat at central-station generators. Includes net electricity imports.

Sources: **2004:** Based on Energy Information Administration (EIA), *Annual Energy Review 2004*, DOE/EIA-0384(2004) (Washington, DC, August 2006). **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo.

Table F4. Delivered Energy Consumption in Canada by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Natural Gas	0.6	0.7	0.7	0.7	0.7	0.7	0.5
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-1.3
Electricity	0.5	0.6	0.7	0.7	0.7	0.8	1.5
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**1.3**	**1.4**	**1.5**	**1.5**	**1.6**	**1.6**	**0.9**
Commercial							
Liquids	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Natural Gas	0.5	0.5	0.6	0.6	0.6	0.6	0.7
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.4	0.6	0.7	0.7	0.7	0.8	2.2
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**1.3**	**1.5**	**1.6**	**1.7**	**1.8**	**1.8**	**1.2**
Industrial							
Liquids	1.5	1.5	1.6	1.6	1.6	1.6	0.2
Natural Gas	2.0	2.6	2.7	2.9	3.2	3.5	2.1
Coal	0.2	0.3	0.3	0.3	0.3	0.3	2.2
Electricity	0.8	0.9	0.9	1.0	1.0	1.1	1.1
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**4.7**	**5.3**	**5.6**	**5.9**	**6.2**	**6.6**	**1.3**
Transportation							
Liquids	2.3	2.3	2.3	2.4	2.4	2.4	0.3
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Total	**2.3**	**2.3**	**2.3**	**2.4**	**2.4**	**2.4**	**0.3**
All End-Use Sectors							
Liquids	4.3	4.4	4.4	4.5	4.5	4.6	0.3
Natural Gas	3.2	3.8	4.0	4.2	4.5	4.8	1.6
Coal	0.2	0.3	0.3	0.3	0.3	0.3	2.2
Electricity	1.8	2.0	2.2	2.4	2.5	2.6	1.5
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.6
Delivered Energy	**9.6**	**10.5**	**11.0**	**11.5**	**12.0**	**12.5**	**1.0**
Electricity-Related Losses	4.1	5.1	4.9	5.2	5.5	5.9	1.4
Total	**13.6**	**15.5**	**15.9**	**16.7**	**17.5**	**18.4**	**1.2**
Electric Power[a]							
Liquids	0.2	0.2	0.2	0.2	0.1	0.1	-2.7
Natural Gas	0.3	0.3	0.3	0.5	0.5	0.5	2.2
Coal	1.0	1.3	1.2	1.3	1.4	1.5	1.4
Nuclear	1.0	1.3	1.3	1.4	1.4	1.5	1.7
Renewables	3.3	3.9	4.0	4.2	4.6	4.9	1.4
Total	**5.9**	**7.1**	**7.1**	**7.6**	**8.0**	**8.5**	**1.4**
Total Energy Consumption							
Liquids	4.5	4.6	4.6	4.7	4.7	4.7	0.2
Natural Gas	3.5	4.1	4.3	4.7	5.0	5.3	1.7
Coal	1.2	1.5	1.5	1.6	1.7	1.8	1.6
Nuclear	1.0	1.3	1.3	1.4	1.4	1.5	1.7
Renewables	3.5	4.0	4.1	4.3	4.7	5.0	1.4
Total	**13.6**	**15.5**	**15.9**	**16.7**	**17.5**	**18.4**	**1.2**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F5. Delivered Energy Consumption in Mexico by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.3	0.3	0.4	0.5	0.5	0.5	1.9
Natural Gas	0.0	0.1	0.1	0.1	0.1	0.1	3.8
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.2	0.3	0.3	0.4	0.4	0.5	4.2
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.5**	**0.7**	**0.8**	**1.0**	**1.1**	**1.2**	**3.1**
Commercial							
Liquids	0.0	0.1	0.1	0.1	0.1	0.1	2.5
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	3.7
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.1	0.1	0.2	0.2	0.3	0.3	5.5
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	4.8
Total	**0.1**	**0.2**	**0.3**	**0.3**	**0.4**	**0.5**	**4.6**
Industrial							
Liquids	0.9	0.9	0.9	1.0	1.1	1.2	1.0
Natural Gas	1.2	1.5	1.7	1.9	2.1	2.3	2.5
Coal	0.1	0.1	0.2	0.2	0.3	0.3	5.3
Electricity	0.5	0.5	0.6	0.7	0.8	0.9	2.4
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	6.1
Total	**2.7**	**3.0**	**3.4**	**3.8**	**4.2**	**4.7**	**2.2**
Transportation							
Liquids	1.8	2.0	2.3	2.8	3.0	3.3	2.3
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	5.7
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Total	**1.8**	**2.0**	**2.3**	**2.8**	**3.0**	**3.3**	**2.3**
All End-Use Sectors							
Liquids	3.1	3.4	3.7	4.3	4.6	5.1	1.9
Natural Gas	1.3	1.5	1.7	2.0	2.2	2.5	2.6
Coal	0.1	0.1	0.2	0.2	0.3	0.3	5.3
Electricity	0.8	0.9	1.1	1.3	1.5	1.8	3.3
Renewables	0.0	0.0	0.1	0.1	0.1	0.1	11.3
Delivered Energy	**5.2**	**6.0**	**6.8**	**7.8**	**8.6**	**9.6**	**2.4**
Electricity-Related Losses	1.4	2.4	2.4	2.4	2.4	2.4	2.1
Total	**6.6**	**8.3**	**9.2**	**10.2**	**11.1**	**12.1**	**2.3**
Electric Power[a]							
Liquids	0.7	0.9	0.9	0.8	0.8	0.7	-0.3
Natural Gas	0.7	1.1	1.4	1.6	1.8	2.1	4.5
Coal	0.3	0.5	0.6	0.6	0.6	0.6	3.3
Nuclear	0.1	0.1	0.1	0.1	0.1	0.1	1.1
Renewables	0.4	0.6	0.6	0.6	0.6	0.7	2.0
Total	**2.2**	**3.3**	**3.5**	**3.7**	**4.0**	**4.2**	**2.6**
Total Energy Consumption							
Liquids	3.8	4.3	4.6	5.1	5.3	5.8	1.6
Natural Gas	1.9	2.7	3.1	3.6	4.0	4.6	3.4
Coal	0.3	0.7	0.7	0.8	0.9	0.9	3.8
Nuclear	0.1	0.1	0.1	0.1	0.1	0.1	1.1
Renewables	0.4	0.6	0.7	0.7	0.7	0.7	2.3
Total	**6.6**	**8.3**	**9.2**	**10.2**	**11.1**	**12.1**	**2.3**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F6. Delivered Energy Consumption in OECD Europe by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	2.8	2.7	2.7	2.7	2.6	2.6	-0.3
Natural Gas	5.7	5.8	5.8	5.9	5.9	6.0	0.1
Coal	0.4	0.3	0.3	0.3	0.3	0.3	-1.4
Electricity	2.9	3.1	3.2	3.2	3.4	3.5	0.8
Renewables	0.1	0.1	0.1	0.1	0.1	0.2	1.8
Total	**11.9**	**12.0**	**12.0**	**12.1**	**12.3**	**12.5**	**0.2**
Commercial							
Liquids	1.1	1.0	1.0	1.0	1.0	1.0	-0.4
Natural Gas	1.6	1.6	1.6	1.7	1.7	1.7	0.3
Coal	0.1	0.0	0.0	0.0	0.0	0.0	-1.5
Electricity	2.5	2.7	2.8	2.9	3.0	3.2	0.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	5.4
Total	**5.2**	**5.4**	**5.5**	**5.6**	**5.7**	**5.9**	**0.5**
Industrial							
Liquids	9.0	9.1	9.1	9.1	9.2	9.2	0.1
Natural Gas	7.4	7.6	7.8	8.5	8.7	8.8	0.6
Coal	3.4	3.3	3.3	3.1	2.9	2.9	-0.6
Electricity	4.7	4.8	5.0	5.2	5.4	5.7	0.7
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.5
Total	**24.6**	**24.9**	**25.3**	**26.0**	**26.2**	**26.6**	**0.3**
Transportation							
Liquids	18.2	18.3	18.5	18.8	19.0	19.2	0.2
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.3	0.3	0.3	0.4	0.4	0.4	1.6
Total	**18.5**	**18.6**	**18.9**	**19.1**	**19.4**	**19.6**	**0.2**
All End-Use Sectors							
Liquids	31.2	31.1	31.3	31.5	31.7	31.9	0.1
Natural Gas	14.8	15.0	15.3	16.1	16.3	16.5	0.4
Coal	3.8	3.6	3.7	3.4	3.2	3.2	-0.7
Electricity	10.4	10.9	11.2	11.7	12.1	12.8	0.8
Renewables	0.2	0.2	0.2	0.2	0.3	0.3	1.5
Delivered Energy	**60.3**	**60.8**	**61.7**	**62.9**	**63.6**	**64.6**	**0.3**
Electricity-Related Losses	20.8	23.3	24.1	23.2	23.9	24.6	0.7
Total	**81.1**	**84.1**	**85.8**	**86.1**	**87.5**	**89.2**	**0.4**
Electric Power[a]							
Liquids	1.2	0.9	0.9	0.9	0.8	0.8	-1.5
Natural Gas	4.6	6.8	8.3	8.8	10.0	11.1	3.5
Coal	9.3	9.6	9.1	8.7	8.4	8.3	-0.4
Nuclear	9.9	10.2	10.0	9.3	9.3	9.4	-0.2
Renewables	6.1	6.7	7.0	7.2	7.5	7.7	0.9
Total	**31.1**	**34.2**	**35.4**	**34.9**	**36.0**	**37.3**	**0.7**
Total Energy Consumption							
Liquids	32.4	32.0	32.2	32.4	32.6	32.7	0.0
Natural Gas	19.3	21.8	23.6	24.8	26.3	27.6	1.4
Coal	13.1	13.2	12.8	12.2	11.6	11.5	-0.5
Nuclear	9.9	10.2	10.0	9.3	9.3	9.4	-0.2
Renewables	6.3	6.9	7.2	7.5	7.7	8.0	0.9
Total	**81.1**	**84.1**	**85.8**	**86.1**	**87.5**	**89.2**	**0.4**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F7. Delivered Energy Consumption in Japan by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.7	0.6	0.6	0.6	0.6	0.6	-0.7
Natural Gas	0.4	0.5	0.5	0.5	0.5	0.5	0.8
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.9	1.0	1.0	1.0	1.0	1.1	0.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	2.1
Total	**1.9**	**2.1**	**2.1**	**2.1**	**2.1**	**2.2**	**0.4**
Commercial							
Liquids	1.1	1.0	1.0	1.0	1.0	1.0	-0.3
Natural Gas	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-0.8
Electricity	0.9	1.1	1.1	1.1	1.2	1.2	1.3
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	4.1
Total	**2.2**	**2.3**	**2.3**	**2.4**	**2.4**	**2.5**	**0.5**
Industrial							
Liquids	4.3	4.3	4.3	4.3	4.3	4.3	0.0
Natural Gas	0.5	0.5	0.6	0.6	0.6	0.6	1.2
Coal	2.6	2.6	2.5	2.5	2.4	2.4	-0.2
Electricity	1.3	1.5	1.5	1.5	1.6	1.6	0.8
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	-2.5
Total	**8.6**	**8.9**	**8.8**	**8.8**	**8.9**	**8.9**	**0.1**
Transportation							
Liquids	4.1	4.2	4.2	4.3	4.3	4.4	0.2
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.1	0.1	0.1	0.1	0.1	0.1	0.3
Total	**4.1**	**4.3**	**4.3**	**4.3**	**4.4**	**4.4**	**0.3**
All End-Use Sectors							
Liquids	10.1	10.0	10.1	10.1	10.2	10.2	0.0
Natural Gas	1.0	1.2	1.3	1.3	1.3	1.3	0.9
Coal	2.6	2.6	2.5	2.5	2.4	2.4	-0.2
Electricity	3.1	3.6	3.6	3.7	3.8	4.0	1.0
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	0.3
Delivered Energy	**16.9**	**17.5**	**17.6**	**17.6**	**17.8**	**18.0**	**0.2**
Electricity-Related Losses	5.7	6.0	6.6	7.0	7.2	7.5	1.0
Total	**22.6**	**23.5**	**24.1**	**24.6**	**25.0**	**25.4**	**0.5**
Electric Power[a]							
Liquids	0.7	0.4	0.4	0.4	0.4	0.4	-1.9
Natural Gas	2.1	2.6	2.8	2.9	3.1	3.2	1.7
Coal	2.2	2.2	2.2	2.2	2.2	2.2	-0.1
Nuclear	2.8	3.2	3.5	3.8	4.0	4.2	1.7
Renewables	1.1	1.2	1.2	1.3	1.3	1.4	1.1
Total	**8.8**	**9.6**	**10.2**	**10.7**	**11.0**	**11.4**	**1.0**
Total Energy Consumption							
Liquids	10.9	10.5	10.5	10.5	10.6	10.7	-0.1
Natural Gas	3.1	3.8	4.0	4.2	4.3	4.5	1.4
Coal	4.8	4.8	4.8	4.7	4.6	4.6	-0.1
Nuclear	2.8	3.2	3.5	3.8	4.0	4.2	1.7
Renewables	1.1	1.3	1.3	1.4	1.4	1.5	1.0
Total	**22.6**	**23.5**	**24.1**	**24.6**	**25.0**	**25.4**	**0.5**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F8. Delivered Energy Consumption in South Korea by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Natural Gas	0.4	0.5	0.5	0.5	0.5	0.5	0.9
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-2.2
Electricity	0.1	0.2	0.2	0.2	0.3	0.3	2.6
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	6.4
Total	**0.8**	**0.9**	**0.9**	**0.9**	**1.0**	**1.0**	**1.1**
Commercial							
Liquids	0.3	0.3	0.3	0.3	0.3	0.3	0.1
Natural Gas	0.1	0.1	0.1	0.1	0.1	0.1	1.7
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.3	0.5	0.6	0.6	0.6	0.7	2.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	15.5
Total	**0.7**	**0.9**	**1.0**	**1.0**	**1.1**	**1.1**	**1.8**
Industrial							
Liquids	2.0	2.1	2.3	2.4	2.5	2.6	1.0
Natural Gas	0.2	0.2	0.2	0.3	0.3	0.4	1.8
Coal	0.9	0.9	0.9	0.9	1.0	1.0	0.5
Electricity	0.6	0.7	0.8	0.9	0.9	1.0	2.2
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	20.1
Total	**3.7**	**3.9**	**4.2**	**4.5**	**4.7**	**4.9**	**1.2**
Transportation							
Liquids	1.7	1.9	2.1	2.2	2.3	2.5	1.3
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Total	**1.8**	**1.9**	**2.1**	**2.2**	**2.3**	**2.5**	**1.3**
All End-Use Sectors							
Liquids	4.2	4.5	4.9	5.1	5.3	5.5	1.1
Natural Gas	0.7	0.8	0.8	0.9	1.0	1.0	1.3
Coal	0.9	0.9	0.9	0.9	1.0	1.0	0.5
Electricity	1.0	1.4	1.6	1.7	1.8	1.9	2.5
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	8.5
Delivered Energy	**6.9**	**7.6**	**8.2**	**8.6**	**9.0**	**9.5**	**1.3**
Electricity-Related Losses	2.1	2.1	2.6	3.1	3.4	3.9	2.4
Total	**9.0**	**9.6**	**10.8**	**11.8**	**12.5**	**13.4**	**1.6**
Electric Power[a]							
Liquids	0.2	0.2	0.2	0.2	0.3	0.3	0.4
Natural Gas	0.4	0.4	0.5	0.5	0.6	0.6	2.2
Coal	1.2	1.3	1.6	1.8	1.9	2.1	2.1
Nuclear	1.2	1.4	1.8	2.2	2.4	2.7	3.0
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	2.9
Total	**3.1**	**3.5**	**4.2**	**4.8**	**5.2**	**5.8**	**2.4**
Total Energy Consumption							
Liquids	4.5	4.7	5.1	5.3	5.6	5.8	1.0
Natural Gas	1.1	1.2	1.3	1.5	1.5	1.7	1.6
Coal	2.1	2.2	2.5	2.7	2.9	3.1	1.5
Nuclear	1.2	1.4	1.8	2.2	2.4	2.7	3.0
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	3.2
Total	**9.0**	**9.6**	**10.8**	**11.8**	**12.5**	**13.4**	**1.6**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F9. Delivered Energy Consumption in Australia/New Zealand by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Natural Gas	0.1	0.1	0.1	0.1	0.1	0.1	0.5
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-0.8
Electricity	0.2	0.3	0.3	0.3	0.3	0.3	1.3
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	2.2
Total	**0.4**	**0.4**	**0.4**	**0.4**	**0.5**	**0.5**	**1.0**
Commercial							
Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Natural Gas	0.1	0.0	0.1	0.1	0.1	0.1	0.4
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-0.4
Electricity	0.2	0.2	0.3	0.3	0.3	0.3	1.7
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	8.6
Total	**0.3**	**0.3**	**0.3**	**0.4**	**0.4**	**0.4**	**1.4**
Industrial							
Liquids	0.5	0.6	0.6	0.6	0.6	0.6	0.4
Natural Gas	0.7	0.8	0.8	0.9	0.9	1.0	1.4
Coal	0.3	0.3	0.4	0.4	0.4	0.4	2.0
Electricity	0.4	0.4	0.5	0.5	0.5	0.6	1.3
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	-1.0
Total	**1.9**	**2.1**	**2.2**	**2.3**	**2.5**	**2.6**	**1.2**
Transportation							
Liquids	1.5	1.5	1.6	1.7	1.8	1.9	1.0
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	7.1
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Total	**1.5**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**1.0**
All End-Use Sectors							
Liquids	2.0	2.1	2.2	2.3	2.5	2.5	0.8
Natural Gas	0.9	1.0	1.0	1.1	1.1	1.2	1.2
Coal	0.3	0.3	0.4	0.4	0.4	0.4	1.9
Electricity	0.8	0.9	1.0	1.1	1.1	1.2	1.4
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	1.9
Delivered Energy	**4.0**	**4.3**	**4.6**	**4.9**	**5.2**	**5.4**	**1.1**
Electricity-Related Losses	2.1	2.5	2.6	2.7	2.9	3.0	1.3
Total	**6.2**	**6.8**	**7.2**	**7.6**	**8.0**	**8.4**	**1.2**
Electric Power[a]							
Liquids	0.0	0.0	0.0	0.0	0.0	0.0	2.6
Natural Gas	0.3	0.3	0.5	0.5	0.5	0.6	3.2
Coal	2.2	2.5	2.5	2.6	2.8	2.9	1.1
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	—
Renewables	0.5	0.6	0.6	0.6	0.7	0.7	1.3
Total	**3.0**	**3.4**	**3.6**	**3.8**	**4.0**	**4.2**	**1.4**
Total Energy Consumption							
Liquids	2.0	2.1	2.2	2.4	2.5	2.6	0.8
Natural Gas	1.1	1.3	1.5	1.6	1.7	1.8	1.8
Coal	2.4	2.8	2.8	2.9	3.2	3.3	1.2
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	—
Renewables	0.5	0.6	0.6	0.7	0.7	0.7	1.3
Total	**6.2**	**6.8**	**7.2**	**7.6**	**8.0**	**8.4**	**1.2**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F10. Total Non-OECD Delivered Energy Consumption by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	5.2	6.1	6.8	7.2	7.4	7.5	1.4
Natural Gas	6.1	7.5	8.7	9.6	10.4	11.5	2.5
Coal	3.0	3.4	3.7	3.7	3.6	3.5	0.5
Electricity	5.1	7.3	9.3	10.9	12.3	13.7	3.9
Renewables	0.0	0.0	0.1	0.1	0.1	0.1	6.0
Total	**19.4**	**24.4**	**28.5**	**31.5**	**33.8**	**36.2**	**2.4**
Commercial							
Liquids	1.6	2.0	2.2	2.3	2.4	2.5	1.8
Natural Gas	1.1	1.4	1.6	1.8	2.0	2.2	2.7
Coal	0.5	0.6	0.8	0.8	0.8	0.8	1.7
Electricity	3.0	4.6	6.1	7.6	9.0	10.5	4.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	17.3
Total	**6.2**	**8.7**	**10.8**	**12.5**	**14.3**	**16.1**	**3.7**
Industrial							
Liquids	27.1	33.0	36.1	39.1	41.6	44.2	1.9
Natural Gas	24.6	29.3	33.8	38.6	42.6	46.7	2.5
Coal	25.9	30.1	35.7	41.0	46.0	51.8	2.7
Electricity	13.5	16.2	19.2	22.5	25.8	29.3	3.0
Renewables	0.1	0.1	0.1	0.1	0.1	0.1	3.3
Total	**91.2**	**108.7**	**124.9**	**141.3**	**156.2**	**172.2**	**2.5**
Transportation							
Liquids	29.0	36.1	41.7	47.4	54.2	61.9	3.0
Natural Gas	0.2	0.2	0.2	0.3	0.3	0.4	2.5
Coal	0.2	0.2	0.2	0.2	0.2	0.1	-2.3
Electricity	0.4	0.5	0.6	0.6	0.7	0.7	1.9
Total	**29.8**	**37.0**	**42.7**	**48.5**	**55.4**	**63.1**	**2.9**
All End-Use Sectors							
Liquids	62.9	77.2	86.7	96.0	105.7	116.1	2.4
Natural Gas	32.0	38.5	44.4	50.2	55.3	60.7	2.5
Coal	29.7	34.3	40.4	45.7	50.6	56.2	2.5
Electricity	22.1	28.6	35.3	41.7	47.8	54.2	3.5
Renewables	0.1	0.2	0.2	0.2	0.2	0.3	4.6
Delivered Energy	**146.7**	**178.7**	**206.9**	**233.8**	**259.6**	**287.5**	**2.6**
Electricity-Related Losses	60.2	77.9	87.3	98.1	108.1	116.0	2.6
Total	**206.9**	**256.6**	**294.2**	**331.9**	**367.8**	**403.5**	**2.6**
Electric Power[a]							
Liquids	6.3	6.9	7.4	7.8	8.2	8.3	1.1
Natural Gas	18.3	22.5	26.0	29.3	33.2	37.4	2.8
Coal	38.1	52.7	60.5	69.4	76.8	83.7	3.1
Nuclear	4.3	5.3	7.2	9.6	11.7	12.4	4.2
Renewables	15.2	19.1	21.4	23.6	26.1	28.5	2.4
Total	**82.3**	**106.5**	**122.6**	**139.8**	**156.0**	**170.2**	**2.8**
Total Energy Consumption							
Liquids	69.3	84.1	94.1	103.8	113.8	124.4	2.3
Natural Gas	50.3	61.0	70.4	79.5	88.5	98.1	2.6
Coal	67.9	86.9	100.9	115.1	127.4	139.8	2.8
Nuclear	4.3	5.3	7.2	9.6	11.7	12.4	4.2
Renewables	15.3	19.3	21.6	23.9	26.3	28.8	2.5
Total	**206.9**	**256.6**	**294.2**	**331.9**	**367.8**	**403.5**	**2.6**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F11. Delivered Energy Consumption in Russia by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.2	0.2	0.2	0.2	0.2	0.2	0.7
Natural Gas	2.2	2.4	2.6	2.8	3.0	3.2	1.5
Coal	0.2	0.2	0.2	0.2	0.2	0.2	-1.3
Electricity	0.5	0.7	0.8	0.8	0.9	1.0	2.4
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**3.1**	**3.4**	**3.7**	**4.0**	**4.3**	**4.6**	**1.5**
Commercial							
Liquids	0.1	0.1	0.1	0.0	0.0	0.0	-0.5
Natural Gas	0.1	0.2	0.2	0.2	0.2	0.2	2.7
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
Electricity	0.3	0.3	0.4	0.5	0.5	0.6	3.0
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.4**	**0.6**	**0.6**	**0.7**	**0.8**	**0.8**	**2.6**
Industrial							
Liquids	2.9	2.9	3.0	3.1	3.2	3.2	0.3
Natural Gas	8.4	8.7	9.0	9.4	9.7	10.0	0.7
Coal	2.1	2.2	2.2	2.2	2.2	2.2	0.2
Electricity	1.8	1.9	2.2	2.4	2.6	2.9	1.8
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	4.7
Total	**15.2**	**15.7**	**16.3**	**17.1**	**17.7**	**18.2**	**0.7**
Transportation							
Liquids	2.2	2.5	2.7	2.8	2.9	3.1	1.3
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	8.5
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.2	0.2	0.3	0.3	0.3	0.3	1.7
Total	**2.4**	**2.7**	**2.9**	**3.0**	**3.2**	**3.4**	**1.3**
All End-Use Sectors							
Liquids	5.4	5.6	5.9	6.1	6.3	6.5	0.7
Natural Gas	10.7	11.3	11.8	12.4	12.9	13.4	0.9
Coal	2.3	2.4	2.4	2.4	2.4	2.4	0.1
Electricity	2.8	3.1	3.5	4.0	4.3	4.7	2.1
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	4.9
Delivered Energy	**21.2**	**22.4**	**23.6**	**24.9**	**26.0**	**27.1**	**0.9**
Electricity-Related Losses	8.9	10.5	11.8	12.7	14.1	14.5	1.9
Total	**30.1**	**32.9**	**35.3**	**37.6**	**40.1**	**41.6**	**1.3**
Electric Power[a]							
Liquids	0.3	0.3	0.3	0.3	0.3	0.3	-0.2
Natural Gas	5.7	6.6	7.4	7.8	8.4	8.8	1.7
Coal	2.5	2.8	2.9	3.3	3.6	3.7	1.6
Nuclear	1.5	1.7	2.2	2.7	3.5	3.7	3.5
Renewables	1.7	2.2	2.4	2.5	2.7	2.8	2.0
Total	**11.7**	**13.6**	**15.3**	**16.7**	**18.5**	**19.2**	**1.9**
Total Energy Consumption							
Liquids	5.7	5.9	6.2	6.4	6.6	6.8	0.7
Natural Gas	16.4	17.9	19.2	20.3	21.3	22.2	1.2
Coal	4.8	5.1	5.3	5.7	6.0	6.1	0.9
Nuclear	1.5	1.7	2.2	2.7	3.5	3.7	3.5
Renewables	1.7	2.2	2.5	2.5	2.7	2.8	2.0
Total	**30.1**	**32.9**	**35.3**	**37.6**	**40.1**	**41.6**	**1.3**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F12. Delivered Energy Consumption in Other Non-OECD Europe and Eurasia by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.1	0.2	0.2	0.2	0.2	0.2	0.8
Natural Gas	1.7	1.8	1.9	2.0	2.1	2.2	1.2
Coal	0.1	0.1	0.1	0.1	0.1	0.1	-1.1
Electricity	0.5	0.7	0.8	0.9	1.0	1.0	2.6
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	15.6
Total	**2.5**	**2.8**	**3.1**	**3.2**	**3.4**	**3.6**	**1.5**
Commercial							
Liquids	0.1	0.1	0.1	0.1	0.1	0.1	0.5
Natural Gas	0.5	0.6	0.6	0.7	0.7	0.8	1.6
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Electricity	0.2	0.3	0.4	0.4	0.5	0.5	3.6
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	12.8
Total	**0.8**	**0.9**	**1.0**	**1.2**	**1.3**	**1.4**	**2.2**
Industrial							
Liquids	1.8	1.9	2.0	2.1	2.2	2.3	1.0
Natural Gas	3.3	3.8	4.1	4.6	4.8	5.0	1.6
Coal	1.6	1.8	2.0	2.1	2.1	2.0	0.8
Electricity	1.1	1.4	1.6	1.8	2.0	2.2	2.7
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	2.6
Total	**7.8**	**8.9**	**9.7**	**10.6**	**11.1**	**11.5**	**1.5**
Transportation							
Liquids	1.7	2.1	2.3	2.7	2.9	3.1	2.3
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-5.1
Electricity	0.1	0.1	0.1	0.1	0.1	0.1	1.4
Total	**1.8**	**2.2**	**2.4**	**2.8**	**3.0**	**3.2**	**2.3**
All End-Use Sectors							
Liquids	3.7	4.2	4.5	5.0	5.3	5.7	1.6
Natural Gas	5.5	6.2	6.7	7.3	7.7	8.0	1.5
Coal	1.8	1.9	2.1	2.2	2.2	2.1	0.7
Electricity	1.9	2.4	2.9	3.2	3.6	3.9	2.7
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	10.8
Delivered Energy	**12.9**	**14.8**	**16.2**	**17.8**	**18.8**	**19.7**	**1.7**
Electricity-Related Losses	6.8	7.1	7.8	9.0	9.8	10.2	1.6
Total	**19.6**	**21.9**	**24.1**	**26.8**	**28.6**	**29.9**	**1.6**
Electric Power[a]							
Liquids	0.5	0.4	0.4	0.4	0.4	0.4	-0.3
Natural Gas	3.2	3.5	4.1	4.7	5.5	6.4	2.6
Coal	2.4	2.6	3.1	3.4	3.4	3.5	1.4
Nuclear	1.4	1.5	1.5	1.9	2.1	1.9	1.2
Renewables	1.2	1.4	1.6	1.8	1.9	2.0	1.9
Total	**8.7**	**9.5**	**10.7**	**12.3**	**13.4**	**14.1**	**1.9**
Total Energy Consumption							
Liquids	4.2	4.7	5.0	5.4	5.7	6.1	1.5
Natural Gas	8.7	9.7	10.7	12.0	13.2	14.4	1.9
Coal	4.2	4.6	5.2	5.6	5.6	5.6	1.1
Nuclear	1.4	1.5	1.5	1.9	2.1	1.9	1.2
Renewables	1.2	1.4	1.6	1.8	1.9	2.0	2.0
Total	**19.6**	**21.9**	**24.1**	**26.8**	**28.6**	**29.9**	**1.6**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F13. Delivered Energy Consumption in China by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.8	1.3	1.3	1.3	1.4	1.5	2.3
Natural Gas	0.4	0.9	1.3	1.6	1.9	2.3	6.8
Coal	2.2	2.5	2.7	2.7	2.6	2.4	0.3
Electricity	0.9	1.6	2.3	2.9	3.6	4.2	5.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**4.4**	**6.3**	**7.5**	**8.5**	**9.4**	**10.4**	**3.4**
Commercial							
Liquids	0.9	1.3	1.3	1.4	1.4	1.4	1.6
Natural Gas	0.1	0.1	0.1	0.2	0.2	0.2	6.1
Coal	0.3	0.3	0.3	0.3	0.3	0.3	0.4
Electricity	0.5	0.9	1.4	1.9	2.4	2.9	7.1
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**1.8**	**2.6**	**3.1**	**3.7**	**4.3**	**4.9**	**4.0**
Industrial							
Liquids	6.5	10.5	11.0	11.7	12.4	13.5	2.9
Natural Gas	0.9	2.0	2.6	3.2	3.8	4.5	6.4
Coal	15.6	18.6	23.1	27.3	31.4	36.5	3.3
Electricity	5.1	6.6	8.1	9.6	11.2	12.8	3.6
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**28.1**	**37.7**	**44.8**	**51.8**	**58.9**	**67.3**	**3.4**
Transportation							
Liquids	4.2	5.8	7.3	9.4	12.0	15.2	5.1
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.1	8.9
Coal	0.2	0.2	0.2	0.2	0.2	0.1	-2.3
Electricity	0.1	0.1	0.1	0.1	0.1	0.1	2.7
Total	**4.4**	**6.1**	**7.7**	**9.7**	**12.3**	**15.5**	**4.9**
All End-Use Sectors							
Liquids	12.4	18.8	20.9	23.7	27.2	31.6	3.7
Natural Gas	1.4	3.1	4.0	5.0	6.0	7.2	6.5
Coal	18.3	21.6	26.3	30.5	34.4	39.3	3.0
Electricity	6.6	9.2	11.8	14.5	17.3	20.1	4.4
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Delivered Energy	**38.7**	**52.6**	**63.1**	**73.8**	**84.9**	**98.1**	**3.6**
Electricity-Related Losses	20.9	29.9	34.0	39.1	43.4	47.3	3.2
Total	**59.6**	**82.6**	**97.1**	**112.8**	**128.3**	**145.4**	**3.5**
Electric Power[a]							
Liquids	0.7	0.5	0.6	0.6	0.7	0.5	-1.4
Natural Gas	0.2	0.2	0.3	0.4	0.6	0.9	6.4
Coal	22.7	33.8	39.0	45.1	50.5	55.9	3.5
Nuclear	0.5	0.7	1.4	2.3	3.0	3.5	7.9
Renewables	3.3	3.9	4.6	5.2	5.9	6.6	2.7
Total	**27.4**	**39.1**	**45.8**	**53.6**	**60.7**	**67.4**	**3.5**
Total Energy Consumption							
Liquids	13.1	19.3	21.5	24.4	27.8	32.1	3.5
Natural Gas	1.6	3.3	4.3	5.4	6.6	8.1	6.5
Coal	41.1	55.3	65.3	75.5	85.0	95.2	3.3
Nuclear	0.5	0.7	1.4	2.3	3.0	3.5	7.9
Renewables	3.3	4.0	4.6	5.3	5.9	6.6	2.7
Total	**59.6**	**82.6**	**97.1**	**112.8**	**128.3**	**145.4**	**3.5**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F14. Delivered Energy Consumption in India by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	1.1	1.1	1.1	1.2	1.2	1.2	0.5
Natural Gas	0.0	0.0	0.1	0.1	0.1	0.1	4.3
Coal	0.3	0.4	0.4	0.4	0.5	0.5	2.6
Electricity	0.4	0.7	0.9	1.0	1.1	1.2	4.0
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**1.8**	**2.2**	**2.5**	**2.7**	**2.9**	**3.0**	**2.0**
Commercial							
Liquids	0.0	0.0	0.0	0.0	0.0	0.0	—
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.1	—
Coal	0.1	0.3	0.4	0.4	0.4	0.3	3.4
Electricity	0.3	0.7	0.9	1.1	1.3	1.5	5.8
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.5**	**0.9**	**1.3**	**1.5**	**1.7**	**1.9**	**5.4**
Industrial							
Liquids	2.3	2.5	3.0	3.4	3.8	4.2	2.3
Natural Gas	0.7	0.9	0.9	1.2	1.6	2.0	4.2
Coal	2.1	2.3	2.6	3.1	3.5	3.8	2.3
Electricity	1.2	1.3	1.6	1.9	2.2	2.6	3.1
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	13.5
Total	**6.3**	**7.0**	**8.2**	**9.6**	**11.1**	**12.6**	**2.7**
Transportation							
Liquids	1.4	1.7	2.3	2.6	3.0	3.3	3.3
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.1	0.1	0.1	0.1	0.1	1.9
Total	**1.5**	**1.8**	**2.4**	**2.7**	**3.1**	**3.4**	**3.3**
All End-Use Sectors							
Liquids	4.8	5.3	6.4	7.2	8.0	8.7	2.3
Natural Gas	0.7	0.9	1.0	1.3	1.7	2.2	4.4
Coal	2.5	2.9	3.4	3.9	4.3	4.7	2.4
Electricity	2.0	2.7	3.5	4.1	4.7	5.4	3.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	15.4
Delivered Energy	**10.0**	**11.8**	**14.3**	**16.4**	**18.8**	**20.9**	**2.9**
Electricity-Related Losses	5.4	6.3	7.4	8.7	9.9	11.0	2.8
Total	**15.4**	**18.2**	**21.7**	**25.1**	**28.6**	**31.9**	**2.8**
Electric Power[a]							
Liquids	0.2	0.2	0.2	0.2	0.2	0.2	0.6
Natural Gas	0.5	1.0	1.3	1.6	1.9	2.1	5.8
Coal	5.6	6.4	7.3	8.4	9.4	10.5	2.4
Nuclear	0.2	0.5	0.8	1.2	1.6	1.8	9.3
Renewables	0.9	1.0	1.1	1.4	1.5	1.7	2.5
Total	**7.4**	**9.0**	**10.8**	**12.7**	**14.6**	**16.4**	**3.1**
Total Energy Consumption							
Liquids	5.0	5.5	6.6	7.4	8.2	8.9	2.2
Natural Gas	1.2	2.0	2.3	2.9	3.6	4.3	5.0
Coal	8.1	9.3	10.7	12.2	13.7	15.2	2.4
Nuclear	0.2	0.5	0.8	1.2	1.6	1.8	9.3
Renewables	0.9	1.0	1.1	1.4	1.6	1.7	2.5
Total	**15.4**	**18.2**	**21.7**	**25.1**	**28.6**	**31.9**	**2.8**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F15. Delivered Energy Consumption in Other Non-OECD Asia by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.8	0.9	1.1	1.2	1.2	1.2	1.5
Natural Gas	0.2	0.4	0.6	0.7	0.7	0.7	4.2
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Electricity	0.7	0.9	1.3	1.5	1.7	1.9	3.7
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**1.8**	**2.2**	**3.1**	**3.4**	**3.6**	**3.9**	**2.9**
Commercial							
Liquids	0.2	0.2	0.3	0.3	0.3	0.4	2.6
Natural Gas	0.2	0.2	0.3	0.3	0.3	0.3	2.9
Coal	0.0	0.0	0.0	0.0	0.0	0.0	3.1
Electricity	0.5	0.8	1.0	1.2	1.4	1.6	4.4
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.9**	**1.2**	**1.5**	**1.8**	**2.0**	**2.3**	**3.8**
Industrial							
Liquids	4.3	4.7	5.4	5.8	6.2	6.6	1.7
Natural Gas	2.7	3.4	4.6	5.8	6.9	8.1	4.3
Coal	2.2	2.7	2.9	3.2	3.5	3.8	2.1
Electricity	1.3	1.6	2.0	2.4	2.8	3.2	3.5
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	9.9
Total	**10.5**	**12.3**	**14.9**	**17.2**	**19.4**	**21.7**	**2.8**
Transportation							
Liquids	6.2	6.9	7.7	8.5	9.4	10.6	2.1
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	3.9
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	2.7
Total	**6.2**	**6.9**	**7.7**	**8.5**	**9.5**	**10.6**	**2.1**
All End-Use Sectors							
Liquids	11.5	12.7	14.4	15.8	17.2	18.8	1.9
Natural Gas	3.1	4.0	5.5	6.7	7.9	9.1	4.3
Coal	2.2	2.7	3.0	3.3	3.6	3.8	2.1
Electricity	2.6	3.2	4.2	5.1	5.9	6.8	3.8
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	12.6
Delivered Energy	**19.4**	**22.6**	**27.1**	**30.8**	**34.6**	**38.5**	**2.7**
Electricity-Related Losses	5.5	7.7	8.8	10.1	11.0	11.6	3.0
Total	**24.9**	**30.3**	**35.9**	**40.9**	**45.6**	**50.2**	**2.7**
Electric Power[a]							
Liquids	1.0	1.2	1.5	1.6	1.7	1.8	2.3
Natural Gas	3.1	4.1	4.8	5.6	6.6	7.8	3.6
Coal	2.1	3.1	3.9	4.7	5.0	5.0	3.4
Nuclear	0.4	0.5	0.7	0.8	0.9	0.9	3.1
Renewables	1.5	2.1	2.2	2.4	2.7	3.0	2.7
Total	**8.0**	**10.9**	**13.0**	**15.1**	**16.9**	**18.4**	**3.2**
Total Energy Consumption							
Liquids	12.5	13.9	15.9	17.4	18.9	20.6	1.9
Natural Gas	6.2	8.0	10.2	12.3	14.5	16.9	4.0
Coal	4.3	5.8	6.9	8.0	8.5	8.8	2.8
Nuclear	0.4	0.5	0.7	0.8	0.9	0.9	3.1
Renewables	1.5	2.1	2.2	2.5	2.7	3.0	2.8
Total	**24.9**	**30.3**	**35.9**	**40.9**	**45.6**	**50.2**	**2.7**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F16. Delivered Energy Consumption in the Middle East by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.9	0.9	1.0	1.0	1.1	1.1	0.8
Natural Gas	1.1	1.1	1.3	1.4	1.5	1.6	1.6
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-1.8
Electricity	0.7	1.0	1.2	1.3	1.4	1.5	3.1
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Total	**2.7**	**3.1**	**3.5**	**3.8**	**4.0**	**4.3**	**1.8**
Commercial							
Liquids	0.2	0.2	0.2	0.2	0.3	0.3	2.4
Natural Gas	0.1	0.2	0.2	0.2	0.3	0.3	3.0
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.4	0.5	0.6	0.7	0.9	1.1	3.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	12.4
Total	**0.7**	**0.9**	**1.1**	**1.2**	**1.5**	**1.7**	**3.4**
Industrial							
Liquids	3.9	4.5	5.0	5.6	6.0	6.3	1.9
Natural Gas	4.5	5.6	6.8	8.0	8.6	9.2	2.8
Coal	0.1	0.1	0.1	0.1	0.1	0.1	2.7
Electricity	0.7	0.7	0.8	0.9	1.0	1.1	1.8
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	27.4
Total	**9.1**	**10.9**	**12.7**	**14.6**	**15.7**	**16.7**	**2.3**
Transportation							
Liquids	4.5	6.4	6.9	7.4	8.2	9.0	2.7
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Total	**4.5**	**6.4**	**6.9**	**7.4**	**8.2**	**9.0**	**2.7**
All End-Use Sectors							
Liquids	9.4	12.0	13.1	14.3	15.6	16.7	2.2
Natural Gas	5.7	6.9	8.3	9.6	10.3	11.1	2.6
Coal	0.1	0.1	0.1	0.1	0.1	0.1	2.7
Electricity	1.8	2.3	2.7	3.0	3.3	3.7	2.8
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	3.3
Delivered Energy	**17.0**	**21.4**	**24.2**	**27.0**	**29.4**	**31.7**	**2.4**
Electricity-Related Losses	4.2	4.9	5.3	5.6	6.1	6.5	1.7
Total	**21.1**	**26.3**	**29.5**	**32.6**	**35.5**	**38.2**	**2.3**
Electric Power[a]							
Liquids	2.2	2.6	2.7	2.9	3.2	3.4	1.7
Natural Gas	3.3	4.1	4.5	4.9	5.5	6.0	2.3
Coal	0.3	0.4	0.4	0.5	0.5	0.5	1.5
Nuclear	0.0	0.1	0.1	0.1	0.1	0.1	—
Renewables	0.1	0.2	0.2	0.2	0.3	0.2	2.6
Total	**6.0**	**7.3**	**7.9**	**8.6**	**9.4**	**10.2**	**2.1**
Total Energy Consumption							
Liquids	11.6	14.6	15.9	17.2	18.7	20.1	2.1
Natural Gas	9.0	11.0	12.8	14.6	15.8	17.1	2.5
Coal	0.4	0.5	0.5	0.5	0.6	0.6	1.6
Nuclear	0.0	0.1	0.1	0.1	0.1	0.1	—
Renewables	0.1	0.2	0.2	0.2	0.3	0.3	2.7
Total	**21.1**	**26.3**	**29.5**	**32.6**	**35.5**	**38.2**	**2.3**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F17. Delivered Energy Consumption in Africa by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.6	0.8	1.0	1.1	1.1	1.1	2.3
Natural Gas	0.1	0.3	0.4	0.4	0.4	0.4	4.3
Coal	0.1	0.2	0.2	0.2	0.2	0.2	2.7
Electricity	0.5	0.7	0.9	1.1	1.2	1.3	3.8
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**1.3**	**2.0**	**2.5**	**2.8**	**2.9**	**3.0**	**3.2**
Commercial							
Liquids	0.1	0.1	0.1	0.1	0.1	0.1	2.7
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	4.4
Coal	0.1	0.1	0.1	0.1	0.1	0.1	2.3
Electricity	0.2	0.3	0.4	0.4	0.5	0.5	4.5
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.3**	**0.4**	**0.6**	**0.6**	**0.7**	**0.8**	**3.8**
Industrial							
Liquids	1.6	1.8	2.1	2.4	2.5	2.5	1.8
Natural Gas	1.3	1.6	1.9	2.2	2.6	3.0	3.3
Coal	1.7	1.8	2.0	2.1	2.2	2.3	1.3
Electricity	0.9	1.0	1.2	1.5	1.8	2.1	3.1
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	2.9
Total	**5.5**	**6.2**	**7.2**	**8.2**	**9.1**	**9.9**	**2.3**
Transportation							
Liquids	3.0	3.5	4.0	4.5	5.0	5.6	2.5
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	4.5
Coal	0.0	0.0	0.0	0.0	0.0	0.0	-4.2
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	2.1
Total	**3.0**	**3.5**	**4.1**	**4.6**	**5.1**	**5.7**	**2.5**
All End-Use Sectors							
Liquids	5.2	6.2	7.2	8.2	8.7	9.3	2.3
Natural Gas	1.5	1.9	2.3	2.6	3.1	3.5	3.4
Coal	1.8	2.0	2.3	2.4	2.6	2.6	1.4
Electricity	1.6	2.0	2.5	3.1	3.5	3.9	3.5
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	4.1
Delivered Energy	**10.1**	**12.1**	**14.3**	**16.2**	**17.8**	**19.3**	**2.5**
Electricity-Related Losses	3.6	4.8	4.9	5.0	5.3	5.6	1.7
Total	**13.7**	**16.9**	**19.2**	**21.2**	**23.1**	**24.9**	**2.3**
Electric Power[a]							
Liquids	0.5	0.7	0.7	0.7	0.7	0.7	1.5
Natural Gas	1.4	1.7	2.0	2.4	2.7	3.1	3.3
Coal	2.3	3.2	3.4	3.6	3.9	4.1	2.2
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	1.7
Renewables	0.9	1.1	1.1	1.2	1.2	1.3	1.5
Total	**5.2**	**6.8**	**7.4**	**8.0**	**8.8**	**9.5**	**2.3**
Total Energy Consumption							
Liquids	5.7	6.9	7.9	8.9	9.4	10.1	2.2
Natural Gas	2.8	3.5	4.3	5.0	5.8	6.6	3.3
Coal	4.1	5.3	5.7	6.0	6.5	6.7	1.9
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	1.7
Renewables	0.9	1.1	1.1	1.2	1.3	1.3	1.5
Total	**13.7**	**16.9**	**19.2**	**21.2**	**23.1**	**24.9**	**2.3**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F18. Delivered Energy Consumption in Brazil by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.3	0.4	0.4	0.5	0.5	0.5	1.8
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.1	8.0
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.3	0.5	0.5	0.6	0.7	0.7	3.3
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.6**	**0.9**	**1.0**	**1.1**	**1.2**	**1.3**	**2.8**
Commercial							
Liquids	0.1	0.1	0.1	0.1	0.1	0.1	2.0
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	5.4
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.3	0.5	0.6	0.8	0.9	1.1	4.9
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.4**	**0.5**	**0.7**	**0.9**	**1.1**	**1.2**	**4.6**
Industrial							
Liquids	1.6	1.7	1.9	2.1	2.3	2.5	1.7
Natural Gas	0.5	0.6	0.6	0.7	0.7	0.9	2.3
Coal	0.4	0.5	0.6	0.7	0.7	0.8	2.8
Electricity	0.7	0.8	0.9	1.1	1.2	1.3	2.4
Renewables	0.0	0.1	0.1	0.1	0.1	0.1	1.3
Total	**3.3**	**3.7**	**4.1**	**4.5**	**5.0**	**5.6**	**2.1**
Transportation							
Liquids	2.5	3.0	3.3	3.7	4.0	4.4	2.1
Natural Gas	0.1	0.1	0.1	0.1	0.1	0.1	1.0
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Total	**2.6**	**3.1**	**3.4**	**3.8**	**4.1**	**4.4**	**2.1**
All End-Use Sectors							
Liquids	4.5	5.1	5.8	6.3	6.9	7.4	1.9
Natural Gas	0.6	0.6	0.7	0.8	0.9	1.0	2.5
Coal	0.4	0.5	0.6	0.7	0.7	0.8	2.8
Electricity	1.3	1.7	2.1	2.5	2.8	3.1	3.3
Renewables	0.0	0.1	0.1	0.1	0.1	0.1	1.4
Delivered Energy	**6.9**	**8.1**	**9.2**	**10.3**	**11.3**	**12.5**	**2.3**
Electricity-Related Losses	2.1	3.1	3.5	3.8	4.1	4.6	3.1
Total	**9.1**	**11.2**	**12.7**	**14.1**	**15.5**	**17.1**	**2.5**
Electric Power[a]							
Liquids	0.1	0.1	0.1	0.1	0.1	0.1	-0.6
Natural Gas	0.1	0.2	0.3	0.3	0.4	0.4	6.4
Coal	0.1	0.2	0.2	0.2	0.2	0.2	5.8
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	2.7
Renewables	3.1	4.2	4.8	5.4	6.0	6.8	3.1
Total	**3.4**	**4.8**	**5.6**	**6.3**	**6.9**	**7.8**	**3.2**
Total Energy Consumption							
Liquids	4.6	5.3	5.8	6.4	7.0	7.5	1.9
Natural Gas	0.6	0.9	1.0	1.1	1.3	1.5	3.3
Coal	0.5	0.7	0.8	0.9	0.9	1.1	3.3
Nuclear	0.1	0.1	0.2	0.2	0.2	0.2	2.7
Renewables	3.1	4.2	4.8	5.4	6.1	6.8	3.1
Total	**9.1**	**11.2**	**12.7**	**14.1**	**15.5**	**17.1**	**2.5**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Table F19. Delivered Energy Consumption in Other Central and South America by End-Use Sector and Fuel, 2004-2030
(Quadrillion Btu)

Sector/Fuel	2004	Projections					Average Annual Percent Change, 2004-2030
		2010	2015	2020	2025	2030	
Residential							
Liquids	0.4	0.5	0.5	0.5	0.6	0.6	1.1
Natural Gas	0.3	0.5	0.6	0.7	0.8	0.8	3.4
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Electricity	0.4	0.6	0.6	0.7	0.8	0.8	2.6
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	6.9
Total	**1.2**	**1.5**	**1.8**	**1.9**	**2.1**	**2.2**	**2.4**
Commercial							
Liquids	0.1	0.1	0.1	0.1	0.1	0.1	1.8
Natural Gas	0.1	0.1	0.1	0.2	0.2	0.2	2.8
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.3	0.5	0.5	0.6	0.7	0.7	3.3
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	—
Total	**0.5**	**0.7**	**0.8**	**0.9**	**1.0**	**1.0**	**3.0**
Industrial							
Liquids	2.2	2.5	2.7	2.9	3.1	3.2	1.5
Natural Gas	2.3	2.8	3.2	3.5	3.8	4.0	2.1
Coal	0.2	0.2	0.3	0.3	0.3	0.3	1.7
Electricity	0.7	0.8	0.9	0.9	1.0	1.1	1.6
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	1.2
Total	**5.5**	**6.4**	**7.0**	**7.6**	**8.2**	**8.6**	**1.8**
Transportation							
Liquids	3.3	4.1	5.1	5.9	6.7	7.6	3.2
Natural Gas	0.1	0.1	0.1	0.1	0.1	0.1	1.1
Coal	0.0	0.0	0.0	0.0	0.0	0.0	—
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	4.3
Total	**3.4**	**4.3**	**5.2**	**6.0**	**6.9**	**7.7**	**3.2**
All End-Use Sectors							
Liquids	6.0	7.2	8.4	9.5	10.5	11.5	2.5
Natural Gas	2.9	3.5	4.1	4.5	4.9	5.1	2.3
Coal	0.2	0.2	0.3	0.3	0.3	0.3	1.7
Electricity	1.5	1.8	2.0	2.3	2.5	2.7	2.3
Renewables	0.0	0.0	0.0	0.0	0.0	0.0	2.8
Delivered Energy	**10.6**	**12.8**	**14.8**	**16.5**	**18.2**	**19.6**	**2.4**
Electricity-Related Losses	3.0	3.7	4.0	4.2	4.4	4.6	1.7
Total	**13.5**	**16.5**	**18.8**	**20.7**	**22.6**	**24.2**	**2.3**
Electric Power[a]							
Liquids	0.9	0.9	0.9	0.9	0.9	0.9	0.1
Natural Gas	0.9	1.2	1.4	1.5	1.7	1.9	3.0
Coal	0.2	0.2	0.3	0.3	0.3	0.3	2.3
Nuclear	0.1	0.1	0.1	0.1	0.1	0.1	1.8
Renewables	2.5	3.2	3.4	3.6	3.9	4.1	1.9
Total	**4.5**	**5.5**	**6.0**	**6.5**	**6.9**	**7.3**	**1.9**
Total Energy Consumption							
Liquids	6.9	8.1	9.3	10.3	11.4	12.3	2.3
Natural Gas	3.7	4.7	5.4	6.0	6.5	7.0	2.4
Coal	0.4	0.4	0.5	0.6	0.6	0.6	2.0
Nuclear	0.1	0.1	0.1	0.1	0.1	0.1	1.8
Renewables	2.5	3.2	3.4	3.6	3.9	4.1	1.9
Total	**13.5**	**16.5**	**18.8**	**20.7**	**22.6**	**24.2**	**2.3**

[a]Fuel inputs used in the production of electricity and heat at central-station generators.

Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Appendix G

Projections of Petroleum and Other Liquids Production in Three Cases:

- **Reference**
- **High World Oil Price**
- **Low World Oil Price**

Table G1. World Total Liquids Production by Region and Country, Reference Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**24.9**	**34.0**	**35.3**	**37.8**	**42.1**	**46.6**	**51.3**	**56.8**	**2.0**
Asia (Indonesia)	**1.5**	**1.2**	**1.1**	**1.0**	**1.0**	**0.8**	**0.7**	**0.7**	**-2.2**
Middle East	**16.1**	**22.9**	**23.5**	**23.3**	**26.0**	**29.9**	**33.8**	**38.6**	**2.0**
Iran	3.1	4.1	4.2	4.2	4.3	4.5	4.8	5.0	0.8
Iraq	2.1	2.0	1.9	2.5	3.3	4.2	4.8	5.3	3.8
Kuwait	1.2	2.5	2.7	2.8	3.2	3.9	4.0	4.1	1.9
Qatar	0.4	1.0	1.1	1.6	2.0	2.4	2.6	2.9	4.0
Saudi Arabia	7.0	10.5	10.7	8.9	9.4	10.4	12.9	16.4	1.7
United Arab Emirates	2.3	2.8	2.8	3.3	3.8	4.5	4.7	4.9	2.2
North Africa	**2.7**	**3.5**	**3.8**	**4.4**	**4.7**	**4.9**	**5.0**	**4.9**	**1.3**
Algeria	1.3	2.0	2.1	2.5	2.8	2.9	3.0	3.1	1.7
Libya	1.4	1.6	1.7	1.9	2.0	2.0	2.0	1.9	0.7
West Africa	**2.3**	**3.4**	**4.0**	**6.3**	**7.6**	**8.1**	**8.6**	**9.2**	**3.9**
Angola	0.5	1.1	1.3	2.7	3.1	3.3	3.6	4.0	5.3
Nigeria	1.8	2.3	2.8	3.6	4.5	4.8	5.0	5.2	3.1
South America (Venezuela)	**2.3**	**3.0**	**2.8**	**2.8**	**2.8**	**2.9**	**3.1**	**3.3**	**0.4**
Non-OPEC	**41.4**	**48.9**	**49.1**	**52.9**	**55.3**	**57.2**	**59.1**	**60.9**	**0.8**
OECD	**20.0**	**22.7**	**21.7**	**22.4**	**22.5**	**22.5**	**22.4**	**22.6**	**0.0**
OECD North America	**14.7**	**15.6**	**15.1**	**16.5**	**17.2**	**17.8**	**18.3**	**18.8**	**0.7**
United States	9.6	8.6	8.2	9.5	10.0	10.1	10.1	10.2	0.6
Canada	2.0	3.1	3.1	3.9	4.2	4.4	4.8	5.1	1.8
Mexico	3.0	3.8	3.8	3.2	3.0	3.2	3.4	3.6	-0.3
OECD Europe	**4.5**	**6.4**	**5.9**	**5.0**	**4.4**	**3.7**	**3.2**	**2.9**	**-2.9**
OECD Asia	**0.8**	**0.7**	**0.7**	**0.9**	**0.9**	**1.0**	**0.9**	**0.9**	**0.7**
Japan	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	1.7
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8
Australia and New Zealand	0.7	0.6	0.6	0.7	0.8	0.8	0.7	0.6	0.4
Non-OECD	**21.4**	**26.2**	**27.3**	**30.5**	**32.7**	**34.7**	**36.7**	**38.3**	**1.5**
Non-OECD Europe and Eurasia	**11.6**	**11.5**	**11.9**	**13.7**	**14.9**	**15.8**	**16.7**	**17.5**	**1.6**
Russia	0.0	9.3	9.5	10.0	10.3	10.7	11.2	11.5	0.8
Caspian Area	0.0	1.9	2.1	3.4	4.3	4.8	5.2	5.7	4.3
Other	11.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-0.2
Non-OECD Asia	**4.4**	**6.4**	**6.8**	**6.8**	**6.9**	**7.3**	**7.7**	**8.0**	**0.8**
China	2.8	3.6	3.8	3.8	3.7	4.2	4.6	4.9	1.1
India	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.7
Other	1.0	2.0	2.1	2.0	2.0	2.0	1.9	1.8	-0.3
Middle East (Non-OPEC)	**1.3**	**1.7**	**1.8**	**1.7**	**1.7**	**1.7**	**1.8**	**1.8**	**0.2**
Africa	**1.7**	**2.5**	**2.6**	**3.1**	**3.4**	**3.5**	**3.6**	**3.7**	**1.6**
Central and South America	**2.4**	**4.1**	**4.3**	**5.2**	**5.8**	**6.3**	**6.9**	**7.3**	**2.3**
Brazil	0.8	1.8	1.9	2.7	3.2	3.6	4.0	4.4	3.6
Other	1.6	2.3	2.4	2.5	2.7	2.7	2.8	3.0	0.9
Total World	**66.3**	**82.9**	**84.3**	**90.7**	**97.4**	**103.8**	**110.4**	**117.7**	**1.4**
OPEC Share of World Production	38%	41%	42%	42%	43%	45%	46%	48%	
Persian Gulf Share of World Production	24%	28%	28%	26%	27%	29%	31%	33%	

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G2. World Conventional Liquids Production by Region and Country, Reference Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**24.9**	**33.3**	**34.7**	**36.8**	**40.7**	**44.8**	**49.0**	**54.1**	**1.9**
Asia (Indonesia)	**1.5**	**1.2**	**1.1**	**1.0**	**1.0**	**0.8**	**0.7**	**0.7**	**-2.2**
Middle East	**16.1**	**22.9**	**23.5**	**23.1**	**25.6**	**29.2**	**33.0**	**37.5**	**1.9**
Iran	3.1	4.1	4.2	4.2	4.3	4.5	4.8	5.0	0.8
Iraq	2.1	2.0	1.9	2.5	3.3	4.2	4.8	5.3	3.8
Kuwait	1.2	2.5	2.7	2.8	3.2	3.9	4.0	4.1	1.9
Qatar	0.4	1.0	1.1	1.5	1.6	1.7	1.7	1.8	2.0
Saudi Arabia	7.0	10.4	10.7	8.9	9.4	10.4	12.9	16.4	1.8
United Arab Emirates	2.3	2.8	2.8	3.3	3.8	4.5	4.7	4.9	2.2
North Africa	**2.7**	**3.5**	**3.8**	**4.4**	**4.7**	**4.9**	**5.0**	**4.9**	**1.3**
Algeria	1.3	2.0	2.1	2.5	2.8	2.9	3.0	3.1	1.7
Libya	1.4	1.6	1.7	1.9	2.0	2.0	2.0	1.9	0.7
West Africa	**2.3**	**3.4**	**4.0**	**6.3**	**7.6**	**8.1**	**8.6**	**9.2**	**3.9**
Angola	0.5	1.1	1.3	2.7	3.1	3.3	3.6	4.0	5.3
Nigeria	1.8	2.3	2.8	3.6	4.5	4.8	5.0	5.2	3.1
South America (Venezuela)	**2.3**	**2.3**	**2.2**	**2.0**	**1.8**	**1.8**	**1.7**	**1.7**	**-1.1**
Non-OPEC	**40.8**	**47.1**	**47.3**	**49.4**	**50.9**	**51.7**	**52.4**	**53.1**	**0.5**
OECD	**19.5**	**21.2**	**20.4**	**19.9**	**19.6**	**18.9**	**18.0**	**17.6**	**-0.7**
OECD North America	**14.3**	**14.2**	**13.8**	**14.2**	**14.4**	**14.4**	**14.1**	**14.1**	**0.0**
United States	9.6	8.3	8.0	9.0	9.5	9.5	9.2	9.1	0.4
Canada	1.7	2.0	2.0	2.0	1.9	1.7	1.6	1.5	-1.3
Mexico	3.0	3.8	3.8	3.2	3.0	3.2	3.3	3.5	-0.3
OECD Europe	**4.5**	**6.3**	**5.9**	**4.9**	**4.3**	**3.6**	**3.1**	**2.7**	**-3.2**
Denmark	0.1	0.4	0.4	0.3	0.2	0.2	0.2	0.2	-3.4
Norway	1.7	3.2	3.0	2.5	2.3	1.9	1.6	1.4	-3.1
United Kngdom	2.0	2.1	1.9	1.5	1.1	0.8	0.6	0.5	-5.4
Other	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-0.2
OECD Asia	**0.8**	**0.7**	**0.7**	**0.8**	**0.9**	**0.9**	**0.8**	**0.7**	**0.2**
Japan	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	1.7
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Australia and New Zealand	0.7	0.6	0.6	0.7	0.8	0.7	0.6	0.6	-0.2

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Table G2. World Conventional Liquids Production by Region and Country, Reference Case, 1990-2030 (Continued)
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
Non-OECD	**21.2**	**25.9**	**26.8**	**29.5**	**31.3**	**32.8**	**34.4**	**35.6**	**1.2**
Non-OECD Europe and Eurasia	**11.6**	**11.5**	**11.9**	**13.7**	**14.9**	**15.8**	**16.7**	**17.5**	**1.6**
Russia	**0.0**	**9.3**	**9.5**	**10.0**	**10.3**	**10.7**	**11.2**	**11.5**	**0.8**
Caspian Area	**0.0**	**1.9**	**2.1**	**3.4**	**4.3**	**4.8**	**5.2**	**5.7**	**4.3**
Azerbaijan	0.0	0.3	0.4	1.1	1.0	1.0	1.1	1.1	4.8
Kazakhstan	0.0	1.2	1.3	1.9	2.7	3.1	3.4	3.7	4.4
Turkmenistan	0.0	0.2	0.2	0.2	0.3	0.3	0.3	0.3	1.7
Uzbekistan	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.6	5.4
Other	**11.6**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**-0.2**
Non-OECD Asia	**4.4**	**6.4**	**6.6**	**6.4**	**6.2**	**6.3**	**6.3**	**6.1**	**-0.2**
China	2.8	3.6	3.8	3.6	3.2	3.4	3.4	3.3	-0.4
India	0.7	0.8	0.8	0.9	1.0	1.0	1.1	1.1	1.2
Brunei	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	1.4
Malaysia	0.6	0.8	0.8	0.6	0.6	0.6	0.5	0.5	-2.1
Thailand	0.1	0.3	0.3	0.3	0.3	0.3	0.2	0.2	-0.5
Vietnam	0.1	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.2
Other	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.7
Middle East (Non-OPEC)	**1.3**	**1.7**	**1.8**	**1.7**	**1.7**	**1.7**	**1.8**	**1.8**	**0.2**
Oman	0.7	0.8	0.8	0.7	0.7	0.7	0.6	0.6	-0.9
Syria	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	-0.7
Yemen	0.2	0.4	0.4	0.5	0.6	0.6	0.7	0.7	2.2
Other	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	-0.3
Africa	**1.6**	**2.3**	**2.4**	**2.8**	**3.1**	**3.2**	**3.3**	**3.4**	**1.4**
Chad	0.0	0.2	0.2	0.2	0.2	0.3	0.3	0.4	3.3
Congo (Brazzaville)	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.6	3.4
Egypt	0.9	0.7	0.8	0.6	0.5	0.5	0.5	0.4	-1.9
Equatorial Guniea	0.0	0.4	0.4	0.4	0.4	0.4	0.3	0.3	-0.6
Gabon	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	-1.5
Sao Tome and Principe	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.3	—
Sudan	0.0	0.3	0.4	0.7	0.7	0.7	0.6	0.6	2.2
Other	0.3	0.3	0.3	0.5	0.5	0.6	0.6	0.6	3.1
Central and South America	**2.3**	**3.9**	**4.1**	**4.8**	**5.4**	**5.9**	**6.3**	**6.8**	**2.1**
Brazil	0.7	1.6	1.7	2.4	2.8	3.2	3.5	3.9	3.5
Argentina	0.5	0.8	0.8	0.8	0.7	0.7	0.6	0.6	-1.2
Colombia	0.5	0.5	0.5	0.6	0.7	0.8	0.8	0.8	1.7
Ecuador	0.3	0.5	0.5	0.5	0.6	0.7	0.8	0.8	1.8
Peru	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.7
Trinidad and Tobago	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.6
Other	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.0
Total World	**65.7**	**80.4**	**81.9**	**86.2**	**91.6**	**96.5**	**101.4**	**107.2**	**1.1**
OPEC Share of World Production	38%	41%	42%	43%	44%	46%	48%	50%	
Persian Gulf Share of World Production	25%	28%	29%	27%	28%	30%	33%	35%	

Note: Conventional liquids include crude oil and lease condensates, natural gas plant liquids, and refinery gains.
Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G3. World Unconventional Liquids Production by Region and Country, Reference Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**0.0**	**0.8**	**0.6**	**1.0**	**1.4**	**1.9**	**2.3**	**2.7**	**5.0**
Biofuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Ultra-Heavy Oil (Venezuela)	0.0	0.6	0.6	0.9	1.0	1.1	1.4	1.6	4.0
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Gas-to-Liquids (primarily Qatar)	0.0	0.1	0.0	0.2	0.4	0.8	0.9	1.1	10.6
Non-OPEC	**0.6**	**1.8**	**1.8**	**3.5**	**4.4**	**5.4**	**6.7**	**7.8**	**5.8**
OECD	**0.5**	**1.5**	**1.3**	**2.5**	**3.0**	**3.6**	**4.4**	**5.0**	**4.9**
Biofuels	0.0	0.2	0.2	0.5	0.6	0.6	0.7	0.7	5.2
Oil Sands/Bitumen (Canada)	0.4	1.1	1.1	1.9	2.3	2.7	3.2	3.6	4.7
Ultra-Heavy Oil (Mexico)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	—
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.1	0.2	0.5	0.7	29.9
Gas-to-Liquids	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	—
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Non-OECD	**0.1**	**0.4**	**0.5**	**1.0**	**1.4**	**1.8**	**2.3**	**2.8**	**8.2**
Biofuels	0.1	0.2	0.4	0.7	0.8	0.9	1.0	1.0	7.1
Ultra-Heavy Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal-to-Liquids	0.1	0.1	0.1	0.3	0.5	0.9	1.3	1.7	12.3
Gas-to-Liquids	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2
World									
Biofuels	0.2	0.3	0.6	1.3	1.4	1.5	1.6	1.7	6.2
Oil Sands/Bitumen	0.4	1.1	1.1	1.9	2.3	2.7	3.2	3.6	4.7
Ultra-Heavy Oil	0.0	0.6	0.6	0.9	1.0	1.1	1.4	1.7	4.2
Coal-to-Liquids	0.1	0.1	0.1	0.3	0.6	1.1	1.8	2.4	13.7
Gas-to-Liquids	0.0	0.3	0.0	0.2	0.5	0.8	0.9	1.2	5.4
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6
World Total	**0.6**	**2.6**	**2.4**	**4.5**	**5.8**	**7.3**	**9.0**	**10.5**	**5.6**
Selected Country Highlights									
Biofuels									
Brazil	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	4.4
China	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	—
India	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
United States	0.0	0.1	0.2	0.5	0.5	0.5	0.6	0.6	5.6
Coal-to-Liquids									
Australia and New Zealand	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	—
China	0.0	0.0	0.0	0.1	0.3	0.7	1.0	1.4	—
Germany	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	22.8
India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	—
South Africa	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	4.2
United States	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	—
Gas-to-Liquids									
Qatar	0.0	0.0	0.0	0.1	0.4	0.8	0.9	1.1	—
South Africa	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G4. World Total Liquids Production by Region and Country, High Oil Price Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**24.9**	**34.0**	**35.3**	**35.3**	**35.6**	**36.7**	**40.0**	**43.2**	**0.9**
Asia (Indonesia)	**1.5**	**1.2**	**1.1**	**1.0**	**0.8**	**0.6**	**0.6**	**0.5**	**-3.3**
Middle East	**16.1**	**22.9**	**23.5**	**21.4**	**22.0**	**23.5**	**26.2**	**28.8**	**0.9**
Iran	3.1	4.1	4.2	4.0	3.5	3.4	3.6	3.8	-0.3
Iraq	2.1	2.0	1.9	2.4	2.7	3.2	3.6	4.0	2.7
Kuwait	1.2	2.5	2.7	2.7	2.6	2.9	3.0	3.1	0.8
Qatar	0.4	1.0	1.1	1.5	1.8	2.2	2.3	2.6	3.6
Saudi Arabia	7.0	10.5	10.7	7.6	8.3	8.4	10.1	11.6	0.4
United Arab Emirates	2.3	2.8	2.8	3.1	3.1	3.4	3.6	3.7	1.1
North Africa	**2.7**	**3.5**	**3.8**	**4.2**	**3.9**	**3.7**	**3.7**	**3.7**	**0.2**
Algeria	1.3	2.0	2.1	2.4	2.3	2.2	2.2	2.3	0.6
Libya	1.4	1.6	1.7	1.8	1.6	1.5	1.5	1.4	-0.4
West Africa	**2.3**	**3.4**	**4.0**	**6.1**	**6.3**	**6.2**	**6.5**	**6.9**	**2.8**
Angola	0.5	1.1	1.3	2.6	2.6	2.5	2.7	3.0	4.1
Nigeria	1.8	2.3	2.8	3.5	3.7	3.6	3.8	3.9	2.0
South America (Venezuela)	**2.3**	**3.0**	**2.8**	**2.7**	**2.6**	**2.7**	**3.0**	**3.3**	**0.4**
Non-OPEC	**41.4**	**48.9**	**49.1**	**52.4**	**52.8**	**54.9**	**57.7**	**60.2**	**0.8**
OECD	**20.0**	**22.7**	**21.7**	**22.1**	**21.8**	**22.6**	**23.5**	**24.4**	**0.3**
OECD North America	**14.7**	**15.6**	**15.1**	**16.3**	**16.8**	**18.3**	**19.7**	**20.9**	**1.1**
United States	9.6	8.6	8.2	9.2	9.6	10.5	11.2	11.9	1.3
Canada	2.0	3.1	3.1	3.9	4.4	4.9	5.4	5.7	2.3
Mexico	3.0	3.8	3.8	3.1	2.8	2.9	3.1	3.2	-0.7
OECD Europe	**4.5**	**6.4**	**5.9**	**4.9**	**4.1**	**3.4**	**3.0**	**2.7**	**-3.2**
OECD Asia	**0.8**	**0.7**	**0.7**	**0.8**	**0.9**	**0.9**	**0.9**	**0.8**	**0.5**
Japan	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	1.3
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3
Australia and New Zealand	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.1
Non-OECD	**21.4**	**26.2**	**27.3**	**30.3**	**31.0**	**32.2**	**34.2**	**35.8**	**1.2**
Non-OECD Europe and Eurasia	**11.6**	**11.5**	**11.9**	**13.6**	**13.9**	**14.3**	**15.1**	**15.8**	**1.2**
Russia	0.0	9.3	9.5	9.9	9.6	9.7	10.1	10.4	0.4
Caspian Area	0.0	1.9	2.1	3.4	4.0	4.3	4.7	5.1	3.9
Other	11.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-0.5
Non-OECD Asia	**4.4**	**6.4**	**6.8**	**6.8**	**6.6**	**7.1**	**7.5**	**7.9**	**0.8**
China	2.8	3.6	3.8	3.8	3.6	4.1	4.5	4.9	1.2
India	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.7
Other	1.0	2.0	2.1	2.0	1.9	1.9	1.8	1.7	-0.5
Middle East (Non-OPEC)	**1.3**	**1.7**	**1.8**	**1.7**	**1.6**	**1.6**	**1.6**	**1.6**	**-0.2**
Africa	**1.7**	**2.5**	**2.6**	**3.1**	**3.2**	**3.3**	**3.4**	**3.5**	**1.3**
Central and South America	**2.4**	**4.1**	**4.3**	**5.1**	**5.6**	**6.1**	**6.6**	**7.0**	**2.1**
Brazil	0.8	1.8	1.9	2.7	3.1	3.5	4.0	4.3	3.5
Other	1.6	2.3	2.4	2.4	2.5	2.5	2.6	2.7	0.6
Total World	**66.3**	**82.9**	**84.3**	**87.7**	**88.4**	**91.6**	**97.6**	**103.4**	**0.9**
OPEC Share of World Production	38%	41%	42%	40%	40%	40%	41%	42%	
Persian Gulf Share of World Production	24%	28%	28%	24%	25%	26%	27%	28%	

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G5. World Conventional Liquids Production by Region and Country, High Oil Price Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**24.9**	**33.3**	**34.7**	**34.3**	**34.0**	**34.5**	**37.2**	**39.9**	**0.7**
Asia (Indonesia)	**1.5**	**1.2**	**1.1**	**1.0**	**0.8**	**0.6**	**0.6**	**0.5**	**-3.3**
Middle East	**16.1**	**22.9**	**23.5**	**21.2**	**21.6**	**22.7**	**25.2**	**27.5**	**0.7**
Iran	3.1	4.1	4.2	4.0	3.5	3.4	3.6	3.8	-0.3
Iraq	2.1	2.0	1.9	2.4	2.7	3.2	3.6	4.0	2.7
Kuwait	1.2	2.5	2.7	2.7	2.6	2.9	3.0	3.1	0.8
Qatar	0.4	1.0	1.1	1.4	1.3	1.3	1.3	1.3	0.9
Saudi Arabia	7.0	10.4	10.7	7.6	8.3	8.4	10.1	11.6	0.4
United Arab Emirates	2.3	2.8	2.8	3.1	3.1	3.4	3.6	3.7	1.1
North Africa	**2.7**	**3.5**	**3.8**	**4.2**	**3.9**	**3.7**	**3.7**	**3.7**	**0.2**
Algeria	1.3	2.0	2.1	2.4	2.3	2.2	2.2	2.3	0.6
Libya	1.4	1.6	1.7	1.8	1.6	1.5	1.5	1.4	-0.4
West Africa	**2.3**	**3.4**	**4.0**	**6.0**	**6.2**	**6.2**	**6.5**	**6.9**	**2.8**
Angola	0.5	1.1	1.3	2.6	2.6	2.5	2.7	3.0	4.1
Nigeria	1.8	2.3	2.8	3.4	3.7	3.6	3.8	3.9	2.0
South America (Venezuela)	**2.3**	**2.3**	**2.2**	**1.9**	**1.5**	**1.3**	**1.3**	**1.3**	**-2.2**
Non-OPEC	**40.8**	**47.1**	**47.3**	**48.8**	**47.5**	**47.4**	**48.2**	**49.2**	**0.2**
OECD	**19.5**	**21.2**	**20.4**	**19.6**	**18.4**	**17.8**	**17.3**	**17.1**	**-0.8**
OECD North America	**14.3**	**14.2**	**13.8**	**13.9**	**13.5**	**13.7**	**13.8**	**14.0**	**0.0**
United States	9.6	8.3	8.0	8.7	9.0	9.3	9.3	9.5	0.5
Canada	1.7	2.0	2.0	2.0	1.7	1.6	1.4	1.3	-1.7
Mexico	3.0	3.8	3.8	3.1	2.8	2.9	3.0	3.2	-0.7
OECD Europe	**4.5**	**6.3**	**5.9**	**4.9**	**4.0**	**3.2**	**2.8**	**2.4**	**-3.6**
Denmark	0.1	0.4	0.4	0.3	0.2	0.2	0.2	0.1	-3.7
Norway	1.7	3.2	3.0	2.5	2.1	1.7	1.5	1.3	-3.5
United Kngdom	2.0	2.1	1.9	1.5	1.0	0.7	0.6	0.4	-5.8
Other	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	-0.6
OECD Asia	**0.8**	**0.7**	**0.7**	**0.8**	**0.8**	**0.8**	**0.7**	**0.7**	**-0.2**
Japan	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	1.3
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Australia and New Zealand	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.5	-0.6

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Table G5. World Conventional Liquids Production by Region and Country, High Oil Price Case, 1990-2030 (Continued)
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
Non-OECD	**21.2**	**25.9**	**26.8**	**29.3**	**29.1**	**29.7**	**30.9**	**32.1**	**0.8**
Non-OECD Europe and Eurasia	**11.6**	**11.5**	**11.9**	**13.6**	**13.9**	**14.3**	**15.1**	**15.8**	**1.2**
Russia	**0.0**	**9.3**	**9.5**	**9.9**	**9.6**	**9.7**	**10.1**	**10.4**	**0.4**
Caspian Area	**0.0**	**1.9**	**2.1**	**3.4**	**4.0**	**4.3**	**4.7**	**5.1**	**3.9**
Azerbaijan	0.0	0.3	0.4	1.1	1.0	0.9	1.0	1.0	4.3
Kazakhstan	0.0	1.2	1.3	1.9	2.5	2.8	3.1	3.4	4.0
Turkmenistan	0.0	0.2	0.2	0.2	0.2	0.3	0.3	0.3	1.3
Uzbekistan	0.0	0.1	0.1	0.2	0.3	0.4	0.4	0.5	4.9
Other	**11.6**	**0.3**	**0.3**	**0.3**	**0.3**	**0.2**	**0.3**	**0.3**	**-0.6**
Non-OECD Asia	**4.4**	**6.4**	**6.6**	**6.4**	**5.7**	**5.7**	**5.6**	**5.5**	**-0.6**
China	2.8	3.6	3.8	3.5	3.0	3.0	3.0	3.0	-0.8
India	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	0.8
Brunei	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.3	1.0
Malaysia	0.6	0.8	0.8	0.6	0.5	0.5	0.5	0.4	-2.5
Thailand	0.1	0.3	0.3	0.3	0.2	0.2	0.2	0.2	-0.9
Vietnam	0.1	0.4	0.4	0.5	0.5	0.4	0.4	0.4	-0.2
Other	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Middle East (Non-OPEC)	**1.3**	**1.7**	**1.8**	**1.7**	**1.6**	**1.6**	**1.6**	**1.6**	**-0.2**
Oman	0.7	0.8	0.8	0.7	0.6	0.6	0.6	0.5	-1.3
Syria	0.4	0.5	0.5	0.4	0.4	0.4	0.3	0.3	-1.1
Yemen	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	1.8
Other	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	-0.7
Africa	**1.6**	**2.3**	**2.4**	**2.8**	**2.9**	**2.9**	**3.0**	**3.1**	**1.0**
Chad	0.0	0.2	0.2	0.2	0.2	0.2	0.3	0.4	2.9
Congo (Brazzaville)	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5	2.9
Egypt	0.9	0.7	0.8	0.6	0.4	0.4	0.4	0.4	-2.3
Equatorial Guniea	0.0	0.4	0.4	0.4	0.4	0.3	0.3	0.3	-1.0
Gabon	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.1	-1.9
Sao Tome and Principe	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.3	—
Sudan	0.0	0.3	0.4	0.7	0.7	0.6	0.6	0.5	1.8
Other	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.6	2.7
Central and South America	**2.3**	**3.9**	**4.1**	**4.8**	**5.0**	**5.3**	**5.7**	**6.1**	**1.7**
Brazil	0.7	1.6	1.7	2.4	2.6	2.9	3.2	3.5	3.1
Argentina	0.5	0.8	0.8	0.8	0.7	0.6	0.6	0.5	-1.6
Colombia	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8	1.3
Ecuador	0.3	0.5	0.5	0.5	0.6	0.6	0.7	0.8	1.4
Peru	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.3
Trinidad and Tobago	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Other	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.6
Total World	**65.7**	**80.4**	**81.9**	**83.1**	**81.4**	**81.9**	**85.4**	**89.1**	**0.4**
OPEC Share of World Production	38%	41%	42%	43%	44%	46%	48%	50%	
Persian Gulf Share of World Production	25%	28%	29%	27%	28%	30%	33%	35%	

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G6. World Unconventional Liquids Production by Region and Country, High Oil Price Case, 1990-2030
(Million Barrels per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**0.0**	**0.8**	**0.6**	**1.0**	**1.6**	**2.2**	**2.8**	**3.3**	**5.8**
Biofuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Ultra-Heavy Oil (Venezuela)	0.0	0.6	0.6	0.9	1.1	1.4	1.7	2.0	4.9
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Gas-to-Liquids (primarily Qatar)	0.0	0.1	0.0	0.2	0.5	0.9	1.0	1.3	11.3
Non-OPEC	**0.6**	**1.8**	**1.8**	**3.6**	**5.3**	**7.4**	**9.5**	**11.0**	**7.2**
OECD	**0.5**	**1.5**	**1.3**	**2.5**	**3.5**	**4.9**	**6.2**	**7.3**	**6.4**
Biofuels	0.0	0.2	0.2	0.6	0.6	0.7	0.7	0.8	5.7
Oil Sands/Bitumen (Canada)	0.4	1.1	1.1	1.9	2.7	3.3	3.9	4.4	5.5
Ultra-Heavy Oil (Mexico)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	—
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.2	0.7	1.4	1.9	35.3
Gas-to-Liquids	0.0	0.2	0.0	0.0	0.0	0.1	0.1	0.1	-2.8
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Non-OECD	**0.1**	**0.4**	**0.5**	**1.1**	**1.9**	**2.6**	**3.2**	**3.7**	**9.5**
Biofuels	0.1	0.2	0.4	0.7	1.2	1.5	1.6	1.6	9.3
Ultra-Heavy Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal-to-Liquids	0.1	0.1	0.1	0.3	0.6	1.0	1.5	2.0	13.0
Gas-to-Liquids	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8
World									
Biofuels	0.2	0.3	0.6	1.3	1.8	2.1	2.3	2.4	7.7
Oil Sands/Bitumen	0.4	1.1	1.1	1.9	2.7	3.3	3.9	4.4	5.5
Ultra-Heavy Oil	0.0	0.6	0.6	0.9	1.1	1.4	1.8	2.0	5.0
Coal-to-Liquids	0.1	0.1	0.1	0.3	0.7	1.8	2.9	3.9	15.9
Gas-to-Liquids	0.0	0.3	0.0	0.2	0.6	1.0	1.2	1.5	6.3
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2
World Total	**0.6**	**2.6**	**2.4**	**4.6**	**6.9**	**9.7**	**12.2**	**14.3**	**6.8**
Selected Country Highlights									
Biofuels									
Brazil	0.1	0.2	0.2	0.3	0.5	0.7	0.8	0.8	6.5
China	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3	—
India	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	—
United States	0.0	0.1	0.2	0.5	0.5	0.5	0.6	0.6	5.8
Coal-to-Liquids									
Australia and New Zealand	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	—
China	0.0	0.0	0.0	0.1	0.3	0.8	1.2	1.6	—
Germany	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	23.5
India	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	—
South Africa	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	4.9
United States	0.0	0.0	0.0	0.0	0.1	0.6	1.2	1.6	—
Gas-to-Liquids									
Qatar	0.0	0.0	0.0	0.1	0.5	0.9	1.0	1.3	—
South Africa	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G7. World Total Liquids Production by Region and Country, Low Oil Price Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**24.9**	**34.0**	**35.3**	**39.4**	**41.9**	**46.3**	**53.9**	**61.5**	**2.3**
Asia (Indonesia)	**1.5**	**1.2**	**1.1**	**1.0**	**1.0**	**0.8**	**0.8**	**0.8**	**-1.7**
Middle East	**16.1**	**22.9**	**23.5**	**24.5**	**26.2**	**30.1**	**35.7**	**41.5**	**2.3**
Iran	3.1	4.1	4.2	4.3	4.3	4.5	5.2	5.8	1.4
Iraq	2.1	2.0	1.9	2.5	3.3	4.2	5.2	6.2	4.4
Kuwait	1.2	2.5	2.7	2.9	3.2	3.9	4.3	4.8	2.5
Qatar	0.4	1.0	1.1	1.7	1.9	2.1	2.4	2.6	3.6
Saudi Arabia	7.0	10.5	10.7	9.7	9.8	10.8	13.5	16.4	1.7
United Arab Emirates	2.3	2.8	2.8	3.4	3.7	4.5	5.1	5.7	2.8
North Africa	**2.7**	**3.5**	**3.8**	**4.5**	**4.7**	**4.9**	**5.4**	**5.7**	**1.9**
Algeria	1.3	2.0	2.1	2.6	2.7	2.9	3.2	3.5	2.3
Libya	1.4	1.6	1.7	1.9	2.0	2.0	2.1	2.2	1.3
West Africa	2.3	3.4	4.0	6.5	7.6	8.1	9.3	10.7	4.5
Angola	0.5	1.1	1.3	2.8	3.1	3.3	3.9	4.6	5.9
Nigeria	1.8	2.3	2.8	3.7	4.4	4.8	5.5	6.1	3.7
South America (Venezuela)	**2.3**	**3.0**	**2.8**	**2.8**	**2.5**	**2.4**	**2.6**	**2.8**	**-0.2**
Non-OPEC	**41.4**	**48.9**	**49.1**	**53.6**	**62.1**	**66.6**	**69.5**	**72.2**	**1.5**
OECD	**20.0**	**22.7**	**21.7**	**22.6**	**23.9**	**23.7**	**23.2**	**23.0**	**0.0**
OECD North America	**14.7**	**15.6**	**15.1**	**16.7**	**17.7**	**18.0**	**18.1**	**18.3**	**0.6**
United States	9.6	8.6	8.2	9.6	10.3	10.1	9.8	9.7	0.4
Canada	2.0	3.1	3.1	3.9	3.8	3.8	3.8	3.8	0.8
Mexico	3.0	3.8	3.8	3.2	3.6	4.1	4.4	4.8	0.8
OECD Europe	**4.5**	**6.4**	**5.9**	**5.1**	**5.1**	**4.6**	**4.0**	**3.7**	**-2.1**
OECD Asia	**0.8**	**0.7**	**0.7**	**0.9**	**1.1**	**1.2**	**1.1**	**1.0**	**1.4**
Japan	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	2.4
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5
Australia and New Zealand	0.7	0.6	0.6	0.7	0.9	0.9	0.9	0.8	1.1
Non-OECD	**21.4**	**26.2**	**27.3**	**31.0**	**38.2**	**42.9**	**46.3**	**49.2**	**2.4**
Non-OECD Europe and Eurasia	**11.6**	**11.5**	**11.9**	**14.0**	**17.8**	**20.1**	**21.9**	**23.5**	**2.8**
Russia	0.0	9.3	9.5	10.2	12.3	13.7	14.7	15.5	2.0
Caspian Area	0.0	1.9	2.1	3.5	5.1	6.1	6.9	7.7	5.5
Other	11.6	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.8
Non-OECD Asia	**4.4**	**6.4**	**6.8**	**6.9**	**7.8**	**8.6**	**9.0**	**9.2**	**1.4**
China	2.8	3.6	3.8	3.9	4.2	4.7	5.0	5.2	1.4
India	0.7	0.8	0.9	1.0	1.3	1.4	1.5	1.6	2.5
Other	1.0	2.0	2.1	2.1	2.4	2.5	2.4	2.3	0.7
Middle East (Non-OPEC)	**1.3**	**1.7**	**1.8**	**1.7**	**2.0**	**2.2**	**2.3**	**2.4**	**1.3**
Africa	**1.7**	**2.5**	**2.6**	**3.1**	**3.9**	**4.3**	**4.5**	**4.7**	**2.5**
Central and South America	**2.4**	**4.1**	**4.3**	**5.2**	**6.7**	**7.7**	**8.6**	**9.4**	**3.2**
Brazil	0.8	1.8	1.9	2.7	3.6	4.3	4.9	5.5	4.5
Other	1.6	2.3	2.4	2.5	3.2	3.4	3.7	3.9	2.0
Total World	**66.3**	**82.9**	**84.3**	**93.0**	**103.9**	**112.9**	**123.4**	**133.7**	**1.9**
OPEC Share of World Production	38%	41%	42%	42%	40%	41%	44%	46%	
Persian Gulf Share of World Production	24%	28%	28%	26%	25%	27%	29%	31%	

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G8. World Conventional Liquids Production by Region and Country, Low Oil Price Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**24.9**	**33.3**	**34.7**	**38.4**	**40.9**	**45.2**	**52.6**	**60.1**	**2.3**
Asia (Indonesia)	**1.5**	**1.2**	**1.1**	**1.0**	**1.0**	**0.8**	**0.8**	**0.8**	**-1.7**
Middle East	**16.1**	**22.9**	**23.5**	**24.4**	**25.9**	**29.6**	**35.3**	**40.9**	**2.3**
Iran	3.1	4.1	4.2	4.3	4.3	4.5	5.2	5.8	1.4
Iraq	2.1	2.0	1.9	2.5	3.3	4.2	5.2	6.2	4.4
Kuwait	1.2	2.5	2.7	2.9	3.2	3.9	4.3	4.8	2.5
Qatar	0.4	1.0	1.1	1.5	1.6	1.7	1.9	2.0	2.6
Saudi Arabia	7.0	10.4	10.7	9.7	9.8	10.8	13.5	16.4	1.8
United Arab Emirates	2.3	2.8	2.8	3.4	3.7	4.5	5.1	5.7	2.8
North Africa	**2.7**	**3.5**	**3.8**	**4.5**	**4.7**	**4.9**	**5.4**	**5.7**	**1.9**
Algeria	1.3	2.0	2.1	2.6	2.7	2.9	3.2	3.5	2.3
Libya	1.4	1.6	1.7	1.9	2.0	2.0	2.1	2.2	1.3
West Africa	**2.3**	**3.4**	**4.0**	**6.5**	**7.5**	**8.1**	**9.3**	**10.7**	**4.5**
Angola	0.5	1.1	1.3	2.8	3.1	3.3	3.9	4.6	5.9
Nigeria	1.8	2.3	2.8	3.7	4.4	4.8	5.5	6.1	3.7
South America (Venezuela)	**2.3**	**2.3**	**2.2**	**2.0**	**1.8**	**1.8**	**1.9**	**2.0**	**-0.5**
Non-OPEC	**40.8**	**47.1**	**47.3**	**50.3**	**59.0**	**63.4**	**65.8**	**68.2**	**1.4**
OECD	**19.5**	**21.2**	**20.4**	**20.3**	**21.8**	**21.6**	**20.9**	**20.4**	**-0.1**
OECD North America	**14.3**	**14.2**	**13.8**	**14.5**	**15.7**	**16.0**	**15.9**	**15.9**	**0.5**
United States	9.6	8.3	8.0	9.2	9.9	9.7	9.4	9.3	0.4
Canada	1.7	2.0	2.0	2.0	2.2	2.2	2.1	1.9	-0.2
Mexico	3.0	3.8	3.8	3.2	3.6	4.0	4.4	4.7	0.8
OECD Europe	**4.5**	**6.3**	**5.9**	**5.0**	**5.1**	**4.5**	**4.0**	**3.5**	**-2.2**
Denmark	0.1	0.4	0.4	0.3	0.3	0.2	0.2	0.2	-2.3
Norway	1.7	3.2	3.0	2.5	2.7	2.4	2.1	1.9	-2.0
United Kngdom	2.0	2.1	1.9	1.5	1.3	1.0	0.8	0.6	-4.4
Other	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.6
OECD Asia	**0.8**	**0.7**	**0.7**	**0.8**	**1.1**	**1.1**	**1.0**	**1.0**	**1.2**
Japan	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	2.4
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9
Australia and New Zealand	0.7	0.6	0.6	0.7	0.9	0.9	0.8	0.7	0.9

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Table G8. World Conventional Liquids Production by Region and Country, Low Oil Price Case, 1990-2030 (Continued)
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
Non-OECD	**21.2**	**25.9**	**26.8**	**30.0**	**37.2**	**41.8**	**45.0**	**47.8**	**2.4**
Non-OECD Europe and Eurasia	**11.6**	**11.5**	**11.9**	**14.0**	**17.8**	**20.1**	**21.9**	**23.5**	**2.8**
Russia	**0.0**	**9.3**	**9.5**	**10.2**	**12.3**	**13.7**	**14.7**	**15.5**	**2.0**
Caspian Area	**0.0**	**1.9**	**2.1**	**3.5**	**5.1**	**6.1**	**6.9**	**7.7**	**5.5**
Azerbaijan	0.0	0.3	0.4	1.1	1.2	1.2	1.4	1.4	6.0
Kazakhstan	0.0	1.2	1.3	2.0	3.2	4.0	4.5	5.0	5.6
Turkmenistan	0.0	0.2	0.2	0.2	0.3	0.4	0.4	0.4	2.9
Uzbekistan	0.0	0.1	0.1	0.2	0.4	0.5	0.6	0.7	6.6
Other	**11.6**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.4**	**0.4**	**0.9**
Non-OECD Asia	**4.4**	**6.4**	**6.6**	**6.5**	**7.3**	**8.0**	**8.1**	**8.2**	**0.9**
China	2.8	3.6	3.8	3.6	3.8	4.2	4.4	4.4	0.7
India	0.7	0.8	0.8	0.9	1.2	1.3	1.4	1.5	2.3
Brunei	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	2.6
Malaysia	0.6	0.8	0.8	0.6	0.7	0.7	0.7	0.7	-1.0
Thailand	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.6
Vietnam	0.1	0.4	0.4	0.5	0.6	0.6	0.6	0.6	1.3
Other	0.1	0.2	0.3	0.3	0.4	0.4	0.4	0.4	1.8
Middle East (Non-OPEC)	**1.3**	**1.7**	**1.8**	**1.7**	**2.0**	**2.2**	**2.3**	**2.4**	**1.3**
Oman	0.7	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.3
Syria	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.4
Yemen	0.2	0.4	0.4	0.5	0.7	0.8	0.9	1.0	3.4
Other	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
Africa	**1.6**	**2.3**	**2.4**	**2.9**	**3.7**	**4.1**	**4.3**	**4.6**	**2.6**
Chad	0.0	0.2	0.2	0.2	0.3	0.3	0.4	0.5	4.5
Congo (Brazzaville)	0.2	0.2	0.2	0.3	0.4	0.5	0.6	0.7	4.5
Egypt	0.9	0.7	0.8	0.6	0.6	0.6	0.6	0.6	-0.8
Equatorial Guniea	0.0	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.5
Gabon	0.3	0.2	0.3	0.2	0.3	0.3	0.2	0.2	-0.4
Sao Tome and Principe	0.0	0.0	0.0	0.0	0.2	0.4	0.4	0.4	—
Sudan	0.0	0.3	0.4	0.7	0.8	0.9	0.8	0.8	3.4
Other	0.3	0.3	0.3	0.5	0.6	0.7	0.8	0.8	4.3
Central and South America	**2.3**	**3.9**	**4.1**	**4.9**	**6.4**	**7.4**	**8.3**	**9.1**	**3.3**
Brazil	0.7	1.6	1.7	2.4	3.3	4.0	4.6	5.3	4.7
Argentina	0.5	0.8	0.8	0.8	0.9	0.9	0.8	0.8	-0.1
Colombia	0.5	0.5	0.5	0.6	0.8	1.0	1.0	1.1	2.9
Ecuador	0.3	0.5	0.5	0.6	0.7	0.8	1.0	1.1	3.0
Peru	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	2.9
Trinidad and Tobago	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	1.7
Other	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	2.0
Total World	**65.7**	**80.4**	**81.9**	**88.7**	**99.9**	**108.6**	**118.5**	**128.3**	**1.8**
OPEC Share of World Production	38%	41%	42%	43%	41%	42%	44%	47%	
Persian Gulf Share of World Production	25%	28%	29%	27%	26%	27%	30%	32%	

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Table G9. World Unconventional Liquids Production by Region and Country, Low Oil Price Case, 1990-2030
(Million Barrels Oil Equivalent per Day)

Region/Country	History (Estimates)			Projections					Average Annual Percent Change, 2004-2030
	1990	2004	2005	2010	2015	2020	2025	2030	
OPEC[a]	**0.0**	**0.8**	**0.6**	**1.0**	**1.0**	**1.1**	**1.3**	**1.4**	**2.5**
Biofuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Ultra-Heavy Oil (Venezuela)	0.0	0.6	0.6	0.8	0.7	0.7	0.8	0.8	1.5
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Gas-to-Liquids (primarily Qatar)	0.0	0.1	0.0	0.2	0.3	0.4	0.5	0.6	7.9
Non-OPEC	**0.6**	**1.8**	**1.8**	**3.3**	**3.0**	**3.2**	**3.7**	**4.0**	**3.0**
OECD	**0.5**	**1.5**	**1.3**	**2.3**	**2.1**	**2.1**	**2.4**	**2.5**	**2.1**
Biofuels	0.0	0.2	0.2	0.5	0.5	0.5	0.5	0.5	3.6
Oil Sands/Bitumen (Canada)	0.4	1.1	1.1	1.8	1.6	1.6	1.8	1.9	2.1
Ultra-Heavy Oil (Mexico)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal-to-Liquids	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	21.3
Gas-to-Liquids	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	—
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Non-OECD	**0.1**	**0.4**	**0.5**	**1.0**	**1.0**	**1.1**	**1.3**	**1.4**	**5.6**
Biofuels	0.1	0.2	0.4	0.7	0.6	0.5	0.5	0.5	4.5
Ultra-Heavy Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Coal-to-Liquids	0.1	0.1	0.1	0.2	0.3	0.5	0.7	0.9	9.6
Gas-to-Liquids	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	—
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
World									
Biofuels	0.2	0.3	0.6	1.2	1.0	1.0	1.0	1.0	4.0
Oil Sands/Bitumen	0.4	1.1	1.1	1.8	1.6	1.6	1.8	1.9	2.1
Ultra-Heavy Oil	0.0	0.6	0.6	0.8	0.7	0.7	0.8	0.9	1.6
Coal-to-Liquids	0.1	0.1	0.1	0.2	0.4	0.6	0.8	1.0	10.0
Gas-to-Liquids	0.0	0.3	0.0	0.2	0.3	0.5	0.5	0.6	2.9
Shale Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9
World Total	**0.6**	**2.6**	**2.4**	**4.3**	**4.0**	**4.3**	**4.9**	**5.4**	**2.9**
Selected Country Highlights									
Biofuels									
Brazil	0.1	0.2	0.2	0.3	0.3	0.2	0.3	0.2	1.8
China	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	—
India	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	—
United States	0.0	0.1	0.2	0.4	0.4	0.4	0.4	0.4	4.1
Coal-to-Liquids									
Australia and New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
China	0.0	0.0	0.0	0.1	0.2	0.4	0.6	0.7	—
Germany	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	19.8
India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
South Africa	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	1.7
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Gas-to-Liquids									
Qatar	0.0	0.0	0.0	0.1	0.3	0.4	0.5	0.6	—
South Africa	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	—

[a]OPEC = Organization of the Petroleum Exporting Countries (OPEC-12).

Sources: **History:** Energy Information Administration (EIA), Office of Energy Markets and End Use. **Projections:** EIA, System for the Analysis of Global Energy Markets, run 2007March21a (2007).

Appendix H

Reference Case Projections for Electricity Capacity and Generation by Fuel

Table H1. World Total Installed Generating Capacity by Region and Country, 2004-2030
(Gigawatts)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**1,114**	**1,177**	**1,164**	**1,234**	**1,317**	**1,418**	**0.9**
United States[a]	946	998	960	1,010	1,076	1,159	0.8
Canada	118	122	136	144	150	155	1.0
Mexico	50	56	68	80	91	104	2.9
OECD Europe	**726**	**756**	**782**	**820**	**841**	**895**	**0.8**
OECD Asia	**360**	**413**	**424**	**436**	**446**	**465**	**1.0**
Japan	244	273	271	277	281	289	0.7
South Korea	59	77	83	86	89	94	1.8
Australia/New Zealand	57	63	69	73	76	81	1.4
Total OECD	**2,199**	**2,345**	**2,370**	**2,491**	**2,605**	**2,777**	**0.9**
Non-OECD							
Non-OECD Europe and Eurasia	**398**	**439**	**484**	**530**	**575**	**627**	**1.8**
Russia	215	230	248	271	288	312	1.4
Other	183	209	236	259	287	315	2.1
Non-OECD Asia	**715**	**905**	**1,118**	**1,329**	**1,533**	**1,745**	**3.5**
China	391	510	631	764	886	1,014	3.7
India	131	165	201	233	262	296	3.2
Other Non-OECD Asia	192	230	286	332	385	436	3.2
Middle East	**112**	**144**	**163**	**179**	**197**	**216**	**2.6**
Africa	**104**	**132**	**164**	**201**	**225**	**247**	**3.4**
Central and South America	**213**	**260**	**294**	**331**	**366**	**402**	**2.5**
Brazil	87	119	139	161	183	204	3.4
Other Central and South America	126	141	155	170	184	198	1.7
Total Non-OECD	**1,541**	**1,880**	**2,223**	**2,571**	**2,897**	**3,236**	**2.9**
Total World	**3,741**	**4,225**	**4,593**	**5,062**	**5,501**	**6,014**	**1.8**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H2. World Installed Liquids-Fired Generating Capacity by Region and Country, 2004-2030
(Gigawatts)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**144**	**141**	**113**	**113**	**112**	**111**	**-1.0**
United States[a]	125	121	92	91	91	89	-1.3
Canada	4	4	4	4	3	3	-1.6
Mexico	14	16	17	18	18	19	1.0
OECD Europe	**32**	**24**	**23**	**23**	**22**	**21**	**-1.7**
OECD Asia	**40**	**42**	**38**	**37**	**36**	**35**	**-0.5**
Japan	33	34	31	30	30	30	-0.4
South Korea	7	7	6	6	5	5	-1.0
Australia/New Zealand	1	1	1	1	1	1	-1.2
Total OECD	**216**	**207**	**175**	**173**	**170**	**167**	**-1.0**
Non-OECD							
Non-OECD Europe and Eurasia	**24**	**21**	**20**	**19**	**19**	**18**	**-1.1**
Russia	8	6	5	5	5	5	-1.8
Other	16	15	15	14	14	13	-0.8
Non-OECD Asia	**52**	**56**	**58**	**61**	**63**	**64**	**0.8**
China	12	11	11	11	11	9	-1.1
India	4	5	5	6	6	6	1.0
Other Non-OECD Asia	35	40	42	44	46	49	1.3
Middle East	**37**	**47**	**54**	**58**	**64**	**70**	**2.5**
Africa	**10**	**10**	**11**	**11**	**12**	**12**	**0.9**
Central and South America	**27**	**28**	**28**	**28**	**28**	**27**	**0.0**
Brazil	4	5	5	5	5	5	1.0
Other Central and South America	23	22	23	23	23	22	-0.2
Total Non-OECD	**150**	**162**	**171**	**177**	**185**	**191**	**0.9**
Total World	**366**	**369**	**346**	**351**	**355**	**358**	**-0.1**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H3. World Installed Natural-Gas-Fired Generating Capacity by Region and Country, 2004-2030
(Gigawatts)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**341**	**382**	**384**	**415**	**446**	**487**	**1.4**
United States[a]	312	349	338	358	381	411	1.1
Canada	12	13	18	21	21	21	2.2
Mexico	17	20	27	36	44	55	4.6
OECD Europe	**184**	**225**	**263**	**305**	**334**	**379**	**2.8**
OECD Asia	**114**	**149**	**156**	**161**	**164**	**174**	**1.6**
Japan	96	119	120	124	127	133	1.2
South Korea	10	16	17	17	17	18	2.3
Australia/New Zealand	9	14	19	21	20	23	3.9
Total OECD	**639**	**756**	**803**	**881**	**944**	**1,039**	**1.9**
Non-OECD							
Non-OECD Europe and Eurasia	**142**	**175**	**203**	**224**	**248**	**288**	**2.8**
Russia	91	108	120	131	136	153	2.0
Other	51	67	84	94	111	135	3.9
Non-OECD Asia	**87**	**108**	**146**	**178**	**228**	**286**	**4.7**
China	7	11	17	24	38	58	8.8
India	10	16	23	27	32	36	5.0
Other Non-OECD Asia	70	81	106	126	158	192	4.0
Middle East	**62**	**82**	**93**	**104**	**116**	**127**	**2.8**
Africa	**39**	**53**	**72**	**98**	**114**	**129**	**4.7**
Central and South America	**48**	**62**	**73**	**86**	**98**	**111**	**3.3**
Brazil	7	10	13	16	19	21	4.5
Other Central and South America	41	52	60	70	79	90	3.0
Total Non-OECD	**377**	**479**	**588**	**690**	**803**	**941**	**3.6**
Total World	**1,016**	**1,235**	**1,391**	**1,571**	**1,748**	**1,980**	**2.6**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H4. World Installed Coal-Fired Generating Capacity by Region and Country, 2004-2030
(Gigawatts)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**340**	**350**	**361**	**392**	**447**	**508**	**1.6**
United States[a]	315	325	329	354	406	465	1.5
Canada	19	16	22	25	26	25	1.2
Mexico	7	8	11	13	15	17	3.8
OECD Europe	**193**	**173**	**158**	**157**	**145**	**145**	**-1.1**
OECD Asia	**104**	**115**	**112**	**112**	**115**	**117**	**0.5**
Japan	46	47	43	41	40	40	-0.5
South Korea	25	35	36	36	36	38	1.6
Australia/New Zealand	33	33	33	35	38	40	0.7
Total OECD	**636**	**637**	**631**	**661**	**706**	**770**	**0.7**
Non-OECD							
Non-OECD Europe and Eurasia	**105**	**114**	**124**	**137**	**147**	**158**	**1.6**
Russia	49	48	48	53	56	60	0.8
Other	56	66	76	84	91	98	2.2
Non-OECD Asia	**395**	**541**	**685**	**827**	**948**	**1,073**	**3.9**
China	271	379	475	584	675	768	4.1
India	82	105	128	146	164	186	3.2
Other Non-OECD Asia	42	57	81	97	109	119	4.0
Middle East	**6**	**8**	**9**	**9**	**9**	**9**	**1.7**
Africa	**32**	**45**	**55**	**66**	**73**	**79**	**3.5**
Central and South America	**6**	**10**	**13**	**14**	**15**	**16**	**4.1**
Brazil	2	5	7	7	7	8	6.7
Other Central and South America	4	5	6	7	7	8	2.4
Total Non-OECD	**544**	**717**	**885**	**1,053**	**1,192**	**1,335**	**3.5**
Total World	**1,180**	**1,354**	**1,516**	**1,714**	**1,899**	**2,105**	**2.3**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H5. World Installed Nuclear Generating Capacity by Region and Country, 2004-2030
(Gigawatts)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**112**	**117**	**119**	**129**	**129**	**131**	**0.6**
United States[a]	100	101	102	112	112	113	0.5
Canada	11	15	15	15	16	17	1.8
Mexico	1	1	1	1	1	1	0.1
OECD Europe	**134**	**129**	**126**	**115**	**113**	**114**	**-0.6**
OECD Asia	**61**	**66**	**75**	**83**	**86**	**92**	**1.5**
Japan	46	49	53	57	58	60	1.1
South Korea	16	17	22	26	28	32	2.7
Australia/New Zealand	0	0	0	0	0	0	—
Total OECD	**307**	**311**	**319**	**326**	**327**	**336**	**0.3**
Non-OECD							
Non-OECD Europe and Eurasia	**42**	**41**	**46**	**57**	**66**	**65**	**1.7**
Russia	22	22	27	33	41	42	2.5
Other	19	18	18	23	25	22	0.5
Non-OECD Asia	**15**	**20**	**36**	**51**	**65**	**72**	**6.3**
China	6	9	18	28	36	42	7.6
India	3	5	9	13	17	19	7.8
Other Non-OECD Asia	6	6	8	10	12	11	2.7
Middle East	**0**	**1**	**1**	**1**	**1**	**1**	**—**
Africa	**2**	**2**	**2**	**2**	**3**	**3**	**1.8**
Central and South America	**3**	**3**	**4**	**5**	**5**	**5**	**1.6**
Brazil	2	2	3	3	3	3	1.6
Other Central and South America	1	1	1	2	2	2	1.6
Total Non-OECD	**61**	**67**	**89**	**116**	**139**	**145**	**3.4**
Total World	**368**	**378**	**408**	**442**	**466**	**481**	**1.0**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H6. World Installed Hydroelectric and Other Renewable Generating Capacity by Region and Country, 2004-2030
(Gigawatts)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**206**	**220**	**223**	**228**	**235**	**243**	**0.6**
United States[a]	122	134	136	137	139	142	0.6
Canada	73	75	76	79	84	88	0.8
Mexico	11	11	11	12	12	12	0.6
OECD Europe	**183**	**205**	**212**	**220**	**228**	**236**	**1.0**
OECD Asia	**40**	**41**	**43**	**44**	**45**	**47**	**0.6**
Japan	23	23	24	25	26	27	0.5
South Korea	2	2	2	2	2	2	0.6
Australia/New Zealand	15	15	16	17	17	18	0.6
Total OECD	**428**	**466**	**478**	**492**	**508**	**526**	**0.8**
Non-OECD							
Non-OECD Europe and Eurasia	**86**	**88**	**91**	**93**	**95**	**98**	**0.5**
Russia	45	46	47	49	50	51	0.5
Other	41	42	43	44	45	47	0.5
Non-OECD Asia	**167**	**180**	**194**	**213**	**229**	**249**	**1.5**
China	95	100	109	117	126	136	1.4
India	32	34	36	41	43	48	1.5
Other Non-OECD Asia	40	46	49	55	60	65	1.9
Middle East	**7**	**7**	**7**	**7**	**8**	**8**	**0.8**
Africa	**21**	**22**	**23**	**23**	**24**	**24**	**0.5**
Central and South America	**129**	**158**	**177**	**199**	**222**	**244**	**2.5**
Brazil	73	97	112	130	148	168	3.3
Other Central and South America	56	61	65	69	73	77	1.2
Total Non-OECD	**410**	**455**	**490**	**535**	**578**	**624**	**1.6**
Total World	**838**	**921**	**969**	**1,026**	**1,086**	**1,150**	**1.2**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H7. World Total Net Electricity Generation From Central Producers by Region and Country, 2004-2030
(Billion Kilowatthours)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**4,619**	**5,141**	**5,579**	**5,990**	**6,409**	**6,887**	**1.5**
United States[a]	3,804	4,214	4,519	4,810	5,125	5,487	1.4
Canada	573	640	708	757	795	835	1.5
Mexico	242	287	352	423	488	565	3.3
OECD Europe	**3,250**	**3,470**	**3,564**	**3,709**	**3,833**	**4,044**	**0.8**
OECD Asia	**1,586**	**1,873**	**1,976**	**2,061**	**2,138**	**2,259**	**1.4**
Japan	974	1,133	1,155	1,183	1,209	1,257	1.0
South Korea	345	447	506	541	570	617	2.3
Australia/New Zealand	266	293	315	336	360	385	1.4
Total OECD	**9,455**	**10,484**	**11,120**	**11,759**	**12,380**	**13,190**	**1.3**
Non-OECD							
Non-OECD Europe and Eurasia	**1,497**	**1,768**	**2,036**	**2,284**	**2,503**	**2,731**	**2.3**
Russia	882	997	1,121	1,258	1,375	1,493	2.0
Other	615	770	915	1,026	1,128	1,238	2.7
Non-OECD Asia	**3,517**	**4,778**	**6,161**	**7,488**	**8,807**	**10,185**	**4.2**
China	2,080	2,894	3,728	4,587	5,446	6,339	4.4
India	631	867	1,098	1,292	1,492	1,705	3.9
Other Non-OECD Asia	807	1,018	1,335	1,608	1,869	2,141	3.8
Middle East	**567**	**740**	**849**	**947**	**1,062**	**1,185**	**2.9**
Africa	**505**	**643**	**797**	**975**	**1,113**	**1,235**	**3.5**
Central and South America	**882**	**1,140**	**1,326**	**1,506**	**1,672**	**1,838**	**2.9**
Brazil	381	556	677	783	888	996	3.8
Other Central and South America	501	584	649	723	784	842	2.0
Total Non-OECD	**6,969**	**9,069**	**11,169**	**13,200**	**15,157**	**17,174**	**3.5**
Total World	**16,424**	**19,554**	**22,289**	**24,959**	**27,537**	**30,364**	**2.4**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H8. World Net Liquids-Fired Electricity Generation From Central Producers by Region and Country, 2004-2030
(Billion Kilowatthours)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**210**	**192**	**210**	**213**	**213**	**215**	**0.1**
United States[a]	122	95	103	103	105	107	-0.5
Canada	12	14	16	14	12	10	-1.0
Mexico	75	83	91	95	96	98	1.0
OECD Europe	**99**	**79**	**76**	**75**	**70**	**67**	**-1.5**
OECD Asia	**107**	**116**	**109**	**104**	**104**	**104**	**-0.1**
Japan	83	90	83	80	79	78	-0.2
South Korea	23	24	24	22	23	24	0.2
Australia/New Zealand	1	3	2	2	1	1	2.3
Total OECD	**416**	**387**	**394**	**392**	**387**	**386**	**-0.3**
Non-OECD							
Non-OECD Europe and Eurasia	**49**	**44**	**44**	**42**	**42**	**41**	**-0.7**
Russia	21	16	16	15	15	15	-1.2
Other	29	28	28	27	27	26	-0.4
Non-OECD Asia	**138**	**162**	**189**	**202**	**210**	**207**	**1.6**
China	33	37	43	48	48	37	0.5
India	14	16	18	19	20	20	1.5
Other Non-OECD Asia	91	108	128	135	142	149	1.9
Middle East	**194**	**249**	**283**	**312**	**346**	**381**	**2.6**
Africa	**50**	**55**	**61**	**62**	**63**	**65**	**1.0**
Central and South America	**91**	**92**	**94**	**97**	**102**	**98**	**0.3**
Brazil	9	13	14	14	13	13	1.2
Other Central and South America	82	78	80	83	88	86	0.2
Total Non-OECD	**522**	**601**	**671**	**714**	**762**	**792**	**1.6**
Total World	**937**	**988**	**1,065**	**1,106**	**1,149**	**1,178**	**0.9**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H9. World Net Natural-Gas-Fired Electricity Generation From Central Producers by Region and Country, 2004-2030
(Billion Kilowatthours)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**833**	**1,038**	**1,224**	**1,324**	**1,317**	**1,317**	**1.8**
United States[a]	715	897	1,023	1,065	1,011	942	1.1
Canada	33	37	56	63	66	67	2.8
Mexico	85	104	146	195	241	307	5.1
OECD Europe	**531**	**749**	**898**	**1,070**	**1,230**	**1,394**	**3.8**
OECD Asia	**333**	**473**	**509**	**526**	**536**	**571**	**2.1**
Japan	271	356	367	380	388	411	1.6
South Korea	40	69	76	73	76	78	2.6
Australia/New Zealand	22	48	67	73	72	82	5.1
Total OECD	**1,697**	**2,260**	**2,632**	**2,919**	**3,083**	**3,282**	**2.6**
Non-OECD							
Non-OECD Europe and Eurasia	**579**	**755**	**904**	**1,018**	**1,133**	**1,315**	**3.2**
Russia	384	472	545	607	646	723	2.5
Other	195	283	359	411	488	592	4.4
Non-OECD Asia	**360**	**468**	**638**	**795**	**1,001**	**1,259**	**4.9**
China	11	22	35	53	82	126	9.7
India	45	91	129	154	183	207	6.1
Other Non-OECD Asia	303	354	474	587	735	926	4.4
Middle East	**326**	**430**	**497**	**563**	**641**	**724**	**3.1**
Africa	**125**	**171**	**241**	**335**	**399**	**475**	**5.3**
Central and South America	**144**	**199**	**243**	**285**	**325**	**369**	**3.7**
Brazil	17	27	36	46	56	62	5.0
Other Central and South America	126	172	206	239	269	307	3.5
Total Non-OECD	**1,533**	**2,021**	**2,523**	**2,995**	**3,498**	**4,141**	**3.9**
Total World	**3,231**	**4,282**	**5,155**	**5,914**	**6,581**	**7,423**	**3.3**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H10. World Net Coal-Fired Electricity Generation From Central Producers by Region and Country, 2004-2030
(Billion Kilowatthours)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**2,117**	**2,280**	**2,486**	**2,716**	**3,130**	**3,589**	**2.1**
United States[a]	1,979	2,142	2,295	2,489	2,880	3,330	2.0
Canada	98	84	123	144	149	152	1.7
Mexico	40	54	68	84	101	107	3.9
OECD Europe	**1,052**	**938**	**869**	**881**	**824**	**826**	**-0.9**
OECD Asia	**587**	**682**	**686**	**691**	**719**	**743**	**0.9**
Japan	240	276	264	251	247	245	0.1
South Korea	152	214	228	232	242	255	2.0
Australia/New Zealand	194	192	194	207	230	244	0.9
Total OECD	**3,756**	**3,900**	**4,041**	**4,287**	**4,673**	**5,159**	**1.2**
Non-OECD							
Non-OECD Europe and Eurasia	**316**	**392**	**455**	**498**	**516**	**554**	**2.2**
Russia	172	189	192	215	225	241	1.3
Other	144	203	263	283	292	313	3.0
Non-OECD Asia	**2,365**	**3,377**	**4,381**	**5,334**	**6,252**	**7,229**	**4.4**
China	1,658	2,423	3,122	3,835	4,554	5,317	4.6
India	467	627	777	894	1,021	1,174	3.6
Other Non-OECD Asia	241	327	482	605	677	737	4.4
Middle East	**32**	**42**	**48**	**50**	**52**	**54**	**2.0**
Africa	**227**	**310**	**383**	**464**	**527**	**566**	**3.6**
Central and South America	**26**	**54**	**70**	**79**	**82**	**87**	**4.8**
Brazil	8	26	39	42	43	47	7.2
Other Central and South America	18	27	31	37	39	40	3.2
Total Non-OECD	**2,966**	**4,174**	**5,337**	**6,424**	**7,428**	**8,491**	**4.1**
Total World	**6,723**	**8,074**	**9,378**	**10,711**	**12,102**	**13,650**	**2.8**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H11. World Net Nuclear Electricity Generation From Central Producers by Region and Country, 2004-2030
(Billion Kilowatthours)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**883**	**910**	**936**	**1,012**	**1,015**	**1,033**	**0.6**
United States[a]	789	789	812	885	886	896	0.5
Canada	86	110	113	116	118	126	1.5
Mexico	9	11	11	11	11	11	0.9
OECD Europe	**941**	**914**	**902**	**835**	**831**	**847**	**-0.4**
OECD Asia	**396**	**433**	**497**	**559**	**592**	**646**	**1.9**
Japan	272	299	325	352	370	394	1.4
South Korea	124	134	172	207	222	252	2.8
Australia/New Zealand	0	0	0	0	0	0	—
Total OECD	**2,220**	**2,257**	**2,335**	**2,406**	**2,438**	**2,526**	**0.5**
Non-OECD							
Non-OECD Europe and Eurasia	**263**	**278**	**323**	**405**	**479**	**476**	**2.3**
Russia	137	149	190	236	299	315	3.2
Other	125	129	133	169	180	161	1.0
Non-OECD Asia	**103**	**148**	**265**	**389**	**495**	**557**	**6.7**
China	48	64	135	217	283	329	7.7
India	15	37	66	97	124	144	9.1
Other Non-OECD Asia	40	47	64	75	88	84	2.9
Middle East	**0**	**5**	**6**	**6**	**6**	**6**	**—**
Africa	**14**	**14**	**15**	**15**	**21**	**21**	**1.5**
Central and South America	**19**	**20**	**28**	**34**	**33**	**33**	**2.2**
Brazil	12	13	18	22	22	22	2.5
Other Central and South America	7	7	10	12	11	11	1.6
Total Non-OECD	**399**	**465**	**637**	**849**	**1,034**	**1,093**	**4.0**
Total World	**2,619**	**2,722**	**2,972**	**3,255**	**3,472**	**3,619**	**1.3**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Table H12. World Net Hydroelectric and Other Renewable Electricity Generation From Central Producers by Region and Country, 2004-2030
(Billion Kilowatthours)

Region/Country	History	Projections					Average Annual Percent Change, 2004-2030
	2004	2010	2015	2020	2025	2030	
OECD							
OECD North America	**748**	**898**	**925**	**953**	**1,003**	**1,043**	**1.3**
United States[a]	370	469	487	495	512	522	1.3
Canada	344	394	401	420	452	481	1.3
Mexico	34	35	36	38	39	41	0.7
OECD Europe	**626**	**791**	**819**	**848**	**878**	**909**	**1.4**
OECD Asia	**163**	**169**	**175**	**181**	**188**	**195**	**0.7**
Japan	109	113	117	121	125	129	0.7
South Korea	6	6	6	7	7	7	0.7
Australia/New Zealand	49	51	52	54	56	58	0.7
Total OECD	**1,537**	**1,858**	**1,919**	**1,983**	**2,069**	**2,147**	**1.3**
Non-OECD							
Non-OECD Europe and Eurasia	**289**	**300**	**310**	**321**	**333**	**345**	**0.7**
Russia	167	172	179	185	191	198	0.7
Other	122	127	132	137	141	146	0.7
Non-OECD Asia	**552**	**624**	**688**	**768**	**850**	**934**	**2.0**
China	330	348	393	434	479	529	1.8
India	90	95	107	128	144	159	2.2
Other Non-OECD Asia	132	181	187	207	226	245	2.4
Middle East	**14**	**15**	**15**	**16**	**18**	**20**	**1.3**
Africa	**89**	**93**	**97**	**100**	**104**	**108**	**0.7**
Central and South America	**603**	**776**	**891**	**1,011**	**1,131**	**1,251**	**2.8**
Brazil	335	477	569	659	754	852	3.7
Other Central and South America	268	300	322	352	377	399	1.5
Total Non-OECD	**1,548**	**1,808**	**2,002**	**2,217**	**2,435**	**2,657**	**2.1**
Total World	**3,086**	**3,666**	**3,921**	**4,199**	**4,504**	**4,804**	**1.7**

[a]Includes the 50 States and the District of Columbia.

Note: Totals may not equal sum of components due to independent rounding.

Sources: **History:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), AEO2007 National Energy Modeling System, run AEO2007.D112106A, web site www.eia.doe.gov/oiaf/aeo; and System for the Analysis of Global Energy Markets (2007).

Appendix I

Comparisons With International Energy Agency and *IEO2006* Projections

Comparisons with IEA's *World Energy Outlook 2006*

The International Energy Agency (IEA) provides projections comparable with those in *IEO2007* in its *World Energy Outlook 2006*. Because IEA releases projections only for the years 2015 and 2030, two time periods are compared here—2004 to 2015 and 2015 to 2030.

In the 2004 to 2015 projection period, both *IEO2007* and IEA expect world energy demand to increase by an average of 2.1 percent per year (Table I1). Not surprisingly, both outlooks project much faster growth in energy demand among the non-OECD nations than in the OECD, with non-OECD energy use growing three times as rapidly. There are, however, some regional differences. IEA's expectations for demand growth in OECD Asia, for instance, are much higher than those in *IEO2007*, and the projected 1.4-percent annual growth rate projected by IEA for the region exceeds the 1.3-percent rate in the *IEO2007* high economic growth case.

In the non-OECD regions, both outlooks have similar projections for growth in Europe and Eurasia. *IEO2007* projects 1.6-percent average annual growth in energy use between 2004 and 2015, and IEA projects 1.4-percent annual growth. IEA projects much slower growth than *IEO2007* over the 2004 to 2015 period for China and other non-OECD Asia, as well as for Africa and Central and South America. In each case, IEA's projected growth rates are lower than those in the *IEO2007* low economic growth case. On the other hand, IEA's projected 4.2-percent annual growth in Middle Eastern energy use over the same period is much higher than the projection of 3.1 percent per year in the *IEO2007* reference case and, in fact, exceeds the projected growth rate in the *IEO2007* high macroeconomic growth case.

In the later years of the projections, *IEO2007* and IEA generally agree, with worldwide energy demand growing by 1.5 percent per year between 2015 and 2030 in the *IEO2007* reference case and by 1.3 percent per year in the IEA projection (Table I2). Both outlooks anticipate similar regional growth over the 2015 to 2030 period. The largest regional difference between the two projections—and the only instance in which IEA regional growth projections fall outside the range defined by the *IEO2007* low and high macroeconomic growth cases—is for China. IEA anticipates that China's energy demand growth will slow to 2.0 percent per year for the final 15 years of the outlook, whereas the *IEO2007* reference case expects that China will maintain a 2.7-percent annual growth rate in energy demand through the end of the

Table I1. Comparison of *IEO2007* and IEA World Energy Consumption Growth Rates by Region, 2004-2015
(Average Annual Percent Growth)

Region	*IEO2007*			IEA
	Low Growth	Reference	High Growth	
OECD	**0.6**	**0.9**	**1.2**	**1.2**
North America	0.9	1.2	1.5	1.3
United States	0.7	1.0	1.3	1.2
Europe	0.3	0.5	0.8	0.8
Asia	0.7	1.0	1.3	1.4
Non-OECD	**2.9**	**3.2**	**3.6**	**3.0**
Europe and Eurasia	1.2	1.6	2.0	1.4
China	4.2	4.5	4.9	4.0
Other Non-OECD Asia	3.0	3.3	3.6	2.8
Middle East	2.7	3.1	3.4	4.2
Africa	2.8	3.1	3.4	2.1
Central and South America	2.8	3.1	3.4	2.4
Total World	**1.8**	**2.1**	**2.4**	**2.1**

Sources: ***IEO2007*:** Energy Information Administration (EIA), System for the Analysis of Global Energy Markets (2007). **IEA:** International Energy Agency, *World Energy Outlook 2006* (Paris, France, November 2006), pp. 492-527.

projection period. The IEA growth projection for energy use in China from 2015 to 2030 is lower than the *IEO2007* low macroeconomic growth case projection.

The projections vary not only with respect to levels of total energy demand but also with respect to the mix of primary energy inputs. In the 2004 to 2015 period, IEA expects slightly higher growth in fossil fuel use and slower growth in the use of non-fossil fuels than does *IEO2007* (Table I3). For both renewables and nuclear power consumption, the growth rates projected by IEA are slower than those in the *IEO2007* low economic growth case. For renewables, the differences may be explained by the fact that IEA renewables projections include estimates for traditional, non-marketed biomass and the *IEO2007* projections do not. Traditional biomass is a substantial portion of the renewable energy base and is not expected, in most regions, to expand as nations migrate away from non-marketed to commercial energy use over the projection period—in contrast to hydroelectric power and other marketed renewable energy sources captured in the *IEO2007* projection.

For nuclear power, there are only small differences in projected growth rates between the *IEO2007* high macroeconomic growth and reference cases and no difference between the reference case and the low macroeconomic growth case. This is because the projections include only a limited number of plants, which are already planned or under construction, with expected completion dates before 2015 that analysts largely agree are achievable.

For the period from 2015 to 2030, *IEO2007* and IEA are largely in agreement. The only exception is nuclear power, for which the IEA growth projection falls below

Table I2. Comparison of *IEO2007* and IEA World Energy Consumption Growth Rates by Region, 2015-2030
(Average Annual Percent Growth)

Region	*IEO2007*			IEA
	Low Growth	Reference	High Growth	
OECD	**0.4**	**0.8**	**1.2**	**0.6**
North America	0.6	1.1	1.5	0.8
United States	0.6	1.0	1.5	0.7
Europe	-0.1	0.3	0.6	0.4
Asia	0.4	0.8	1.2	0.6
Non-OECD	**1.6**	**2.1**	**2.6**	**1.8**
Europe and Eurasia	0.6	1.2	1.7	0.8
China	2.3	2.7	3.2	2.0
Other Non-OECD Asia	1.9	2.4	2.9	2.1
Middle East	1.3	1.7	2.2	2.1
Africa	1.3	1.8	2.2	1.8
Central and South America	1.4	1.8	2.3	2.0
Total World	**1.1**	**1.5**	**2.0**	**1.3**

Sources: ***IEO2007*:** Energy Information Administration (EIA), System for the Analysis of Global Energy Markets (2007). **IEA:** International Energy Agency, *World Energy Outlook 2006* (Paris, France, November 2006), pp. 492-527.

Table I3. Comparison of *IEO2007* and IEA World Energy Consumption Growth Rates by Fuel, 2004-2015
(Average Annual Percent Growth)

Fuel	*IEO2007*			IEA
	Low Growth	Reference	High Growth	
Liquids	1.2	1.5	1.9	1.7
Natural Gas	2.0	2.4	2.7	2.5
Coal	2.2	2.6	2.9	2.7
Nuclear	1.5	1.5	1.6	1.2
Renewable/Other	2.1	2.3	2.6	2.0
Total	**1.8**	**2.1**	**2.4**	**2.1**

Note: In the IEA projections, Renewable/Other includes traditional biomass.
Sources: ***IEO2007*:** Energy Information Administration (EIA), System for the Analysis of Global Energy Markets (2007). **IEA:** International Energy Agency, *World Energy Outlook 2006* (Paris, France, November 2006), pp. 492-527.

that in the *IEO2007* low macroeconomic growth case (Table I4). IEA projects that nuclear power expansion will slow from the annual growth rate of 1.2 percent projected for relative to the 2004 to 2015 period to 0.4 percent for the 2015 to 2030 period. *IEO2007* projects increases in world nuclear power use averaging 1.3 percent per year from 2015 to 2030, compared with 1.5 percent per year from 2004 to 2015.

Comparisons With *IEO2006*

The *IEO2007* outlook for total energy consumption in 2015 is largely the same as the outlook in *IEO2006*. In *IEO2007* total marketed energy consumption in 2015 is projected to be 559 quadrillion Btu, as compared with 563 quadrillion Btu in *IEO2006* (Table I5). There are, however, some regional differences between the two *IEO*s. In *IEO2007*, total energy consumption for the OECD region in 2030 is about 5 quadrillion Btu lower than was projected in *IEO2006*. Most (3 quadrillion Btu) of the difference is attributed to lower demand in North America (largely, the United States), where the projection for average annual GDP growth from 2003 to 2015 is 0.2 percentage points lower in *IEO2007* than was projected in *IEO2006*.

For the non-OECD region, the largest differences between the projections for 2015 in *IEO2007* and *IEO2006* are found in two regions—China and non-OECD Europe and Eurasia. In *IEO2007*, China's projected total energy use in 2015 is 5 quadrillion Btu higher than projected in *IEO2006*. IEO2007 assumes much more rapid economic growth for China between 2003 and 2015 than was assumed in *IEO2006*—8.1 percent per year versus 7.0 percent per year. A 10-percent increase in China's GDP between 2003 and 2004 helped to spur a 20-percent increase in its energy use, a development that was not anticipated in the *IEO2006* projection, which was based on historical data series that ended in 2003.

For non-OECD Europe and Eurasia, the *IEO2007* reference case projects total energy consumption in 2015 that is 4 quadrillion Btu lower than projected in *IEO2006*. Nearly all of the difference resulted from a reassessment of energy demand in the region's industrial sector. For example, in the *IEO2006* reference case, demand for electric power in the industrial sector was projected to increase by an average of 4.3 percent per year from 2003 to 2015; in *IEO2007*, the corresponding projection is for a more moderate growth rate of 2.4 percent per year. EIA believes that the lower rate is more consistent with the annual increases seen in the region's industrial electricity consumption since 1998 (when industrial sector electricity use stopped declining after the fall of the Soviet Union and began to recover), which have averaged about 2.5 percent per year.[20]

The near-term differences between the *IEO2007* and *IEO2006* projections are carried through to 2030. The *IEO2007* reference case projection for total energy use worlwide in 2030 is 20 quadrillion Btu (about 3 percent) lower than the *IEO2006* projection. Again, the largest regional differences between the 2030 projections are for China and non-OECD Europe and Eurasia. In the *IEO2007* reference case, China's GDP is projected to increase at an average rate of 6.6 percent per year between 2003 and 2030, 0.6 percentage points higher than the GDP growth rate projected for China in *IEO2006*. As a result, the reference case projection for China's total energy use in 2030 is 6 quadrillion Btu (5 percent) higher in *IEO2007* than was projected in *IEO2006*. For non-OECD Europe and Eurasia, total projected energy consumption in 2030 is 7 quadrillion Btu lower in *IEO2007* than it was in *IEO2006*, largely as a result of EIA's reassessment of the potential for growth in the industrial sector.

Along with regional differences between the *IEO2007* and *IEO2006* projections, there are some differences

Table I4. Comparison of *IEO2007* and IEA World Energy Consumption Growth Rates by Fuel, 2015-2030
(Average Annual Percent Growth)

Fuel	*IEO2007*			IEA
	Low Growth	Reference	High Growth	
Liquids	0.8	1.3	1.7	1.1
Natural Gas	1.1	1.6	2.1	1.7
Coal	1.3	1.8	2.3	1.3
Nuclear	1.2	1.3	1.5	0.4
Renewable/Other	1.1	1.4	1.7	1.7
Total	**1.1**	**1.5**	**2.0**	**1.3**

Note: In the IEA projections, Renewable/Other includes traditional biomass.

Sources: ***IEO2007*:** Energy Information Administration (EIA), System for the Analysis of Global Energy Markets (2007). **IEA:** International Energy Agency, *World Energy Outlook 2006* (Paris, France, November 2006), pp. 492-527.

[20]International Energy Agency, *Energy Balances in Non-OECD Countries* (Paris, France, 2006), web site http://data.iea.org.

between the two projections in the mix of energy resources expected to be consumed (Table I6). The projections for worldwide consumption of petroleum and other liquids consumption are virtually the same throughout the projections, but there are pronounced differences in the other fuel outlooks. In *IEO2007*, the potential for nuclear power is viewed with more optimism than it was in *IEO2006*. As a result, the projection for nuclear power consumption in 2015 is 5 percent higher in *IEO2007* than in *IEO2006*, and the difference between the two projections increases to 14 percent in 2030.

With the higher projection for nuclear power in the *IEO2007* reference case, projections for consumption of natural gas and renewables in the electric power sector are lower throughout the period from 2004 to 2030. The impact on renewable energy sources is larger: total renewable energy use is 12 percent lower in 2015 and 14 percent lower in 2030 in the *IEO2007* projections than in *IEO2006*. The difference is somewhat inflated, however, because consumption of biofuels in the *IEO2007* projections is included with petroleum and other liquids consumption, whereas it was included with renewable energy consumption in *IEO2006*. Removing the transportation biofuels portion of renewable energy consumption from the *IEO2006* projections reduces the difference to about 10 percent in both 2015 and 2030.

Table I5. Comparison of *IEO2007* and *IEO2006* Total World Energy Consumption, Reference Case, 2015 and 2030
(Quadrillion Btu)

Region	2015		2030		Change in *IEO2007*	
	IEO2007	*IEO2006*	*IEO2007*	*IEO2006*	2015	2030
OECD	**265**	**270**	**298**	**309**	**-5**	**-11**
North America	137	140	162	166	-3	-5
United States	112	114	131	134	-2	-3
Europe	86	87	89	95	-1	-5
Asia	42	43	47	48	-1	-1
Non-OECD	**294**	**293**	**404**	**413**	**1**	**-9**
Europe and Eurasia	59	63	72	79	-3	-7
China	97	92	145	139	5	6
India	22	23	32	33	-1	-1
Other Non-OECD Asia	36	35	50	52	1	-2
Middle East	29	28	38	38	1	0
Africa	19	20	25	27	-1	-2
Central and South America	31	32	41	46	-1	-4
Total World	**559**	**563**	**702**	**722**	**-4**	**-20**

Sources: ***IEO2007***: Energy Information Administration (EIA), System for the Analysis of Global Energy Markets (2007). ***IEO2006***: EIA, *International Energy Outlook 2006*, DOE/EIA-0484(2006) (Washington, DC, June 2006), Table A1, p. 83.

Table I6. Comparison of *IEO2007* and *IEO2006* World Energy Consumption by Fuel, Reference Case, 2015 and 2030
(Quadrillion Btu)

Fuel	2015		2030		Change in *IEO2007*	
	IEO2007	*IEO2006*	*IEO2007*	*IEO2006*	2015	2030
Liquids	198	199	239	239	-2	0
Natural Gas	134	140	170	190	-6	-19
Coal	152	144	199	196	7	4
Nuclear	33	31	40	35	2	5
Renewable/Other	43	48	53	61	-5	-8
Total	**559**	**563**	**702**	**722**	**-4**	**-20**

Sources: ***IEO2007***: Energy Information Administration (EIA), System for the Analysis of Global Energy Markets (2007). ***IEO2006***: EIA, *International Energy Outlook 2006*, DOE/EIA-0484(2006) (Washington, DC, June 2006), Table A2, pp. 84-85.

Appendix J

System for the Analysis of Global Energy Markets (SAGE)

Projections of world energy consumption and supply in *IEO2007* were generated using EIA's SAGE model. SAGE is used to project energy use in detail at the end-use sector level. It is an integrated set of regional models that provide a technology-rich basis for estimating regional energy consumption. For each region, reference case estimates of 42 end-use energy service demands (e.g., car, commercial truck, and heavy truck road travel; residential lighting; steam heat requirements in the paper industry) are developed on the basis of economic and demographic projections. Projections of energy consumption to meet the energy demands are estimated on the basis of each region's existing energy use patterns, the existing stock of energy-using equipment, and the characteristics of available new technologies, as well as new sources of primary energy supply.

Period-by-period market simulations aim to provide each region's energy services at minimum cost by simultaneously making end-use equipment and primary energy supply decisions. For example, in SAGE, if there is an increase in residential lighting energy service, either existing generation equipment must be used more intensively or new equipment must be installed. The choice of generation equipment (type and fuel) incorporates analysis of both the characteristics of alternative generation technologies and the economics of primary energy supply.

SAGE produces projections for 16 regions or countries of the world, including OECD North America as a whole and the United States, Canada, and Mexico individually; OECD Europe; OECD Asia and the countries of Japan, South Korea, and Australia/New Zealand individually; non-OECD Europe and Eurasia as a whole and Russia individually; non-OECD Asia and China and India individually; and Central and South America as a whole and Brazil individually. Projections of world oil prices over the projection horizon are provided to the *IEO2007* from EIA's *AEO2007*. All U.S. projections are taken from *AEO2007*.

IEO2007 provides projections of total world marketed energy consumption, as well as projections of energy consumption by primary energy type (liquids, natural gas, coal, nuclear, and hydroelectric and other renewable resources) and projections of net electricity consumption. Projections of carbon dioxide emissions resulting from fossil fuel use are also provided.

A new addition to this year's report is the inclusion of world oil price scenarios. The World Energy Projections Plus (WEPS+) model is an enhancement to the SAGE modeling system that was used to generate the high and low world oil price cases that appear in *IEO2007*, as well as the high and low macroeconomic growth cases. WEPS+ is a microeconomic model, used primarily to provide alternative energy projections under different assumptions about GDP growth and fossil fuel prices. It serves as a repository for reference case output generated from complex models that focus on specific supply or demand series. The reference case reflects output from those models and incorporates analysts' judgment on the potential for demand by end-use sector and fuel type on a regional basis. Carbon dioxide emissions, electricity generation, and installed electricity generation capacity also are projected within the WEPS+ system.

After the reference case is established, WEPS+ is used to calculate coefficients for the response surface and save them into a database. The reference case output tables reflect the same information that is embedded in the input tables. Alternative cases reflect changes in assumptions about future economic growth (as measured in GDP) and prices. When an alternative case is run, the model uses the previously calculated coefficients to produce new projections relative to changes in GDP and energy prices and produces output tables that reflect the changes.

The projections for world liquids production in *IEO2007* reflect an expanded assessment of world oil supply, using assumptions about additions to proved reserves, the relationship between proved reserves and production, geopolitical constraints, and prices to generate conventional crude oil production cases. Projections of conventional liquids production for 2009 through 2015 are based on analysis of investment and development trends around the globe. Projections of unconventional liquids production are based on exogenous analysis.

Nine major streams of liquids production are tracked on a volume basis: (1) crude oil and lease condensates, (2) natural gas plant liquids, (3) refinery gains, (4) Canadian oil sands, (5) ultra-heavy oils, (6) coal-to-liquids, (7) gas-to-liquids, (8) shale oils, and (9) biofuels (tracked on both a volume basis and an oil equivalent basis). Biofuels are reported in terms of barrels of oil equivalent, unless otherwise stated.

A full description of the SAGE model is available in a two-volume set. The first volume provides a general understanding of the model's design, theoretical basis, necessary user-defined assumptions, and output. It also

lists the software necessary to develop and analyze the results of SAGE-based policy and energy market scenarios. In addition, Volume I includes a Reference Guide, which explains each equation in detail. The second volume serves as a User's Guide for those actively developing SAGE-based scenario analyses. The documentation is available on EIA's web site in the model documentation section of "Current Publications" (http://www.eia.doe.gov/bookshelf/docs.html). SAGE documentation is also available as part of the documentation for the MARKAL family of models (http://www. etsap.org/MRKLDOC-III_SAGE.pdf).

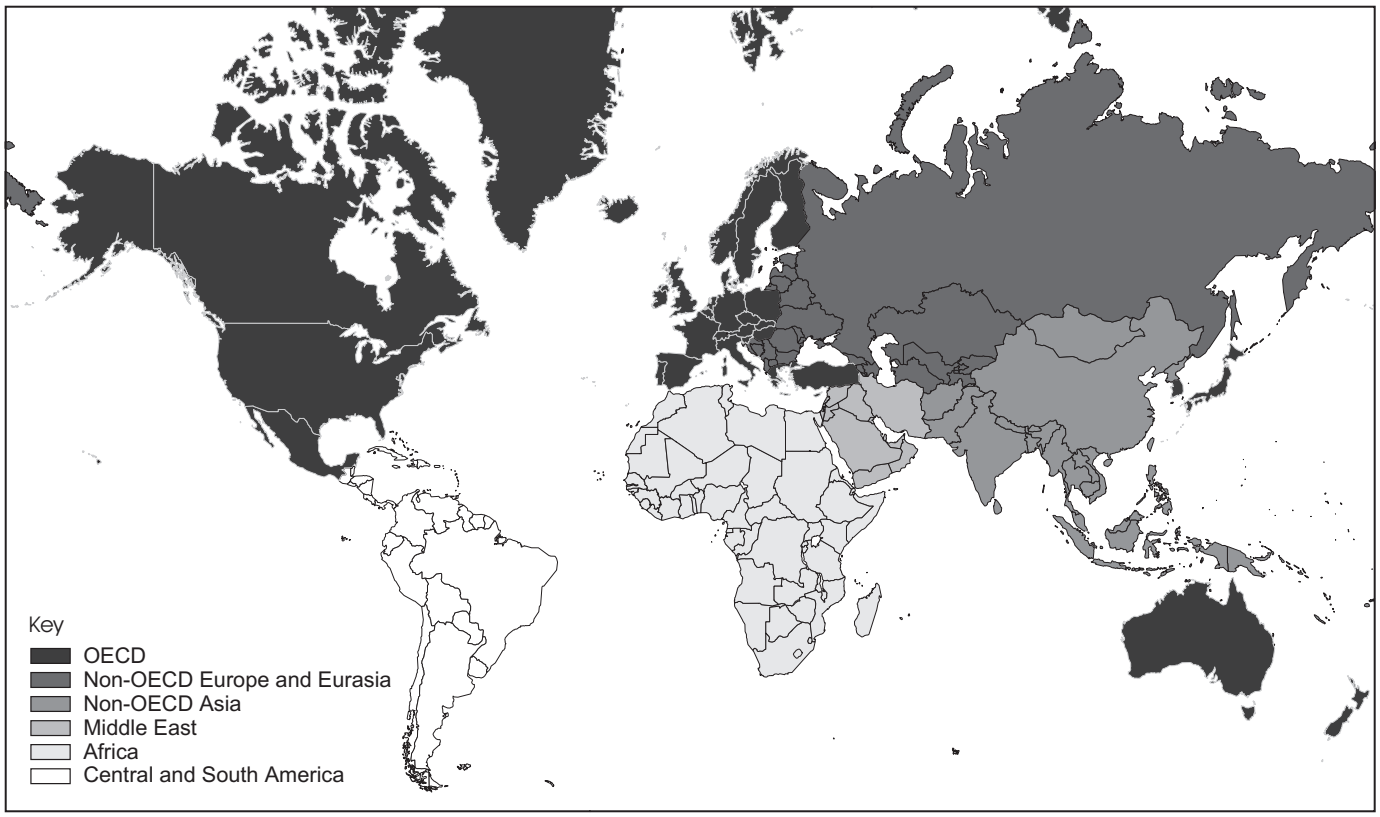
Appendix K

Regional Definitions

The six basic country groupings used in this report (Figure K1) are defined as follows:

- **OECD** (18 percent of the 2007 world population): **North America**—United States, Canada, and Mexico; **OECD Europe**—Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. **OECD Asia**—Japan, South Korea, Australia, and New Zealand.
- **Non-OECD** (82 percent of the 2007 world population):
  - **Non-OECD Europe and Eurasia** (5 percent of the 2007 world population)—Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Malta, Moldova, Montenegro, Romania, Russia, Serbia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.
  - **Non-OECD Asia** (53 percent of the 2007 world population)—Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia (Kampuchea), China, Fiji, French Polynesia, Guam, Hong Kong, India, Indonesia, Kiribati, Laos, Malaysia, Macau, Maldives, Mongolia, Myanmar (Burma), Nauru, Nepal, New Caledonia, Niue, North Korea, Pakistan, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Taiwan, Thailand, Tonga, Vanuatu, and Vietnam.
  - **Middle East** (3 percent of the 2007 world population)—Bahrain, Cyprus, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, the United Arab Emirates, and Yemen.
  - **Africa** (14 percent of the 2007 world population)—Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Brazzaville), Congo (Kinshasa), Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali,

Figure K1. Map of the Six Basic Country Groupings



Source: Energy Information Administration, Office of Integrated Analysis and Forecasting.

Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, St. Helena, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Western Sahara, Zambia, and Zimbabwe.

- **Central and South America** (7 percent of the 2007 world population)—Antarctica, Antigua and Barbuda, Argentina, Aruba, Bahama Islands, Barbados, Belize, Bolivia, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Montserrat, Netherlands Antilles, Nicaragua, Panama Republic, Paraguay, Peru, Puerto Rico, St. Kitts-Nevis, St. Lucia, St. Vincent/Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, U.S. Virgin Islands, and Venezuela.

In addition, the following commonly used country groupings are referenced in this report:

- **Countries that have ratified, accepted, acceded, or approved the Kyoto Climate Change Protocol on Greenhouse Gas Emissions as of April 17, 2007:** Albania, Algeria, Antigua and Barbuda, Argentina, Armenia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Chile, China, Colombia, Congo (Brazzaville), Congo (Kinshasa), Cook Islands, Costa Rica, Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Lesotho, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia, Monaco, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Niue, North Korea, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Rwanda, Saint Lucia, Samoa, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, South Korea, Spain, Sri Lanka, St. Vincent/Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, and Zambia.
- **Annex I Countries participating in the Kyoto Climate Change Protocol on Greenhouse Gas Emissions:** Austria, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, European Community, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom.[21]
- **European Union (EU):** Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.
- **G8:** Canada, France, Germany, Italy, Japan, Russia, United Kingdom, and the United States.
- **North American Free Trade Agreement (NAFTA) Member Countries:** Canada, Mexico, and the United States.
- **Organization for Economic Cooperation and Development (OECD):** Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, South Korea, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.
- **Organization of the Petroleum Exporting Countries (OPEC):** Algeria, Angola, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.
- **Pacific Rim Developing Countries:** Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Thailand.
- **Persian Gulf Countries:** Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

[21]Turkey is an Annex I nation that has not ratified the Framework Convention on Climate Change and did not commit to quantifiable emissions targets under the Kyoto Protocol. In 2001, the United States withdrew from the Protocol, and in 2002 Australia announced that it will not ratify the Kyoto Protocol unless the United States does.