

## Chapter 5

# World Coal Markets

*In the IEO2006 reference case, world coal consumption nearly doubles from 2003 to 2030, with the non-OECD countries accounting for 81 percent of the increase. Coal's share of total world energy consumption increases from 24 percent in 2003 to 27 percent in 2030.*

In the IEO2006 reference case, world coal consumption nearly doubles, from 5.4 billion short tons<sup>7</sup> in 2003 to 10.6 billion tons in 2030 (Figure 48). Coal consumption increases by 3.0 percent per year on average from 2003 to 2015, then slows to an average annual increase of 2.0 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 81 percent of the growth in world coal consumption projected over the entire IEO2006 projection horizon.

In 2003, coal accounted for 24 percent of total world energy consumption (Figure 49). Of the coal produced worldwide in 2003, 67 percent was shipped to electricity producers, 30 percent to industrial consumers, and most of the remaining 3 percent to coal consumers in the residential and commercial sectors. Coal's share of total world energy consumption increases to 27 percent in

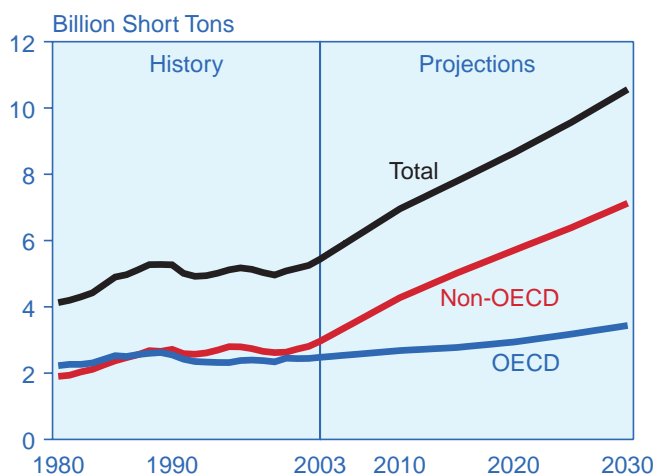
2030, and in the electric power sector its share in 2030 remains at 41 percent, the same as in 2003.

International coal trade increases in the reference case from 764 million tons in 2004 to 1,122 million tons in 2030. Because the largest increase in coal 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 13 percent in 2003 to 11 percent in 2030.

## Reserves

Total recoverable reserves of coal<sup>8</sup> around the world are estimated at 1,001 billion tons—enough to last approximately 180 years<sup>9</sup> at current consumption levels (Table 10). Historically, estimates of world recoverable coal reserves, although relatively stable, have declined gradually from 1,174 billion tons at the beginning of 1990 to 1,083 billion tons in 2000 and 1,001 billion tons in 2003

**Figure 48. World Coal Consumption by Region, 1980-2030**



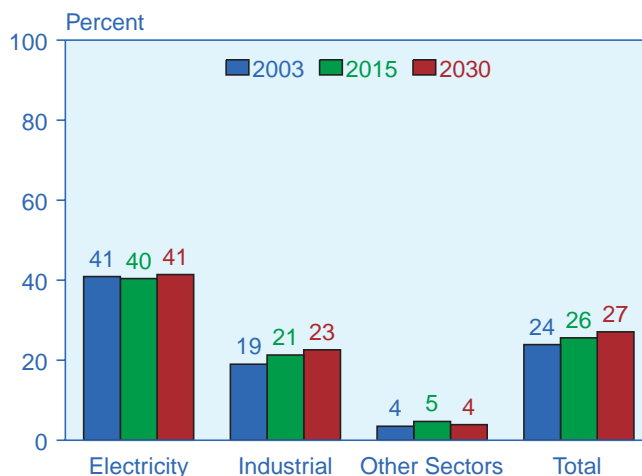
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site [www.eia.doe.gov/iea/](http://www.eia.doe.gov/iea/). **Projections:** EIA, System for the Analysis of Global Energy Markets (2006).

<sup>7</sup>Throughout this chapter, tons refer to short tons (2,000 pounds).

<sup>8</sup>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.

<sup>9</sup>Based on the IEO2006 reference case forecast for coal consumption, and assuming that world coal consumption would continue to increase at a rate of 2.0 percent per year after 2030, current estimated recoverable world coal reserves would last for about 70 years.

**Figure 49. Coal Share of World Energy Consumption by Sector, 2003, 2015, and 2030**



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

[1]. 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 [2].

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 2003, these four countries, taken together, accounted for 63 percent of total world coal production [3]. 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 coal, 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 [4]. 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 2003 indicate that the average heat content of lignite in major producing countries varies from a low of 4.3 million Btu per ton in Greece to a high of 12.3 million Btu per ton in Canada [5].

## Regional Demand Forecasts

### OECD Countries

Coal consumption in the OECD countries rises at a relatively even pace in the reference case, from 2.5 billion tons in 2003 to 2.8 billion tons in 2015 and 3.4 billion tons in 2030 (Figure 50). The increases represent average growth of 1.2 percent per year over the entire period and a slightly higher rate of 1.4 percent per year from 2015 to 2030.

Much of the 0.9-billion-ton increase in coal consumption projected for the OECD countries from 2003 to 2030 is the result of expected strong growth in U.S. coal demand. With the exception of OECD Europe and Japan, where coal consumption is expected to be essentially constant, moderate increases in coal consumption are projected for the OECD countries, including South Korea, Canada, Australia/New Zealand, and Mexico. In OECD Europe, natural gas captures an increasing share of the region's total energy mix, displacing oil and, to a lesser extent, coal and nuclear energy. In Japan, slow

**Table 10. World Recoverable Coal Reserves**  
(Billion Short Tons)

Region/Country	Bituminous and Anthracite	Subbituminous	Lignite	Total
<b>World Total</b> .....	<b>530.4</b>	<b>297.0</b>	<b>173.4</b>	<b>1,000.9</b>
United States.....	125.4	109.3	36.0	270.7
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 <sup>a</sup> .....	1.8	0.4	0.1	2.3

<sup>a</sup>Includes Mexico, Middle East, Japan, and South Korea.

\*Less than 0.05 billion short tons.

Note: Data for the United States represent recoverable coal estimates as of January 1, 2004. Data for other countries are as of January 1, 2003.

Sources: **United States:** Energy Information Administration, unpublished data from the Coal Reserves Database (August 2004). **All Other Countries:** World Energy Council, *2004 Survey of Energy Resources*, Eds. J. Trinnaman and A. Clarke (London, UK: Elsevier, December 2004).

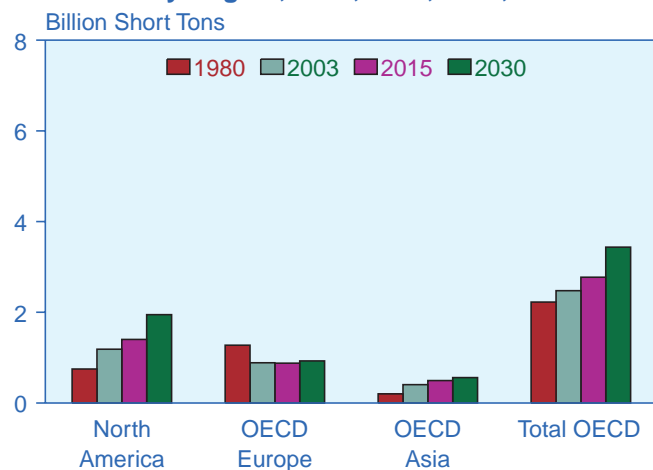
economic growth results in sluggish growth in overall energy demand in the *IEO2006* projections, keeping projected quantities of coal consumption near the 2003 level.

### North America

In 2003, the United States consumed 1.1 billion tons of coal, accounting for 92 percent of total coal consumption in North America and 44 percent of the OECD total. U.S. coal consumption rises to 1.8 billion tons 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 51 percent in 2003 to 48 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 decline and remain competitive with coal prices for electricity generation. Although some new natural-gas-fired capacity comes 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 was completed from 1999 through 2004. After 2015, rising natural gas prices gradually tilt economic decisions toward new coal-fired power plants. From 2015 to 2030, 155 gigawatts of new coal-fired capacity is built, representing 89 percent of the total coal builds from 2003 to 2030.

**Figure 50. OECD Coal Consumption by Region, 1980, 2003, 2015, and 2030**



Sources: **1980 and 2003:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site [www.eia.doe.gov/iea/](http://www.eia.doe.gov/iea/). **2015 and 2030:** EIA, *System for the Analysis of Global Energy Markets* (2006).

<sup>10</sup>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.

In Canada, coal consumption increases from 69 million tons in 2003 to 123 million tons in 2030. In the near term, Canada’s coal consumption remains relatively flat as the Ontario government moves ahead with plans to shut down all of the Province’s 7.6 gigawatts of coal-fired generating capacity by early 2009 [6]. 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 was 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.

### OECD Europe

Coal consumption in OECD Europe increases by only 40 million tons (5 percent) in the *IEO2006* reference case; however, the region is and will continue to be a major market for coal. Coal consumption in OECD Europe, at 887 million tons in 2003, represented 36 percent of total OECD coal use. The major coal-consuming countries of the region, all with consumption of 65 million tons or more in 2003, include Germany, Poland, Greece, Turkey, the United Kingdom, and the Czech Republic. Although OECD Europe relies heavily on imports of hard coal,<sup>10</sup> low-Btu lignite represents an important domestically produced source of energy. In 2003, lignite accounted for 47 percent of the region’s total coal consumption on a tonnage basis and 23 percent on a Btu basis [7].

The stable outlook for coal consumption in OECD Europe represents a departure from the decline of 32 percent that occurred between 1990 and 2003. In addition to some planned and recently completed coal-fired capacity additions in Turkey and Greece, renewed interest in coal is evidenced in a number of other countries in the region, related to the replacement or refurbishment of existing capacity. Electricity producers in Germany, Spain, France, Italy, Poland, the Czech Republic, and Slovakia have announced plans to upgrade or replace existing coal-fired generating facilities over the next two decades. Power producers in Germany recently announced plans to build 11.5 gigawatts of new coal-fired generating capacity by 2011, primarily as a replacement for existing plants [8]. A key incentive for the new coal builds in Germany is a provision guaranteeing carbon dioxide emission rights for the new capacity during its first 14 years of operation.

Among the most important factors keeping OECD Europe’s coal consumption from increasing more rapidly in the projections is the region’s relatively slow growth in overall energy consumption (0.7 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 member countries of the European Union to reduce subsidies that support domestic production of hard coal.

In 2003, the countries of OECD Asia (Australia, New Zealand, Japan, and South Korea) consumed 404 million tons of coal, representing 16 percent of total OECD coal consumption. In addition to being an important coal-consuming region, OECD Asia also plays an important role in the area of international coal trade. In 2003, Australia was the world's leading coal exporter, supplying 238 million tons of coal to the international market, while Japan and South Korea were the world's leading importers, receiving 181 and 77 million tons of coal, respectively, from other countries [9].

In the *IEO2006* reference case, coal consumption in OECD Asia increases by 156 million tons, to 560 million tons 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 increases by an average of 1.4 percent per year, from 147 million tons in 2003 to 216 million tons in 2030. With substantial coal reserves, Australia/New Zealand continues to rely heavily on coal for electricity generation. Coal-fired power plants in the two countries supplied 73 percent of their total electricity generation in 2003, and they continue to supply more than 70 percent of generation through 2030.

Electricity generation also drives the 94-million-ton expansion in total coal consumption projected for South Korea between 2003 and 2030. South Korea's generating companies plan to add more than 8.0 gigawatts of coal-fired capacity from 2004 through 2010 [10], including two 800-megawatt units that came on line at Korea South-East Power Company's Yonghung plant in 2004.

### Non-OECD Countries

Coal consumption in non-OECD countries increases by 140 percent in the *IEO2006* reference case, from 3.0 billion tons in 2003 to 7.1 billion tons in 2030, led by strong economic growth and rising demand for energy in China and India (Figure 51). The increase of 4.2 billion tons represents 81 percent of the projected increase in total world coal consumption. In the non-OECD countries, coal's share of total energy consumption increases slightly, from 29 percent in 2003 to 32 percent in 2030.

Coal consumption in non-OECD countries grows at an average annual rate of 4.5 percent from 2003 to 2015,

then slows to 2.4 percent per year from 2015 to 2030. A gradual slowing of economic growth in non-OECD Asia, which currently is expanding at a rapid pace, underlies the declining growth rate for non-OECD coal consumption.

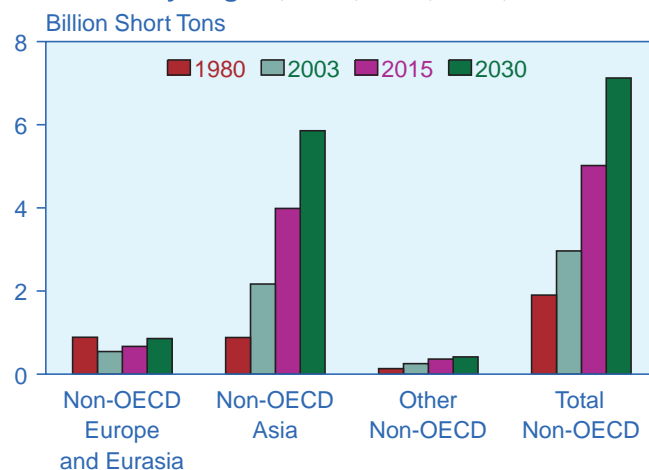
Tremendous growth in coal use is projected for China and India. In total, the two countries' coal consumption increases by 3.6 billion tons (3.9 percent per year) from 2003 to 2030, representing 86 percent of the increase for the non-OECD region. Coal consumption in the other non-OECD countries grows by an average of 1.7 percent per year, expanding by 0.6 billion tons from 2003 to 2030.

### Non-OECD Asia

China and India are very large countries in terms of both population and land mass, and both have substantial quantities of remaining coal reserves. Together, they account for 70 percent of the projected increase in world coal consumption. Strong economic growth (averaging 6.0 percent per year in China and 5.4 percent per year in India from 2003 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 increases from 16.3 quadrillion Btu in 2003 to 50.1 quadrillion Btu in 2030, at an average rate of 4.2 percent per year (Figure 52). In comparison, coal consumption in the U.S. power sector grows by 1.6 percent annually, from 20.2 quadrillion Btu in 2003 to 30.7 quadrillion Btu in 2030. At the end of 2003, China had an estimated 239 gigawatts of coal-fired

**Figure 51. Non-OECD Coal Consumption by Region, 1980, 2003, 2015, and 2030**



Sources: **1980 and 2003:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site [www.eia.doe.gov/iea/](http://www.eia.doe.gov/iea/). **2015 and 2030:** EIA, *System for the Analysis of Global Energy Markets* (2006).

capacity in operation. To meet the demand for electricity that is expected to accompany its rapid economic growth, an additional 546 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 2003 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 2003 [11]. Over the projection period, coal demand in China's non-electricity sectors is expected nearly to triple, increasing by 26.1 quadrillion Btu. Despite such substantial growth, however, the non-electricity share of total coal demand remains close to the 2003 level. 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.

With a substantial portion of the increase in China's demand for both oil 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 mid-2007 with the completion of the country's first coal-to-liquids plant [12], located in the Inner Mongolia Autonomous Region. It is being built by the Shenhua Coal Liquefaction Corporation and will have an initial capacity of approximately 60,000 barrels per day. In another development, China's Shenhua and Ningxia Coal Groups have

initiated a feasibility study regarding the construction of two 80,000 barrel per day plants to be sited in the Ningxia Autonomous Region and the Shaanxi Province.

In India, almost 70 percent of the growth in coal consumption is expected to be in the electric power sector and most of the remainder in the industrial sector. In 2003, India's coal-fired power plants consumed 5.0 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 2.7 percent per year, to 10.3 quadrillion Btu in 2030, as an additional 94 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 *IEO2006* projections, from 67 gigawatts in 2003 to 161 gigawatts in 2030. Currently, India's government indicates that 16.5 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 is targeting the completion of more than 50 gigawatts of new coal-fired capacity during its eleventh plan period (ending in March 2012) [13].

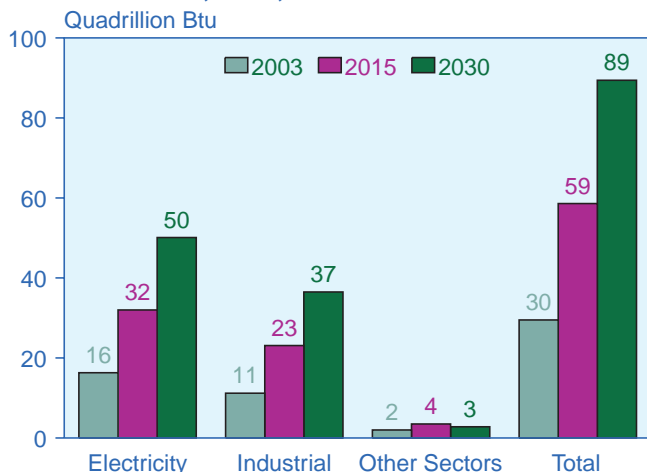
Like China, India relies heavily on imported oil to meet demand. In 2003, approximately 65 percent of India's total oil supply originated from foreign producers. Currently there are no coal-to-liquids projects under construction in India; however, a domestic coal-to-liquids industry would represent a viable means of increasing domestic oil supply. The country's Indian Oil Corporation is evaluating construction of an 80,000-barrel-per-day coal liquefaction facility, which would be based on the coal-to-liquids technology developed by the South African company Sasol and would use both domestic and imported coal as feedstock [14]. Elsewhere in non-OECD Asia, Indonesia also is investigating the startup of a coal-to-liquids industry, primarily as a strategy to offset declines in its petroleum production [15].

In other non-OECD Asia, coal consumption is projected to grow by an average of 1.7 percent per year, from 206 million tons in 2003 to 323 million tons 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 1.7 percent per year, from 543 million tons in 2003 to 856 million tons in 2030. The region contains a substantial amount of coal reserves. Russia alone has an estimated 173 billion tons

**Figure 52. Coal Consumption in China by Sector, 2003, 2015, and 2030**



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

of recoverable coal 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 number one coal-consuming country in the region. Its 2003 coal consumption, at 251 million tons, corresponded to 46 percent of total coal consumption in non-OECD Europe and Eurasia. In 2030, Russia's coal use is projected to total 382 million tons.

In 2003, coal supplied 16 percent of Russia's total energy requirements, and coal-fired power plants provided 20 percent of its electricity. Although coal's share of the country's total energy consumption remains at about 16 percent in the *IEO2006* projections, its share of total electricity generation declines to 10 percent in 2030. In most cases, natural gas is expected to be the most economical option for new generating capacity in Russia. As a result, the natural gas share of Russia's total electricity generation rises from 40 percent in 2003 to 54 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 292 million tons in 2003 to 474 million tons by 2030, growing by 1.8 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, is a significant indicator 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 117 million tons from 2003 to 2030. South Africa currently accounts for 93 percent of the coal consumed in 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 the 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

individual units at the plants, with a combined generating capacity of 3.8 gigawatts, are scheduled to return to service during the years 2005 through 2011. Projections of power shortages for southern Africa in the latter half of this decade have led to increased interest in new coal-fired power projects not only in South Africa but also in Zimbabwe, Tanzania, Swaziland, 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 (Sasol II and Sasol III) in South Africa 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 35 million tons of coal in 2003. Brazil, with the world's ninth largest steel industry in 2003, accounted for 68 percent of the region's coal demand, and much of the remainder occurred in Colombia, Chile, Puerto Rico, Peru, and Argentina [21].

In the projections, coal consumption in Central and South America increases by 39 million tons from 2003 to 2030, with 56 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]. 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 coal 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 16 million tons of coal in 2003. Israel accounted for 87 percent of the total and Iran most of the remainder. The region's coal consumption increases only slightly in the projections, to 19 million tons in 2030.

### **Trade**

Most of the countries that consume significant amounts of coal have their own domestic coal resources. For that reason, the volume of world coal trade tends to be small relative to worldwide coal consumption. In 2003, only 13

percent of the coal consumed around the world was imported. In the *IEO2006* reference case, coal trade grows at an average rate of 1.5 percent per year, from 764 million tons in 2004 to 1,122 million tons in 2030 (Figure 53 and Table 11), and its share of total world coal consumption falls to 11 percent in 2030.

Although both steam coal and metallurgical (coking) coal are traded internationally, steam coal—used primarily for electricity generation but also for other industrial applications, including for direct heat and for pulverized coal injection in the steel industry—predominates, accounting for 72 percent of international coal trade in 2030. The largest increase in steam coal imports is projected for South Korea, where economic expansion and population growth are expected to stimulate an expansion of coal-fired electricity generation. The largest increase in imports of coking coal is projected for China, from 7 million tons in 2004 to 59 million tons in 2030.

Countries that import coal do so for a variety of reasons. For countries like Malaysia, which has a national fuel diversity goal, coal imports may be an important part of a secure energy supply strategy. Others, such as Japan, South Korea, and the countries of OECD Europe, may lack, or may have depleted, their own resources. Still others, like China and India, may require coal imports to supplement their own domestic supplies. Coal quality may also be a factor. For example, Indonesia’s low-sulfur coal is in demand by electricity generators

required to comply with environmental regulations in the United States. Coal-exporting countries typically have large reserves of high-quality coal and production capacity exceeding their own domestic demand requirements.

The six largest exporters of coal in 2004 were Australia, Indonesia, China, South Africa, Colombia, and the United States. Australia has large reserves of high-quality coal that is suitable for both electricity generation and industrial applications. In the projections, Australia remains the world’s foremost coal exporter through 2030, while Indonesia holds a distant second place. Australia and Indonesia both benefit from their highly productive mines and proximity to Asian markets. China continues to export some coal even as its imports increase to meet domestic demand. Colombia, a relative newcomer to maritime coal trade, is the third largest exporter of coal in 2030, and Vietnam increases its share of world coal trade to 5 percent in 2030.

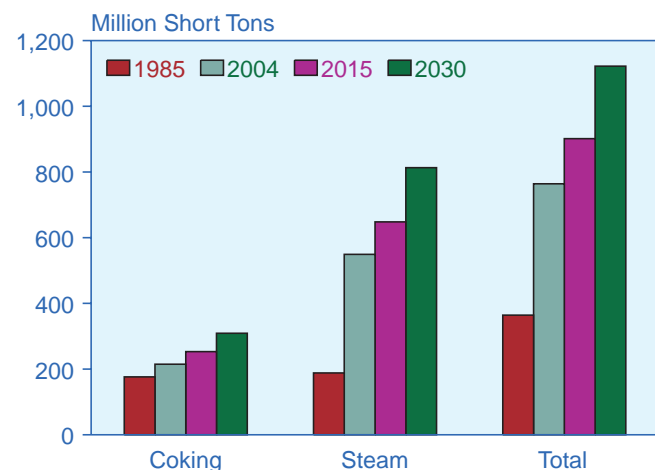
In anticipation of future coal trade volumes, exporting countries are investing in their port, coal mining, and coal transportation infrastructures. Australia has plans to expand the total export capacity of its coal terminals at Abbot Point, Dalrymple Bay, Hay Point, R G Tanna, Barney Point, and Fisherman Islands by about 55 million tons by 2010. In addition, a feasibility study in Australia is underway for a terminal at Wiggins Island in Queensland, with a throughput capacity of 22 million tons. Australia also plans to expand rail transportation capacity in Queensland to 281 million tons [24]. Richards Bay Coal Terminal in South Africa aspires to reach 101 million tons of throughput capacity by 2008 [25]. Venezuela has cumulative coal export capacity expansion plans of 24 million tons by 2009 [26], and additional port expansions are also planned in Vietnam [27].

### Asia

Primarily as a result of China’s growing demand for coal, the largest increases in imports of both steam and metallurgical coal are projected for Asia. Currently a net exporter of coal, China is expected to import 22 million tons more than it exports in 2030. Lacking coal resources of its own, Japan is expected to remain the world’s largest importer of coal in 2030, despite a decline of 10 million tons from its import total in 2004. South Korea produces a small amount of coal domestically, but in 2030 it still will import most of the coal it consumes. South Korea and Taiwan, with planned increases in coal-fired capacity, together are projected to increase their share of world steam coal imports from 22 percent in 2004 to 27 percent in 2030. In India, coal imports are expected to double from 2004 to 2030.

Australia remains the largest provider of steam coal exports to Asia in the projections. In addition, Vietnam,

**Figure 53. World Coal Trade, 1985, 2004, 2015, and 2030**



Sources: **1985:** Energy Information Administration (EIA), *Annual Prospects for World Coal Trade 1987*, DOE/EIA-0363(87) (Washington, DC, May 1987). **2004:** SSY Consultancy and Research, Ltd., *SSY’s Coal Trade Forecast*, Vol. 14, No. 3 (London, UK, September 2005); and Energy Information Administration, *Quarterly Coal Report*, October-December 2004, DOE/EIA-0121(2004/4Q) (Washington, DC, March 2005). **2015 and 2030:** Energy Information Administration, National Energy Modeling System, run IEO2006.D041306A.

**Table 11. World Coal Flows by Importing and Exporting Regions, Reference Case, 2004, 2015, and 2030**  
(Million Short Tons)

Exporters	Importers											
	Steam				Coking				Total			
	Europe <sup>a</sup>	Asia	Americas	Total <sup>b</sup>	Europe <sup>a</sup>	Asia <sup>c</sup>	Americas	Total <sup>b</sup>	Europe <sup>a</sup>	Asia	Americas	Total <sup>b</sup>
<b>2004</b>												
Australia . . . . .	6.3	109.8	3.3	<b>119.4</b>	30.6	88.5	9.1	<b>128.2</b>	36.9	198.3	12.4	<b>247.6</b>
United States . . . . .	3.6	2.3	16.1	<b>22.0</b>	13.4	5.2	7.4	<b>26.0</b>	17.0	7.4	23.6	<b>48.0</b>
South Africa . . . . .	68.6	2.4	0.7	<b>73.7</b>	0.8	0.0	0.4	<b>1.2</b>	69.3	2.4	1.1	<b>74.9</b>
Former Soviet Union . .	36.0	11.7	0.2	<b>47.9</b>	2.1	5.6	0.0	<b>7.8</b>	38.1	17.3	0.2	<b>55.7</b>
Poland . . . . .	15.1	0.0	0.1	<b>15.2</b>	1.0	0.1	0.0	<b>1.1</b>	16.0	0.1	0.2	<b>16.3</b>
Canada . . . . .	0.0	0.6	1.6	<b>2.2</b>	9.2	12.8	4.4	<b>26.6</b>	9.2	13.3	6.1	<b>28.8</b>
China . . . . .	4.2	84.2	0.8	<b>89.2</b>	0.0	6.3	0.0	<b>6.3</b>	4.2	90.4	0.8	<b>95.5</b>
South America <sup>d</sup> . . . . .	37.0	0.0	28.5	<b>65.9</b>	0.0	0.0	0.0	<b>0.0</b>	37.0	0.0	28.5	<b>65.9</b>
Vietnam . . . . .	0.3	9.9	0.0	<b>10.3</b>	0.0	0.0	0.0	<b>0.0</b>	0.3	9.9	0.0	<b>10.3</b>
Indonesia/Other <sup>e</sup> . . . . .	17.6	81.7	3.4	<b>103.5</b>	0.2	17.3	0.1	<b>17.6</b>	17.8	99.0	3.5	<b>121.2</b>
<b>Total . . . . .</b>	<b>188.8</b>	<b>302.5</b>	<b>54.8</b>	<b>549.2</b>	<b>57.3</b>	<b>135.7</b>	<b>21.5</b>	<b>214.8</b>	<b>246.0</b>	<b>438.3</b>	<b>76.3</b>	<b>764.0</b>
<b>2015</b>												
Australia . . . . .	5.0	112.0	0.0	<b>116.9</b>	30.3	124.1	10.9	<b>165.4</b>	35.3	236.1	10.9	<b>282.3</b>
United States . . . . .	4.9	1.4	5.4	<b>11.7</b>	0.2	0.0	14.2	<b>14.4</b>	5.1	1.4	19.6	<b>26.1</b>
South Africa . . . . .	62.8	19.8	6.3	<b>88.9</b>	0.9	0.0	0.7	<b>1.7</b>	63.8	19.8	7.0	<b>90.5</b>
Former Soviet Union . .	44.0	23.7	0.0	<b>67.7</b>	3.2	9.4	0.0	<b>12.5</b>	47.2	33.0	0.0	<b>80.2</b>
Poland . . . . .	6.6	0.0	0.1	<b>6.7</b>	1.1	0.0	0.0	<b>1.1</b>	7.7	0.0	0.1	<b>7.8</b>
Canada . . . . .	0.0	0.0	3.3	<b>3.3</b>	18.9	15.6	1.3	<b>35.8</b>	18.9	15.6	4.6	<b>39.1</b>
China . . . . .	0.0	89.4	1.0	<b>90.4</b>	0.0	6.9	0.0	<b>6.9</b>	0.0	96.3	1.0	<b>97.3</b>
South America <sup>d</sup> . . . . .	59.6	0.0	43.4	<b>103.0</b>	0.0	0.0	0.0	<b>0.0</b>	59.6	0.0	43.4	<b>103.0</b>
Vietnam . . . . .	0.0	30.9	0.0	<b>30.9</b>	0.0	0.0	0.0	<b>0.0</b>	0.0	30.9	0.0	<b>30.9</b>
Indonesia/Other <sup>e</sup> . . . . .	3.6	123.1	2.1	<b>128.7</b>	0.5	15.0	0.0	<b>15.4</b>	4.1	138.0	2.1	<b>144.2</b>
<b>Total . . . . .</b>	<b>186.5</b>	<b>400.2</b>	<b>61.5</b>	<b>648.2</b>	<b>55.1</b>	<b>171.0</b>	<b>27.2</b>	<b>253.2</b>	<b>241.6</b>	<b>571.2</b>	<b>88.7</b>	<b>901.4</b>
<b>2030</b>												
Australia . . . . .	7.3	170.2	0.0	<b>177.5</b>	36.1	155.5	15.3	<b>206.9</b>	43.4	325.7	15.3	<b>384.4</b>
United States . . . . .	2.8	1.4	6.1	<b>10.3</b>	0.6	0.0	17.9	<b>18.6</b>	3.4	1.4	24.1	<b>28.9</b>
South Africa . . . . .	64.3	23.8	11.0	<b>99.0</b>	0.0	0.0	0.8	<b>0.8</b>	64.3	23.8	11.8	<b>99.8</b>
Former Soviet Union . .	44.0	28.8	0.0	<b>72.8</b>	6.5	11.0	0.0	<b>17.5</b>	50.5	39.8	0.0	<b>90.3</b>
Poland . . . . .	4.0	0.0	0.4	<b>4.4</b>	0.6	0.0	0.0	<b>0.6</b>	4.5	0.0	0.4	<b>5.0</b>
Canada . . . . .	0.0	0.0	3.3	<b>3.3</b>	18.3	21.5	1.7	<b>41.6</b>	18.3	21.5	5.0	<b>44.9</b>
China . . . . .	0.0	94.9	3.2	<b>98.1</b>	0.0	7.7	0.0	<b>7.7</b>	0.0	102.6	3.2	<b>105.8</b>
South America <sup>d</sup> . . . . .	51.0	0.0	92.7	<b>143.7</b>	0.0	0.0	0.0	<b>0.0</b>	51.0	0.0	92.7	<b>143.7</b>
Vietnam . . . . .	0.0	59.5	0.0	<b>59.5</b>	0.0	0.0	0.0	<b>0.0</b>	0.0	59.5	0.0	<b>59.5</b>
Indonesia/Other <sup>e</sup> . . . . .	0.0	137.5	7.0	<b>144.5</b>	0.4	15.0	0.0	<b>15.4</b>	0.4	152.5	7.0	<b>159.9</b>
<b>Total . . . . .</b>	<b>173.3</b>	<b>516.1</b>	<b>123.8</b>	<b>813.2</b>	<b>62.5</b>	<b>210.7</b>	<b>35.7</b>	<b>309.0</b>	<b>235.8</b>	<b>726.9</b>	<b>159.6</b>	<b>1,122.2</b>

<sup>a</sup>Europe/Mediterranean, including coal shipments to the Middle East and Africa.

<sup>b</sup>In 2004, total world coal flows include a balancing item used to reconcile discrepancies between reported exports and imports. The 2004 balancing items by coal type were 3.2 million tons (steam coal), 0.3 million tons (coking coal), and 3.4 million tons (total).

<sup>c</sup>Includes 15.4 million tons of coal for pulverized coal injection at blast furnaces shipped to Japanese steelmakers in 2004.

<sup>d</sup>Coal exports from South America are projected to originate from mines in Colombia and Venezuela.

<sup>e</sup>Includes shipments from other countries not modeled for the projection period. The 2004 exports from other countries by coal type were 3.1 million tons (steam coal), 2.2 million tons (coking coal), and 5.3 million tons (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: **2004:** SSY Consultancy and Research, Ltd., *SSY's Coal Trade Forecast*, Vol. 14, No. 3 (London, UK, September 2005); and Energy Information Administration, *Quarterly Coal Report*, October-December 2004, DOE/EIA-0121(2004/4Q) (Washington, DC, March 2005). **2015 and 2030:** Energy Information Administration, National Energy Modeling System, run IEO2006.D041306A.



a relatively new competitor in international coal trade, competes strongly in the Asian market by 2030. Its proximity to China will be instrumental in the growth of Vietnam's coal export volume from 10 million tons in 2004 to nearly 60 million tons in 2030.

### Europe, Middle East, and Africa

Total coal imports to the Europe/Mediterranean market (including the Middle East and Africa) decline in the projections (Figure 54). 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. In addition, with the phaseout of mining subsidies in Europe, imports of coal from South America and Russia increase.

### The Americas

The United States is projected to import 91 million tons of coal in 2030, 64 million tons more than in 2004. Although this is still a small share of overall U.S. consumption, at 5.0 percent, it represents 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 rising demand for coal in the Southeast, imports become increasingly competitive with domestic U.S. coal production. Already, plans are being made to expand U.S. ports to

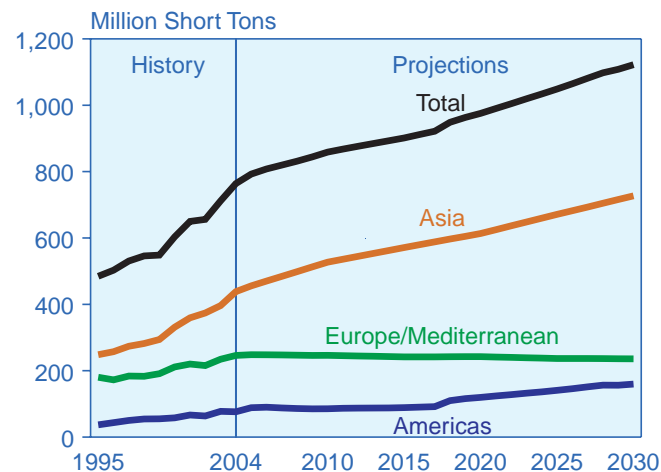
accommodate coal imports. For example, Dominion Terminal Associates has announced plans to add 7 million tons of coal import port capacity in Virginia by 2008 [28]. In recent years, Canada has been the largest importer of U.S. coal; however, Ontario's plans to close its five coal-fired generating plants by 2009 will reduce U.S. exports of steam coal by about 10 million tons between 2004 and 2030 [29].

Brazil, with rich reserves of iron ore but no coking grade coal, will fuel the planned expansion of its steel industry with imports from Australia, South Africa, and the United States. Coking coal imports to Brazil are projected to grow by 16 million tons from 2004 to 2030, at an average rate of 2.9 percent per year. Much of the coal imported by the countries of Central and South America is expected to come from Australia and from South American coal producers—in particular, Colombia. Colombia is also expected to increase its coal exports to the United States.

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**Figure 54. Coal Imports by Major Importing Region, 1995-2030**



Sources: **History:** SSY Consultancy and Research, Ltd., *SSY's Coal Trade Forecast*, Vol. 14, No. 3 (London, UK, September 2005); International Energy Agency, *Coal Information 2001* (Paris, France, September 2001), and previous issues; and Energy Information Administration, *Quarterly Coal Report*, October-December 2004, DOE/EIA-0121(2004/4Q) (Washington, DC, March 2005), and previous issues. **Projections:** Energy Information Administration, National Energy Modeling System run IEO2006.D041306A.

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