

EMD Coal Committee Annual Report

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Coal Commodity Report

Executive Summary

Coal is the second-largest energy commodity worldwide in terms of energy use, exceeded only by oil. Coal represents 37% of the world's electricity generation and is still maintained as an important commodity in iron and steel manufacture. World coal production in 2017, led by China, India, and the United States, rose by 105 million metric tons (115.7 million short tons) of oil equivalent (mtoe). Global coal consumption also increased by 25 mtoe, most of which was from India (18 mtoe). The top seven coal-producing countries in 2017 were: (1) China (3,523 million metric tons [3,883.4 million short tons]), (2) India (716 million metric tons [789.3 million short tons]), (3) United States (702 million metric tons [773.8 million short tons]), (4) Australia (481 million metric tons [774.9 million short tons]), (5) Indonesia (461 million metric tons [508.2 million short tons]), (6) The Russian Federation (411 million metric tons [453.0 million short tons]), and (7) South Africa (252 million metric tons [277.8 million short tons]). Demand for coal has decreased in Europe, because of increased electricity generation from renewable sources. However, demand for thermal-coal imports to Asian countries remains high. Vietnam plans an additional 2 gigawatts (GW) of new coal-fired power plants and coal imports in India are expected to increase in 2019 because of a projected 5% growth in electricity generation. Volatility in the global thermal coal market in 2019 could occur because of uncertainty over possible import controls and stricter environmental regulations in China. Some countries plan to phase out coal and increase supplies of natural gas. Reduced costs for renewable energy have also had an impact on coal's contribution to the global energy mix, which is projected to be only 25% by 2023, down by 2% from 2017. The United States is expected to continue to be a net exporter of coal and coke to at least 2050, although these exports may be flat because of competition from other countries. Annual coal production in the U.S. has declined since 2014, from a relatively high value of 907.2 million metric tons (1 billion short tons) to 702.6 million metric tons (774.6 million short tons) in 2017. In contrast, U.S. coal exports in January to September, 2018 were greater than those in from January to September, 2017 by approximately 18%. Electric power generation continues to dominate coal consumption in the U.S., representing approximately 93% of end-use type in 2017.

Leading Coal-Producing Countries in 2017

According to the BP Statistical Review of World Energy, cited in Coyne (2018), the top seven coal-producing countries in 2017 were: (1) China (3,523 million metric tons [3,883.4 million short tons]), (2) India (716 million metric tons [789.3 million short tons]), (3) United States (702 million metric tons [773.8 million short tons]), (4) Australia (481 million metric tons [774.9 million short tons]), (5) Indonesia (461 million metric tons [508.2 million short tons]), (6) The Russian Federation (411 million metric tons

[453.0 million short tons]), and (7) South Africa (252 million metric tons [277.8 million short tons]).

This report provides details of the top-seven coal-producing countries because coal production from the remaining three coal-producing countries in the world top ten is substantially less than that of South Africa, the seventh-leading coal-producing country. Rounding out the top-ten coal-producing countries in terms of million metric tons of oil equivalent, they are: (8) Colombia (61.4 million metric tons [67.7 million short tons] of oil equivalent, (9) Poland (49.6 million metric tons [54.7 million short tons] of oil equivalent, and (10) Kazakhstan (47.9 million metric tons [52.8 million short tons] of oil equivalent) (British Petroleum, 2018).

World Coal-Production Trends

According to British Petroleum (2018), world coal production in 2017 rose by 105 million metric tons (115.7 million short tons) of oil equivalent (mtoe) (Fig. 1). This increase was greater in China than in the United States (56 versus 23 mtoe, respectively). Coal consumption also grew by 25 mtoe, mainly from India (18 mtoe). Coal consumption in China was a modest 4 mtoe, following three successive years of decline from 2014 to 2016.

Although concerns continue to be expressed about coal's contributions to greenhouse-gas emissions, coal still accounts for the generation of approximately 37% of the world's electricity and is maintained in its vital role in iron and steel manufacture (Creamer Media, 2018). It will continue to be a significant energy source for decades to come.

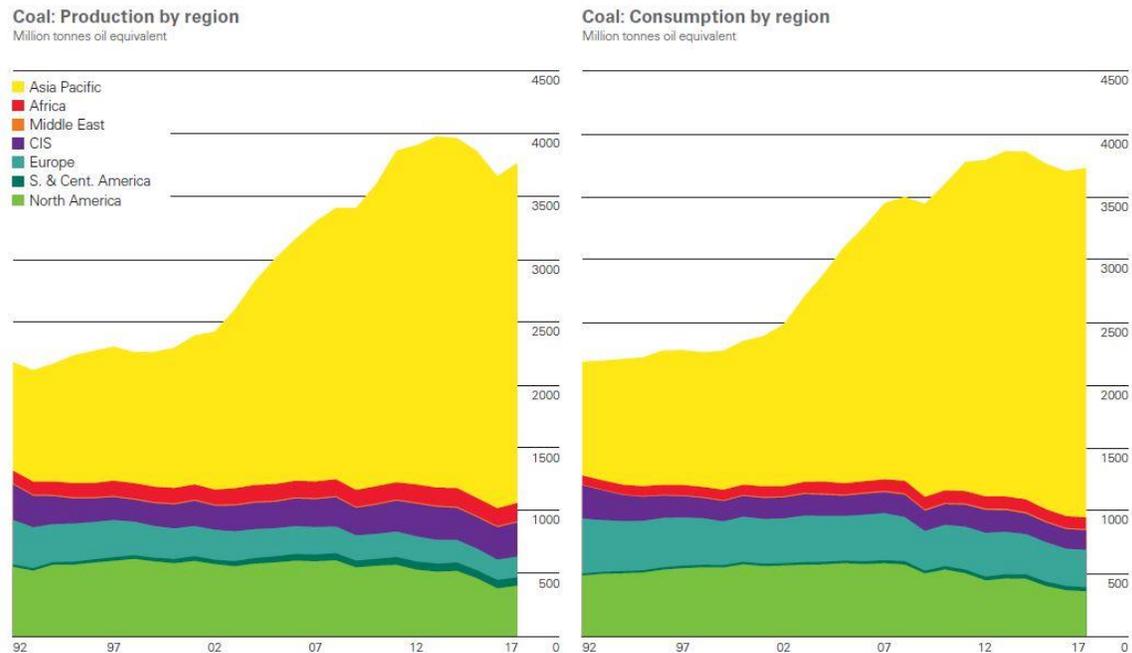


Figure 1. World coal production and consumption since 1992. Values are in millions of metric tons of oil equivalent. From British Petroleum (2018).

World Coal Production and Demand

Although there was weak demand for coal in Europe (particularly in Germany) in 2018, this has been offset by thermal-coal imports to China, India, and Southeast Asia (International Energy Agency, 2018a; Thiruvudula, 2019). For example, electricity production in Germany from coal and lignite was reduced by 16% and 1%, respectively, in 2017. Concurrently, electricity from renewable sources in Germany increased by 15%.

Demand for coal remains strong in Asia because it is both affordable and easily accessed. The greatest demand in Asia in 2018 was in India at an almost 4% level of increase. Other countries in Southeast Asia where demand for coal is expected include Pakistan, Malaysia, Indonesia, Vietnam, and the Philippines. Increased demand in Southeast Asia

is spurred by Vietnam, which plans an additional 2 GW of new coal-fired power plants (Kalb, 2019). Coal imports in India are also expected to increase in 2019 as a result of a projected 5% growth in electricity generation.

No significant changes in production are anticipated in 2019 in the major export countries, except in Indonesia, where 25% of production is dedicated to the domestic market (Thiruvedula, 2019). However, volatility in the global thermal coal market in 2019 could result from uncertainty over possible import controls in China, coupled with increasingly stricter environmental regulations (Kalb, 2019). In addition, coal-phase out plans by some countries, increasing supplies of natural gas, and reduced costs for renewable energy has impacted coal's contribution to the global energy mix, projected to be only 25% by 2023, down by 2% from 2017 (International Energy Agency, 2018a).

Significant differences exist between different countries and regions with respect to coal's share in electricity generation (Fig. 2). Eastern and central Europe remain heavily dependent on coal for electricity generation, particularly Poland and the Czech Republic, and even Germany, despite recent initiatives to develop additional non-hydrocarbon-based energy sources such as wind and solar. Germany still generates almost 40% of its electricity from coal and lignite (International Energy Agency, 2018b).

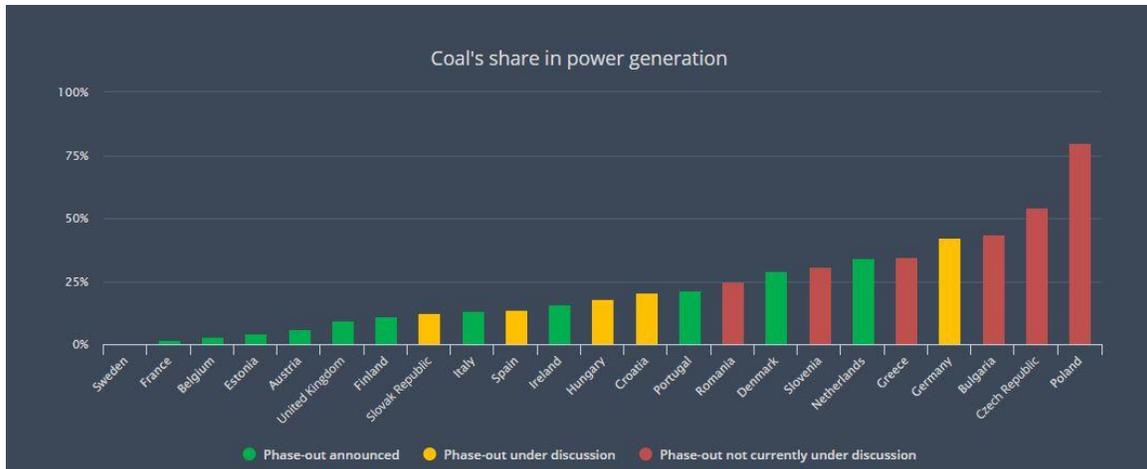


Figure 2. Coal’s share in electricity generation in selected countries. From International Energy Agency (2018b).

China

Coal in China comprises 14% of global primary energy (International Energy Agency, 2018a). China also leads the world in coal production, having accounted for 3,523 million metric tons (3,883.4 million short tons) in 2017, approximately 46% of the world’s production and nearly 50% of the world’s coal consumption (British Petroleum, 2018; International Energy Agency, 2018a). However, this is an 11.3% decline from 2013, when China’s coal production was 3,974 million metric tons (4,380.6 million short tons).

Chinese companies are constructing or planning to develop more than 700 new coal-fired plants in China and around the world (Tabuchi, 2017). Approximately 20% of these new plants, to be located outside of China, would increase the world’s coal-fired electricity output by >40%. Electricity generation in China is operated by state-owned holding companies, although limited private and foreign investments have recently been made in the electricity sector. China has expanded the construction of natural gas-fired and renewable power plants to introduce power to remote population centers. The relative

contribution of coal for generation of electricity is projected to decline from 72 to 47% by 2040, with increasing contributions from other fuels. Coal will continue to be important feedstock for electricity generation in China, reaching a high value of approximately 4,400 billion kilowatt-hours by 2030. Already 150 GW of new coal-fired capacity has been canceled or delayed until at least 2020, in view of China's plans for stricter emission controls and retirements of old, inefficient power plants that account for up to 20 GW of power.

India

India, having recently surpassed the United States in coal production, is ranked second in world coal production in 2017, having produced 716 million metric tons of coal (789.3 million short tons). This represents 9.2% of the world's coal production (British Petroleum, 2018).

Most of India's coal reserves occur in the eastern part of the country. Jharkhand, Chhattisgarh, and Odisha states together comprise 64% of the country's coal reserves. Other significant coal-producing states include West Bengal, Andhra Pradesh, Madhya Pradesh, and Maharashtra. Coal India Limited (CIL) is India's largest and the world's largest coal producer, having produced >80% of the country's coal in the last five years (Reuters, 2016).

Most of India's coal consumption is from electric power. Coal demand in India, especially thermal coal for electricity generation, has risen markedly in the last four years, because of industrial growth and continued rural electrification (Reuters, 2019). Even though coal is the greatest provider of electricity generation in India, accounting for approximately 60% of installed power capacity, coal shortages continue to cause shortfalls in electricity generation, resulting in frequent blackouts. Approximately 90% of the country's coal mines are opencast mines, which although being cost-effective, cause environmental damage. India lacks advanced technology for large-scale, underground

mining operations with the result that overall productivity levels in the country are low. Low levels of competition in the coal sector inhibit private and foreign investment and state regulations continue to cause delays for mining companies in receiving mining permits.

United States

The United States was ranked as the world's third largest coal producer in 2017, accounting for 702 million metric tons of coal (773.8 million short tons), or 9.1% of world coal production (British Petroleum, 2018). The United States is expected to continue to be a net exporter of coal and coke to at least 2050, although these exports are anticipated to not increase because of competition from other countries (Energy Information Administration, 2019a).

Trends in the U.S. Coal Industry

U.S. coal production in the period from January to September 2018 was approximately 1% less than a comparable period in 2017 (Table 1). Annual coal production in the U.S. has declined since 2014, from a relatively high value of 907.2 million metric tons (1 billion short tons) to 702.6 million metric tons (774.6 million short tons) in 2017. In contrast, U.S. coal exports in January to September, 2018 were greater than those in from January to September, 2017 by approximately 18% (Table 2 and Fig. 3 [Energy Information Administration, 2019b]). U.S. coal exports had been declining annually since 2014, when they were 88.2 metric tons (~97.3 million short tons). Coal imports to the U.S. remain minor, having been only 7.05 million metric tons (7.8 million short tons) in 2017 (Table 2). Electric power generation continues to dominate coal consumption in the U.S., representing approximately 93% of end-use type in 2017 (Table 3). Coal provided the largest generation share in 18 states in 2017, a reduction from 28 states in 2007 (Fig. 4) Energy Information Administration, 2018). Although natural gas provided the largest

source of electricity generation in 16 states, it accounted for 32% of total U.S. electricity generation, higher than that from coal (30%).

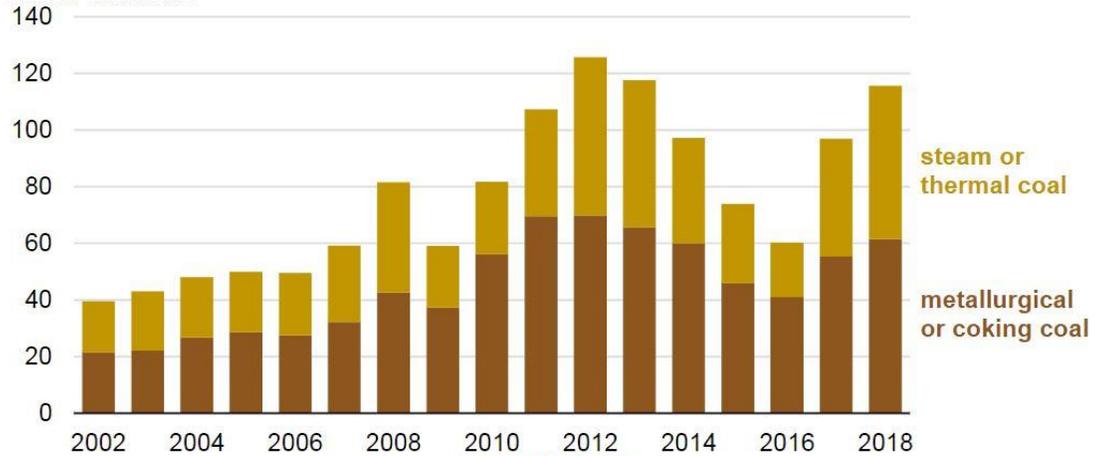
Production by State

Most U.S. states had declining coal production from July 2017 to July 2018 (Table 4). More than half of U.S. coal mines that were open in 2008 have been closed (Fig. 5 [Energy Information Administration, 2019c]). The state with the greatest fall in coal production was Tennessee (nearly 60% decline). Other states with significant decreases in coal production were New Mexico (38.5%), Maryland (33.4%), and Texas (27.6%), although Maryland's coal production is minor compared to that of Texas. Although coal production in Wyoming fell by only 5.2%), this is significant since Wyoming has recently been a leading coal-producing state.

Some U.S. states saw moderate increases in coal production, including Alabama (13.7%), Montana (8.7%), and Indiana (8.0%) (Table 4). Other states saw even greater percentages in increased production, such as Oklahoma, although actual production in this state was minor compared to that of Alabama, Montana, and Indiana. The only U.S. region to see any increase in coal production was Appalachia, with a modest 1.7% rise.

U.S. coal exports (2002-2018)

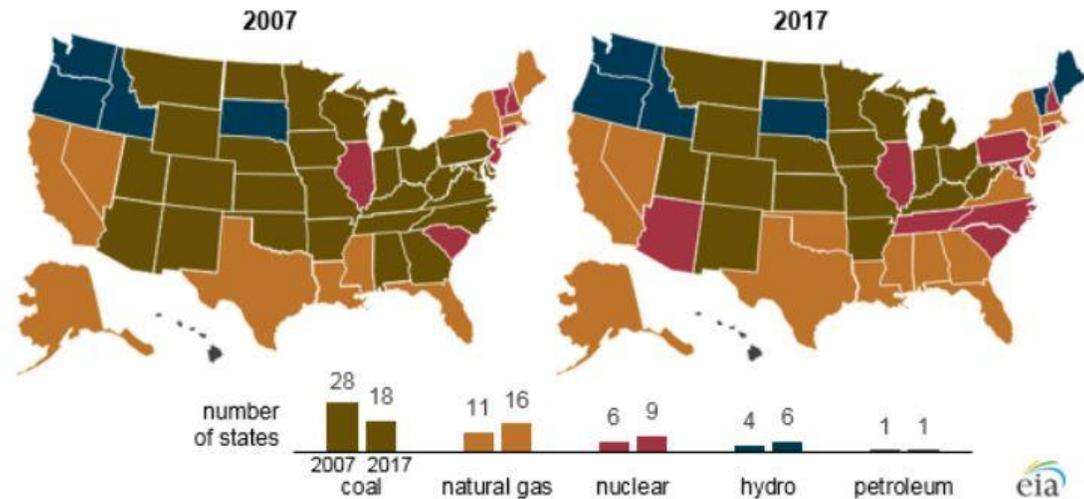
million short tons



Source: U.S. Energy Information Administration, *Annual Coal Report*, and the U.S. Department of Commerce, Census Bureau

Figure 3. U.S. coal exports, 2002 to 2018. Values are in million thousand short tons. From Energy Information Agency (2019b).

Most prevalent utility-scale electricity generation fuel by state (2007 and 2017)



Source: U.S. Energy Information Administration, *Electric Power Monthly*

Figure 4. Electricity generation by fuel type in the U.S., 2007 and 2017. From Energy Information Agency (2018).

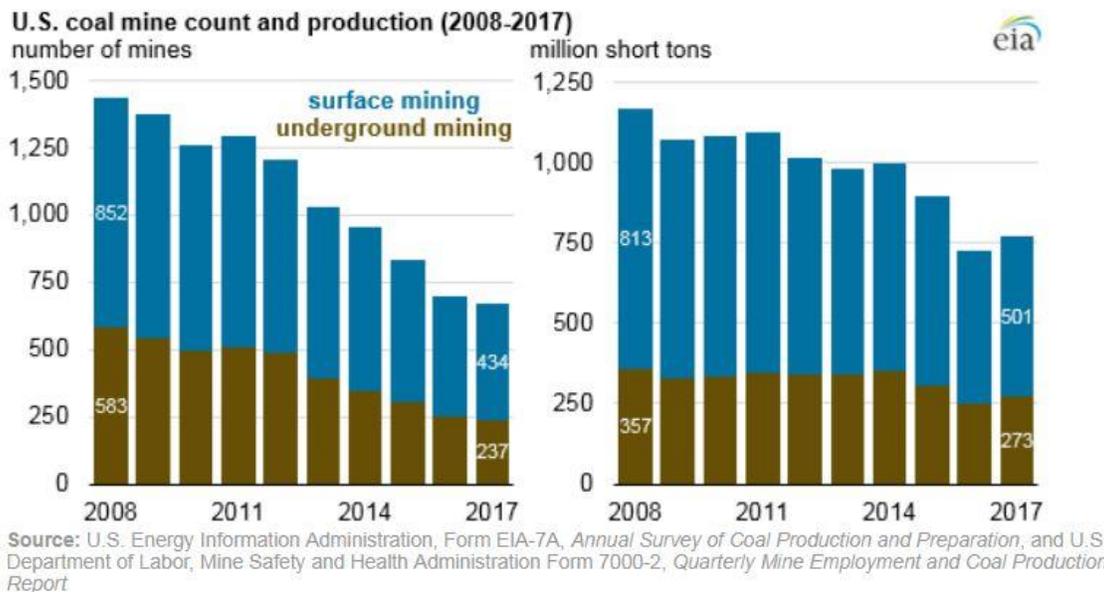


Figure 5. U.S. coal mine count and production (2008-2017). Values are in million thousand short tons. From Energy Information Agency (2019c).

Year	January - March	April - June	July - September	October - December	Total
2012	266,865	241,047	258,956	249,591	1,016,458
2013	244,867	243,211	257,595	239,169	984,842
2014	245,271	245,844	255,377	253,557	1,000,049
2015	240,324	212,557	236,823	207,237	896,941
2016	173,225	160,853	195,101	199,186	728,364
2017	197,138	187,098	196,440	193,933	774,609
2018	187,639	180,785	194,663	-	563,088

- = No data reported.

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. U.S. coal production, 2012 to September, 2018. Values are in thousand short tons. From Energy Information Agency (2019d).

Year	January - March		April - June		July - September		October - December		Total	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
2012	28,642	2,022	37,534	2,329	31,563	2,415	28,006	2,394	125,746	9,159
2013	31,835	1,429	29,427	2,756	28,589	2,398	27,809	2,323	117,659	8,906
2014	27,584	2,450	24,674	3,574	22,723	3,151	22,276	2,174	97,257	11,350
2015	21,979	3,009	19,766	2,640	16,914	2,965	15,299	2,705	73,958	11,318
2016	14,153	2,698	14,223	2,292	12,552	2,733	19,343	2,124	60,271	9,846
2017	22,307	1,915	21,796	2,197	24,644	2,308	28,206	1,357	96,953	7,777
2018	27,221	1,367	30,876	1,546	29,067	1,439	-	-	87,163	4,352

- = No data reported.

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

Source: Exports: U.S. Department of Commerce, Bureau of the Census, 'Monthly Report EM 545,' and Imports: U.S. Department of Commerce, Bureau of the Census, 'Monthly Report IM 145.'

Table 2. U.S. coal exports and imports, 2012 to September, 2018. Values are in thousand short tons. From Energy Information Agency (2019d).

Year and quarter	Electric power sector ¹	Coke plants	Other Industrial			Commercial and institutional			Total
			CHP ²	Non-CHP ³	Total	CHP ⁴	Non-CHP ⁵	Total	
2012									
January - March	190,664	5,283	5,531	5,667	11,198	418	270	688	207,833
April - June	185,721	5,296	4,598	5,528	10,125	319	94	414	201,555
July - September	238,076	5,044	4,950	5,521	10,470	347	46	393	253,984
October - December	209,091	5,128	4,987	6,057	11,044	366	184	550	225,813
Total	823,551	20,751	20,065	22,773	42,838	1,450	595	2,045	889,185
2013									
January - March	211,971	5,280	5,115	5,942	11,057	418	260	679	228,987
April - June	199,845	5,471	4,747	5,554	10,301	307	91	397	216,014
July - September	237,205	5,429	4,830	5,538	10,368	299	57	355	253,357
October - December	208,942	5,294	5,069	6,260	11,329	333	187	520	226,084
Total	857,962	21,474	19,761	23,294	43,055	1,356	595	1,951	924,442
2014									
January - March	231,534	4,886	5,153	6,029	11,181	381	348	729	248,329
April - June	195,922	5,174	4,561	5,853	10,414	232	140	372	211,881
July - September	231,066	5,636	4,683	5,743	10,425	221	105	326	247,453
October - December	193,081	5,601	4,680	6,245	10,925	229	231	460	210,068
Total	851,602	21,297	19,076	23,870	42,946	1,063	824	1,887	917,731
2015									
January - March	196,656	5,156	4,602	5,791	10,393	277	290	567	212,772
April - June	174,376	4,987	4,095	5,216	9,311	166	136	302	188,975
July - September	214,811	5,030	4,316	4,957	9,273	173	105	278	229,393
October - December	152,601	4,535	3,971	5,511	9,482	183	174	357	166,974
Total	738,444	19,708	16,984	21,475	38,459	798	706	1,503	798,115
2016									
January - March	152,744	4,124	3,954	5,177	9,131	225	224	448	166,448
April - June	147,491	4,096	3,496	4,986	8,482	128	81	209	160,278
July - September	210,512	4,163	3,771	4,713	8,483	145	55	200	223,358
October - December	167,807	4,102	3,499	5,253	8,752	185	141	326	180,987
Total	678,554	16,485	14,720	20,129	34,849	683	500	1,183	731,071
2017									
January - March	160,569	4,236	3,482	5,052	8,534	194	179	373	173,712
April - June	154,230	4,325	3,096	5,012	8,107	121	82	203	166,866
July - September	190,545	4,491	3,083	5,168	8,251	136	59	195	203,482
October - December	159,649	4,485	3,314	5,057	8,371	159	130	290	172,796
Total	664,993	17,538	12,975	20,289	33,264	610	451	1,061	716,856
2018									
January - March	154,802	4,228	3,496	4,620	8,116	175	180	354	167,501
April - June	144,173	4,610	3,044	4,622	7,666	128	65	193	156,643
July - September	181,598	4,737	2,894	4,654	7,549	147	26	173	194,057
Total	480,574	13,575	9,434	13,896	23,331	449	270	720	518,200
2017 January - September	505,344	13,052	9,661	15,232	24,893	451	321	771	544,060
2016 January - September	510,747	12,382	11,221	14,876	26,097	498	359	857	550,083

1 The electric power sector (electric utilities and independent power producers) comprises electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity or electricity and heat to the public (i.e. NAICS 22 plants). The reported coal consumption is the total for producing electricity and useful thermal output.

2 Industrial combined-heat-and-power (CHP) and a small number of industrial electricity-only plants. The reported coal consumption is the total for producing electricity and useful thermal output.

3 All industrial sector fuel use other than in 'Coke Plants' and 'Industrial CHP.'

4 Includes commercial combined-heat-and-power (CHP) and a small number of commercial electricity-only plants, such as hospitals and universities. The reported coal consumption is the total for producing electricity and useful thermal output.

5 All commercial sector fuel use other than that in 'Commercial CHP.' Excludes residential use.

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

Table 3. U. S. coal consumption by end-use sector, 2012 to September, 2018. Values are in thousand short tons. From Energy Information Agency (2019d).

Coal-producing region and state	July - September		Year to date		Percent change	
	2018	April - June 2018	July - September 2017	2018		2017
Alabama	3,648	3,538	2,850	11,085	9,754	13.7
Alaska	210	185	237	631	695	-9.2
Arizona	1,720	1,692	1,374	4,938	4,424	11.6
Arkansas	-	-	-	-	43	-
Colorado	3,628	3,779	3,147	10,682	11,301	-5.5
Illinois	12,346	12,096	11,328	37,053	36,768	0.8
Indiana	8,369	8,857	7,738	25,697	23,804	8.0
Kentucky Total	9,689	9,956	9,805	29,840	31,817	-6.2
Eastern (Kentucky)	4,123	4,339	4,222	12,899	13,525	-4.6
Western (Kentucky)	5,566	5,617	5,583	16,941	18,292	-7.4
Louisiana	512	447	164	1,191	1,589	-25.1
Maryland	273	285	430	936	1,405	-33.4
Mississippi	862	770	453	2,271	2,022	12.4
Missouri	64	65	63	194	184	5.1
Montana	9,568	9,077	10,450	27,704	25,493	8.7
New Mexico	3,045	1,740	3,175	6,808	11,078	-38.5
North Dakota	7,921	6,884	7,463	22,338	21,281	5.0
Ohio	2,404	1,671	2,368	6,525	7,048	-7.4
Oklahoma	241	251	131	623	416	49.8
Pennsylvania Total	11,675	13,498	11,666	37,136	36,919	0.6
Anthracite (Pennsylvania)	474	479	402	1,373	1,390	-1.2
Bituminous (Pennsylvania)	11,201	13,019	11,264	35,762	35,529	0.7
Tennessee	45	44	90	146	361	-59.6
Texas	6,642	6,486	9,439	19,192	26,503	-27.6
Utah	3,478	3,047	3,272	10,159	10,199	-0.4
Virginia	3,156	3,054	3,125	9,449	10,081	-6.3
West Virginia Total	23,505	25,031	21,603	71,911	68,546	4.9
Northern (West Virginia)	11,319	11,707	10,345	34,118	34,379	-0.8
Southern (West Virginia)	12,186	13,323	11,258	37,792	34,167	10.6
Wyoming	81,469	68,188	85,867	226,042	238,402	-5.2
Appalachia Total	48,827	51,461	46,353	150,087	147,638	1.7
Appalachia Central	19,509	20,761	18,694	60,287	58,133	3.7
Appalachia Northern	25,670	27,161	24,809	78,715	79,752	-1.3
Appalachia Southern	3,648	3,538	2,850	11,085	9,754	13.7
Interior Region Total	34,604	34,589	34,899	103,162	109,621	-5.9
Illinois Basin	26,281	26,570	24,649	79,691	78,864	1.0
Interior	8,322	8,018	10,250	23,471	30,757	-23.7
Western Region Total	111,039	94,592	114,985	309,301	322,874	-4.2
Powder River Basin	86,615	72,862	91,214	240,322	251,004	-4.3
Uinta Region	6,849	6,501	6,116	19,970	20,549	-2.8
Western	17,575	15,229	17,655	49,009	51,321	-4.5
East of Mississippi River	75,971	78,800	71,454	232,049	228,524	1.5
West of Mississippi River	118,500	101,841	124,782	330,501	351,609	-6.0
U.S. Subtotal	194,470	180,641	196,236	562,550	580,133	-3.0
Refuse recovery	193	145	204	537	544	-1.2
U.S. Total	194,663	180,785	196,440	563,088	580,677	-3.0

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 4. U.S. coal production by state, July 2017 to July 2018. Values are in thousand short tons. From Energy Information Agency (2019d).

U.S. Coal Data Sources

The Energy Information Administration 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.

The Energy Information Administration also provides an energy mapping system for a variety of energy sources that include coal, including coal mines and location and identity of coal-fired electricity installations in the United States. Information on coal can be accessed at: <https://www.eia.gov/state/maps.cfm?v=Coal>. The general site can be reached via: <https://www.eia.gov/state/maps.cfm?v=Fossil%20Fuel%20Resources>.

Australia

Australia was the world's fourth largest coal producer in 2017, having produced 481 million metric tons of coal (508.2 million short tons), or 6.2% of total world coal production (British Petroleum, 2018). Most of the Australia's coal, which is typically low in ash content, occurs in Queensland and New South Wales (Sydney and Bowen Basins, respectively). These basins account for most of Australia's black coal production (Australian Mining, 2019). Coal exports from Queensland in 2018 were 223 million metric tons (245.9 million short tons), exceeding the recent 2016 record by 2 million metric tons (2.2 million short tons), reported by the Queensland Resources Council.

Coal surpassed iron ore in 2018 for the first time in the Australian export market, with thermal and coking coal export values reaching AU\$67 billion in 2018-2019, compared to AU\$61 billion for iron ore (Latimer, 2018). Coking coal exports are expected to rise 8.7% from fiscal 2017 to AU\$41.1 billion, whereas thermal coal exports are projected to increase 14.6% from fiscal 2017 to AU\$25.9 billion (Matsumoto, 2019). According to the Australian Financial Review, Glencore has recently spent AU\$3.4 billion on coal projects in Australia, including coking coal. Australian thermal coal prices, which declined 15% to \$90 per ton between February and April 2018, rose again to \$120 in June because of increased demand in China and other countries in Asia (Matsumoto, 2019).

However, future demand from China for Australian coal may decline. China has recently been reconsidering coal-fired power in an effort to reduce air pollution. Other factors that may lead to decreased coal production in the near future are related to policymakers who are antipathetic to thermal coal, deemed to be a major source of greenhouse gases. For example, British-Australian Rio Tinto recently sold its remaining coal assets in August, 2018 and Mitsubishi Corporation and Mitsui & Company have plans to sell their investments in thermal coal mines as well (Matsumoto, 2019).

Indonesia

Indonesia in 2017 was the world's fifth largest coal producer. It produced 461 million metric tons (508.2 million short tons), approximately 6% of the world coal production (British Petroleum, 2018). The three largest coal-resource regions in Indonesia are South Sumatra, South Kalimantan, and East Kalimantan (Fig. 6).

Indonesia leads the world in thermal coal exports (Indonesia-Investments, 2018). More than 70% of Indonesia's coal production is exported (Table 5). Much of its exported thermal coal is of medium quality (between 5,100 and 6,100 cal/gram). Its lower-quality thermal coal has a high demand in China and India. Despite Indonesia's active export market for thermal coal, there has recently been a significant increase in domestic coal sales because ambitious construction of mostly coal-fired power plants. The top five producers in Indonesia (PT Bumi Resources Tbk, PT Adaro, PT Kideco Jaya, PT Indotambang Raya Megah, and PT Berau) account for more than 45% of coal production (Indonesia-Investments, 2018).

Indonesia's energy mix, projected to the year 2025, includes increased reliance on coal, although renewable energy is expected to rise at a higher rate than that for coal (Table 6). Indonesia is projected to increase annual coal production by an average of 3% to 2020 (Jardine Lloyd Thompson Group, 2017). One of the main reasons for this projected increase is because the Government of Indonesia plans to invest in power infrastructure in the near future, hoping to reach a level of 99.7% electrification by 2025. This plan calls for coal to compose 60% of the overall national fuel mix to achieve a total power capacity of 90.5 GW by the end of 2019.



Figure 6. The three major coal-resource regions in Indonesia. Regions are (1) South Sumatra, (2) South Kalimantan, and (3) East Kalimantan. From Indonesia-Investments (2018).

Indonesian Production, Export, Consumption & Price of Coal:

	2014	2015	2016	2017	2018	2019
Production (in million tons)	458	461	456	461	425 ¹	400 ¹
Export (in million tons)	382	375	365	364	311 ¹	160 ¹
Domestic (in million tons)	76	86	91	97	114 ¹	240 ¹
Price (HBA) (in USD/ton)	72.6	60.1	61.8	n.a.	n.a.	n.a.

¹ = projection

Table 5. Coal production, export, consumption, and prices in Indonesia from 2014 to 2019. From Indonesia-Investments (2018).

Indonesia's Energy Mix:

	Energy Mix 2011	Energy Mix 2025
Oil	50%	23%
Coal	24%	30%
Gas	20%	20%
Renewable Energy	6%	26%

Source: Ministry of Energy and Mineral Resources

Table 6. Projected energy mix in Indonesia projected to the year 2025. From Indonesia-Investments (2018).

Russian Federation

The Russian Federation accounted for 411 million metric tons (453.0 million short tons) of coal production in 2017, representing 5.3% of the world's total coal production (British Petroleum, 2018). Approximately 80% of Russia's coal production is thermal (steam) coal and 20% is metallurgical (coking) coal. Russia's coal reserves account for almost 18% of the world's total coal reserves (Sliviyak, 2015). More than half of Russia's coal exports, which have risen significantly since 2002, go to Europe. China accounts for 16% of Asian exports, whereas the United Kingdom receives 10%.

Russia's production and exports of coal in 2018 were at their greatest levels since 2013, according to S&P Global Platts estimates of data from Russia's Energy Ministry (Rt.com, 2019). Coal exports in Russia increased 3.4% from 2017 to 2018, reaching 191 million metric tons (210.5 million short tons). Coal production was greater by 6% in the same period (Paraskova, 2019).

The Russian Federation plans to invest approximately 1.5 trillion Russian rubles in both its own coal industry and port facilities and infrastructure (Rt.com, 2019; Paraskova,

2019). Russian coal producers have recently attempted to dominate the European coal market (De Wilde, 2019). Russia is embarked on a course to make inroads into the Asian market. From January to October 2018, Taiwan imported 8.5 million metric tons (9.4 million short tons) of Russian thermal coal, whereas in the first 11 months in of 2018, South Korea imported 18.6 million metric tons (20.5 million short tons) of Russian thermal coal (De Wilde, 2019).

South Africa

South Africa in 2017 was the world's seventh largest coal producer. The country produced 252 million metric tons of coal (277.8 million short tons), or 3.3% of the world's total coal production (British Petroleum, 2018). South Africa has an estimated coal-resource base of 30 billion metric tons (33.1 billion short tons) and its exports account for 6% of all those globally. Most of South Africa's coal production is from Mpumalanga in the northeastern part of the country. Coal also generates the greatest revenue in the country's mining industry, representing approximately R131.40 billion in 2017 (Creamer Media, 2018).

Coal is responsible for generating 82% of South Africa's electricity. Eskom, a state-owned utility, which operates 16 power stations and which is constructing two more power plants that will commence operations in 2021, provides most of the country's coal-fired electricity. In addition, Sasol produces approximately 40 million metric tons (44.1 million short tons) per year for gasification and liquid-fuel production. Sasol's Secunda facility has the capacity of 160,000 barrels per day (bbl/d) of oil equivalent and plans are being made to expand production capacity by an additional 30,000 bbl/d.

South Africa exports have recently accounted for approximately 25% of its coal production. However, development of global alternative energy sources has affected South African coal-export markets (Olalde, 2017). In addition, there has been a trend of an increasing number of smaller coal-mining companies in South Africa, formerly dominated by large companies such as Eskom. Despite shrinking coal-export markets,

domestic coal mining in South Africa remains a vital part of the economy, having employed more than 77,500 people in 2016, representing 17% of the total employment in the South African mining sector.

Reductions in investment in coal mining and the existence of many old mines reaching their productive limits are currently a concern in South Africa (Snide, 2018). These reductions are projected to adversely affect coal productivity, supply for electricity generation by Eskom, exports, and to cause coal prices to rise, especially in the domestic market.

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