

## **EMD Coal Committee Mid-Year Report**

**William A. Ambrose, Chair**

**November 17, 2014**

**Vice-Chairs:**

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

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# Coal Commodity Report

## Executive Summary

Coal still is the second-largest energy source worldwide, exceeded only by oil. However, there exists a current global oversupply of coal, with surpluses at approximately 10 million metric tons in 2014. In spite of these surpluses, as well as downturn in global coal prices, many of the top ten coal-producing countries are planning to ramp up production in expectation of the oversupply being consumed by 2016. Although renewable energy and natural gas continue to compete with coal as sources of electricity generation, coal still has a powerful influence on electricity prices, and coal plants are likely to remain price-setting power units for many countries. Consequently, future security of coal supply will be necessary to maintain stability in wholesale electricity prices.

Coal production in the U.S. has been slightly declining since early 2012. Major production shortfalls occurred in the Western and Appalachian regions in 2012 and 2013. However, the Energy Information Administration anticipates that U.S. coal production will increase in the fourth quarter of 2014 and that annual production will grow 1.4% to ~905 million metric tons (998 million short tons) in 2014. In 2015, U.S. coal production is projected to increase by 0.4% to ~909 million metric tons (1,002 million short tons). Wyoming continues to be the top coal-producing state, with 85.7 million metric tons (94.465 million short tons) of production from April to June 2014. Inventories for coal dedicated to electric power declined to 113.3 million metric tons (125 million short tons) at the end of July, 2014, 6.3 million metric tons (7 million short tons) less than in June, 2014. Lower demand for coal in U.S. markets is projected from a combination of factors that include increasingly strict federal regulations, lower natural gas prices, and coal-plant retirements. Market conditions and environmental regulations will contribute to 59 to 77 gigawatts (GW) of coal plant retirements by 2016. By 2035 natural gas will overtake coal as the nation's largest source of energy for electricity generation, including both the power and end-use sectors. Increased electricity generation from renewables is expected to be mainly policy-driven in the next ten years, but is then expected to become more competitive by 2035, accounting for 16% of total U.S. electricity generation in 2040.

## World Coal Production and Consumption

Coal is still the second-largest energy source worldwide, exceeded only by oil. Global coal production in 2012 was ~7.9 billion metric tons (~8.7 billion short tons) (**Energy Information Administration, 2014a**). China accounted for 3.65 billion metric tons (~4.02 billion short tons), or 46% of the world's total, whereas the U.S. was responsible for 0.91 billion metric tons (1.01 billion short tons), or 11.6% of the world's total. Other countries that rounded out the top ten in 2012, in descending order, were India with 589.2 million metric tons (649.6 million short tons [7.6%]), Indonesia with 442.7 million metric tons (488.1 million short tons [5.6%]), Australia with 410.7 million metric tons (463.8 million short tons [5.3%]), Russia with 353.8 million metric tons (390.1 million short tons [4.5%]), South Africa with 359.2 million metric tons (285.8 million short tons [3.3%]), Germany with 196.9 million metric tons (217.1 million short tons [2.5%]), Colombia with 89.4 million metric tons (98.6 million short tons [1.1%]), and Turkey with 69.5 million metric tons (76.6 million short tons [0.9%]). These top coal-producing countries are discussed individually in following sections of this report.

## Worldwide Impact of Hard Coal on Electricity Prices

Hard coal, defined in a recent report by the **International Energy Agency (2014a)** as coal of gross calorific value  $\geq 5,700$  kcal/kg (kilocalories per kilogram) on an ash-free but moist basis and with a mean random vitrinite reflectance value of  $\geq 0.6\%$ , is the primary feedstock in electric power generation worldwide because full-generation costs are less than those of oil, gas or renewable energy sources. When power prices are based on short-run marginal costs (the merit order principle), fuel costs tend to be set by power plants. As a result, inexpensive coal serves to decrease the price of electricity, when the price-setting plant is a coal-fired one. The U.S., Australia, China and South Africa have significant contributions from hard coal power generation, as they are largely self-suppliers of lower-cost domestic coal. Moreover, hard coal also is an important electric power generation source in Japan or Europe, although both are dependent on hard

coal imports, since coal prices are well below prices of alternative energy sources. As expansion of renewables continues, electric power generation from coal in certain regions might decline. However, the impact of coal prices on power prices is expected to remain strong, as coal plants are likely to remain price-setting power units in many countries. Therefore, future security of coal supply will be necessary to maintain stability in wholesale electricity prices.

### **Worldwide Coal Markets and Supply**

The global market for seaborne thermal coal in 2014 is experiencing an oversupply by ~10 million metric tons (~11 million short tons) (**Reuters, 2014**). This is expected to move coal prices below profitable levels for many coal producers in 2014 and 2015, with the result of some mines having to close or suspend operations until more favorable prices return. Coal prices have been reduced by as much as 50% in the past three years because of increased production from exporters that include the U.S., Australia, South Africa, Indonesia, and Colombia. **Reuters (2014)** reported that the oversupply for seaborne thermal coal was estimated by coal traders and analysts to range from 7 to 12 million metric tons (7.7 to 13.2 million short tons), and surplus coal could continue to be problematic into 2016. Demand for thermal coal, in Asia, particularly in China, is slowing. Economic growth in China has recently slackened, and in combination with pressure from the government to use more natural gas to mitigate air-pollution problems, coal mines may close. However, demand may pick up in 2016 as the thermal-coal oversupply begins to fall as a result of coal-mine closures. In other Asian markets, Indian utilities may require more imported coal if Coal India cannot meet demand. This could result in a 6% increase in demand to almost 790 million metric tons (~871 million short tons) by the end of fiscal year 2015.

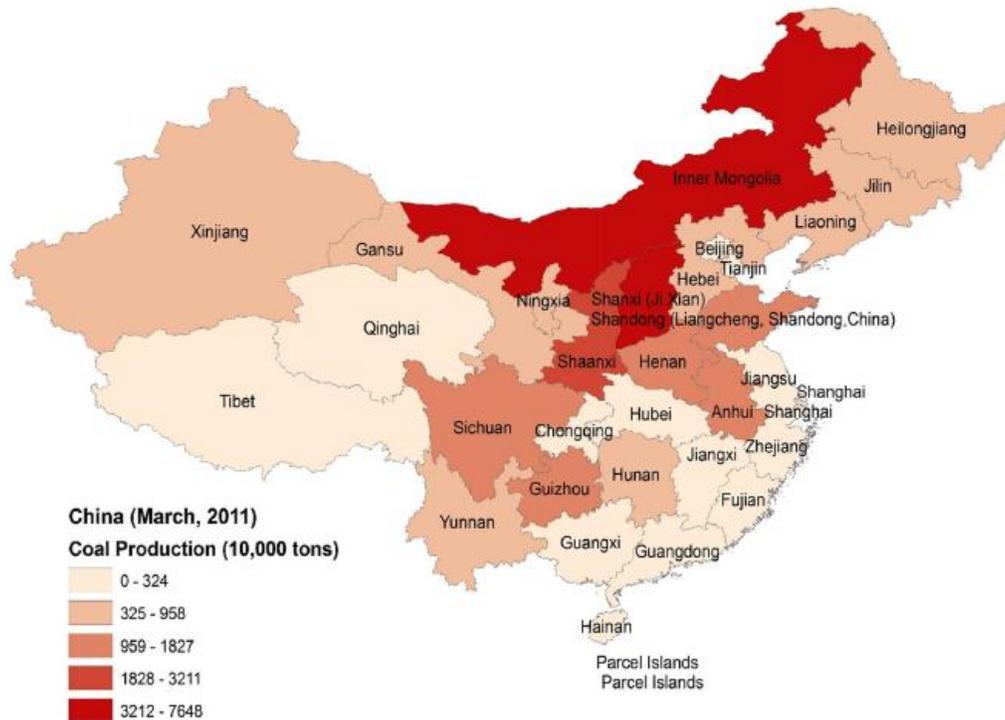
## Worldwide Electricity from Coal: Future Technology Issues

The IEA (International Energy Agency) has issued a study of coal technology and the role of coal in CO<sub>2</sub>-related issues in the 21<sup>st</sup> century (**International Energy Agency, 2014b**). Titled “21<sup>st</sup> Century Coal”, this study’s salient points are:

- Over 30% of the world’s total energy demand and >40% of generated electricity comes from coal.
- Benefits from electricity generated from coal are vital in improving the quality of human life, particularly in developing countries. The challenge for coal in the 21<sup>st</sup> century will be improving technology for electricity from coal to address increases in CO<sub>2</sub> emissions, while at the same time continuing to provide access to energy for developing countries.
- A large portfolio of technologies will be required in reducing GHG (greenhouse gas) emissions at low cost levels, commencing with advanced coal power generation with CCS (carbon capture and sequestration). However, lowering CO<sub>2</sub> emissions from coal-fueled power plants will require an increase in thermal efficiency.
- The IEA roadmap for technology involving electricity generated from coal with CCS currently envisages slightly less than 280 GW of CCS-equipped power plants worldwide by 2030. Approximately 630 GW of coal-fueled power plants with CCS would be required by 2050.

## China

China continues to be the number one producer and consumer of coal in the world (**World Coal Association, 2014**), using more coal than the United States, Europe, and Japan combined (**Moore, 2011; Vince, 2012; Sweet, 2013**). Areas in China with greatest coal production encompass parts of Inner Mongolia, as well as Shanxi and Shandong Provinces (**Michieka, 2014**) (**Fig. 1**). More than 90% of coal produced by China is from underground mines (**Meng et al. 2009**). However, risks in Chinese coal markets have recently increased, with prices having fallen as a result of slower growth and the central government's move to restrict formal credit creation by state-controlled banks (**Stratfor, 2014**). This has forced a number of small companies to seek alternate funding, with Chinese coal prices having fallen in the last three years. Coupled with increasingly strict government controls on air pollution, several of Shanxi's largest private coal mining companies have been in danger of bankruptcy, such as Zhenfu Energy which has been supported by loans, typical of many Chinese coal companies at the present time.



**Figure 1.** Distribution of recent coal production in China. These trends have changed little since 2011. From **Michieka (2014)**.

## United States

### U.S. Coal Consumption and Production

U.S. coal consumption in 2014 showed no increasing trends (**Energy Information Administration, 2014b**) (**Fig. 2**). Coal production in the U.S. has been slightly declining since early 2012 (**Fig. 3**). Major production shortfalls occurred in the Western and Appalachian regions in 2012 and 2013, although this trend was reversed in the last quarter of 2013. EIA anticipates that U.S. coal production will increase in the fourth quarter of 2014 and that annual production will grow 1.4% to ~905 million metric tons (998 million short tons) in 2014. In 2015, U.S. coal production is projected to increase by 0.4% to ~909 million metric tons (1,002 million short tons). Wyoming continues to be the top coal-producing state, with 85.7 million metric tons (94.465 million short tons) of production from April to June 2014 (**Table 1**).

Inventories for coal dedicated to electric power declined to 113.3 million metric tons (125 million short tons) at the end of July, 2014, 6.3 million metric tons (7 million short tons) less than in June, 2014 (**Energy Information Administration, 2014c**). In particular, reductions in coal inventories for the U.S. Midwest and South, two regions that depend greatly on electricity from coal, were ~0.9 and 1.8 million metric tons (1 and 2 million short tons), respectively, compared to 2013.

Coal-Producing Region and State	April - June 2014	January - March 2014	April - June 2013	Year to Date		Percent Change
				2014	2013	
Alabama	3,644	4,427	4,689	8,071	9,105	-11.4
Alaska	399	408	442	807	742	8.7
Arizona	1,844	1,970	2,184	3,814	4,009	-4.9
Arkansas	23	17	2	40	6	NM
Colorado	6,516	5,277	5,520	11,793	11,302	4.4
Illinois	13,583	14,152	13,474	27,735	27,470	1.0
Indiana	9,650	9,872	9,516	19,523	18,938	3.1
Kansas	4	7	5	11	9	13.8
Kentucky Total	19,832	19,495	20,770	39,328	41,348	-4.9
Eastern (Kentucky)	10,208	8,970	10,482	19,179	20,614	-7.0
Western (Kentucky)	9,624	10,525	10,288	20,149	20,734	-2.8
Louisiana	306	120	645	426	1,528	-72.1
Maryland	503	474	540	977	1,090	-10.4
Mississippi	949	986	714	1,935	1,504	28.6
Missouri	110	64	99	173	204	-14.8
Montana	10,981	8,928	10,350	19,909	19,636	1.4
New Mexico	5,823	5,767	6,300	11,591	11,685	-0.8
North Dakota	6,752	8,021	6,051	14,773	13,425	10.0
Ohio	6,305	5,551	7,049	11,856	13,773	-13.9
Oklahoma	235	252	298	487	580	-16.0
Pennsylvania Total	15,425	15,242	12,854	30,666	27,482	11.6
Anthracite (Pennsylvania)	418	424	546	842	1,067	-21.1
Bituminous (Pennsylvania)	15,007	14,817	12,308	29,824	26,414	12.9
Tennessee	181	193	276	375	596	-37.2
Texas	10,277	10,285	9,944	20,562	19,526	5.3
Utah	4,586	4,377	4,401	8,964	8,540	5.0
Virginia	3,829	3,948	4,315	7,777	8,552	-9.1
West Virginia Total	29,176	28,127	30,405	57,303	59,089	-3.0
Northern (West Virginia)	12,132	12,477	11,373	24,609	21,763	13.1
Southern (West Virginia)	17,044	15,649	19,032	32,693	37,326	-12.4
Wyoming	94,465	96,660	91,655	191,124	186,540	2.5
Appalachia Total	69,271	66,931	70,610	136,203	140,301	-2.9
Appalachia Central	31,263	28,760	34,106	60,023	67,089	-10.5
Appalachia Northern	34,364	33,744	31,816	68,108	64,108	6.2
Appalachia Southern	3,644	4,427	4,689	8,071	9,105	-11.4
Interior Basin Total	44,761	46,280	44,985	91,041	90,499	0.6
Illinois Basin	32,857	34,549	33,279	67,406	67,143	0.4
Interior	11,904	11,731	11,706	23,635	23,357	1.2
Western Total	131,366	131,408	126,903	262,774	255,879	2.7
Powder River Basin	99,627	101,173	96,577	200,800	195,703	2.6
Uinta Region	10,623	9,212	9,553	19,836	19,250	3.0
Western	21,116	21,022	20,773	42,138	40,925	3.0
East of Mississippi River	103,078	102,466	104,602	205,544	208,948	-1.6
West of Mississippi River	142,321	142,153	137,896	284,474	277,731	2.4
U.S. Subtotal	245,398	244,619	242,498	490,018	486,679	0.7
Refuse Recovery	429	567	323	996	678	46.8
U.S. Total	245,827	245,186	242,821	491,013	487,358	0.8

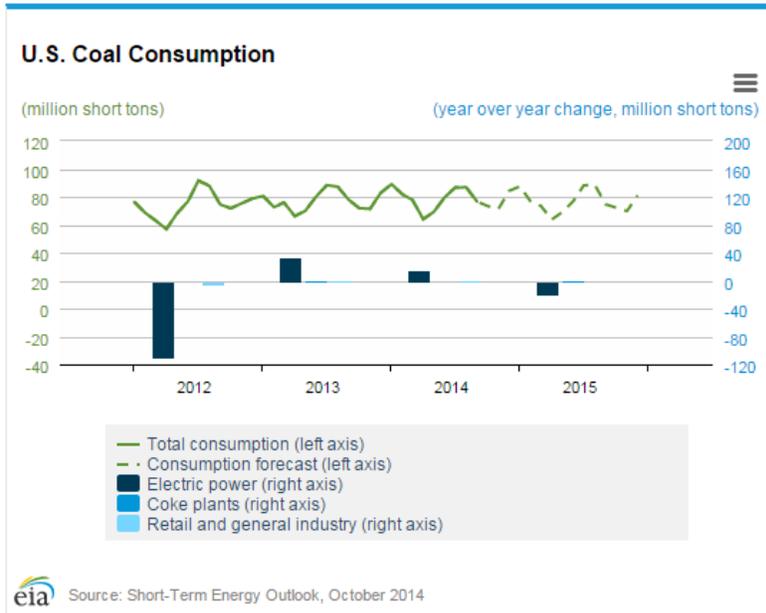
NM = Not meaningful due to changes of 500 percent or more.

Note: Total may not equal sum of components because of independent rounding.

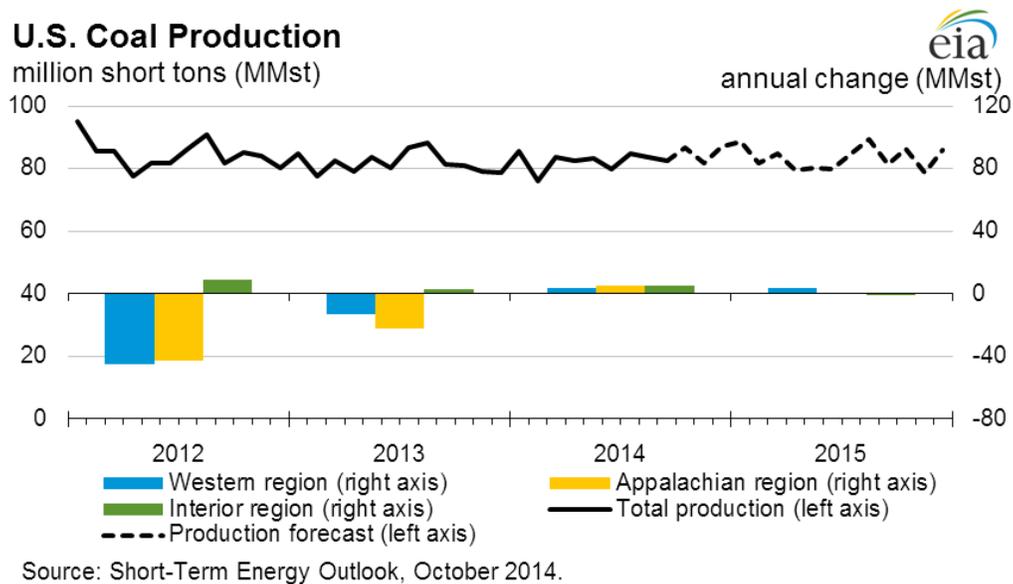
Source: U.S. Department of Labor, Mine Safety and Health Administration, Form 7000-2, 'Quarterly Mine Employment and Coal Production Report.'

**Table 1.** Recent coal production by state and region in the U.S. Units are thousand short tons. From **Energy Information Administration, 2014c).**

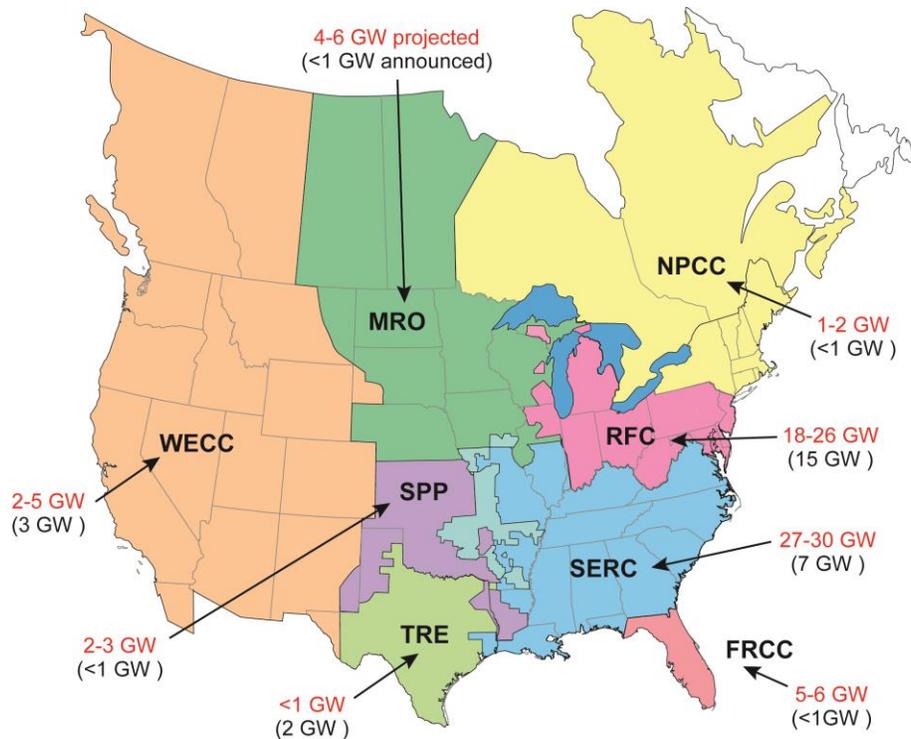
Although U.S. coal production for exports continues to be strong, coal's share of the country's overall energy production is declining, primarily the result of expanded natural gas production (**Humphries and Sherlock, 2013**). Lower demand for coal in U.S. markets is projected from a combination of factors that include increasingly strict federal regulations, lower natural gas prices, and coal-plant retirements. **Reuters (2012)**, based on data from **NERC (2011)**, estimated that market conditions and environmental regulations will contribute to 59 to 77 GW of coal plant retirements by 2016 (**Fig. 4**). Greatest loss of coal-fired electricity generation is projected to occur in the southeastern U.S., with 27 to 30 GW of plant retirements, followed by the northeastern U.S. (18 to 26 GW). According to a recent report by the **Energy Information Administration (2014d)**, by 2035 natural gas will overtake coal as the nation's largest source of energy for electricity generation, including both the power sector and end-use sector (reference case, **Fig. 5**). Increased electricity generation from renewables is expected to be mainly policy-driven in the next ten years, but is then expected to become more competitive by 2035, accounting for 16% of total electricity generation in 2040. Moreover, the number of coal and nuclear plant retirements has recently increased, owing partly to competition from low natural gas prices. A scenario involving accelerated coal-plant retirements in which plant operating costs are higher than currently envisaged, calls for natural gas surpassing coal by 2019 (**Fig. 6**).



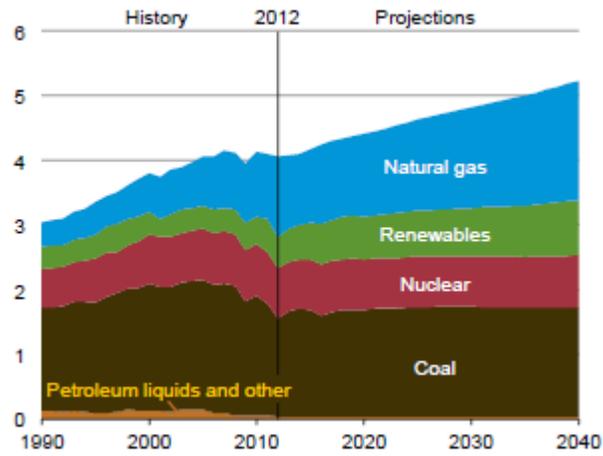
**Figure 2.** U.S. coal consumption, 2012 to October, 2014. Units are million short tons. From Energy Information Administration, 2014b).



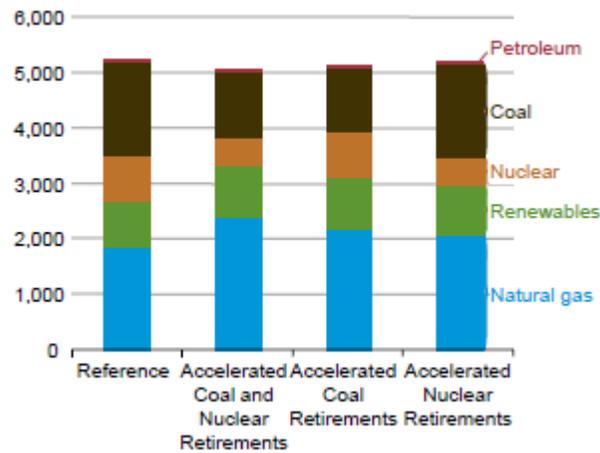
**Figure 3.** U.S. coal production, 2012 to October, 2014. Units are million short tons. From Energy Information Administration, 2014b).



**Figure 4.** Distribution of anticipated U.S. coal plant retirements in terms of power-generation losses expressed in gigawatts (GW). Modified from **Reuters (2012)**, based on data from **NERC (2011)**. Florida Reliability Coordinating Council (FRCC); Midwest Reliability Organization (MRO); Northeast Power Coordinating Council (NPCC); ReliabilityFirst Corporation (RFC); SERC Reliability Corporation (SERC); Southwest Power Pool, RE (SPP); Texas Reliability Entity (TRE); Western Electricity Coordinating Council (WECC).



**Figure 5.** U.S. electricity generation by fuel type, reference case from **Energy Information Administration (2014d)**. Units are trillion kilowatt-hours.



**Figure 6.** U.S. electricity generation by fuel in four cases. From **Energy Information Administration (2014d)**. Units are billion kilowatt-hours.

## **U.S. Coal Markets: Prices, Exports, and Imports**

Annual average coal prices for the electric power industry declined from \$2.39 per million British Thermal Units (MMBtu) in 2011 to \$2.35/MMBtu in 2013 (**Energy Information Administration, 2014b**). Average delivered coal prices are expected to be \$2.36/MMBtu in 2014 and remain so in 2015.

Coal exports for the first seven months of 2014 are estimated to have been 15.5% lower (9.9 million metric tons [10.9 million short tons]) compared with the same period last year, with a significant decline in tonnage for steam coal exports compared to that for metallurgical coal (more than 4x) (**Energy Information Administration, 2014b**). Exports of coal are projected to be only ~87 million metric tons (96 million short tons) in 2014, down from 107 million metric tons (118 million short tons) in 2013. This decline is the result of lower international coal prices, decreased global demand, and increases in production in other coal-exporting countries. Moreover, U.S. coal exports are projected to remain nearly flat during 2015 (**Energy Information Administration, 2014b**). U.S. coal imports for the first seven months in 2014 increased by ~1.7 million metric tons (1.9 million short tons), or by 36.5% compared with the same period in 2013. Total coal imports are projected to be 10.3 million metric tons (11.4 million short tons) in 2014, but decline to 9.7 million metric tons (10.7 million short tons) in 2015.

## U.S. Coal Data Sources

EIA has an interactive, online Coal Data Browser that provides detailed information on U.S. coal. Accessible at <http://www.eia.gov/beta/coal/data/browser/>, this data site integrates comprehensive information, statistics, and visualizations for U.S. coal, including electricity generation. The browser also allows users to access data from the Mine Safety and Health Administration and coal trade information from the U.S. Census Bureau.

The Coal Data Browser allows the user to:

- Map coal imports and exports by country and by U.S. ports handling coal.
- Map where mines send coal and where power plants obtain coal.
- Analyze coal receipts by sulfur, ash, and heat content, as well as per mine.
- Observe changes in coal prices.
- Cross-link mine-level data pages with EIA's [U.S. Energy Mapping System](#) to discover data on all active coal mines.
- Observe changes in coal-worker employment in specific states.

## India

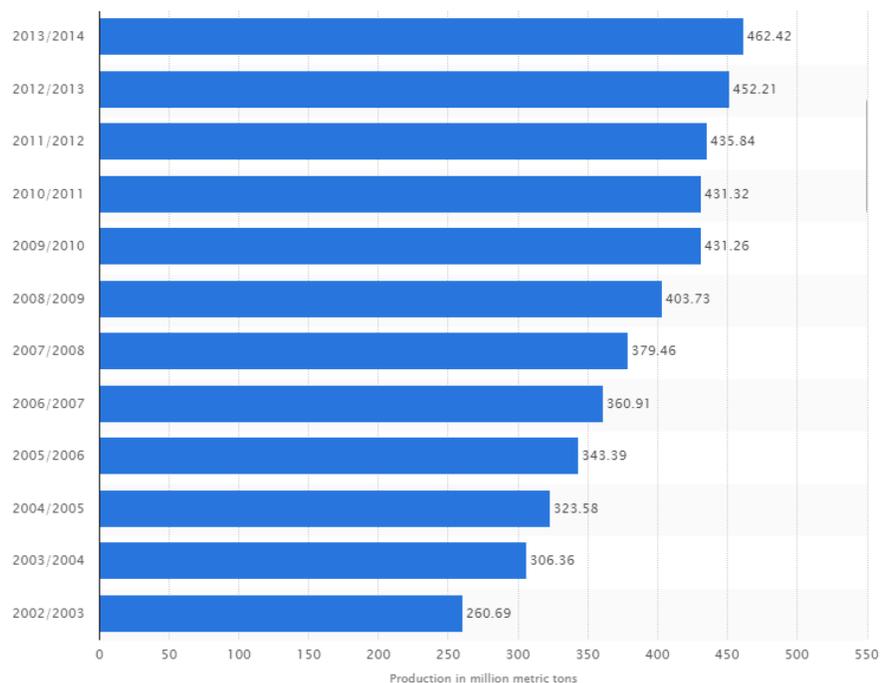
The coal industry in India was the world's third largest in terms of production and the fourth largest in terms of reserves in 2012 (**Economywatch, 2014**). Annual production from Coal India, the primary operator of coal in the country, has steadily climbed in the last decade (**Fig. 7**). Approximately 70% of total coal production in India is dedicated to electricity generation, whereas remaining coal production is devoted to cement, steel, and other heavy industries. However, India is dependent on coal imports, as output continues to fall short of targets. The Indian coal ministry plans to scale down its production target of 795 million metric tons (876.4 million short tons) in the period from 2016 to 2017, owing to perceived problems in rail transport and compliance with environmental

regulations (Thakkar, 2014). India is facing a coal shortage, coupled with rising prices of imported coal.

According to India's coal ministry's advisor for projects, D. N. Prasad,

"We will not be able to achieve 8% growth in coal production for the 12th Plan and need to revise estimates during mid-term review. When coal ministry set targets, it was not aware that Comprehensive Environment pollution Index will make us lose 42 million tonnes of coal production from seven important mines. We also spent considerable time to comply with laws related to tribal rights. Besides these, three railways projects to evacuate coal did not take off in time."

India's Planning Commission estimated Indian coal demand at 770 million metric tons (~849 million short tons) for the period 2013 to 2014, although only 606 million metric tons (~668 million short tons) were projected to be produced.



**Figure 7.** Recent coal production in Coal India. From Statista (2014). Units are million metric tons.

## Indonesia

Indonesia, which is the world's largest exporter of thermal coal, and which produces coal in three principal areas (**Fig. 8**), is expected to boost total 2014 production beyond the Indonesian government's initial limits, even as a worldwide coal oversupply (exceeding 4.9 million metric tons [5.4 million short tons]) drives prices down to lowest levels in more than four years (**Wulandari, 2014; Cahyafitri, 2014**). Moreover, the Indonesian Coal Mining Association (APBI) notes that illegal mining was responsible for production of 56 million metric tons (61.7 million short tons) of coal in 2012, which contributed to oversupply in the global market. Total Indonesian coal production in 2014 may ultimately increase to 425 million metric tons (468.6 million short tons), compared to 421 million metric tons (464.2 million short tons) in 2013. Most coal produced in Indonesia (75%) in the first six months of 2014, has been sold overseas. The government has been trying to increase domestic consumption, in part by supporting the development of mine-mouth power plants and promoting coal liquefaction and gasification. However, declining coal prices have caused >30 small companies in Jambi province on Sumatra island to halt operations, whereas other operators are reducing costs to increase efficiency. In early 2014, Glencore Xstrata signed a one-year deal to sell thermal coal to Tohoku Electric Power Company. This is the lowest price (\$81.80 per metric ton [\$74.19 per short ton]) since 2009 (**Inajima and Sharples, 2014**) and is significant because the price that electric power producers in Japan negotiate with Glencore commonly is the benchmark for Asian contracts.

**(map) Major Coal Production Sites of Indonesia**

1. South Sumatra
2. South Kalimantan
3. East Kalimantan



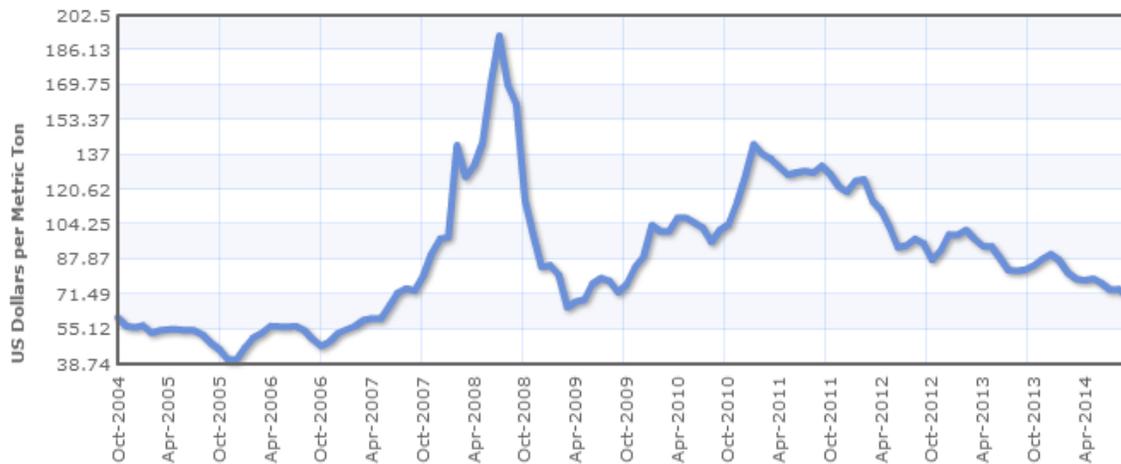
**Figure 8.** Principal coal-mining areas in Indonesia. From **Indonesia Investments (2013)**.

### **Australia**

Many coal operators in Australia are cutting costs in an effort to adjust to the recent global fall in coal prices (**Paton, 2014**). These cost-cutting measures are seen as a temporary measure, ahead of an anticipated market recovery in 2015. Ben Willacy, a Sydney-based analyst at Wood Mackenzie, believes that Australian operators, even those operating at a loss, will continue to survive through the fourth quarter of 2014 and will take advantage of better conditions in the future, despite recent declines in the price of Australian thermal coal (**Fig. 9**) (**Indexmundi, 2014a**).

Benchmark coal prices are forecast to increase to \$130 per metric ton next year from an average of \$126 per metric ton (\$114.28 per short ton) this year, according to Wood Mackenzie. Metallurgical coal production in Australia, despite declining prices, will increase by 16% to 184 million metric tons (202.9 million short tons) from January to June 2014, according to the Australian government's Bureau of Resources and Energy

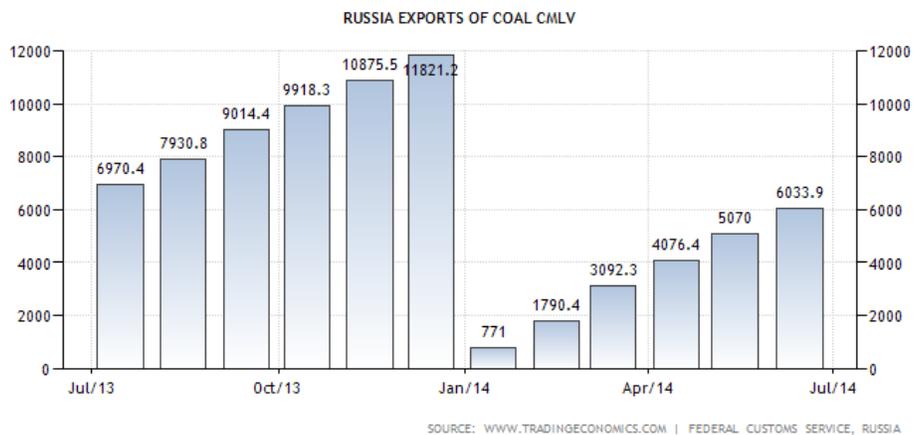
Economics. Paul Flynn at Whitehaven believes the worst may be over for coal prices as demand for Australia's second largest export catches up with supply (**Indexmundi, 2014b**). Australian coal producers that have already inaugurated cost-cutting strategies include BHP Billiton Ltd. and Glencore. However, some mines such as Isaac Plains have announced plans for mine closure, although only three steelmaking coal mines in Australia have shut down operations in 2014. Nevertheless, more than 10 steelmaking coal mines in Australia currently are operating at a loss, with smaller operators more at risk for closures than the large operators, such as BHP's venture with Mitsubishi Corp.



**Figure 9.** Monthly price of Australian thermal coal in USD per metric ton, October 2004 to April 2014. From **Indexmundi (2014a)**.

## Russia

Russia has inaugurated a long-term development plan for its flagging coal industry and is calling for an increase in coal production and electricity generation from coal (**Dobrovidova, 2014**). Russian coal exports in July 2014 failed to reach comparable levels to July 2013 (**Fig. 10**). Coal production in Russia, accounting for 16% of the nation's total energy mix, showed a consolidated loss of 22 billion rubles in 2013. Part of the reason for this loss is cheaper natural gas and global fall in coal prices. Russia plans to increase coal production to ~372 to 435.4 million metric tons (410 to 480 million short tons) by 2030, which would involve a growth in exports by 63.4 million metric tons (~70 million short tons). Domestic consumption would grow from 83.4 to ~118 million metric tons (92 to 130 million short tons) per year in this scenario. In order to meet this target of increased coal production, Russia has agreed to develop Siberian coal for Chinese markets (**Homeriki, 2014**). Rostech has signed an agreement with China's Shenhua Group to develop Siberian coal deposits in Russia's Siberia and Far East. The project will cost between \$8 and \$10 billion USD.



**Figure 10.** Russian coal exports, July 2013 to July 2014. CMLV = cumulative values for each year. Numbers on y axis are exports valued in terms of USD million. From **Tradingeconomics.com (2014)**.

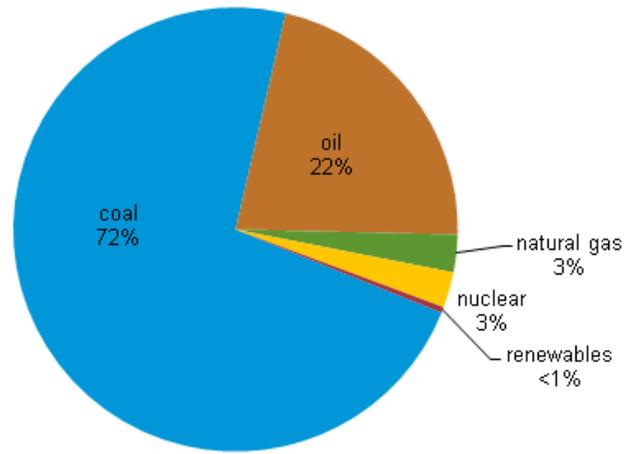
## South Africa

The Chamber of Mines reported that coal in 2012 was the most mined commodity in South Africa, with total sales revenues of R96,1bn (96.1 billion Rands) (**Ryan, 2014**). Coal accounted for 72% of primary energy consumption in 2013 (**Fig. 11**). Coal revenues in South Africa in 2012 exceeded those of gold (R76,8bn) and the platinum group metals (R69,2bn). Approximately 54% of coal in South Africa was devoted to the domestic industry in 2012, with 85% of South Africa's electricity coming from coal. Almost 50% of South Africa's coal exports in 2012 were targeted for India and China (**Fig. 12**). Demand is expected to increase, with Eskom predicting that it will require new supplies of 60 million metric tons (66.2 million short tons) per year by 2020 to replace coal from declining mines. Coal 3, a new proposed power plant on the same scale of other South African plants at Medupi and Kusile, is under construction and will generate 4.8 GW. Exports are also projected to rise to over 100 million metric tons (110.3 million short tons) per year from 2012 levels of 78 million metric tons (86 million short tons) per year.

Some mining groups in South Africa are reducing their involvement in the coal mining industry. Total Coal SA announced in January, 2014 that it was offering two operating mines for sale and BHP Billiton has been decreasing its part of the coal business in South Africa in the last ten years. Rio Tinto in 2010 also sold its Chapudi coal projects in Limpopo to Australian junior Coal of Africa (CoAL).

Regulatory uncertainty also is a potential roadblock to expanded coal production, as a proposal from the South African government declaring coal a strategic mineral, could result in stricter regulation of domestic prices and export volumes. The bill was passed by the National Assembly, but still has yet to be passed by the National Council of Provinces.

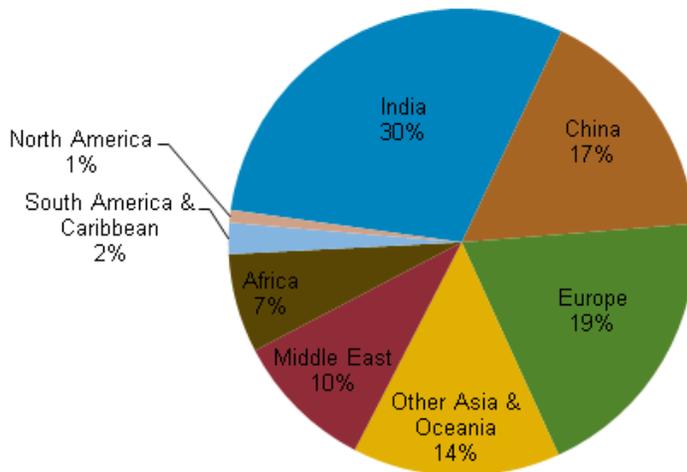
### Total primary energy consumption in South Africa, 2012



Source: BP Statistical Review of World Energy 2013

**Figure 11.** Total primary energy consumption in South Africa in 2012. From **Energy Information Administration (2014e)**.

### South Africa's total coal exports, by destination, 2012

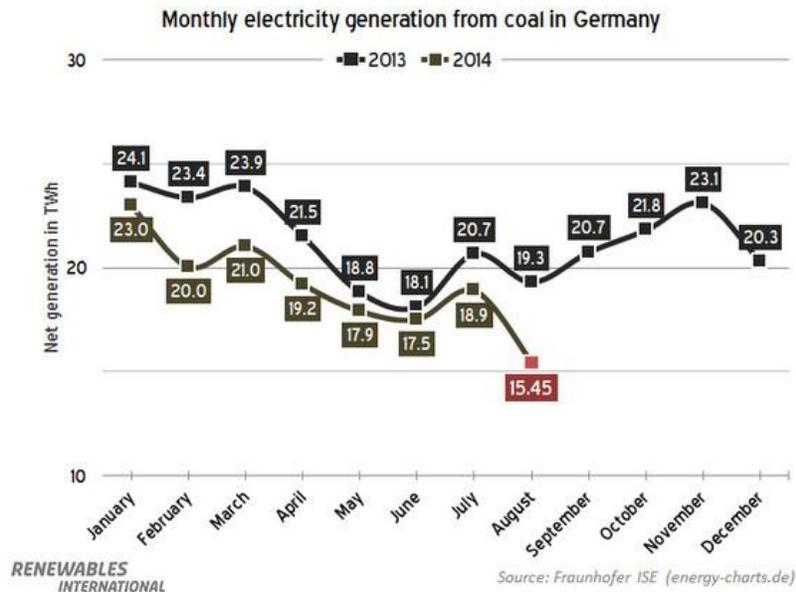


Source: Global Trade Atlas (GTA); South African Revenue Service

**Figure 12.** South Africa's total coal exports by destination in 2012. From **Energy Information Administration (2014e)**.

## Germany

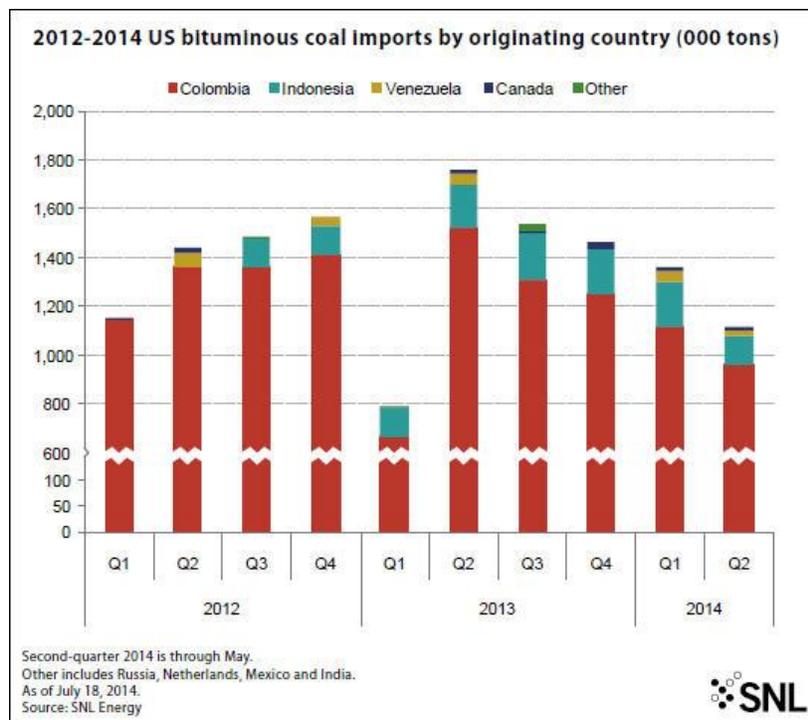
Germany is considering a return to electricity generation from lignite to replace lost power from nuclear energy (Andresen, 2014). The recent decision by Germany's Chancellor Angela Merkel to close all 17 of Germany's nuclear power stations by 2022 has resulted in the German power utility company RWE AG posting its first loss since World War II. RWE has increased production from its coal-fired facilities, most of which are fueled by lignite. As a result, RWE now generates 52% of its electricity in Germany from lignite, a 7% increase since 2011. However, environmental legislation limits the return to coal as an electricity-generating source, and electricity generation from coal in Germany is down in 2014 compared to 2013 (Fig. 13). E.ON is one of the world's largest investor-owned power and gas companies and operates facilities across Europe, Russia, and North America. E.ON has recently fared better than RWE, producing power for new international markets. Nevertheless, RWE still plans to continue with lignite and is moving ahead with plans to construct a 1.1 GW power plant in Niederaussem, Germany. The plant is scheduled to commence operations in 2018.



**Figure 13.** Monthly electricity generation from coal in Germany, 2013 to end of July 2014. From Gerke (2014).

## Colombia

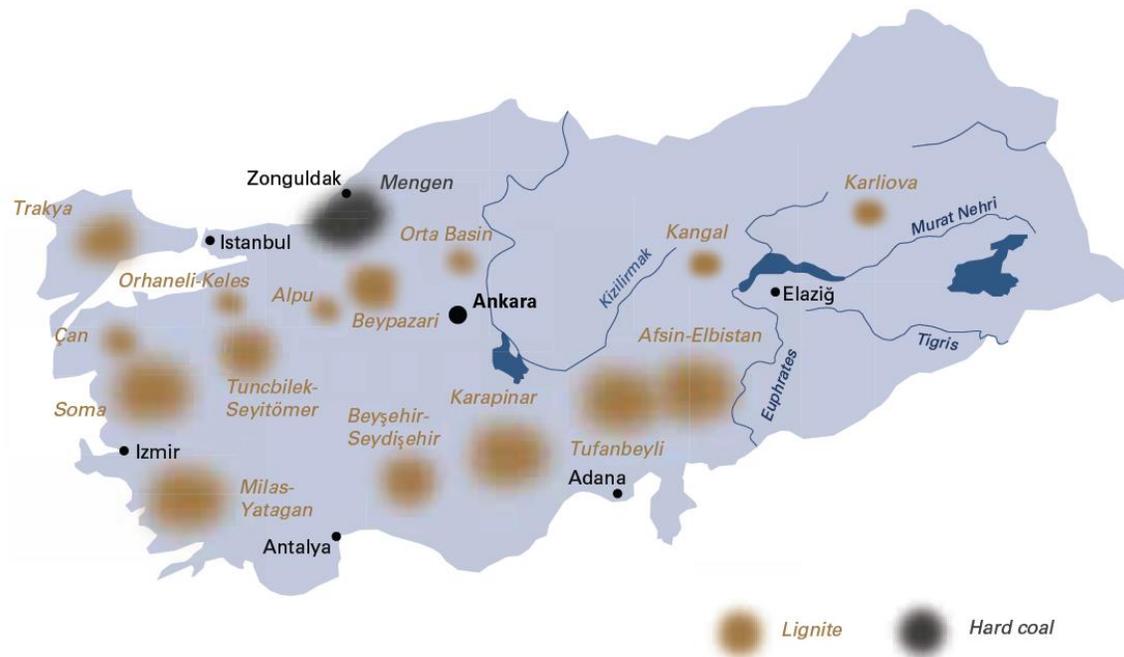
Colombia, the number one producer of coal in South America, is increasing production to record levels in 2014. The U.S. is dependent on bituminous coal imports from Colombia, obtaining much more bituminous coal from Colombia than from any other country (**Fig. 14**). Estimated total production in Colombia in 2014 is between 94 to 97 million metric tons (103.6 to 106.9 million short tons), up from the previously forecasted 89 million metric tons (98.1 million short tons). This surge in Colombian coal production is ongoing, despite recent lower prices for coal delivery to Europe (\$77.25 per metric ton [\$70.07 per short ton] in July, 2014). Additional increases in production could result from Colombian Natural Resources, owned by Goldman Sachs Group Inc., overcoming a current export ban that involves prohibition of coal loading in ports using barges. The government of Colombia is planning to auction mining blocks for >10 strategic minerals, including coal in 2014-2015.



**Figure 14.** Bituminous coal imports to the U.S., showing predominance from Colombia. Units are thousand metric tons. From **SNL Energy (2014)**.

## Turkey

Turkey has ~1.3 billion metric tons (1.43 billion short tons) of hard coal and ~11.5 billion metric tons (12.7 billion short tons) of lignite resources, of which 0.5 billion metric tons (0.55 billion short tons) and 9.8 billion metric tons (10.8 billion short tons), respectively, are proven reserves (**Euracoal, 2014**). Hard coal in Turkey is limited to a small area east of Istanbul, whereas lignite occurs throughout central and western Turkey (**Fig. 15**). Most coal production in Turkey is devoted to domestic power generation (**Sourcewatch, 2014**). Although Turkey has been meeting rising power demand from gas-fired power plants in the last decade, the government has recently decided to emphasize domestic coal, owing to concerns about possible disruptions of gas supplies. Plans call for 5 to 6 GW of new plants, with as much as 18 GW by 2023.



**Figure 15.** Distribution of lignite and hard coal in Turkey. From **Euracoal (2014)**.

## References

Andresen, T., 2014, Coal returns to German utilities replacing lost nuclear: <http://www.bloomberg.com/news/2014-04-14/coal-rises-vampire-like-as-german-utilities-seek-survival.html>, last accessed November 11, 2014.

Cahyafitri, R., 2014, Indonesia's coal production rises, despite plunging prices: The Jakarta Post: <http://www.thejakartapost.com/news/2014/07/12/indonesia-s-coal-production-rises-despite-plunging-prices.html>, last accessed November 11, 2014.

Dobrovidova, O., 2014, Russia reveals plans to boost flagging coal industry: <http://www.rtcc.org/2014/04/22/russia-reveals-plans-to-boost-flagging-coal-industry/>, last accessed November 11, 2014.

Economywatch, 2014, India coal industry, <http://www.economywatch.com/business-and-economy/india-coal-industry.html>, last accessed November 11, 2014.

Energy Information Administration, 2014a, International energy statistics: coal: <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=1&pid=7&aid=1>, last accessed November 11, 2014.

Energy Information Administration, 2014b, Short-term energy and winter fuels outlook, release date October 7, 2014: <http://www.eia.gov/forecasts/steo/report/coal.cfm>, last accessed November 11, 2014.

Energy Information Administration, 2014c, Quarterly coal report, April – June 2014, released October 8: <http://www.eia.gov/coal/production/quarterly/pdf/qcr.pdf>, last accessed November 11, 2014.

Energy Information Administration, 2014d, Annual energy outlook 2014: [http://www.eia.gov/forecasts/aeo/pdf/0383\(2014\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf), last accessed November 11, 2014.

Energy Information Administration, 2014e, South Africa overview: <http://www.eia.gov/countries/cab.cfm?fips=sf>, last accessed November 11, 2014.

Euracoal, 2014, Turkey: <http://www.euracoal.org/pages/layout1sp.php?idpage=475>, last accessed November 11, 2014.

Gerke, T. 2014, German coal power generation falls to 10-year low: <http://reneweconomy.com.au/2014/german-coal-power-generation-10-year-low-august-69763>, last accessed November 11, 2014.

Homeriki, L., 2014, Russia, China agree to develop Siberian coal: [http://rbth.com/business/2014/09/29/russia\\_china\\_agree\\_to\\_develop\\_siberian\\_coal\\_40187.html](http://rbth.com/business/2014/09/29/russia_china_agree_to_develop_siberian_coal_40187.html), last accessed November 11, 2014.

Humphries, M., and Sherlock, M. F., 2013, U.S. and world coal production, federal taxes, and incentives: Congressional Research Service, Report for Congress: <http://www.fas.org/sgp/crs/misc/R43011.pdf>, last accessed November 11, 2014.

Inajima, T., and Sharples, B., 2014, Glencore said to sell coal to Tohoku at five-year low: <http://www.bloomberg.com/news/2014-03-28/glencore-said-to-sell-year-s-coal-to-tohoku-at-lowest-since-2009.html>, last accessed November 13, 2014.

Indxmundi, 2014a, Coal commodities news: <http://www.indxmundi.com/commodities/?commodity=coal-australian&months=120> , last accessed November 11, 2014.

Indxmundi, 2014b, Coal commodities news: <http://www.indxmundi.com/commodities/news/coal/australia>, last accessed November 11, 2014.

Indonesia Investments, 2013, Indonesia's coal production projected to rise due to increased foreign demand: <http://www.indonesia-investments.com/news/todays-headlines/indonesias-coal-production-projected-to-rise-due-to-increased-foreign-demand/item660>, last accessed November 11, 2014.

International Energy Agency, 2014a, The Impact of Global Coal Supply on Worldwide Electricity Prices: [http://www.iea.org/publications/insights/insightpublications/ImpactGlobalCoalSupply\\_WorldwideElectricityPrices\\_FINAL.pdf](http://www.iea.org/publications/insights/insightpublications/ImpactGlobalCoalSupply_WorldwideElectricityPrices_FINAL.pdf) , last accessed November 11, 2014.

International Energy Agency, 2014b, 21<sup>st</sup> century coal: advanced technology and global energy solution:

[http://www.iea.org/publications/insights/21stcenturycoal\\_final\\_web.pdf](http://www.iea.org/publications/insights/21stcenturycoal_final_web.pdf), last accessed November 11, 2014.

Meng, L., Feng, Q., Zhou, L., Ping, L., and Meng, Q., 2009, Environmental cumulative effects of coal underground mining: *Procedia Earth and Planetary Science*, vol. 1, no. 1, p. 1280–1284.

Michieka, N. M., 2014, Energy and the environment: the relationship between coal production and the environment in China: *Natural Resources Research*, v. 23, no. 2, p, 285–298.

Moore, M., 2011, China's coal rush leaves three million living on the edge: *The Telegraph*, London:  
<http://www.telegraph.co.uk/news/worldnews/asia/china/8738873/Chinas-coal-rushleaves-three-million-living-on-the-edge.html>, last accessed November 11, 2014.

NERC (North American Electric Reliability Corporation), 2011, Potential impacts of future environmental regulations: <http://www.nerc.com/files/EPA%20Section.pdf>, last accessed November 11, 2014.

Paton, J., 2014, Australian coal miners cutting costs not output as rebound seen: *Bloomberg News*: <http://www.bloomberg.com/news/2014-10-02/australian-coal-miners-cutting-costs-not-output-as-rebound-seen.html> , last accessed November 11, 2014.

Reuters, 2012, U.S. study sees 59,000 MW of coal output too costly to run:  
<http://www.reuters.com/article/2012/11/13/us-utilities-coal-idUSBRE8AC05D20121113>, last accessed November 11, 2014.

Reuters, 2014, Global seaborne coal market oversupply to be 10 mln T this year:  
<http://uk.reuters.com/article/2014/07/21/energy-coal-supplies-idUKL6N0PM3M220140721>, last accessed November 11, 2014.

Ryan, B., 2014, SA's coal industry: muddling along:  
<http://www.financialmail.co.za/coverstory/2014/03/27/sa-s-coal-industry-muddling-along>, last accessed November 11, 2014.

SNL Energy, 2014, US utilities turn to Colombia, Russia for coal in 2014:  
<http://www.mining.com/web/us-utilities-turn-to-colombia-russia-for-coal-in-2014/>,  
last accessed November 13, 2014.

Sourcewatch, 2014, Turkey and coal:  
[http://www.sourcewatch.org/index.php/Turkey\\_and\\_coal](http://www.sourcewatch.org/index.php/Turkey_and_coal) , last accessed November 11, 2014.

Statista, 2014, Coal production of Coal India Limited:  
<http://www.statista.com/statistics/244516/coal-production-of-coal-india-limited/>, last  
accessed November 11, 2014.

Stratfor, 2014, Rising Financial Risks in China's Coal Sector (Free article):

<http://www.stratfor.com/sample/analysis/rising-financial-risks-chinas-coal-sector>, last accessed November 11, 2014.

Sweet, C., 2013, China uses nearly as much coal as the rest of world combined, EIA says:

The Wall Street Journal:

<http://online.wsj.com/article/SB10001424127887323829504578272233059490240.html>, last accessed November 14, 2014.

Thakkar, M., 2014, India misses coal target again, will depend more on imports:

<http://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/india-misses-coal-target-again-will-depend-more-on-imports/articleshow/31568756.cms>,

last accessed November 11, 2014.

Tradingeconomics.com., 2014, Russia exports of CMLV:

<http://www.tradingeconomics.com/russia/exports-of-coal-cmlv>, last accessed November 11, 2014.

Vince, G., 2012, Can China create the solutions to our energy problems? News Article,

BBC, London: <http://www.bbc.com/future/story/20120518-chinas-clean-coal-goal>,

last accessed November 11, 2014.

World Coal Association, 2014, Coal statistics for 2013:

<http://www.worldcoal.org/resources/coal-statistics>, last accessed November 11, 2014.

Wulandari, F., 2014, Indonesia Coal Output May Rise Even as Prices Decline, ICMA Says:  
Bloomberg News: <http://www.bloomberg.com/news/2014-03-31/indonesia-coal-output-may-rise-even-as-prices-decline-icma-says.html>, last accessed November 11, 2014.