

Coal

Introduction

Source: Coal Technical Area of EMD: http://emd.aapg.org/technical_areas/coal.cfm

Coal is a solid, brittle, combustible, carbonaceous rock formed by the decomposition and alteration of vegetation by compaction, temperature, and pressure. It ranges in color from brown to black and is usually stratified. The sources of the vegetation include all plant forms and some coals may contain significant amounts of wood. Coal deposits are usually called beds or seams and may range in thickness from fractions of an inch (centimeter) to hundreds of feet (60 + meters). Although coals are found in geologic periods from the Silurian through the Quaternary, the oldest commercially important coals are found in rocks of Mississippian age (Carboniferous in Europe). Coals generally form either in intercontinental basins in fluvial environments or in paralic basins open to marine incursions.

Coal is found on every continent, and world coal reserves may exceed 1 trillion tons (<http://www.eia.doe.gov/emeu/iea/res.html>). The largest reserves, however, are found in the U.S., former Soviet Union, and China. The U.S. has about 28% of the world's reserves; and former Soviet Union has about 25%. China, which has about 13% of the world's reserves, is the world's leading producer of coal followed by the U.S.

About 13% of the U.S. is underlain by coal, which occurs in 37 of 50 states. Over 2,000 active surface and underground mines are producing approximately 1 billion tons of coal per year in the U.S. At current consumption rates, the U.S. has a 240 year supply of coal reserves, with an estimated recoverable reserve of 268.4 billion tons of coal (http://www.eia.doe.gov/cneaf/coal/page/acr/acr_sum.html). Of this amount, Montana ranks first with 75 billion tons; Wyoming is second with 42.2 billion tons; Illinois is third with 38 billion tons; and West Virginia is fourth with 18.3 billion tons of recoverable coal.

Coals are generally termed steam (for use by power plants for electric generation) or coking (for conversion to coke for iron and steel making). About 56% of the power generated in the U.S. comes from power plants fueled by coal, the country's most abundant fossil fuel. A lesser amount of coal is also used for residential, commercial, and industrial applications.

Coal is generally classified according to rank. Rank classifications are based on a coal's content of fixed carbon, volatile matter, calorific value, and coking properties. In the coalification process, coal first takes the form of peat, then progresses through lignite (brown coal), subbituminous, bituminous, and finally to anthracite and graphite. Lignite has a low calorific value and a high moisture content of 30 to 50 %. Accordingly, lignite is used to generate electricity in power plants that are located close to mines because

the high moisture content makes it so expensive to ship, as in California, Louisiana, Mississippi, Montana, North Dakota, and Texas. Subbituminous coal is transitional in rank from lignite to bituminous coal and is primarily produced from the Powder River basin in Wyoming, the major coal-producing state in the U.S. Powder River basin coal is found in thick coal seams with relatively low sulfur on a Btu basis, and is mined with large-scale surface operations that produce the coal at a low cost.

Bituminous coal is the most common form of coal in the U.S.; it is black and contains bands of both bright and dull material. The moisture content of bituminous coal is usually under 20%, and it is mined in the Appalachian, Interior, and Rocky Mountain coal fields. Low-sulfur coal is mined in the Rocky Mountain and central Appalachian coal fields for electric power generation and for coking purposes. Coal produced from the Illinois basin and northern Appalachian coal fields generally has a higher sulfur content and is commonly used in power plants that are equipped to remove the sulfur during the combustion process or from flue gasses.

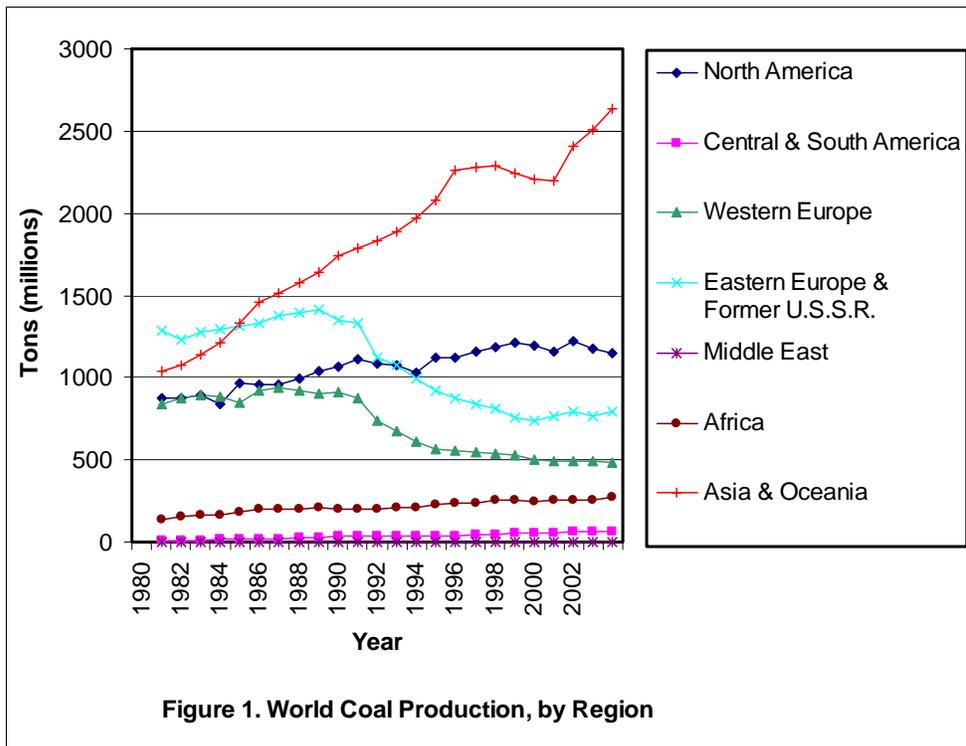
Anthracite is jet black with a high luster. It is the highest rank of economically usable coal with a moisture content less than 10%. In the U.S., relatively small amounts of anthracite are mined, principally in Pennsylvania, and it is used in retail and industrial markets.

Coal is the principal fuel used for electric power generation in the United States, and annual production has been relatively steady the last several years at 1.1 to 1.2 billion short tons. Increasing demand for energy is improving coal markets domestically and abroad, and rising energy prices are significantly improving market conditions for coal. Companies that were just trying to survive a year ago are beginning to explore for new reserves, and emerging clean-coal technologies are paving the way for increased coal utilization with reduced environmental consequences. Coal combustion research remains dynamic and the U.S. Department of Energy (DOE) is planning to expand the clean-coal technology program. Carbon sequestration is also spurring on new avenues of coal research because carbon dioxide and other waste gases from power plants can be injected into coal and may potentially be used to enhance coalbed methane production.

World Production and Consumption of coal

Tables 1 to 3 and figures 1 and 2 provide a general overview of world production and consumption of coal from 1980 until 2003 (**DOE/EIA International Energy Annual, 2003: <http://www.eia.doe.gov/emeu/iea/coal.html>**). The data illustrate the pronounced increase in the production and consumption of coal in China during the past several decades, as well as the decline of coal production and consumption in Europe and the Former Soviet Union. During this time, production in North America has remained relatively constant, somewhat more or less than 1 billion tons per year.

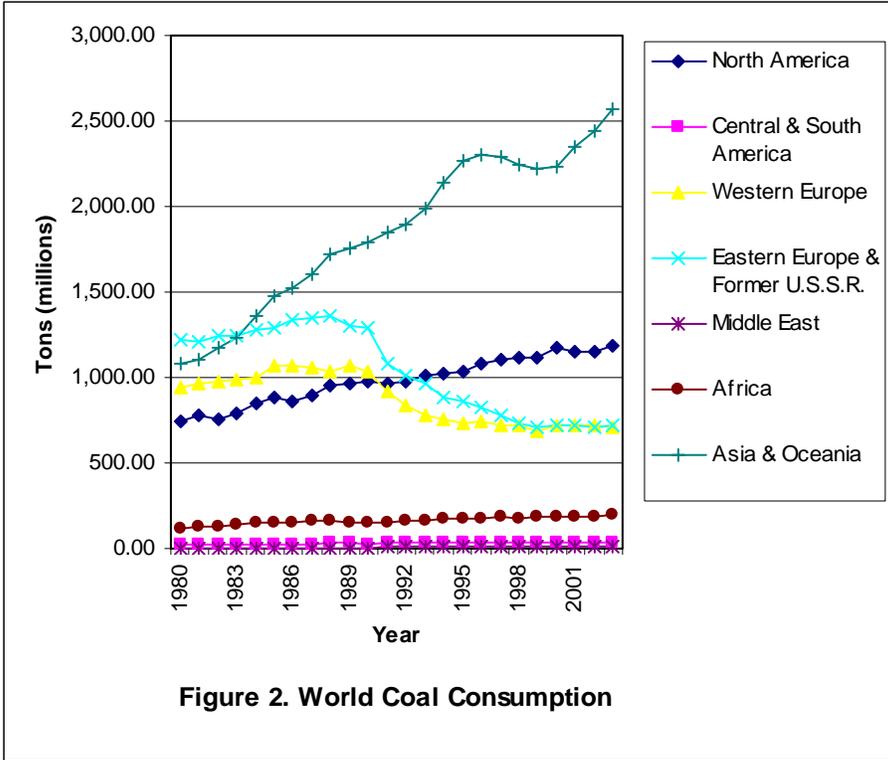
| Table 1. World Coal Production, 2003 (million short tons) | |
|--|-----------------|
| Asia & Oceania | 2,638.52 |
| North America | 1,149.85 |
| Eastern Europe & Former U.S.S.R. | 795.49 |
| Western Europe | 484.32 |
| Africa | 269.76 |
| Central & South America | 67.29 |
| Middle East | 1.05 |
| World Total | 5,406.27 |
| Energy Information Administration <i>International Energy Annual 2003</i> | |



Data from Energy Information Administration
International Energy Annual 2003

| Table 2. Major coal-producing countries, 50 million tons, or more, by region | | |
|---|----------------|------------------------|
| Region | Country | 2003 Production |
| North America | | 1,149.85 |
| | United States | 1,069.50 |
| | Canada | 68.49 |
| Central & South America | | 67.29 |
| | Colombia | 52.50 |
| Western Europe | | 484.32 |
| | Germany | 229.10 |
| | Greece | 75.29 |
| | Turkey | 53.11 |
| Eastern Europe & Former U.S.S.R. | | 795.49 |
| | Russia | 294.03 |
| | Poland | 177.80 |
| | Kazakhstan | 86.45 |
| | Czech Republic | 70.44 |
| | Ukraine | 63.47 |
| Africa | | 269.76 |
| | South Africa | 263.78 |
| Asia & Oceania | | 2,638.52 |
| | China | 1,634.97 |
| | India | 403.12 |
| | Australia | 373.36 |
| | Indonesia | 132.39 |
| World Total | | 5,406.27 |
| Energy Information Administration; <i>International Energy Annual 2003</i> | | |

| Table 3. World Coal Consumption, 2003 (million short tons) | |
|--|-----------------|
| Asia & Oceania | 2,572.08 |
| North America | 1,183.97 |
| Eastern Europe & Former USSR | 717.52 |
| Western Europe | 712.54 |
| Africa | 202.60 |
| Central & South America | 35.07 |
| Middle East | 15.55 |
| World Total | 5,439.33 |
| Energy Information Administration <i>International Energy Annual 2003</i> | |



Data from Energy Information Administration
 International Energy Annual 2003

The following are excerpts from the U.S. Department of Energy's *Country Analyses Briefs* for the major coal-producing countries in each region, generally as of 2004.

China

Source: <http://www.eia.doe.gov/emeu/cabs/china.html>

Coal makes up 65% of China's primary energy consumption, and China is both the largest consumer and producer of coal in the world. China's coal consumption in 2003 was 1.53 billion short tons, or 28% of the world total. The Chinese government has made major upward revisions to coal production and consumption figures covering the last several years. The new figures show coal consumption rising sharply in 2001-2003, reversing the decline seen from 1997 to 2000. The decline during that period also is much less than the previously reported data.

China's demand for coal is rising rapidly as its economy grows. As recently as 2002, China had a surplus of coal, and was seeking to export the extra coal to other markets in Asia. Previously, in the late 1990s, China had attempted to shut down tens of thousands of small coal mines, both for safety reasons and as a result of overproduction. Anecdotal evidence suggests that not all of the mines which officially "closed" actually ceased production, however. Chinese statistical data for the late 1990s was adjusted upward in 2001 and 2002, after previously showing a sharp decline in production. Since 2004, surging domestic demand has caused exports to fall, which rapidly reversed an earlier trend in 2002-2003 of depressed prices in Asian coal markets due to Chinese exports.

Over the longer term, China's coal demand is projected to rise significantly. While coal's share of overall Chinese energy consumption is projected to fall, coal consumption will still be increasing in absolute terms. Several projects exist for the development of coal-fired power plants co-located with large mines, so called "coal by wire" projects. Other technological improvements also are being undertaken, including the first small-scale projects for coal gasification, and a coal slurry pipeline to transport coal to the port of Qingdao. Coalbed methane production also is being developed, with recent investors in this effort including BP, ChevronTexaco, and Virgin Oil, which was awarded a concession for exploration in Ningxia province in January 2001. ChevronTexaco is the largest foreign investor in coalbed methane, with activities in several provinces. Far East Energy of the U.S. received approval from Chinese authorities in April 2004 for a farmout agreement with ConocoPhillips, under which it would undertake exploratory drilling for coalbed methane in Shaanxi province, in a location near the West-to-East Pipeline route.

In contrast to the past, China is becoming more open to foreign investment in the coal sector, particularly in modernization of existing large-scale mines and the development of new ones. The China National Coal Import and Export Corporation is the primary Chinese partner for foreign investors in the coal sector. Areas of interest in foreign investment concentrate on new technologies only recently introduced in China or with environmental benefit, including coal liquefaction, coalbed methane production, and slurry pipeline transportation projects. Over the longer term, China plans to aggregate the large state coal mines into seven corporations by the end of 2005, in a process similar to the creation of CNPC and Sinopec out of state assets. Such firms might then seek to pursue foreign capital through international stock offerings.

China has expressed a strong interest in coal liquefaction technology, and would like to see liquid fuels based on coal substitute for some of its petroleum demand for transportation. A coal liquefaction facility is under construction by the Shenhua Group in Inner Mongolia, with a projected startup date of 2005. Despite the high costs, Chinese officials have shown increasing interest in further research into improving coal liquefaction technologies, in the hope that it may eventually provide an economically viable domestic source of liquid fuels.

India

Sources: <http://www.eia.doe.gov/emeu/cabs/india.html>; Sinha, M.K., 2004, A perspective on Indian coal resources, *in* Pierce, B.S., Dennen, K.O., and Finkleman, R.B., Coal quality: global priorities international conference U.S. Geological Survey – Reston, Virginia September 24-25, 2001: U.S. Geological Survey Circular 1272 CD ROM.

Coal is the dominant commercial fuel in India, satisfying more than half of India's energy demand. Power generation accounts for about 70% of India's coal consumption, followed by heavy industry. Coal consumption is projected in the International Energy Annual 2004 to increase to 430 million short tons (Mmst) in 2010, up from 359 million short tons (Mmst) in 2000. India is the world's third largest coal producer (after China and the United States), so domestic supplies satisfy most of the country's coal demand. Indian coal generally has a high ash content and low calorific value, so most coking coal must be imported. Major Indian coal fields are found in Bihar, West Bengal, and Madhya Pradesh.

The Indian government controls almost all coal production, which has been plagued by low productivity, distribution problems, and an increasing loss of domestic market share to higher quality, less expensive imports. Nearly all of India's 390 mines are under Coal India Ltd. (CIL), which accounts for about 90% of the country's coal production. Current policy allows private mines only if they are "captive" operations

which feed a power plant or factory. The current government has called off plans for further coal-sector liberalization in the face of strong opposition from labor unions.

The coal resources of India are estimated to be 214 Bt as of January, 2001, at depths that range from the surface to 1,200 meters. Of the 214 Bt, 84.4 Bt are considered proved, 90.2 indicated, and 30.3 are classified as inferred resources. In addition to the Permian Gondwana coal fields in southeastern India, there are minor deposits of Tertiary age in the northeastern Himalayas.

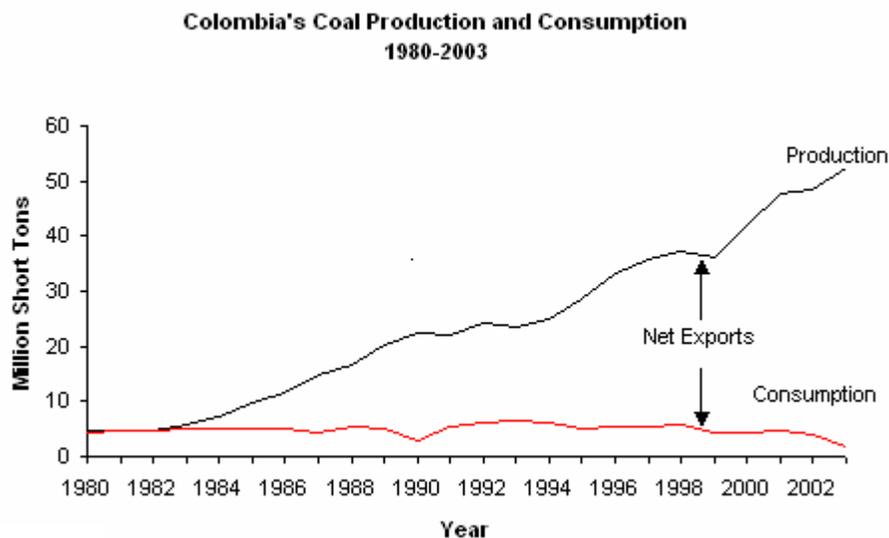
Columbia

Source: <http://www.eia.doe.gov/emeu/cabs/Colombia/Coal.html>

Colombia had 7,287 million short tons (Mmst) of proven coal reserves in 2003, consisting of high-quality bituminous coal and a small amount of metallurgical coal. The country has the second-largest coal reserves in South America, behind Brazil, with most of those reserves concentrated in the Guajira peninsula in the north and the Andean foothills. Colombia's coal is relatively clean-burning, with a sulfur content of less than 1 percent. Over the past decade, production has more than doubled, to 52.5 Mmst in 2003. It is likely that Colombia's coal production will continue to increase in coming years, as exploration and profitable developments continue throughout the north and interior of the country.

Sector Organization

Colombia completed the privatization of its coal sector in 2004 with the shuttering of Minercol, the former state-owned coal company. The largest coal producer in the country is the Carbones del Cerrejon consortium, composed of Anglo-American, BHP Billiton, and Glencore. The consortium operates the Cerrejon Zona Norte (CZN) project, the largest coal mine in Latin America and the largest open-cast coal mine in the world. CZN, which consists of an integrated mine, railroad, and coastal export terminal, produces some 22 Mmst per year.



Drummond operates the second-largest coal mine in Colombia, La Loma, also an integrated mine-railway-port project. La Loma produced 12 Mmst of coal in 2001. The company also owns the El Descanso mine, in the vicinity of La Loma. In 2004, Glencore announced that it would purchase the Jagua coal mine, Colombia's third-largest,

combining it with its existing integrated coal project, Prodeco. The acquisition will give Glencore total coal production capacity in Colombia of 8.3 Mmst per year.

Currently, most Colombia coal exports go to North America, Europe, and Latin America, as the vast majority of Colombia's coal producing and exporting infrastructure is located on the Caribbean coast. However, the country hopes that a planned expansion of the Panama Canal would allow it to export coal to new markets in Asia. Some of the non-integrated coal mines in Colombia export coal via the Venezuelan ports of La Cieba and Maracaibo. In early 2005, tensions between the two countries over the capture of Rodrigo Granda, the "foreign minister" of the Revolutionary Armed Forces of Colombia (FARC) caused Venezuela to close access to these ports, affecting some exports.

Germany

Source: <http://www.eia.doe.gov/emeu/cabs/germany.html>

Consumption

Although coal is Germany's most abundant indigenous energy resource, its role in the country's energy mix, albeit significant, has been decreasing, from 30% of total primary energy consumption in 1991 to 23% in 2002. Despite this decline, Germany was the world's fourth largest coal consumer in 2002, behind the United States, China and India. The drop in consumption can be attributed to the closure of coal-fired generation plants in the former East Germany, diversification of energy supply, restructuring of the country's coal sector and adoption of stricter environmental regulations.

Production

As of October 2001, Germany's total recoverable coal reserves stood at 72.8 billion short tons, by far the largest amount within the EU-15 (Greece had the second largest amount at 3.2 billion short tons). Total coal production has also dropped off considerably, from 540.7 million short tons (Mmst) in 1989 (includes both West Germany and the former East Germany) to 230.9 Mmst in 2002.

Germany produces two grades of coal: bituminous, also known as "hard coal", and lignite, or "brown coal" (Germany also produces a small amount of anthracite, which can be classified as hard coal). Germany is the world's largest producer of brown coal, accounting for an estimated 22% of global output in 2002. Brown coal is also Germany's most important indigenous energy resource, accounting for 45% of the country's total primary energy production in 2002, according to the organization Statistik der Kohlenwirtschaft. In the years following reunification, a number of inefficient coal mines in the former East Germany were closed, resulting in production dropping 50% from 1989 to 1994. In recent years, however, brown coal production has actually started to increase, mainly due to increased demand from power plants, such as from RWE's Niederaußem powerplant. In 2002, about 55% of Germany's brown coal was extracted in the Rhineland region.

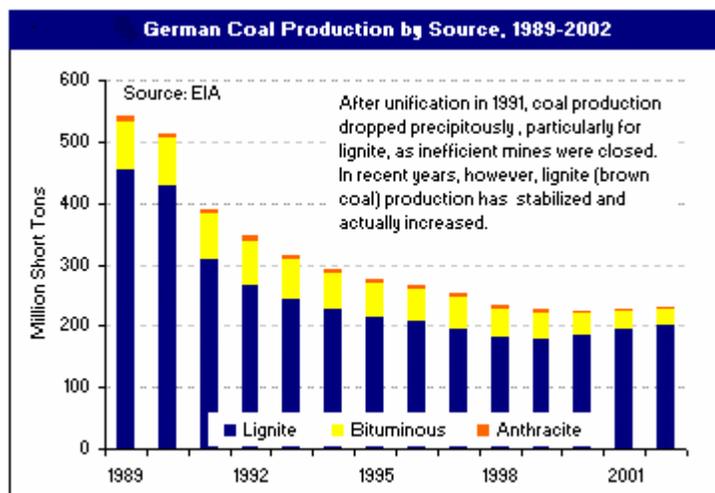
Most of the country's hard coal deposits are located deep underground, making extraction expensive and only viable with heavy subsidization. In 1997, the German government reached an agreement with the hard coal mine operators on incrementally reducing subsidies between 1998 and 2005. The reduction in subsidies has resulted in considerable downsizing of the sector. For perspective, in 1991, Germany operated 26 hard coal mines and employed 66,073 miners, while in 2003, only 10 mines were in operation and 45,581 miners employed. After 2006, the German government will

continue downsizing and rationalizing the coal industry, but intends to maintain core capacity for domestic coal production.

These measures fall in line with those outlined in the European Commissions green paper, published in 2000 and adopted by the European Parliament in 2001, on a European strategy for the security of energy supply. According to the report, it remains necessary to undertake measures “to guarantee access to coal reserves and hence a potential availability of Community coal.” Regulation 1407/2002 (adopted in July 2002) permits three forms of aid: 1) reducing activity (this form expired on December 31, 2002); 2) maintaining access to coal reserves; 3) covering exceptional costs, such as costs related to environmental rehabilitation of former coal mining sites. In 2004, Germany provided the country's coal industry with an estimated \$3.7 billion in subsidies.

Imports

With declining domestic coal production, Germany is becoming a significant net-importer of coal. In 2002, Germany imported 43 Mmst. The countries largest suppliers in 2002 were South Africa, Poland, Colombia and Australia.



Russia

Source: <http://www.eia.doe.gov/emeu/cabs/russia.html>

With 173 billion short tons, Russia holds the world's second largest recoverable coal reserves, behind only the United States, which holds roughly 274 billion short tons. However, years of poor management during the Soviet era, and a sharp decline in demand for coal during the early 1990s, significantly undermined the Russian coal sector. In 2004, Russian energy ministry sources estimate total coal production was 308.6 million short tons, less than one-third of U.S. production.

Between 1996 and 2001, Russia worked with the World Bank to restructure the country's coal industry. As a result, the state monopoly, formally known as RosUgol, has been dissolved, and roughly 77% of domestic coal production comes from independent producers. Russian coal production began a three-year upswing in 1999, with the Russian energy ministry estimates growth of 1.2% in 2004 and 1.8% growth in 2005 year-over-year. According to the government's energy strategy, Russia should produce between 441 and 496 million short tons by 2020. The government has high hopes for the future of the coal industry. Exports of coal and coke from CIS countries to non-CIS countries rose a staggering 60% between 2002 and 2003, and recent articles in the trade press expect rising coal demand (especially in Asia) to continue. However, some problems may hinder the industry's development potential. Russia's agreement to the Kyoto Protocol may lower utility sector demand for coal. In a recent British Broadcasting Company interview, the governor of the Kemerovo Region, which is responsible for over half of the country's coal production, voiced concerns over his region's ability to sustain coal production growth. He noted his region had already seen almost 200 rivers ruined, and those that were left are smaller than in previous decades. These environmental problems may hinder Russia's desire to keep increasing coal production.

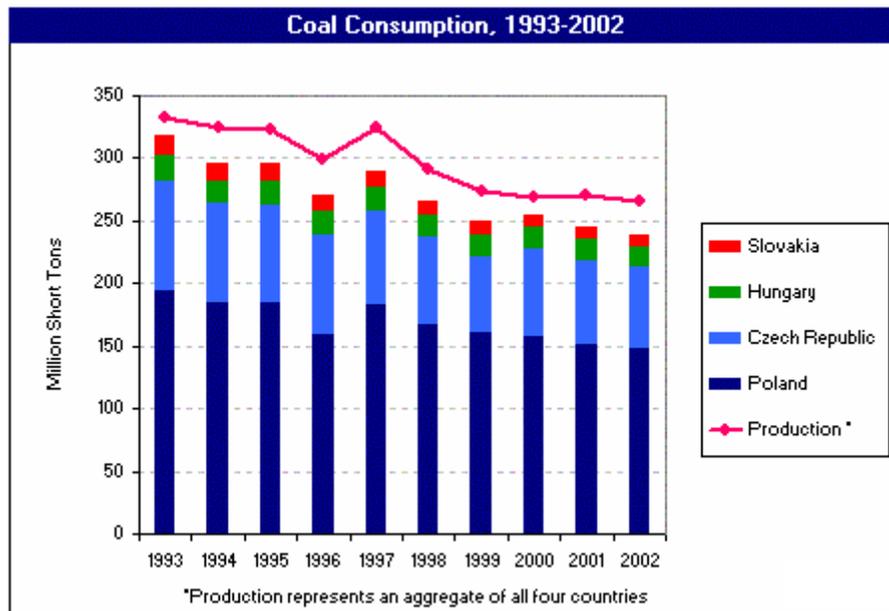
Visegrad Group

Source: <http://www.eia.doe.gov/emeu/cabs/visegrad.html>

Poland, the Czech Republic, the Slovak Republic (commonly referred to as Slovakia), and Hungary are members of the Visegrad Group, created in February 1991 at the northern Hungarian town of Visegrad. After World War II until 1989-1990, these countries were Communist states, as well as members of the Warsaw Pact. (On January 1, 1993, the Czech and Slovak Republics, previously Czechoslovakia, split to form two separate states).

Coal

Coal is the most prevalent energy resource in the Visegrad countries, although its role as a fuel and as an industry has declined over the past decade. In 1993, for example, coal accounted for 58.4% of the Group's combined total primary energy consumption and in 2002, for 45.6%. Poland is the exception, where coal accounted for 93% of the country's primary energy production in 2002, and remains one of the country's most important employers. Coal also remains significant in the Czech Republic, where it constituted 43.0% of the primary energy consumption in 2002.



The region holds 32,090 million short tons (Mmst) of proven recoverable coal reserves, of which Poland has 24,400 Mmst. The Czech Republic contains 6,300 Mmst; Hungary 1,200 Mmst; and Slovakia 190 Mmst. In 2002, the region produced 266.2 Mmst, of which Poland was responsible for 67%. Slovakia was the smallest producer (3.8 Mmst), preceded by the Czech Republic (70.4 Mmst) and Hungary (14.2 Mmst).

Coal consumption has decreased sharply in the region in recent years. Between 1993 and 2002, coal consumption fell by 40% in Slovakia, 27% in the Czech Republic, 23% in Poland and 21% in Hungary. In 2002, total coal consumption for the region was approximately 239 Mmst, a decrease of 2.7% year-on-year.

Restructuring

Over the past decade, the Visegrad countries have continually restructured and downsized their coal industries by reducing the number of inefficient mines in operation, cutting the

labor force associated with coal mining, and increasing awareness of environmental issues related to the industry in line with EU standards.

In Poland, the coal industry is one of the country's largest industries and employers, but inefficiencies have resulted in large annual losses, spurring the government to reform the sector. In 1998, the government introduced a five-year (1998-2002) Hard Coal Sector Reform Program which reduced employment from 248,000 to 140,000 at the end of 2002. In November 2003, the government introduced a second program to further consolidate and reform Poland's coal sector – Program of Restructuring of the Hard Coal Mining Sector for 2003-2006. The program plans to close inefficient mines and reduce employment on a voluntary basis. For those who voluntarily leave, the government is providing other private sector employment for workers, such as retraining, social hardship allowances, and early retirement pensions. The program also plans to privatize the country's coal industry by 2006. In April 2004, the World Bank provided Poland with a loan of \$160 million to support the country's restructuring program.

According to the Czech Republic's State Energy Policy (Government Decision No. 211 – March 10, 2004), coal, particularly lignite, will remain the country's primary energy source in coming decades, despite increased use of natural gas and nuclear energy. The government expects coal, including black (hard) and brown (lignite), to account for 30.5% of total consumption in 2030. In line with EU regulations, the government lifted quotas on coal imported from Poland and Ukraine, as of January 2004. The decision was welcomed by Czech steel makers, which now have access to cheaper coal, namely Polish. Prior to this decision, steel makers, such as ISPAT NOVÁ HUŤ, were required to buy a large portion of its black coal requirements locally.

The Czech Republic's coal industry consists of six companies: three hard coal (black) mining companies (Ostrasko-Karvinske Doly; Ceskomoravske Doly; and Zapadoceske Uhelne Doly); and three lignite (brown) mining companies (Mostecká uhelná společnost, Severoceske Doly, and Sokolovska uhelna).

South Africa

Source: <http://www.eia.doe.gov/emeu/cabs/safrica.html>

Coal is the primary fuel produced and consumed in South Africa. The country has the world's seventh largest amount of recoverable coal reserves (54.6 billion short tons), approximately 5% of the world total.

Production

South Africa is the world's sixth largest coal producer, producing 245.3 million short tons (mmst) of coal in 2002. The Mpumalanga province accounts for 83% of South African coal production, while Free State (9%) Limpopo (7%) and KwaZulu-Natal (1%) also house production facilities. Although South Africa has 19 official coal fields, 70% of recoverable reserves lie in the Highveld, Waterberg, and Witbank fields. Anglo American's Anglo Coal (Anglo), BHP Billington's Ingwe Coal (Ingwe), domestic mining firms Eyesizwe Coal (Eyesizwe), Kumba Resources (Kumba), Sasol Mining (Sasol), and Swiss-based Xstrata Coal South Africa (XCSA) are responsible for the majority of South Africa's coal production.

In July 2003, Anglo American and Sasol announced plans to develop the Kriel South coalfield, from which each is expected to produce 5.5 mmst annually. Anglo will establish an operation on the northern portion of the field, and Sasol plans to expand its existing underground operations at the Syferfontein colliery in its southern portion. Anglo Coal will invest \$96 million and Sasol \$40 million in the project, which is expected to commence in 2005. In October 2004, Kumba Resources revealed plans to invest \$52 million to build two additional coal mines, Grootegeluk and Leeuwpan, to be completed by July 2006.

XCSA's WitCons Colliery is currently undergoing a \$4.8 million expansion expected to increase production by 50%. XCSA is also upgrading the Tavistock Colliery to raise annual production capacity from 1.2 mmst to 2 mmst. A feasibility study for full-scale production is being undertaken at XCSA's new Goedgevonden Colliery, currently a small contractor open-pit facility that utilizes production facilities at XCSA's nearby South Witbank mine.

In January 2003, Ingwe announced the sale of its Delmas colliery in Mpumalanga to Kuyasa Mining, a small South African empowerment firm. The sale of Delmas leaves Ingwe with operational control of seven mines in South Africa, four of which it owns and three of which are jointly owned with XCSA. Ingwe is considering merging some of its operations to maintain its position as the main supplier to South Africa's electricity utility, Eskom.

Exports

Although only one-third of coal produced in South Africa is exported, primarily to the European Union (EU) and East Asia, South Africa was the world's third largest net coal exporter (73.7 mmst) in 2002.

The vast majority of South African coal exports are shipped through the Richards Bay Coal Terminal (RBCT). With the capacity to export 79.4 mmst annually, RBCT is the world's largest coal export facility. At present, only shareholding members of the RBCT Company-- including Ingwe, Anglo, XCSA, Total South Africa, Sasol, Kangra and Eyesizwe, and JCI/Lonrho/Duiker. Ingwe, Anglo and XCSA-- are permitted to use the export facility. Ingwe, Anglo, and XCSA combined own 86% of the RBCT.

Although the South Dunes Coal Terminal (SDCT) opened in 2000 to facilitate the participation of empowerment companies in the coal export sector, RBCT exporters and the SDCT partners agreed in June 2001 to expand the RBCT as well. Because no new rail infrastructure is needed, the expansion of RBCT is considered the most cost-effective method of increasing South Africa's coal export capability. RBCT's expansion will increase its annual export capacity by 11 mmst. SDCT firms will be permitted to export 7.2 mmst per year from the terminal. In March 2002, SDCT firms secured \$41 million of the expansion's \$52 million total cost. The remaining \$11 million will be financed by RBCT shareholders. The first shipment of coal by an empowerment entrant was loaded at the RBCT in October 2003. Its full expansion is expected to be completed in 2005.

Kumba and the Iron and Steel Corporation of South Africa (ISCOR) export coal through the Durban Coal Terminal (DCT), whereas Gold Fields utilizes the Matola Coal Terminal (MCT), both of which are located in Maputo, Mozambique. Although only 1.4 mmst of South African coal was exported through MCT in 2001, \$13.8 million worth of improvements planned for the South Africa-Maputo railway and the planned dredging of the Port of Maputo to allow access to larger vessels may encourage increased exports. MCT management anticipates that the facility will have the capacity to export 5.5 mmst of coal by 2006; however, increased rail charges may hinder South African exports. Spoornet, South Africa's state-owned rail company, announced plans in 2003 to increase freight charges to the MCT and DCT by 30% on average over three years.

Consumption

South Africa consumed 171.6 mmst of coal in 2002, 90% of which was used for electricity generation and the synthetic fuel industry. Other coal consuming sectors include the non-synthetic fuels industrial sector, metallurgical industries, and the merchant & domestic sectors.

United States

Source: <http://www.eia.doe.gov/emeu/cabs/usa.html>

The United States produced 1,072 million short tons (Mmst) of coal in 2003, down 2.1% from 2002 output, and the second annual decline in a row. In contrast, during the first ten months of 2004, coal production increased 3.0% year-over-year. Led by Wyoming (376 Mmst of production in 2003), the West accounts for about 56% of the U.S. total, overwhelmingly from surface mines. Appalachia (led by West Virginia and Kentucky) accounts for about 35% of total U.S. coal production, mainly from underground mines. Around three-fifths of U.S. coal production is bituminous, one-third subbituminous, and about one-tenth lignite (brown coal). Around 80,000 miners work in the \$20 billion U.S. coal industry, down from a peak of 700,000 in 1923, when U.S. coal production was half what it is today. Major U.S. coal companies include Peabody Energy (the largest in terms of production), Arch Coal (the second largest coal producer); and Kennecott Energy.

Coal production in the Appalachian Region declined in 2003 to a total of 376.0 million short tons, the lowest level seen since 1978, when coal production was curtailed by a United Mine Workers of America strike curtailed coal production from December 6, 1977, to March 25, 1978. The recent decline was the result of several factors. The legacy of past lawsuits, that had temporarily halted the issuance of needed permits to open new mines, continued to constrain the amount of coal produced. Bankruptcies continued to plague Appalachia as another mid-sized coal company filed for Chapter 11 in early 2003, while several other coal companies were still working through their bankruptcy processes. Geological problems and underground mine fires added to the decline in coal production in some Appalachian States. Finally, several mines closed as they reached the end of their reserve base adding to the continuing reserve depletion that is affecting coal production in the East. Declining productivity and increasing labor costs also contributed to lower production levels in the region.

During 2005, coal production is expected to rise slightly in Appalachia, fall slightly in the U.S. interior, and increase strongly in the West. In 1998, low-sulfur western coal production surpassed relatively higher-cost, higher-sulfur, Appalachian coal for the first time, following strong increases since 1994, prompted largely by Phase 1 of the CAAA (1990). CAAA originally took effect during 1995, and required lower sulfur emissions from coal combustion. In response, Wyoming increased its coal production sharply, particularly low-sulfur, low-ash (and low cost) coal from the Powder River Basin, where coal is strip-mined.

Several factors had an impact on coal production in 2003. Among the minor issues were weather (rain or the lack thereof), transportation bottlenecks, and a one-day disruption in the electric power grid. The weather played a part in some of the transportation bottlenecks. The lack of rain led to low water levels in the river transportation system, in particular on the Mississippi River in January and again in August, which resulted in delayed coal barge shipments. Severe rains in the Powder River Basin in June impacted both coal production (causing some mine pit flooding and collapsing highwalls) and transportation (delays in train deliveries). Rail congestion problems continued to occur periodically in some States in the Western Region during the year. In August 2003, there was an electricity blackout that affected over 50 million customers in the northeast United States and portions of Canada.

Legal issues continued to affect all aspects of the coal industry during 2003. For example, a new lawsuit was filed over the level of environmental review needed in the permitting system process, and there have been challenges to the New Source Review program requirements for power plants. A coalition of environmental groups filed a lawsuit stating that all applications for permits should get full environmental review, while a coalition of several States and local governments sued the Environmental Protection Agency (EPA) to block the implementation of the new rule published at the end of October 2003. Also, on January 29, 2003, the Fourth Circuit Court of Appeals ruled in favor of the coal industry and the Department of Justice by overturning Judge Charles Haden's May 2002 ban on new valley fill permits at coal mines in West Virginia and eastern Kentucky. The three-judge panel ruled that the 2002 ruling had been "over

broad" and essentially supported the existing policies that the Army Corps of Engineers has followed for many years in issuing fill permits under the Clean Water Act.

In 2003 the rebounding U.S. economy, coupled with the slightly warmer than normal summer experienced in the western part of the country, helped drive up demand for coal. For the year, the United States consumed 1,095 Mmst, up 2.7% from 2002. Although preliminary data show that total electricity generation decreased by 0.2% in 2003, coal-based generation increased by 1.6%, resulting in a 26.8-Mmst increase in coal consumed in the electric power sector. Total coal use in the non-electricity sector (coke plants, other industrial plants, and the residential and commercial sectors) rose by 1.8 % during 2003, to a level of 90.4 Mmst.

Coal prices at mines declined slightly in 2003 at the national level. The average open market price of coal was \$17.85 per ton in 2003, a drop of 14 cents per ton from 2002. The price per ton of surface mined coal declined in 2003 by 23 cents per ton, while the price of underground coal increased by 3 cents per ton at the national level. Coal prices in the consuming sectors were mixed in 2003. Coal prices to electric utilities (a subset of the electric power sector) increased for the third year. However, the delivered price of coal declined in the other sectors in 2003. The average delivered price of coal to electric utilities was \$25.29 per short ton (124.3 cents per million Btu), up 2.2% from the annual 2002 level of \$24.74 per short ton (121.8 cents per million Btu)

The electric power sector (made up of electricity producers whose primary business is producing power for public distribution) accounts for the vast majority over 90%) of U.S. coal consumption, with coke plants and "other industrial" accounting for most of the remainder. In coming years, as sulfur dioxide emissions standards are tightened (in 2000, for instance, Phase 2 of the Clean Air Act Amendments -- CAAA -- took effect), the share of low-sulfur coal (mainly from the western U.S.) in the country's coal consumption mix is expected to increase. In 2002, production of medium- and high-sulfur coal was 578 Mmst (52%), while low-sulfur coal output was 527 Mmst (48%). By 2025, medium- and high-sulfur coal is expected to make up just 43% of total U.S. coal output, with low-sulfur coal accounting for 57% of the total.

U.S. gross coal exports fell sharply starting in the mid-1990s due mainly to lower world coal prices and increased competition from other coal-producing nations (i.e., Australia, South Africa, China, Venezuela, Colombia), plus natural gas -- especially in Europe. In 2002, the United States exported 40 Mmst of coal, down from 108 Mmst of exports in 1991. In 2003, U.S. coal exports increased slightly, to 43 Mmst, of which nearly half went to Canada. In coming years, the U.S. coal industry is expected to continue to face strong competition from other coal-exporting countries, with limited or negative growth in import demand in Europe and the Americas. U.S. gross coal imports are estimated at 25.0 Mmst in 2003, up 48% from 16.9 Mmst in 2002. The continued rise in U.S. gross coal imports is partly attributable to heightened demand for low-sulfur coal, and in part to the need to meet stricter sulfur emission requirements of Phase II of the CAAA.

Bankruptcies continued to exert influence on the coal industry as several producers and a few consumers attempted to emerge from Chapter 11 during the year and another mid-sized coal company filed for bankruptcy protection in 2003 as it tried to realign its finances. The year also saw the continuing effort of several companies trying to exit the coal business by selling their mining interests to other parties. Adverse geological conditions and equipment problems continue to trouble some mining operations in both the Appalachian and Western Regions, while underground fires in Appalachia caused some mining operations to temporarily suspend production during 2003.

Clean Coal Technology:

The future of coal and its impact on the world economy and environment in the 21st Century and beyond is dependant largely on our capabilities to burn coal cleanly and, especially, to reduce greenhouse gas emissions. Following is a list of comments condensed from an article in the Fall 2005 issue of OnEarth Magazine, entitled *How to Clean Coal*, by Craig Canine (<http://www.nrdc.org/onearth/05fal/coal1.asp>).

- Obsolete coal-fired power plants built in the 1950s and 1960s need to be replaced.
- U.S. utility companies plan to build more than 100 new coal plants over the next 10 to 15 years.
- The largest plants will have generating capacities of around 1,000 megawatts (MW).
- These plants, which could cost close to \$1 billion to build, would have an operating expectancy of 60 years or longer.
- "If the plants are not designed up front to capture their CO₂, they will lock us into large amounts of global-warming emissions for their entire operating lifetimes."
- The U.S., China, and India have large resources of low-cost coal.
- On a global basis, future CO₂ emissions derived from the burning of the world's remaining coal endowment could increase atmospheric CO₂ concentrations to 10 times pre-industrial levels.
- Some environmentalists are convinced that coal simply has no acceptable future as a major energy source because of the CO₂ problem.
- Instead, new coal-fired power plants must be designed to capture CO₂ and other pollutants, and the CO₂ would then be piped deep into the earth for permanent storage.
- "The National Commission on Energy Policy, a bipartisan panel of 16 energy experts from industry, academia, government, and nonprofit groups, released a landmark report last December that includes carbon capture and sequestration among its key policy recommendations."
- It is essential to develop carbon capture and sequestration systems that which allow the major coal-burning countries to utilize their coal in a way that does not increase future carbon emissions.

To meet future needs for pollution-free coal-fired electric power plants, the U.S. Department of Energy is conducting "...a \$1 billion, 10-year demonstration project to create the world's first coal-based, zero-emissions electricity and hydrogen power

plant...." (President George W. Bush, February 27, 2003).

(<http://www.fossil.energy.gov/programs/powersystems/futuregen/>).

Coal Meetings:

Go to the International Energy Agency (IEA) home Page for up-to-date lists of international coal meetings: <http://www.iea-coal.org.uk/site/ieacc/home>.