EMD 2010 Annual Business Meeting
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Coal Committee Annual Report
William A. Ambrose, Chair

1. Where are the active coal basins and which ones are the most likely to see future growth?

Basins in China:

China currently has known coal reserves of ~1,031 billion tonnes and its predicted resources are 3,800 billion tonnes. Coal in China is geographically widespread and occurs in every stratigraphic interval from the Devonian to Tertiary. China's coal basins are summarized in a map by the USGS, which depicts the geographic extent of China's coal basins, together with rank, geologic age, and annual production from selected major coal mines:

Source: **http://pubs.usgs.gov/of/2000/of00-047/china_coal.pdf**

For more information on coal activity in China, especially pertaining to levels of new coal-fired electric facilities, refer to Platt and Ambrose (2009).

Sources:

Scott, A. C., and Bangzhuo, M., 2008, The coal geology of China: Geology Today, v. 9, p. 14-18.

Meta data for coal basins in China:
http://geo-nsdi.er.usgs.gov/metadata/open-file/00-47/sed_basins.faq.html

Platt, J., and Ambrose, W. A., 2009, Coal at center of power shift: AAPG Explorer, v. 50, p. 46, 50.

Basins in the United States:

Coal basins are distributed throughout Alaska and the lower 48 United States. Historic US coal-production trends have been dominated by the Appalachian Basin, which has accounted for 40 billion tons. The Illinois Basin has produced ca. 10 billion tons, whereas the Rocky Mountain region has produced 4 billion tons. However, recent demand for low-sulfur coal as well as increased demand for coal for electric-power generation has favored such basins as the Powder River Basin in northwest Wyoming and southeast Montana, the leading coal-producing basin in the U.S., recently accounting for >37% of total production.

Source:
http://www.byronwine.com/files/coal.pdf

Other sources:

US-Basin-specific source:
http://energy.er.usgs.gov/coalres.htm

State-specific source:
http://energy.er.usgs.gov/products/databases/USCoal/reference.htm

USGS Coal assessments (NCRA) and databases (includes NCRDS, COALQUAL, COALPROD, NaCQ):
http://energy.er.usgs.gov/coal_assessments/
http://energy.er.usgs.gov/coal_assessments/ncra/summary.html

NCRDS (National Coal Resources Data System)
http://energy.er.usgs.gov/coalres.htm

http://energy.er.usgs.gov/coal_quality/coal_databases.html

Coal on federal lands:
http://energy.cr.usgs.gov/regional_studies/fedlands/index.html

Basins in India:

Most of India's coal reserves are relatively high-ash, bituminous coal and are located in Jharkhand, Orissa and West Bengal. Coal reserves in India are plentiful but low quality. India has 10% of the world's coal, at over 92 billion tones. At current rates of production, India has enough coal for the next 217 years.

Source:
http://www.worldcoal.org/assets_cm/files/PDF/ecoal_focus_on_india.pdf

The major coal-bearing formations in India are from the Lower Gondwana (Permian) and Eocene and Oligocene formations in northeastern India, including Rajasthan, Gujarat, Jammu, and Kashmir. Coal is distributed in 17 major coalfields in India.

Source:
http://www.methanetomarkets.org/m2m2009/documents/toolsres_coal_overview_ch14.pdf

Basins in Australia:

Coal in Australia occurs in Permian, Mesozoic and Tertiary basins. Permian coal occur throughout Australia, including the Collie Basin near Perth, the Fitzroy Basin in Western Australia, the Arckaringa Basin in South Australia, the Sydney Basin in New South Wales, the Bowen Basin, the Cooper Basin, and the Galilee Basin in Queensland. These Permian coal basins underwent a high rate of subsidence, coupled with significant volumes of sediment infill. Coal-seam thickness in the Collie Basin, an intracratonic rift basin, ranges from 5 to 40 ft (1.5 to 12 m). These subbituminous coals are low in sulfur in ash. The Cooper and Galilee Basins in Queensland contain inertinite-rich, low-sulfur coal seams that range in thickness from 66 to 100 ft (20 to 30 m). The Cooper basin is to far away from the coast to be mined economically, in contrast to the Galilee Basin. The Sydney and Bowen Basins are dominated by low-sulfur, vitrinite-rich coal seams. Mesozoic (Jurassic) coal seams in Australia occur in the southern Bowen Basin and the northern Sydney Basin. These coal seams in the Surat Valley have relatively greater gas, carbon (ca. 80 %) and hydrogen (5 to 7 %) contents. Tertiary coal seams are widespread in Australia. For example, the Gippsland Basin in Victoria contains the youngest minable coals in Australia. The in situ reserve is 100,000 million tonnes. Individual coal-seam thickness is commonly >330 ft (>100 m). Most of Australia's resources of black coal are in New South Wales (Sydney-Gunnedah Basin) and Queensland (Bowen Basin). New South Wales contains a total of 34,110 million tonnes (Mt) of resources, whereas Queensland has 28,380 Mt. Lesser amounts of black coal resources occur in South Australia, Western Australia, and Tasmania.

Sources:
http://www.australiancoal.com.au/resources.htm
http://www.geo.tu-freiberg.de/oberseminar/os07_08/australien.pdf

Basins in Russia:

Russia produces coal from >20 coal basins. Most production is from 7 basins; three are west of the Ural Mountains and four are in Siberia. The 3 western basins are the Donetskii Basin (on the border between Russia and Ukraine), the Moscow Basin (west and southwest of Moscow), and the Pechora Basin (extreme northeast part of European Russia).

The Donetskii Basin has the longest history of production of Russia's coal basins and is the largest producer from underground mines. Production in the Donetskii Basin consists of bituminous to anthracite. The basin is a major source of metallurgical and thermal coal for Europe.

The Moscow Basin produces lignite whereas the Pechora basin produces higher-rank coal. Pechora Basin coals contain high ash content, making it more suitable for thermal rather than metallurgical coal.

The 4 Siberian Basins are the Kuznetski, Kansk-Achinsk, and the Irkutsk (south-central Russia) and the South Yakutsk Basin in the Russian Far East. The Kansk-Achinsk Basin produces lignite whereas the other basins produce bituminous and anthracite coal.

Russia also contains undeveloped coal basins, including the Tunguski and Lenski in north-central and northeast Russia and the Russian Far East, respectively. The Lenski, or Lena, Basin is considered to be the largest coal basin in the world. Much of Russia's long-term coal potential lies in these basins.

Source:
http://www.mma1.com/company/pdf/papers/An%20Introduction%20of%20the%20Russian%20Coal%20Industry.pdf

Basins in South Africa:

Coal is mined in South Africa in several regions, mainly in the East Rand around Witbank, in the Vaal valley around the Vaal Triangle and at Dundee and Newcastle in the north part of Natal. There has been a recent discovery of >1 billion tonnes of bituminous coal in Limpopo province.

Sources:
http://www.mbendi.co.za/indy/ming/coal/af/p0005.htm
http://www.azom.com/News.asp?NewsID=11227

Basins in Germany:

German coal is open-cast mined at three major brown coal fields–in the Lower Rhine Bight, in Central Germany and in Lausitz. Hard coal mining in Germany is mined in the Ruhr, Saar and Ibbenbüren coalfields in the western part of Germany, centered on the Rhine River valley. Mining of hard coal in Germany is in decline, with subsidies to be phased out completely by 2018. Hard-coal mines produced 41.3 Mt in 1998, 39.2 Mt in 1999, 33.3 Mt in 2000 and 27.1 Mt in 2001. By 2006, their combined output had fallen to 20.7 Mt.
Sources:

Anonymous, 2007, Hydrocarbons: Cleaning browncoal – the green approach: Filtration+Separation: Elsevier Ltd., 7doi:10.1016/S0015-1882(07)70121-0

Source:
http://www.mining-technology.com/projects/germany/

Basins in Indonesia:

Most of Indonesia's coal basins are in Sumatra and Kalimantan in the Indonesian part of Borneo. According to EIA estimates, Indonesia has 5.5 billion short tons of recoverable coal reserves, of which 85 percent is lignite and sub-bituminous rank. Roughly two-thirds of the country's coal reserves are located in Sumatra, with the balance located in Kalimantan, West Java, and Sulawesi. Coal basins in Indonesia are geologically young. The presence of higher- rank coals near the present land surface is dependent upon uplift or the presence of igneous intrusions. These basins are either Paleogene intramontane and continental margin (or possibly retro-arc) in origin, or Neogene retro-arc. The coal seams were deposited in environments ranging from fluvial to deltaic, with little marine influence. Eocene coals from Kalimantan tend to have a much higher content of minerals compared with younger coals.

Sources:
http://www.australiancoal.csiro.au/pdfs/cook_daulay.pdf
http://www.eia.doe.gov/emeu/cabs/Indonesia/Coal.html

Basins in Poland:

Poland has three major Upper Carboniferous coal fields with resources estimated at 16.6 billion tons. The primary coalfield (Gornoslaskie Zaglebie Weglowe) is in Upper Silesia and is one of the biggest (~4,500 km^2) hard-coal fields in the world. To date, 9 billion tons have been produced. Hard coal is also located in the Bogdanka coal field (known as Lubelskie Zaglebie Weglowe). Within this coal field, coal seams are distributed from the Polish-Ukrainian border to Radzyn Podlaski. Hard-coal deposits are also present in Lower Silesia. However, they are difficult to exploit and all local mines were closed down by 2000. Poland's brown coal reserves are estimated at nearly 14 billion tons. They are located in eight regions, mainly in central Poland (coal fields at Konin, Belchatow and in Wielkopolska) and in west Poland (at Turoszow on the Polish side of the Lusatian Neisse). Poland is the world's sixth leading producer of brown coal, with 78 documented deposits, of which the exploited twelve contain 2.1 billion tons.

Source:
http://www.poland.gov.pl/Natural,,Resources,310.html

Basins in Kazakhstan:

Coal in Kazakhstan is produced in the Karaganda region and along the northern border of the country where the Bogatyr and Severny coal fields are located. Russian firms are stakeholders in the Kazakh coal industry and roughly 16 Mmst are transited annually from Kazakhstan northward via rail to power plants in southern Russia.. Kazakhstan obtains >80% of its electricity production from coal. The country's largest power generator, AES-owned Ekibastuz No. 1, is located in north-central Kazakhstan

Source:
http://www.eia.doe.gov/emeu/cabs/Kazakhstan/Coal.html

Additional links for world coal basins:

World Coal Institute
http://www.worldcoal.org/pages/content/index.asp?PageID=104

U.S. Department of Energy, Energy Information Administration (EIA)
http://www.eia.doe.gov/emeu/international/coalproduction.html

For a review of US coal production, refer to the following EIA website:
http://www.eia.doe.gov/cneaf/coal/page/acr/acr_sum.html#fes1

For a review of future projections of coal use and production, refer to EIA's International Energy Outlook 2007 report on coal, available at the following website:
http://www.eia.doe.gov/oiaf/ieo/index.html
http://www.eia.doe.gov/oiaf/ieo/coal.html

2. How much coal is currently being produced and what is the forecast for future production?

According to the, Energy Information Administration (EIA), for which the most recently posted data are from October 17, 2008, the top 10 coal-producing countries in 2007, in descending order with approximate values of coal production in millions of short tons, were China (2,804), United States (1,146), India (529), Australia (428), Russia (347), and South Africa (283) Germany (228), Indonesia (180), Poland (162), and Kazakhstan (103).

Source: U.S. Department of Energy, Energy Information Administration (EIA)
http://www.eia.doe.gov/emeu/international/coalproduction.html

Worldwide Coal Production:

The worldwide production of coal in 2007, as recently reported by EIA in its posting dated October 17, 2008, was approximately 7,036 million short tons (Energy Information Agency [EIA]). Asia and Oceania led the world with 4,069 million short tons. China and the United States are expected to continue to lead the world in coal production, with increased production also anticipated in India, which accounted for 528.50 million tons, and Australia which produced 428.40 million tons in 2007. Coal production in other areas of the world in 2007 in descending order, with chief country in parentheses, was:

North America 1,233.64 (United States 1,145.57)
Europe 814.20 (Germany 227.76)
Eurasia 537.23 (Russia 346.68)
Africa 288.74 (South Africa 282.56)
Central & South America 91.90 (Colombia 74.85)
Middle East 1.40 (Iran 1.40)

Source: U.S. Department of Energy, Energy Information Administration (EIA)
http://www.eia.doe.gov/emeu/international/coalproduction.html

Coal Exporters:

The leading coal-exporting countries in 2007, including metallurgical and thermal-coal exports, combining ABARE and BP Statistical Review data, include:

Top Exporters*				2007 Reserves (BP)			Prod'n*	Hard Coal P/R and R/P**	
	Thermal	Met	Exp Total	Anthracite and Bit	Subbit and Lignite	Reserves Total	Hard coal prod	P/R (%)	R/P (years)
Australia	**111.6**	**120.5**	232.1	37,100	39,500	76,600	309	0.8%	120
Indonesia	**170.0**		170.0	1,721	2,607	4,328	169	9.8%	10
Russian Fed'n	**81.7**	**15.8**	97.5	49,088	107,922	157,010	233	0.5%	210
South Africa	**67.7**		67.7	48,000		48,000	244	0.5%	196
China	**58.9**	**4.8**	63.7	62,200	52,300	114,500	2,382	3.8%	26
Colombia	**59.7**		59.7	6,578	381	6,959	64	1.0%	103
United States	**19.9**	**25.8**	45.7	112,261	130,460	242,721	977	0.9%	115
Canada	**3.2**	**27.4**	30.6	3,471	3,107	6,578	26	0.8%	132
Poland	**13.1**	**3.1**	16.2	6,012	1,490	7,502	94	1.6%	64

* 2006 Exports and Production, ABARE

**US prod incl subbituminous
US ratios do not include subbit reserves

Exports from the major producing countries, including Australia, Indonesia and Colombia, are expected to increase during 2009 together with increased production capacity. Restricted exports from China are expected to maintain spot prices. In 2009, world thermal coal trade was forecast to increase by 3% to 745 million tonnes. The increased world import demand for thermal coal is expected to be met by Australia, Colombia, and Indonesia. Exports from South Africa are expected t to be 65 million tonnes in 2008 and 67 million tonnes in 2009 because of capacity limitations at the Richards Bay Terminal.

Japan's imports of thermal coal are forecast to decline by 3% to 130 million tonnes in 2009. Although the addition of 600 megawatts (MW) of coal-fired electricity generation capacity is expected to support increased consumption, this is expected to be offset by increased usage of nuclear power.

The Republic of Korea is expected to add 5200 MW of coal-fired generation capacity between 2007 and 2009, resulting in increased thermal coal imports by 9% to 72 million tonnes in 2008 and by an additional 8% to 77 million tonnes in 2009.

In 2009, European Union imports of thermal coal were forecast to increase to 180 million tonnes. Germany's production of coal is expected to decline as mines are closed, which will support additional imports.

Indonesia's exports of thermal coal are anticipated to increase by 7% in 2009 to 217 million tonnes. Many companies are expanding production in response to high export prices by mining previously economically marginal deposits.

Colombia's thermal coal exports in 2009 are projected to increase by 4% to 73 million

tonnes, owing to additional capacity expansions.

U. S. exports are forecast to remain at ~26 million tonnes in 2009. Exporters in the U. S. have benefited from supply limitations in the Atlantic market, especially in South Africa, as well as a weaker U. S. dollar.

Australian thermal coal exports are forecast to increase by 7% to 122 million tonnes in 2008 to 2009. Earnings from thermal coal exports will at least double to $17.8 billion in these years, mainly due to increased production and prices.
Several projects are scheduled to commence operation in 2008 and 2009, including an upgrade in the Liddell Plant, Rocglen, and Narrabri.

Source:
http://www.abareconomics.com/interactive/08ac_Sept/htm/coal.htm

Coal Production in China:

Coal in China continues to be the most important source of electric power in the country, accounting for ~80% of generation capacity. China's 30,000 coal mines produced more than two billion tons in 2005. China is the world's largest and fastest growing producer and consumer of coal, by a factor of 2.2 or more. This number is derived from the BP Statistical Review estimates of 2007 production for the U.S., the second largest producer (587.2 million tonnes oil equivalent) and China (1,289.6 MTOE). In 2006, 102 GW of new generating capacity was added in China, and the pace of development over the past three years has been estimated as equivalent to adding three to four 500 megawatt power plants per week. For additional details, refer to Platt and Ambrose (2009) below.

Sources:

Finch, J., 2006, Beyond China's Coal Fields: Expanding Its Gas Resources: online publication: **http://ezinearticles.com/?Beyond-Chinas-Coal-Fields:-Expanding-Its-Gas-Resources&id=271034**

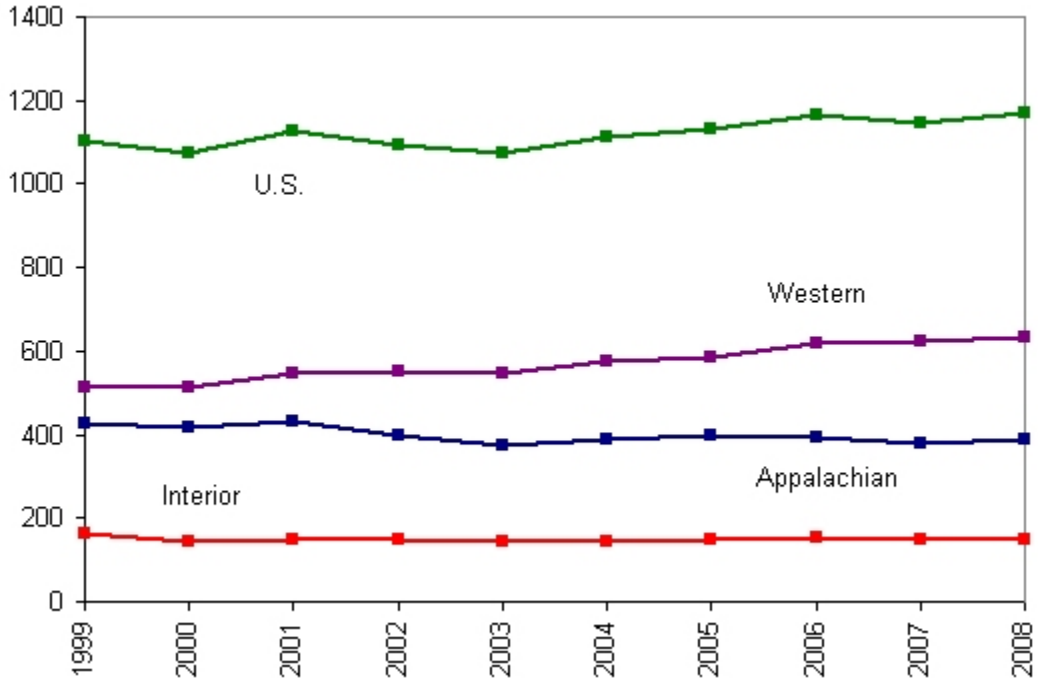
Platt, J., and Ambrose, W. A., 2009, Coal at center of power shift: AAPG Explorer, v. 50, p. 46, 50.

The Energy Information Agency (EIA) has recently compiled a summary of coal production in China. The EIA summary reports that >50% of China's recoverable reserves (estimated to exceed 126 billion short tons) are composed of anthracite and bituminous coal. China is focusing development on these higher grade coals, resulting in bituminous coal accounting for ~75% of annual coal production, with most of the remainder dominated by anthracite.
http://www.eia.doe.gov/emeu/cabs/china/part3.html

Coal Production in the United States:

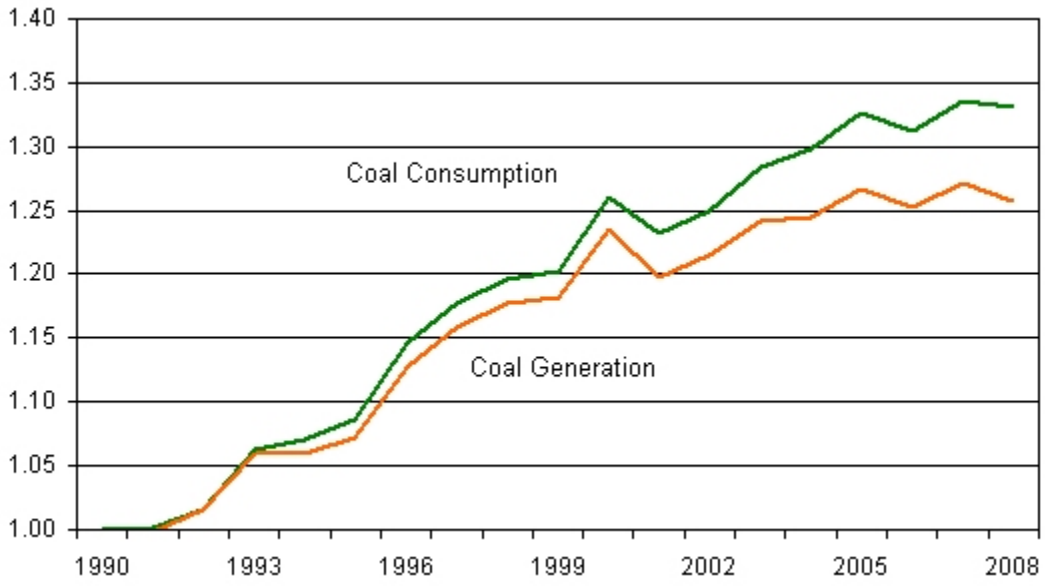
Preliminary U.S. coal-production data analysis for 2008 from an EIA released on April 15, 2009 includes:

- Coal production increased by 2.2 percent, or 24.8 million short tons from the 2007 level to reach a record level of 1,171.5 million short tons. The western U. S. continued to lead other regions in coal production (see following figure from EIA):



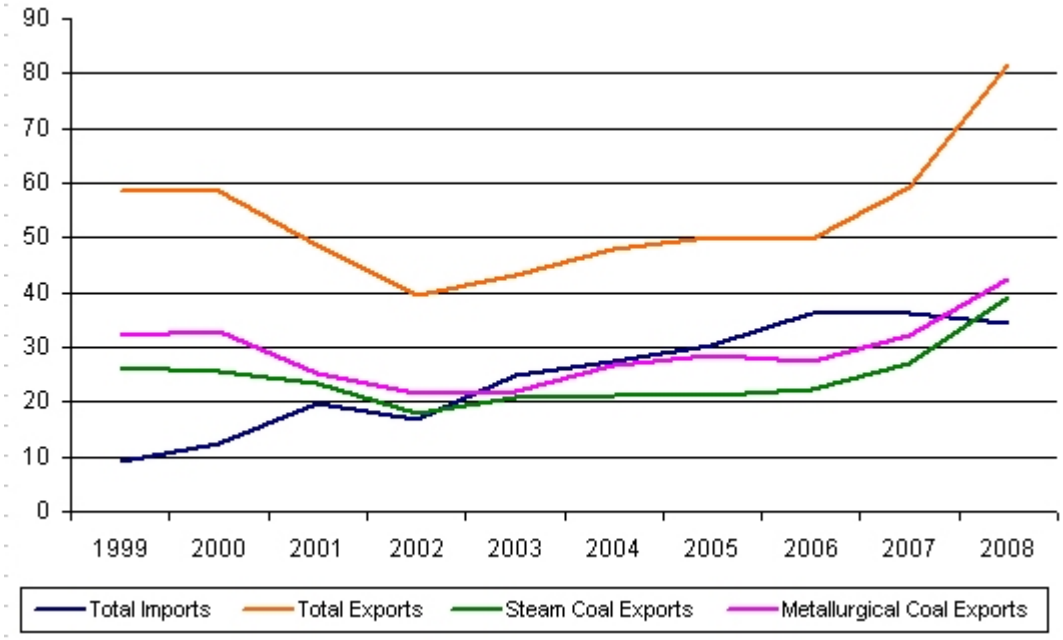
Values are in million short tons.
Source:
http://www.eia.doe.gov/cneaf/coal/page/special/fig2.html

- Although U.S. coal consumption declined in every coal-consuming sector, consumption continues to outpace coal production (see following figure from EIA):



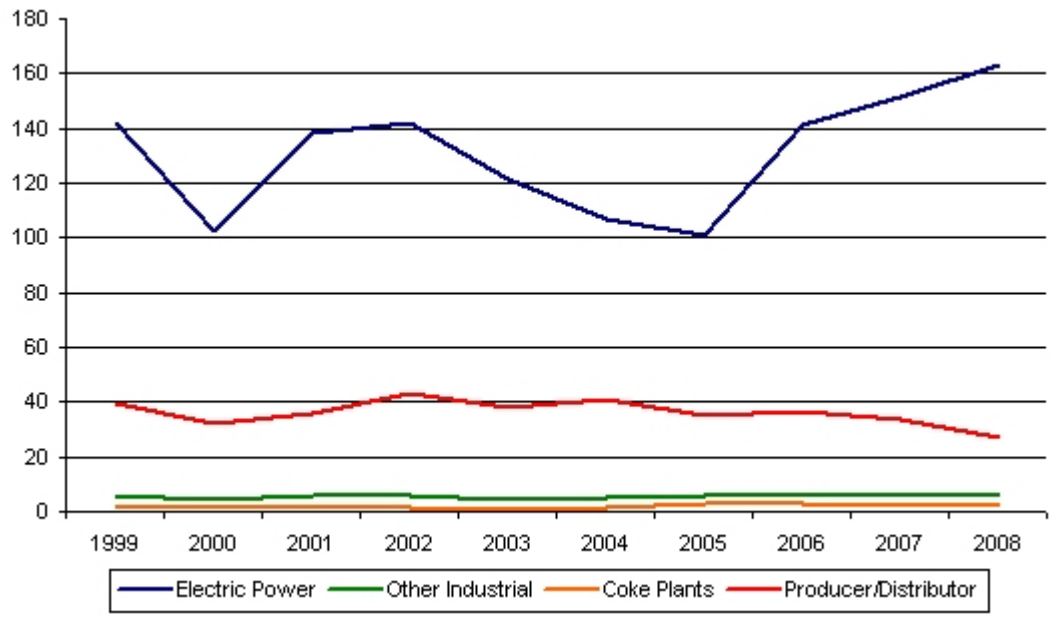
Values are in thousands of short tons.
Source of figure:
http://www.eia.doe.gov/cneaf/coal/page/special/fig4.html

- U.S. coal exports were significantly higher in 2008, while coal imports decreased slightly (see following figure from EIA):



Values are millions of short tons.
Source of figure:
http://www.eia.doe.gov/cneaf/coal/page/special/fig8.html

- Total coal stocks increased during the year as some consumers continued to add to their stockpiles.



The next U. S. coal-production data release date is scheduled for April, 2010.

Values are millions of short tons.
Source of figure:
http://www.eia.doe.gov/cneaf/coal/page/special/fig9.html

General Source: U.S. Department of Energy, Energy Information Administration (EIA)
http://www.eia.doe.gov/cneaf/coal/page/special/feature.html

A more detailed report for the year 2008 can be accessed via:

http://www.eia.doe.gov/cneaf/coal/page/special/article_dc.pdf

Coal Production in India:

Coal production in India was 375 Mt (million tones) in 2005. India has 565 coal mines, most of which are operated by Coal India and its subsidiaries, which produce approximately 86% of the country's coal. Most of the coal production in India comes from opencast mining, contributing >83% of the total production. Coal India is one the 5 largest companies in India and employs ~460,000 people. According to IEA projections, coal will remain the dominant fuel in India's energy mix to 2030. Demand is projected to grow from 391 Mt in 2002 to 758 Mt in 2030.

Source:
http://www.worldcoal.org/assets_cm/files/PDF/ecoal_focus_on_india.pdf

Coal is the dominant source of energy for electric power generation in India, which consumes >70% of India's coal production. Other uses for coal in India include steel, cement, fertilizer, chemical, paper, and industrial plants, although coal is no longer significant in the rail transport industry. India is dependent on imports for coking coal since its domestic coal is high-ash and has low-BTU values. The demand for coking coal is a major reason why India imported almost 11% of its total coal consumption in 2005.

Source:
http://www.methanetomarkets.org/m2m2009/documents/toolsres_coal_overview_ch14.pdf

Coal Production in Australia:

Permian coals in Australia are range from high-volatile bituminous to anthracite in rank, whereas Mesozoic coals are high-volatile bituminous. Tertiary deposits are lignites. There were 118 producing black coal mines in Australia at the end of 2006, an increase of 105 by the end of 2005. Almost all of these mines are in New South Wales and Queensland. The proportion of open-cut mines has recently increased greatly; in 1997 there were 58 underground and 60 open-cut mines. At the end of 2006 the number of underground mines was 44. The number of open-cut mines increased by 74. Thirteen new coal projects were competed in New South Wales and Queensland in 2007.

Asia is the main region for export. For example, Australia exports coking coal to China and anthracite to Japan.

Sources:
http://www.australiancoal.com.au/industrystats.htm
http://www.geo.tu-freiberg.de/oberseminar/os07_08/australien.pdf

Coal Production in Russia:

Although Russia produced <350 Mt in 2006, the country holds the world's second largest recoverable coal reserves of 173 billion short tons (bn). Russia consumed about 260 Mt in 2006, leaving 61 Mt for export. According to the government's energy projections, Russia should produce between 441-496 Mt per year by 2020. After recent restructuring, almost 80% of domestic coal production now comes from independent producers. Russia's strategy to increase coal production and build more coal-fired power plants will help reduce demand for natural gas, thus allowing for more natural gas exports.

Source:
http://www.entrepreneur.com/tradejournals/article/182660372.html

Coal Production in South Africa:

Approximately 77% of South Africa's primary energy needs are provided by coal. This is unlikely to change greatly in the near future, due to a lack of alternatives to coal as an energy source. Opencast mines provided 53% production during 2006, while room-and-pillar mining provided 38%, stoping 5%, and longwall 3%. The ten largest collieries, with an output of >12 million tons a year each, produced 204 million tons and 22 middle-sized mines produced 87 million tons. In 2006, mines controlled by the five largest mining groups, Anglo Coal, BHP Billiton, Sasol, Exxaro and Xstrata, supplied almost 90% of South Africa's saleable coal production. Coal mines discarded 70 million tons of waste or unsalable coal. Approximately 21% of the coal produced is exported, and 21% is used locally (excluding power-station coal). Coal is expected to maintain its share of the overall electricity generation market until 2020.

Sources:
http://www.dme.gov.za/energy/coal.stm
http://www.miningweekly.com/article.php?a_id=115238

Coal Production in Germany:

More than 97% of Germany's recoverable reserves of 7.4 billion short tons (Bst) are lignite (brown coal), with the remainder consisting of bituminous and anthracite (hard coal). Brown coal is Germany′s most important domestic energy source. According to Statistik der Kohlenwirtschaft, brown coal production represents >40% of domestic energy production in Germany. German coal production has declined since 1990, mainly due to closing of older, inefficient mines in the former East Germany. Currently, >50% of Germany′s lignite production is from the Rhineland region. Most of Germany′s hard coal deposits are deeply buried and difficult and expensive to extract. Although the German government has been providing large subsidies to the industry to maintain production, there are only 8 hard-coal mines in operation, down from more than 100 at the industry's peak in the late 1950s. The last of those will close by 2018, when subsidies come to an end. Brown coal production, however, is mostly feasible without subsidies.

Sources:
http://www.oilgasarticles.com/articles/47/1/Coal-Reserves-and-Coal-Consumption-in-Germany/Page1.html
http://www.washingtonpost.com/wp-dyn/content/article/2007/07/29/AR2007072901078.html

Coal Production in Indonesia:

In 2004, Indonesia produced 142 million short tons (MMst) of coal, an increase of 68% since 2000. Coal consumption in Indonesia has remained stable, with consumption in 2004 at 24 MMst. According to EIA statistics, Indonesia was the second largest net exporter of coal in the world in 2004, with 118 MMst of apparent net exports. Although Australia is the world's leading coal exported, Indonesia is the fastest growing exporter and by 2006 it was the world leader among exporters of thermal coal, 50% greater than Australia. Indonesia's electricity needs have also been rapidly growing, which is leading to policies to assure sufficient supplies to serve its domestic markets (Platt and Ambrose, 2009)..

Source:
http://www.eia.doe.gov/emeu/cabs/Indonesia/Coal.html

Coal Production in Poland:

Poland's reserves of hard coal are estimated at 45.4 billion tons. With current annual production >100 million tons, these resources are projected to meet the country's demand for almost 500 years. However, due to Poland replacing some hard-coal with natural gas, by 2020 hard-coal production is anticipated to be reduced to 82 million tons a year, and by 2050 to ~40 million tons.

Source:
http://www.poland.gov.pl/Natural,,Resources,310.html

Coal Production in Kazakhstan:

Kazakhstan contains Central Asia's largest recoverable coal reserves, with 34.5 billion short tons of mostly anthracite and bituminous coal. Kazakhstan produced 106 million short tons (Mmst) in 2006 and consumed 78 Mmst, resulting in 28 Mmst of net exports. Coal production in Kazakhstan has declined 35% since it became independent of Russia. Much of this decline is the result of mine accidents and difficulty in obtaining outside foreign investment. However, according to the Kazakh Ministry of Energy and Natural Resources, the country plans to be producing 100 to 105 Mmst annually by 2015.

Source:
http://www.eia.doe.gov/emeu/cabs/Kazakhstan/Coal.html

Additional links for world coal production:

For additional information on world coal production and consumption see also the World Coal Institute 'Global Coal Market' section (PDF file) of the report: The Coal Resource - A Comprehensive Overview of Coal at:
http://www.worldcoal.org/assets_cm/files/PDF/globalcoalmarket.pdf

U.S. Department of Energy, Energy Information Administration (EIA)
http://www.eia.doe.gov/emeu/international/coalproduction.html

For International production statistics, see the following websites:

International Production (Country Analysis Briefs)
http://www.eia.doe.gov/emeu/cabs/index.html

World Coal Institute
http://www.worldcoal.org/pages/content/index.asp?PageID=104

For detailed information on US coal production, see the following website:
EIA
http://www.eia.doe.gov/cneaf/coal/page/acr/table1.html

For a review of US coal consumption by industry type see:
EIA
http://www.eia.doe.gov/cneaf/coal/quarterly/html/t28p01p1.html

The World Coal Quality Inventory: A status report
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V8C-4G65TXY-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_version=1&_urlVersion=0&_userid=10&md5=324f0c316c826aa326a008622bbd1763

3. What are the sources of funding for current and planned activities?

DOE continues to support research in clean-coal technology. New-generation, clean-coal power plants in the U.S. are expected to go online around 2010. Cambridge Energy Research Associates (CERA) estimates that at least 5 GW of new clean-coal power will be required to meet the growing demand for coal to fuel clean-coal energy. The National Coal Council estimates a new demand of 375 million tons/year for 100 GW of new clean-coal power in the U.S. (Beck, 2006).

Clean-coal technology is included in the recent Federal Stimulus Initiative, in which CO_2 capture and sequestration is an integral part. Selected links to information about proposed federal funding for additional research in clean-coal technology, as well as specific information on clean-coal technology programs with which DOE and NETL are involved, include:

http://www.fossil.energy.gov/aboutus/budget/stimulus.html

http://www.fossil.energy.gov/programs/powersystems/cleancoal/

http://www.netl.doe.gov/technologies/coalpower/cctc/index.html

Sources:

Beck, R. A., 2006, Coal: the cornerstone to America's energy future: Power, v. 150, p. 42-46.
http://fossil.energy.gov/news/techlines/2008/08023-FutureGen_FOA_Released.html
http://www.fossil.energy.gov/programs/powersystems/cleancoal/
http://fossil.energy.gov/programs/powersystems/futuregen/

4. What kinds of research are taking place and who is doing it?

Research in the microstructure of coal and its components is underway as a result of current interest in coalbed methane and CO_2 sequestration. Work is being conducted to to document and model the processes affecting adsorption and desorption of gases in coal beds. In a recent report, the U.S. Geological Survey demonstrated that adsorption capacities for CO_2 can be up to 18 times higher than the adsorption capacities of methane in some subbituminous coals and lignites. This research implies that deeply buried, low-rank coal seams could be potential reservoirs for CO_2 sequestration, even with low methane contents.

Source:
http://www.geotimes.org/july03/high_coal.html

Numerous research organizations are actively involved in coal-related research. The following is a selected list, together with key research topics:

British Coal Utilisation Research Association
Topics: flue gases from coal gasification, coal and biomass for low-emission, clean-coal facilities, carbon capture and storage
http://bcura.org/

Coal Research Center, Southern Illinois University Carbondale
Coal gasification, mining technology to reduce production costs, carbon capture and storage
http://www.crc.siu.edu/

CSIRO, Commonwealth Scientific and Industrial Research Organisation of Australia
Hydrogen from coal, carbon capture and storage, coal gasification for low-emission power generation, coalbed methane production enhancement
http://www.csiro.au/science/Coal.html

European Coal and Steel Research
Coal mining operations, mine infrastructure and management, coal preparation, coal conversion, coal combustion and gasification
http://cordis.europa.eu/ecsc/home.html

The University of Kentucky Center for Applied Energy Research
Mine mapping, ash, environmental and mercury analysis, coal petrology, separations, Fischer-Tropsch technology, syngas and hydrogen
http://www.caer.uky.edu/

U.S. Department of Energy's Office of Fossil Energy
Clean coal, carbon capture and storage, gasification technologies, advanced combustion systems
http://www.fe.doe.gov/programs/powersystems/index.html
http://www.fossil.energy.gov/programs/powersystems/advresearch/index.html

Coal Ash Research Center at the University of North Dakota (UND) Energy & Environmental Research Center (EERC)
Coal ash, mercury, IGCC by-products
http://www.undeerc.org/carrc/

Max-Planck-Institut für Kohlenforschung (coal research)
Organic chemistry related to coal and coal compounds
http://www.mpi-muelheim.mpg.de/kofo/english/mpikofo_home_e.html

National Energy Technology Center
Clean-coal power generation, coal gasification technology (turbines, hydrogen generation, etc.), coal-utilization by products, emissions control, technical innovations for existing coal-fired power plants
http://www.netl.doe.gov/technologies/coalpower/index.html
http://www.netl.doe.gov/technologies/coalpower/advresearch/ucr/main.html

National Research Center for Coal & Energy
Coal-to-liquids technology, combustion by-products recycling, advanced separations technology. mine reclamation, zero-emissions technology
http://www.nrcce.wvu.edu/

Ohio Coal Research Center at Ohio University
Mercury removal using membrane-enhanced ESP, Vapor-grown carbon fibers from coal tailings, biosequestration of greenhouse gases, sulfides conversion
http://www.ent.ohiou.edu/~ohiocoal/

Purdue University Energy Center
Clean-coal energy, coal gasification and liquid fuel, coal-slurry deposits, coal-quality assessment, coal-transportation infrastructure
http://www.purdue.edu/dp/energy/research/cleanCoal.php
http://www.purdue.edu/dp/energy/CCTR/

U.S. Geological Survey Energy Program
Coal resources, coalbed methane, organic petrology, coal databases, coal assessments, coal and coke production
http://energy.usgs.gov/coal.html

Virginia Center for Coal and Energy Research
Environmental impacts of energy resources extraction and utilization; public policy issues related to energy, marketing, and transportation of coal; integration of high technology into systems design and education; international energy development; sustainable development issues; carbon management; and deregulation issues.
http://www.energy.vt.edu/

The Center for Energy and Economic Development (CEED)
Clean coal technology and economics
http://www.ceednet.org/ceednet/

5. Which companies are considered the leaders?

Fifteen leading coal companies included on the Yahoo Finance list of top coal companies include Yanzhou Coal Mining Co (the only coal mining stock to be listed in both the Hong Kong, Shanghai, and New York Stock Exchanges), Westmoreland Coal Company, SGI International, Peabody Energy Corporation, Natural Resource Partners, Massey Energy Company, KFX Inc., Headwaters Incorporated, Foundation Coal Holdings, Fording Canadian Coal Trust, CONSOL Energy Inc., Beard Company, Arch Coal, Inc., Alpha Natural Resources, and Alliance Resource Partners. Details of economic profiles for each of these companies are posted at:

Yahoo Finance list of top coal companies:
http://biz.yahoo.com/p/ccoallconamed.html

Most of the top producing mines in the US are in the Powder River Basin in Wyoming and Montana, with other mines in Pennsylvania and West Virginia in the Appalachian Basin. Production per mine in 2007 ranged from approximately 4 Mt to slightly more than 90 Mt. EIA has prepared a table of major coal-producing mines, along with companies:

http://www.eia.doe.gov/cneaf/coal/page/acr/table9.pdf

6. What is the focus of recent activity?

Much recent activity in the field of coal resources and power generation from coal is currently focusing on clean-coal technology. Issues regarding coal gasification and coal-to-liquids are also being discussed, although much of the current funding emphasis is on clean-coal technology. New research institutions and governmental agencies, including the US Department of Energy (DOE), the International Energy Agency, are conducting research in clean-coal, coal gasification, FutureGen-type power-generating facilities, as well as sequestration and industrial application of gasification by-products.

Clean Coal

The National Energy Policy Development Group (NEPDG) report states that from 2007 to 2030, 139 gigawatts (GW) of new coal-based generating capacity is projected to be added to the overall US electrical-generation base. This will involve an increased reliance on coal, resulting in a 78% increase of coal use. DOE is seeking to invest ~$1.3 Billion to commercialize carbon capture and storage technology and is soliciting applications for the restructured FutureGen program. In June, 2008 DOE issued a Funding Opportunity Announcement (FOA) to invest in Integrated Gasification Combined Cycle (IGCC) or other clean-coal power plants with capture and storage (CCS) technology. DOE anticipates that $290 million will be available for funding of selected projects through FY 2009 and an additional $1.01 billion is expected to be available later.

In early March, 2010, DOE announced that it awarded a cooperative agreement to Summit Texas Clean Energy LLC to design, build and demonstrate a coal-gasification plant near Odessa, Texas. The project was selected during the third-round phase of DOE's Clean Coal Power Initiative, a collaborative program between government and industry. The new coal-gasification plant is designed to provide electricity for >165,000 homes. Approximately 90% of the CO_2 produced from the plant will be captured and transported using existing CO_2 pipelines to Permian Basin oilfields for enhanced oil recovery (EOR). Funding will be provided by the DOE's Office of Fossil Energy and the National Energy Technology Laboratory (NETL). The estimated total cost for the project is $1.73 billion. The DOE share will be $350 million (~20% of the total cost).

Other DOE-sponsored projects related to clean-coal technology include the Post Combustion CO_2 Capture Project with the Basin Electric Power Cooperative in Beulah, North Dakota and the Hydrogen Energy California Project: Commercial Demonstration of Advanced IGCC with Full Carbon Capture with Hydrogen Energy International LLC in Kern County, California. The $100 million Post Combustion CO_2 Capture Project, which will partner the Basin Electric Power Cooperative with Powerspan and Burns & McDonnell, will demonstrate CO_2 removal from flue gas by adding CO_2 capture and sequestration (CCS) to Basin Electric's 450-megawatt (MW) Antelope Valley Station. Ammonia-based technology will be used to capture CO_2 from Antelope Valley Station Unit 1. This will result in 90% removal of CO_2 from the treated flue gas, yielding 1,000,000 tons per year of CO_2. The ammonia-based SO_2 scrubbing system will also produce ammonium sulfate for fertilizer.

The Hydrogen Energy California Project is a joint venture owned by BP Alternative Energy and Rio Tinto, which will design, construct, and operate an integrated gasification combined cycle power plant. Blends of coal and petroleum coke, mixed with non-potable water, will be used for conversion into hydrogen and CO_2. The CO_2 will be separated from the hydrogen using the methanol-based Rectisol process. The hydrogen gas will be used to fuel a power station, and the CO_2 will be transported by pipeline to nearby oil reservoirs for EOR. The project will capture more than 2,000,000 tons per year of CO_2.

Sources:
http://fossil.energy.gov/news/techlines/2008/08023-FutureGen_FOA_Released.html

http://www.oaoa.com/news/agreement-44479-doe-gets.html
http://www.fossil.energy.gov/aboutus/fe_cleancoal_brochure_web2.pdf

http://www.netl.doe.gov/publications/press/2009/09043-DOE_Announces_CCPI_Projects.html

Australia, the world's largest coal exporter, has announced an initiative to develop clean coal technology. The institute, funded with 100 million dollars (US$70 million), will help develop clean-coal technology. More than 80 nations, corporations and institutions have joined the institute.

Sources:
http://www.zero-emissionplatform.eu/website/docs/GA3/ZEP%202008%20GA%20-%20Hartwell%20Australian%20insights.pdf

http://www.grist.org/article/2009-04-16-australia-coal-initiative/

The World Resources Institute is also involved in research in CO_2 capture and storage (CCS), especially in regard to coal. Information from the World Resources Institute on CCS Guidelines can be accessed at

http://www.wri.org/project/carbon-capture-sequestration
http://pdf.wri.org/ccs_guidelines.pdf

The program performance goal of DOE in coal gasification is by 2010 to complete research and development for advanced power systems capable of achieving 45 to 50 percent electrical efficiency at a capital cost of $1000 per kilowatt (in constant 2003 dollars) or less for a coal-based plant.

Source:
http://www.fossil.energy.gov/programs/powersystems/gasification/index.html

DOE also has a goal for the year 2015 to have ready an operating zero-emission, high-efficiency, co-production power plant that will produce hydrogen from coal. Partial oxidation of coal is a promising technology for co-production of hydrogen and electric power and hydrogen using IGCC technology. However, currently there are no commercial demonstrations of these joint power and hydrogen plants.

Source:
http://www.fossil.energy.gov/programs/fuels/hydrogen/Hydrogen_from_Coal_R&D.html

Coal Gasification

Underground Coal Gasification (UCG) consists of converting unmined subsurface coal into a gas that can be used for power generation, manufacture of hydrogen, synthetic natural gas, liquid fuels, fertilizers, or for industrial heating. According to the World Coal Institute, the fundamental UCG process calls for drilling two wells into coal seams. One well is for injection of oxidants such as combinations of water and air or water and oxygen, and the other well produces syngas created from coal combustion. Tests in Europe ~15 years ago demonstrated the feasibility of creating large cavities in coal seams for efficient combustion. This process generates large volumes of hydrogen, currently in demand as a feedstock for the chemical industry and for fuel cells.

An advantage of UCG technology is low plant costs, owing to no requirements for surface gasifiers, as well as no coal-transport expenditures. UCG processes are also associated with fewer surface emissions and could be employed in conjunction with CO_2 storage after gasification.

Recent UCG activity in four (4) example countries includes (1) China, operating ~30 projects in different phases of preparation, (2) India, which plans to employ UCG in ~350 billion tonnes of coal resources, (3) South Africa, which has been operating UCG with the Sasol and Eskom companies, and (4) Australia, which embarked on UCG in 2000 with operations by Linc Energy. Carbon Energy also successfully concludes a 100-day study in 2008.

Source:
http://www.worldcoal.org/coal/uses-of-coal/underground-coal-gasification/

Other coal-gasification links:

http://en.wikipedia.org/wiki/Underground_coal_gasification
http://www.syngasrefiner.com/ucg/
http://www.ergoexergy.com/

Coal-to-Liquids (CTL)

There are two basic processes for converting coals to liquids. These are (1) direct liquefaction, which involve breaking coal down into a solvent at high temperatures and pressures, followed by treating it with hydrogen gas and a catalyst. The other process (2), indirect liquefaction, involves an initial stage of gasifying coal into an artificial syngas, and then manufacturing synthetic fuels from the syngas. With modern technology, indirect liquefaction results in clean zero-sulfur liquid fuels.

CTL fuels have many benefits, including:

- Coal is affordable and available worldwide, with countries having access to domestic coal reserves. Moreover, there is a strong international coal market. Access to these domestic potential fuels decreases reliance on oil imports and improves energy security.
- Coal liquids can be used for a variety of activities and products, including transport, cooking, power generation, and manufacture of chemicals.
- Coal-derived fuels are sulphur-free, and low in nitrogen oxides, and are low in particulate content.
- CTL fuels are ultra-clean for cooking, alleviating health risks from indoor air pollution

CTL fuel is deemed viable when the per-barrel price of oil >$45-50, owing to high front-end expenditures. For example, a 10,000 barrel-a-day plant can cost $600-700 million to construct. Moreover, the refinement process is three to four times more expensive than refining an equivalent amount of oil. When biomass is mixed with coal, the process is even more expensive, requiring oil prices above $90 per barrel to be economically viable. This estimate does not include costs of sequestrating captured CO_2, projected to increase CTL fuel prices to $5 per barrel. Introduction of carbon caps would also raise these costs, resulting in CTL production plus carbon storage at costs ranging from $1.40 to $2.20 per gallon or more by 2025.

South Africa, through its SASOL Co., has produced >700 million barrels of synthetic fuels from coal since the early 1980s. Approximately 85% of the coal consumed in South Africa is used as synfuels feedstock or to produce electricity. China is planning a $6 billion investment in new liquefaction plants for a projected total annual production capacity of 440 million barrels of liquid fuel. A CTL facility planned for Mongolia in 2007, and based primarily on U.S.-developed technology), is producing 50,000 barrels daily of clean-burning gasoline and diesel fuel.

The Society for Organic Petrology (TSOP) provides a comprehensive list of links to current activity in coal and coal-related topics. The TSOP web site can be accessed at: **http://www.tsop.org/links/links.htm**

Additional links:
International Energy Agency: Clean Coal Technology R, D&D
http://www.iea-coal.org.uk/content/default.asp?PageId=1194
http://www.iea-coal.org.uk/site/ieacoal/reportdetails?LogDocId=81775
http://www.iea-coal.org.uk/site/ieacoal/reportdetails?LogDocId=81104

World Coal Institute: Coal gasification
http://www.worldcoal.org/pages/content/index.asp?PageID=424

Coal to liquids
International Energy Agency: Clean fuels from coal
http://www.iea-coal.org.uk/site/ieacoal/reportdetails?LogDocId=81104

World Coal Institute: Coal to liquids
http://www.worldcoal.org/pages/content/index.asp?PageID=423
http://www.worldcoal.org/coal/uses-of-coal/coal-to-liquids/

National Mining Institute: Coal to liquids
http://www.nma.org/pdf/liquid_coal_fuels_100505.pdf

AAAS: Coal to liquids
http://www.aaas.org/spp/cstc/briefs/coaltoliquid/

World Coal Institute: Hydrogen from coal
http://www.worldcoal.org/pages/content/index.asp?PageID=426

International Energy Agency: Prospects for hydrogen from coal
http://www.iea-coal.org.uk/publishor/system/component_view.asp?LogDocId=81106

7. What are the estimated U.S. and international resources/reserves, and what is the strategic impact of these resources?

Table 1. U.S. Coal Supply, Disposition, and Prices, 2004 - 2008
(Million Short Tons and Nominal Dollars per Short Ton)

Item	2004	2005	2006	2007	2008
Production By Region					
Appalachia	389.9	396.7	391.2	377.8	389.8
Interior	146.0	149.2	151.4	146.7	146.7
Western	575.2	585.0	619.4	621.0	633.6
Refuse Recovery	1.0	0.7	0.8	1.2	1.4
Total	1,112.1	1,131.5	1,162.8	1,146.6	1,171.5
Consumption By Sector					
Electric Power	1,016.3	1,037.5	1,026.6	1,045.1	1,041.6
Coke Plants	23.7	23.4	23.0	22.7	22.1
Other Industrial Plants	62.2	60.3	59.5	56.6	54.5
Residential/Commercial Users	5.1	4.7	3.2	3.5	3.5
Total	1,107.3	1,126.0	1,112.3	1,128.0	1,121.7
Year-End Coal Stocks					
Electric Power	106.7	101.1	141.0	151.2	163.1
Coke Plants	1.3	2.6	2.9	1.9	2.3
Other Industrial Plants	4.8	5.6	6.5	5.6	6.0
Producers/Distributors	41.2	35.0	36.5	34.0	27.3
Commercial/Institutional	-	-	-	-	0.5
Total	154.0	144.3	186.9	192.8	199.2
U.S. Coal Trade					
Exports	48.0	49.9	49.6	59.2	81.5
Steam Coal	21.2	21.3	22.1	27.0	39.0
Metallurgical Coal	26.8	28.7	27.5	32.2	42.5
Imports	27.3	30.5	36.2	36.3	34.2
Steam Coal	25.1	28.7	34.6	34.7	32.5
Metallurgical Coal	2.2	1.8	1.7	1.7	1.7
Net Exports	20.7	19.5	13.4	22.8	47.3
Average Prices					
Domestic					
Average Delivered Price					
Electric Utilities	$27.30	$31.22	$34.26	$36.06	$41.23
Independent Power Producers	$27.27	$30.39	$33.04	$33.11	$39.31
Coke Plants	$61.50	$83.79	$92.87	$94.97	$118.09
Other Industrial Plants	$39.30	$47.63	$51.67	$54.42	$63.44
International					
Average Free Alongside Ship (f.a.s.) Price					
Exports	$54.11	$67.10	$70.93	$70.25	$97.68
Steam Coal	$42.03	$47.64	$46.25	$47.90	$57.35
Metallurgical Coal	$63.63	$81.56	$90.81	$88.99	$134.62

The U. S. coal supply increased by 6.4 million short tons from 2007 to 2008, up to 199.2 million short tons, according to EIA. However, estimated coal stocks from producers and distributors were lower by 19.6%, owing to coal producers using existing stocks to supplement an increasing demand which has led to increased prices. Table 1 (previous page) summarizes the most current data on U. S. coal supply:

Source:
http://www.eia.doe.gov/cneaf/coal/page/special/tbl1.html

According to EIA, the United States leads the list of the top 10 countries with total recoverable coal (see Table below).

World Estimated Recoverable Coal			
(Million Short Tons)			
Region/Country	**Recoverable Anthracite and Bituminous**	**Recoverable Lignite and Subbituminous**	**Total Recoverable Coal**
United States	123,746	143,808	267,554
Russia	54,110	118,964	173,074
China	68,564	57,651	126,215
India	99,302	2,601	101,903
Australia	42,549	43,982	86,531
South Africa	53,738	0	53,738
Ukraine	17,939	19,708	37,647
Kazakhstan	31,031	3,448	34,479
Former Serbia and Montenegro	10	18,279	18,288
Poland	15,432	0	15,432

Although volumes of recoverable coal reserves for China are reported to be lower than those in the United States, China exceeded the United States in coal productivity in 2007 (see section 1 of this report). Lower volumes of reserves in China may reflect great uncertainties estimating these coal reserves. As China's coal production continues to increase, much of which is already devoted to electric-power generation (approximately 80%), global impacts on air quality and atmospheric CO_2 levels will continue to be an issue. For example, in 2006 China led the world in CO_2 emissions from coal combustion with 4.9 Gt (billion tons), compared to 2.1 Gt from coal combustion in the United States.
Sources:
http://www.eia.doe.gov/emeu/iea/coal.html
http://www.eia.doe.gov/pub/international/iealf/tableh4co2.xls
http://www.eia.doe.gov/cneaf/coal/reserves/reserves.html

8. What are the critical technology needs and how are these being addressed?

The World Coal Institute is active in research related to critical technology needs. Their major research topics include improving combustion technologies to increase efficiency and to reduce emissions from coal combustion, carbon capture and storage, as well as coal-to-liquids and coal-gasification studies.

Source:
http://www.worldcoal.org/pages/content/index.asp?PageID=236

Two primary areas where technology development is critical in supporting new initiatives in coal-related energy include clean coal (coal gasification) and coal-to-liquids. For current activity in these areas, please refer to section 6 of this report.

For clean coal, technology needs include:

- Increased efficiency in low nitrogen oxide burners, selective catalytic reduction, and flue gas desulfurization
- Efficient and cost-effective carbon capture
- Cost-effective new pipeline construction
- Accurate and detailed reservoir characterization for CO_2 sequestration
- Measurement, monitoring, and verification of effective CO_2 storage
- Development of fuel cells

These technology issues are being addressed with several DOE-sponsored research programs. For example, in 2006 there were demonstrations of two mercury-control techniques for existing plants with the goal of currently removing 50 to 70%, followed by eventual removal of 90%. Lignite-drying technology is being explored which will increase electrical-generation efficiency as well as decreasing levels of air pollution.

By 2012, advanced turbines that fire up to 100% hydrogen, will be integrated into clean-coal power plants. There are also efforts directed toward lowering costs of pre- and post-combustion capture of CO_2. For fuel cell manufacture and design, SECA (Solid State Energy Conversion Alliance) seeks to conduct structural failure analyses, improve design criteria, as well as modifying contact materials at the electrode to interconnect interface. Other issues involve increased power density, voltage, and cell size.

For coal-to-liquids (CTL), technology needs include:

- Increased efficiency in fluidized bed combustion (FBC)
- Improvements in catalysts and reactors

CTL technology is a well-established process that does not require significant levels of future research to successfully produce liquid transportation fuels. Nevertheless, further research into emissions from CTL and CBTL production and large-scale carbon sequestration will be needed for compliance with new CO_2 emission standards. Because of the United States' heavy dependence on coal as an energy source, these research steps will likely be taken regardless of whether the US decides to expand production of CTL fuels.

Sources:
http://www.fossil.energy.gov/aboutus/fe_cleancoal_brochure_web2.pdf
http://www.netl.doe.gov/technologies/coalpower/fuelcells/index.html

http://www.netl.doe.gov/technologies/coalpower/fuelcells/publications/SECA_Shultz_1Feb10.pdf

http://www.nma.org/pdf/liquid_coal_fuels_100505.pdf
http://www.aaas.org/spp/cstc/briefs/coaltoliquid/

9. What are the critical environmental or geohazard issues and how are these being addressed?

A variety of environmental issues related to coal mining, production, and combustion include land reclamation, coal-mine fires, mine safety, mining-related illnesses such as black lung disease, and potential contamination from ash and heavy metals, water quality issue, chromium, as well as CO_2 (greenhouse gas) emissions. The Division of Environmental Geology (DEG) publishes a monthly peer-reviewed journal, *Environmental Geoscience*, that contains articles pertaining to environmental issues related to coal production, among other related topics. For additional details on environmental issues related to coal, please refer to the following links:

EPA's Clear Skies
http://www.geotimes.org/july03/high_coal.html
http://www.geotimes.org/sept06/feature_HealthImpacts.html
http://www.worldcoal.org/pages/content/index.asp?PageID=412
http://www.worldcoal.org/pages/content/index.asp?PageID=414
http://www.acaa-usa.org/ http://www.mii.org/recl.html
http://www.worldcoal.org/pages/content/index.asp?PageID=126

10. What EMD technical sessions, publications, workshops etc. exist or are planned that are relevant to this commodity?

EMD at the AAPG 2010 Annual Meeting
April 11-14, 2010• New Orleans, Louisiana
Technical session: **Coal: Versatile Fuel Source for the Future**

Session description: Coal is an indispensable energy source, primarily because of its availability and also because of its versatility. Future coal use is expected to increase in countries that rely on coal for electric power generation, particularly China, which receives ~80% of its electricity from coal. Coal-to-liquids (CTL) technology is an alternative source of liquid fuel that can be exploited by countries with a rich coal-resource base, such as South Africa, which has relied on CTL technology since the 1970s. Coal is also a source for natural gas (from coalbed methane or underground gasification), and for hydrogen for use in fuel cells or petroleum refineries. Today, however, coal combustion in power plants is a major source of CO_2 emissions. The total global level of emissions of CO_2 from combustion of coal in 2006 exceeded 12 billion metric tons, according to the Energy Information Agency. The CO_2 produced from these power plants is a potential source of gas for use in enhanced oil recovery (EOR) in depleted oil fields and for enhanced coalbed methane (ECBM) production. Clean coal technology can help to address the challenge of increasing CO_2 emissions through sequestration for EOR/ECBM or long-term storage in deep, brine-bearing formations. In addition, cap-and-trade scenarios also may provide economic incentives to reduce CO_2 emissions from coal-combustion power plants. Furthermore, economic issues with coal will need to be addressed as coal prices rise because of increasing demand and depletion of the more economic resources, and as electric power generation from coal may be replaced by renewable energy resources and uranium.

This session seeks abstracts for potential oral and/or poster presentations on a wide variety of topics that demonstrate the versatility of coal as a source of energy to meet the growing worldwide energy demand. In addition, research topics related to geologic, environmental, technical, and economic aspects of coal extraction and use are invited as these will be an essential part of the solution in dealing with future environmental issues such as CO_2 emissions.

Co-Chairs: William A. Ambrose and Peter D. Warwick

Contact:
william.ambrose@beg.utexas.edu
pwarwick@usgs.gov

EMD at the AAPG 2011 Annual Meeting
April 10-13, 2011• Houston, Texas
Technical session: **Clean Coal Technology – Fact or Fiction**
Co-Chairs: William A. Ambrose and Peter D. Warwick

Also see:

AAPG Conferences and Exhibitions
http://www.aapg.org/meetings/endorsed.cfm

American Geological Institute - Geosciences Calendar
http://www.agiweb.org/calendar/index.html

Coal Geology Division, Geological Society of America
http://www.uky.edu/KGS/coal/GSA/

International Energy Agency Clean Coal Center's listing of forthcoming coal conferences, meetings and workshops
http://www.iea-coal.org.uk/content/default.asp?PageId=901

International Energy Agency: Coal information
http://www.iea.org/Textbase/subjectqueries/keyresult.asp?KEYWORD_ID=4101

International Pittsburgh Coal Conference
http://www.engr.pitt.edu/pcc/

The Clearwater Coal Conference
http://www.coaltechnologies.com/index.html

The International Committee for Coal and Organic Petrology
http://www.iccop.org

The Canadian Society for Coal Science and Organic Petrology
http://www.cscop.org/

The Society for Organic Petrology
http://www.tsop.org/

See the following EMD website for information about the EMD publications listed below
http://emd.aapg.org/publications.cfm

Atlas of Coal Geology
AAPG Studies in Geology, No. 45
by Alexander R. Papp, James C. Hower, and Douglas C. Peters

Geology in Coal Resource Utilization
by Douglas C. Peters

Sequence Stratigraphy, Paleoclimate, and Tectonics of Coal-Bearing Strata
AAPG Studies in Geology, No. 51
by Jack C. Pashin and Robert A. Gastaldo

Unconventional Energy Resources of North America
AAPG Poster
by John R. Dyni

Special Publication in Progress: Coal Assessment of the Gulf Coast
by Peter D. Warwick