

EMD Coal Committee Annual Report

William A. Ambrose, Chair

April 21, 2012

Vice-Chairs:

Dr. John S. Mead (Vice-Chair: University), Southern Illinois University, Carbondale, Illinois

Susan J. Tewalt (Vice-Chair: Government), U.S. Geological Survey, Reston, Va.

Committee Activities

The EMD Coal Committee appointed two Vice-Chairs, (1) Dr. John S. Mead (jmead@siu.edu), Director of the Coal Research Center at Southern Illinois University, as the University Vice Chair, and (2) Susan J. Tewalt (stewalt@usgs.gov), geologist and NCRDS State Coops Technical Officer at USGS, who is serving as the Government Vice Chair.

EMD is a sponsor for the Gulf Coast coal report: Geologic Assessment of Coal in the Gulf of Mexico Coastal Plain, U.S.A., edited By Peter D. Warwick, Alexander K. Karlsen, Matthew Merrill, and Brett J. Valentine: AAPG Discovery Series No. 14, AAPG Studies in Geology No. 62 (2011). The CD-ROM is available via the AAPG book store: <http://members.aapg.org/scriptcontent/BeWeb/Orders/ProductDetail.cfm?pc=1086>. The GIS supporting files and a recorded GIS demonstration webinar is also available for free via the AAPG Datapages open-file portal:

<http://www.datapages.com/Partners/AAPGGISPublicationsCommittee/GISOpenFiles/GulfCoastCoalAssessment.aspx>.

Coal Commodity Report

Worldwide Coal Occurrence and Production

World coal production was 7.985 billion short tons (bst) in 2010, up from 7.546 bst in 2009. Global demand has almost increased by a factor of two since 1980, driven by increases in Asia, where demand is up >400% from 1980 to 2010 (Fig. 1). Asian demand is dominated by China, where it has increased almost five-fold between 1980 to 2010.

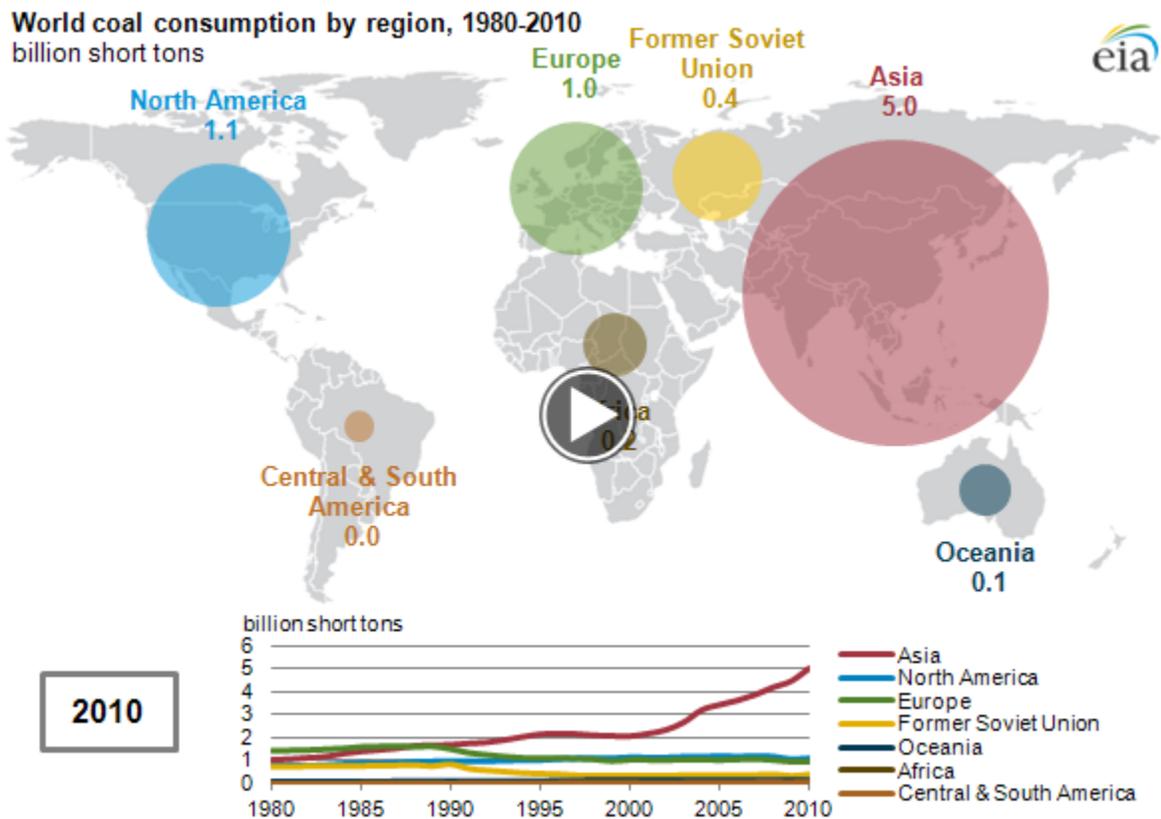


Figure 1. World coal consumption by region in billion short tons, 1980-2010.

Sources:

<http://www.eia.gov/todayinenergy/detail.cfm?id=4390>

<http://www.eia.gov/coal/data.cfm#intl>

A comprehensive and interactive table of international coal production can be accessed at the EIA web site at:

<http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=1&pid=7&aid=1>

China

China currently has known coal reserves of ~1,031 billion tonnes (metric tons, with 1 metric ton defined as 1.1023 short tons) 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

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. Coal consumption is currently dominated by Asia (Fig. 2). Europe and the Former Soviet Union experienced declining coal consumption between 1980 and 2010, with reductions in 32% and 42% respectively. Asia's share of global coal use has increased from 24% to 63%.

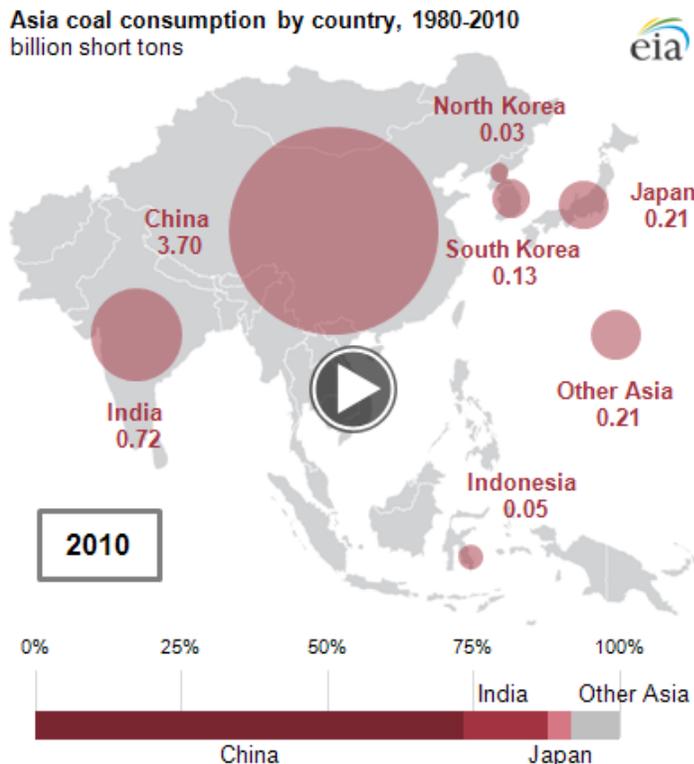


Figure 2. Coal consumption in Asia in billion short tons, 1980-2010. Source: <http://www.eia.gov/todayinenergy/detail.cfm?id=4390>

The Energy Information Agency (EIA) reports that >50% of China's recoverable reserves (estimated to exceed 126 bst) 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.

Source:

<http://205.254.135.7/countries/country-data.cfm?fips=CH>

Other 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.

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

United States

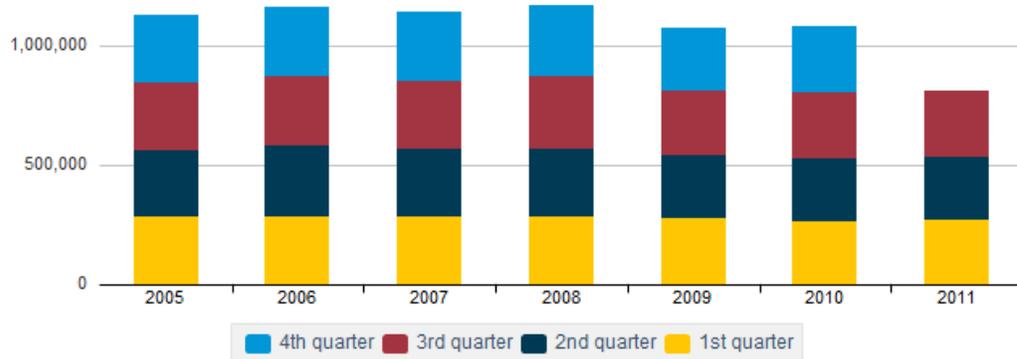
U.S. Coal production during the week ending March 10, 2012 was below the five-year range and 10% lower than the week ending March 12, 2011, according to EIA and the latest quarterly production data from Mine Safety and Health Administration (MSHA). Warm winter weather, coupled with high stockpile levels and strong competition from natural gas depressed demand for coal by U.S. electric generators, which accounted for over 93% of total domestic coal use in the first nine months of 2011. Production declines were greatest in Appalachian coal basins where many mine operators such as Consol Energy, Alpha Natural Resources, and Royal Coal Corporation, have suspended operations owing to decreased demand.

Monthly U. S. coal production from January to August, 2011 ranged from 85 to 95 mst (million short tons), comparable to production in the same period in 2009 and 2010 (Fig. 3). However, the Energy Information Administration predicts a decline in coal consumption in the electric sector in 2012, with 944.4 mst consumed, down from a previous forecast of 966.5 mst (Noh, 2011). The main reason for this projected decline is the expectation that more electricity generation will come from natural gas, with a 3.5% increase compared to <1% increase from coal (Fig. 4).

Coal production through 3rd quarter of 2011 >

Quarterly coal production in the United States

thousand short tons
1,500,000



Includes refuse recovery. Source: U.S. Energy Information Administration: "Quarterly Coal Report."

Figure 3. Quarterly coal production in the U.S. in thousand short tons, 2011.
Source: <http://www.eia.gov/coal/>

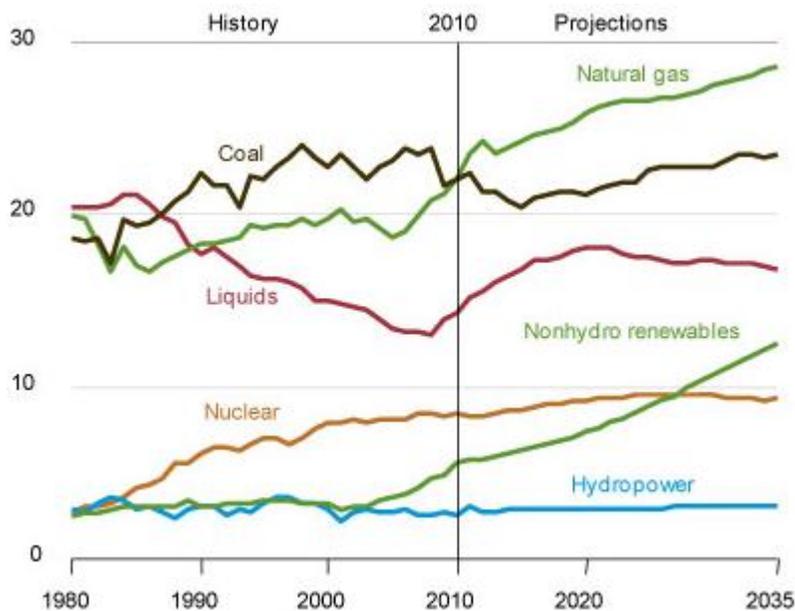


Figure 4. Energy production by fuel in the U.S. in quadrillion Btu, 1980-2035. Source: http://www.eia.gov/forecasts/aeo/er/early_production.cfm

Sources:

http://www.eia.gov/forecasts/aeo/er/early_production.cfm

<http://www.byronwine.com/files/coal.pdf>

<http://www.eia.gov/coal/>

<http://www.eia.gov/coal/annual/>

Noh, C., 2011, EIA sees small decline in U. S. coal consumption in 2012: <http://www.platts.com/RSSFeedDetailedNews/RSSFeed/Coal/6356480>, last accessed November 3, 2011.

Other sources:

NCRDS (National Coal Resources Data System):

<http://energy.usgs.gov/Tools/NationalCoalResourcesDataSystem.aspx>

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

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

Coal on federal lands:

http://energy.cr.usgs.gov/regional_studies/fedlands/index.html

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, with >92 billion tonnes. At current rates of production, India has enough coal for >200 years. 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 in India is distributed in 17 major coalfields with >560 mines. Coal India and its subsidiaries 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 (million tonnes) in 2002 to 758 Mt in 2030.

Coal is the dominant source of energy for electric power generation in India, which consumes >70% of India's coal production. Hydrocarbons account for the majority of India's energy use

(Fig. 5). 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.

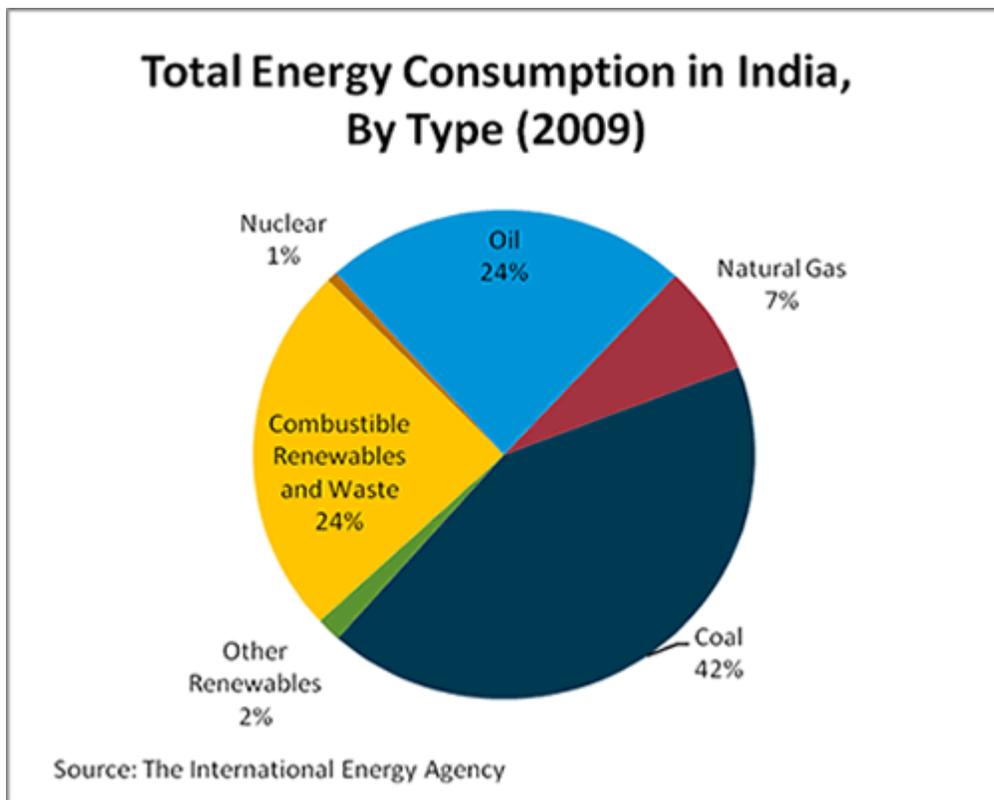


Figure 5. Energy consumption by fuel in India.

<http://www.eia.gov/cabs/india/Full.html>

Other source: "Geographic Information System (GIS) Representation of Coal-Bearing Areas in India and Bangladesh", Compiled By Michael H. Trippi and Susan J. Tewalt:

<http://pubs.usgs.gov/of/2011/1296/>

Australia

Coal in Australia occurs in Permian, Mesozoic and Tertiary basins. Permian coal resources 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. 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. 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. More than 70% of Australia's metallurgical coal exports and >94% thermal (steam) coal exports went to Asia in 2008. Basic production data are summarized in Table 1.

Australian Financial Years	2006-07	2007-08	2008-09 ^f	2009-10 ^f
Production (Mt)				
Thermal Coal	181.1	185.1	200.5	190.7
Metallurgical Coal	142.6	140.1	135.4	136.3
Exports (Mt):				
Thermal coal	115.6	115.1	130.5	122.5
Metallurgical coal	132.0	137	119	128
Total	243.6	252.1	249.5	250.5
Export Value (A\$m):				
Thermal coal	6,758	8,365	17,589	9,815
Metallurgical coal	15,039	16,038	34,464	18,628
Total	21,797	24,403	52,053	28,443

ABARE Australian Commodities, June Quarter 2009

^f ABARE forecast

ABARE Australian Commodities, June Quarter 2009 ^f ABARE forecast

Table 1. Summary of coal production and exports in Australia.

Source:

http://www.ret.gov.au/resources/mining/australian_mineral_commodities/Pages/australia_coal_in_dustry.aspx

Other Sources:

<http://www.australiancoal.com.au/>

http://www.geo.tu-freiberg.de/oberseminar/os07_08/australien.pdf

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, within mining operations dating from the 1790s. It 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. Russia produced approximately 357 mst of coal in 2010, of which 256.8 mst was consumed.

Sources:

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

<http://205.254.135.7/countries/country-data.cfm?fips=RS>

<http://www.russiancoal.com/coalminingrussia/generalprofile.html>

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. Almost 80% of South Africa's primary energy needs are provided by 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. More than two-thirds of domestic coal consumption in South Africa is devoted to electricity generation, provided by Eskom, the national power utility company (Fig. 6). Coal-to-liquid-fuel (CTL) plants, operated by Sasol, represent 20% coal consumption.

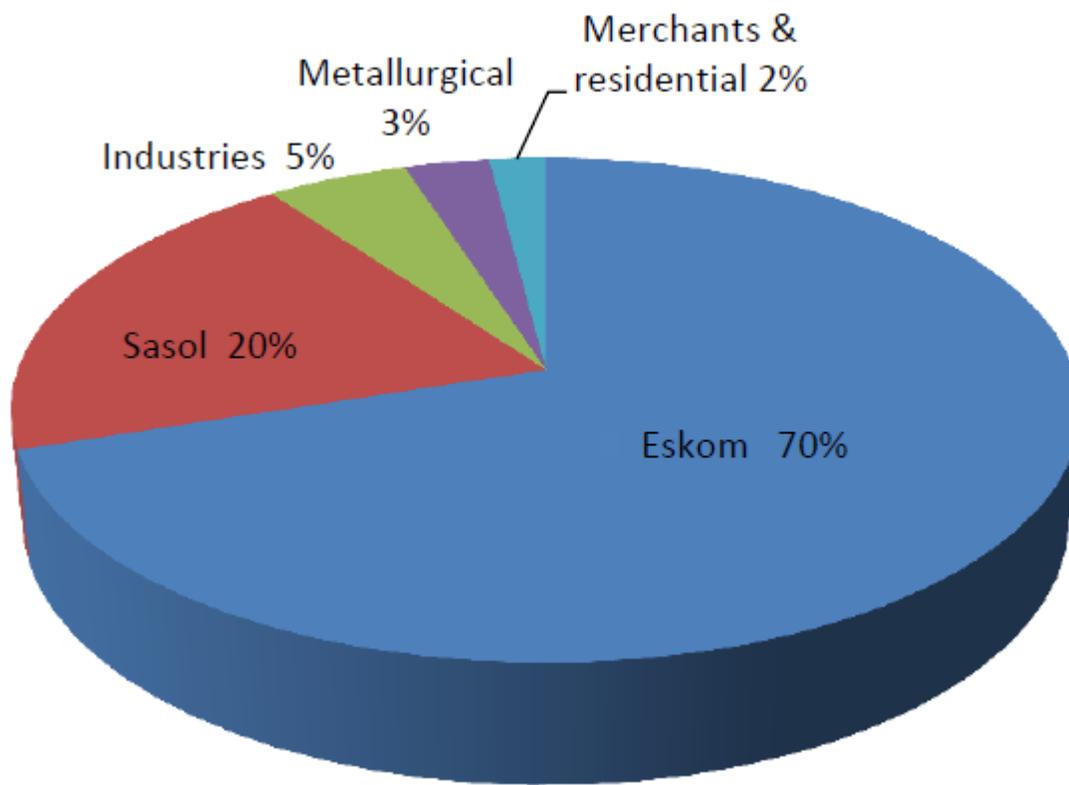


Figure 6. Coal use in South Africa.

Source:

http://iis-db.stanford.edu/pubs/23082/WP_100_Eberhard_Future_of_South_African_Coal.pdf

Other Sources:

<http://www.mbendi.co.za/indy/ming/coal/af/p0005.htm>

<http://www.azom.com/News.asp?NewsID=11227>

http://www.miningweekly.com/article.php?a_id=115238

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 occurs 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. More than 97% of Germany's recoverable reserves of 7.4 bst are lignite (brown 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. However, German coal production has declined since 1990, mainly due to closing of older, inefficient mines in the former East Germany (Table 2). Moreover, Germany plans to invest approximately 200 billion Euros in renewable energy, thereby supplanting coal and nuclear as significant sources of electricity.

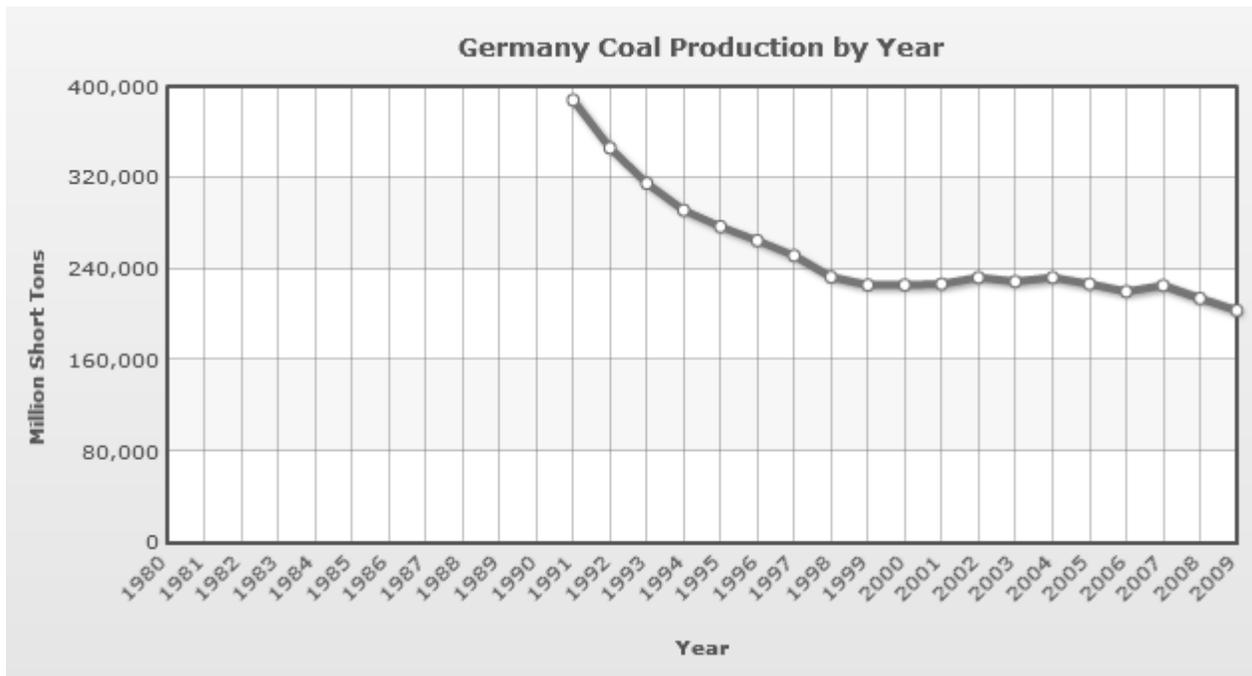


Table 2. Coal production in Germany to 2009.

Source:

<http://www.indexmundi.com/energy.aspx?country=de&product=coal&graph=production>

Other Sources:

<http://www.dw.de/dw/article/0,,2331545,00.html>

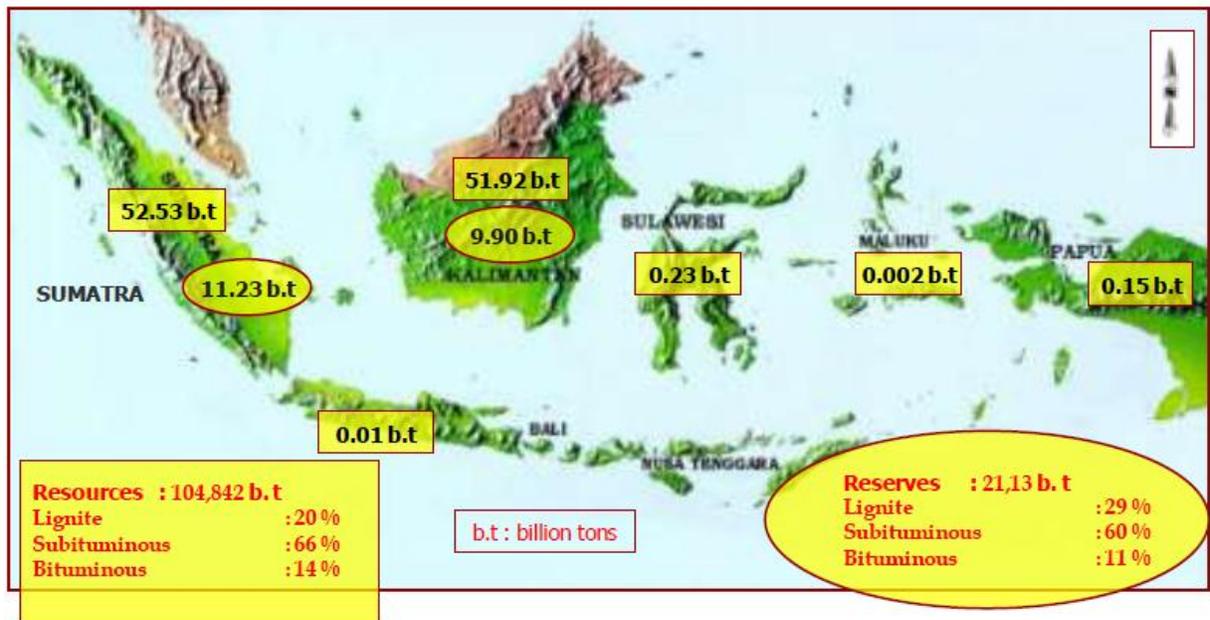
Energy News, March 28, 2012.

Anonymous, 2007, Hydrocarbons: Cleaning browncoal – the green approach:

Filtration+Separation: Elsevier Ltd., [doi:10.1016/S0015-1882\(07\)70121-0](https://doi.org/10.1016/S0015-1882(07)70121-0)

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% 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 (Fig. 7). 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. In 2009, Indonesia produced >300 mst of coal, an increase of almost 100% since 2004. Coal consumption in Indonesia has likewise increased from 24 mst in 2004 to >50 mst in 2010. According to EIA statistics, Indonesia exported 316 mst of coal.



Source: Geological Agency, 2010, and other sources

Figure 7. Distribution of coal resources and reserves in Indonesia.

Source:

http://www.iea.org/work/2011/WEO_Coal/05_02_KAMANDANU.pdf

Other Sources:

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

http://www.marston.com/Portals/0/MARSTON_Review_of_Indonesian_Thermal_Coal_Industry.pdf

<http://www.mbendi.com/indy/ming/coal/as/id/p0005.htm>

http://www.iea.org/work/2011/WEO_Coal/05_02_KAMANDANU.pdf

Poland

Poland has three major Upper Carboniferous coal fields with resources estimated at 16.6 billion tonnes. The primary coalfield (Gornoslaskie Zagłębie Weglowe) is in Upper Silesia and is one of the biggest (~4,500 km²) hard-coal fields in the world. To date, 9 billion tonnes have been produced. Hard coal is also located in the Bogdanka coal field (known as Lubelskie Zagłębie Weglowe). Within this coal field, coal seams are distributed from the Polish-Ukrainian border to Radzyn Podlaski. Poland's brown coal reserves are estimated at nearly 14 billion tonnes. 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 tonnes. Poland's reserves of hard coal are estimated at 45.4 billion tonnes. With current annual production >100 million tonnes, 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 tonnes a year, and by 2050 to ~40 million tonnes.

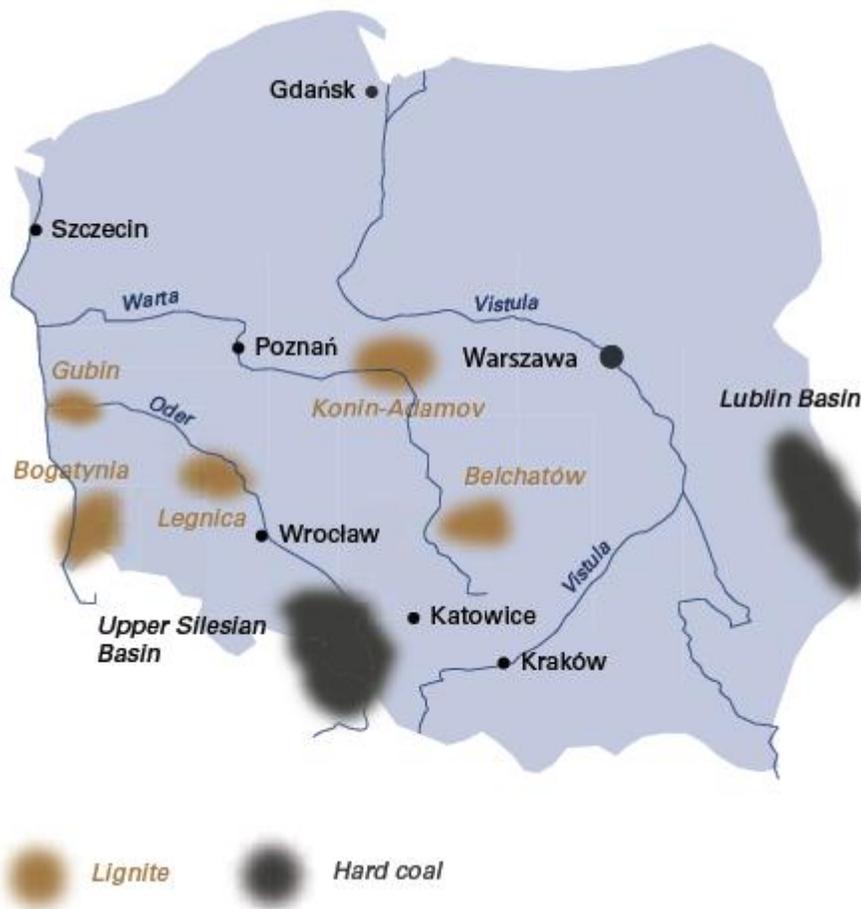


Figure 8. Distribution of lignite and hard coal in Poland.

<http://www.euracoal.be/pages/layout1sp.php?idpage=76>

Other Source:

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

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 mst 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. The country contains Central Asia's largest recoverable coal reserves, with 34.5 billion short tons of mostly anthracite and bituminous coal. Kazakhstan produced 122.1 mst in 2010 and consumed 86.9 mst.

Sources:

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

<http://aboutkazakhstan.com/about-kazakhstan-economy/coal>

<http://www.coalinfo.net.cn/coalbed/meeting/2203/papers/coal-mining/CM025.pdf>

<http://silkroadintelligencer.com/2011/06/01/coal-to-remain-kazakhstans-top-energy-source/>

Additional Links for World Coal Production

World Coal Association

<http://www.worldcoal.org/coal/where-is-coal-found/>

<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>

<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](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)