Mining Review

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Minerals are fundamental to the U.S. economy, contributing to the real gross domestic product (GDP) at several levels—mining, processing and manufacturing finished products. The estimated growth rate for the real GDP of the United States was 2.1 percent and the nominal GDP was about $13.8 trillion in 2007 (Table 1).

The prime interest rate decreased to 7.25 percent in December from 8.25 percent at the beginning of 2007, reflecting actions taken by the Federal Reserve Board to counter financial difficulties surrounding subprime mortgages. Delinquencies on subprime mortgages increased throughout the year, affecting not only the delinquent home owners but also financial instruments invested in mortgage-backed securities. The average contract mortgage rate for the purchase of previously occupied homes in the United States was 6.35 percent in November; a slight decrease from 6.37 percent in January but still greater than 5.34 percent reported in July 2003, the lowest rate in the past five years. With the tightening of credit, the seasonally adjusted annualized rate for new privately owned housing starts declined 27 percent from December 2006 to November 2007. The loss in the residential market was balanced by a 9-percent increase in nonresidential construction between January and August 2007, during which slight increases occurred in nearly all

FIG. 1

The role of nonfuel minerals in the U.S. economy in 2007. Values estimated by the USGS and the U.S. Department of Commerce. Major consuming industries of processed mineral materials are construction, durable goods and some nondurable goods manufacturing. The value for domestic mineral raw materials from mining does not include the values for fixed nitrogen and sulfur — values not included in the corresponding figure in USGS Mineral Commodity Summaries 2008.

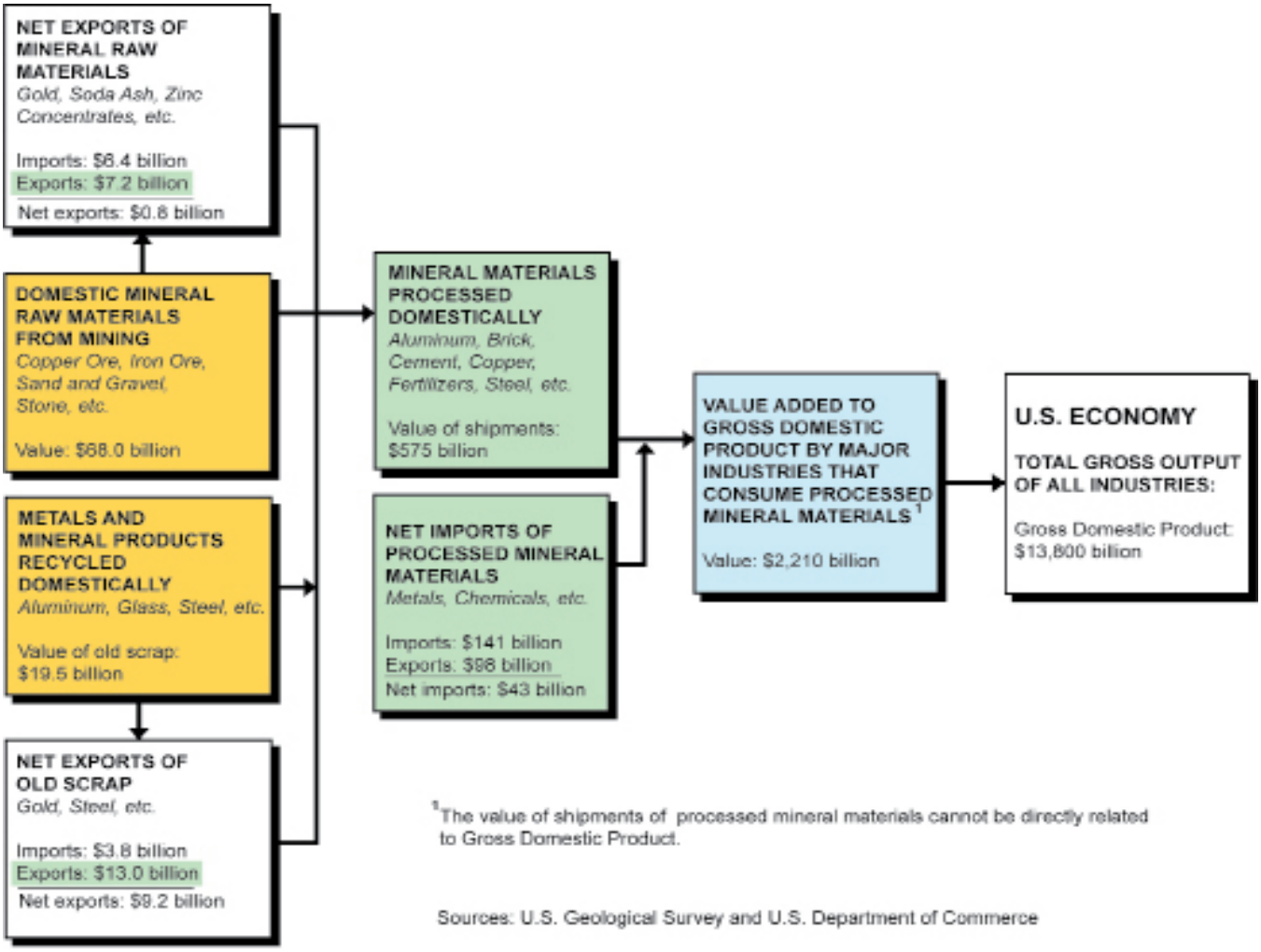
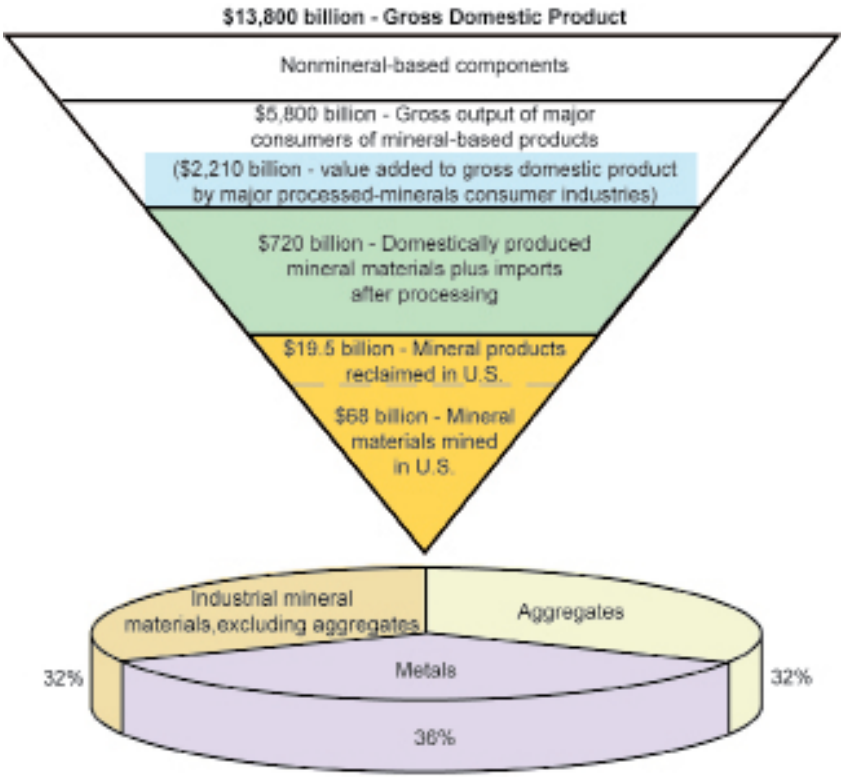


FIG. 2

Relation of nonfuel to gross domestic product (value added) in the U.S. economy during 2007. Vertical axis of triangle is a semilog plot of the values. Pie chart shows percentage of the $68 billion of mineral materials mined in the U.S. and includes the values for fixed nitrogen and sulfur in all forms.



nonresidential construction categories. Housing prices declined in many parts of the country, reducing state and municipal revenues from real estate and housing sales taxes that might have been used for construction projects.

The unemployment rate in the United States was 5 percent in December 2007, an increase from 4.4 percent in December 2006. However, employment increased in all sectors of the mining industry between January and November 2007. The nation's international trade deficit in goods and services increased to $57.8 billion in October 2007 from $57.1 billion in September 2007, as imports increased at a slightly greater rate than exports. This was still less than the $58.2 billion deficit in October 2006.

Production of nonfuel minerals in the United States in 2007 decreased slightly from 2006. The value, however, increased slightly to $68 billion (Table 2) from $66 billion because of increased unit prices for some metals — particularly copper, lead, tin and other base metals — and increased energy costs passed along to customers by producers of industrial minerals. Infrastructure expansion and manufacturing in China and India continued to absorb a significant portion of world output. Domestic production decreased for several of the industrial mineral materials associated directly with housing construction, such as cement, construction sand and gravel, and crushed stone, and those associated with the manufacture of goods used by the housing industry, such as ceramic tile, paint, sanitaryware, roofing and wallboard.

Production of 13 mineral commodities was worth more than $1 billion each in the United States in 2007. These were crushed stone, cement, copper, construction sand and gravel, gold, molybdenum (concentrates), iron ore (shipped), zinc, clays (all varieties), lime, salt, soda ash and phosphate rock, listed in decreasing order of value.

In 2007, 10 states each produced more than $2 billion worth of nonfuel mineral commodities. These states were, in descending order, Arizona, Nevada, California, Utah, Alaska, Florida, Texas, Minnesota, Missouri and Georgia. The mineral production of these states accounted for 55 percent of the total U.S. output value (Table 3).

Mineral industry performance

The estimated value of all nonfuel mineral materials processed in the United States during 2007 totaled $575 billion, 1.5 percent more than in 2006 (Fig. 1). The total value of U.S. raw nonfuel mineral production alone was $68 billion (Fig. 2), 3 percent more than in 2006.

The United States continued to rely on foreign sources for raw and processed mineral materials. In 2007, the United States supplied more than one-half of its apparent consumption of 44 mineral commodities through imports and was 100 percent import reliant for 19 of those (Fig. 3). The value of raw and processed mineral material exports increased by 42 percent to $105 billion. The value of exported ores and concentrates of metals and industrial minerals in 2007 was $7.2 billion. The value of raw and processed mineral material imports increased to $148 billion from $133 billion in 2006. The value of mineral raw material imports was $6.4 billion, an increase from $5.9 billion in 2006. The value of net imports of raw and processed mineral materials during 2007 decreased to $42 billion from $61 billion in 2006. As in recent years, aluminum, copper, and iron and steel were among the leading imports in terms of value (U.S. Census Bureau, 2007). The decline in value of the U.S. dollar relative to major world currencies probably helped to boost U.S. mineral exports in 2007 while at the same time making mineral imports more expensive.

The number of production workers in U.S. nonfuel mineral mining rose slightly in 2007. There were 29,000 workers in metal mining in 2007 and 82,000 in the industrial minerals mining sector (Fig. 4). Average weekly earnings of metal mining production workers increased by about 10 percent compared with 2006, while average weekly earnings of production workers in industrial minerals mining rose slightly.

In fiscal year 2007, the Defense Logistics Agency (DLA) sold $368 million of excess mineral materials from the National Defense Stockpile (NDS). Under the authority of the Defense Production Act of 1950, the U.S. Geological Survey (USGS) advises the DLA on acquisitions and disposals of NDS mineral materials. At the end of the fiscal year, mineral materials valued at $1.24 billion remained in the stockpile.

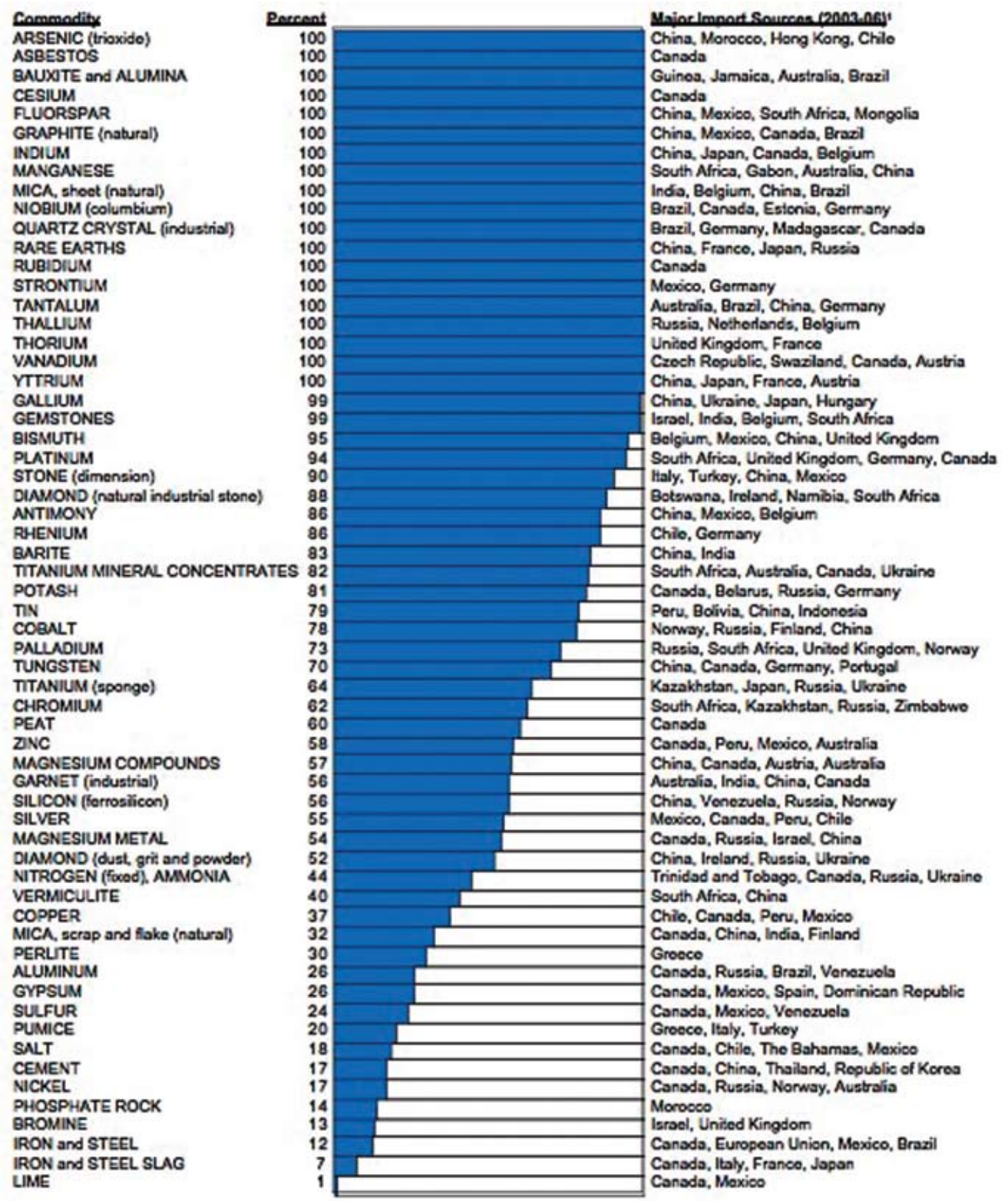
Metals

The estimated value of U.S. metal mine production in 2007 was $24.8 billion, about 6 percent greater than in 2006. Principal contributors to the total value of metal mine production in 2007 were copper (35 percent), gold (20 percent), molybdenum (14 percent), iron ore and zinc (11 percent each) and lead (4 percent). Metals with the largest increases in value of mine production were lead and silver (23 percent each), magnesium metal (20 percent), molybdenum (16 percent), zinc (11 percent), copper (6 percent) and palladium (4 percent).

In 2007, U.S. domestic pig iron production increased by about 2 percent while steel production remained the same as in 2006 (Fig. 5). Shipments of steel mill prod-

FIG. 3

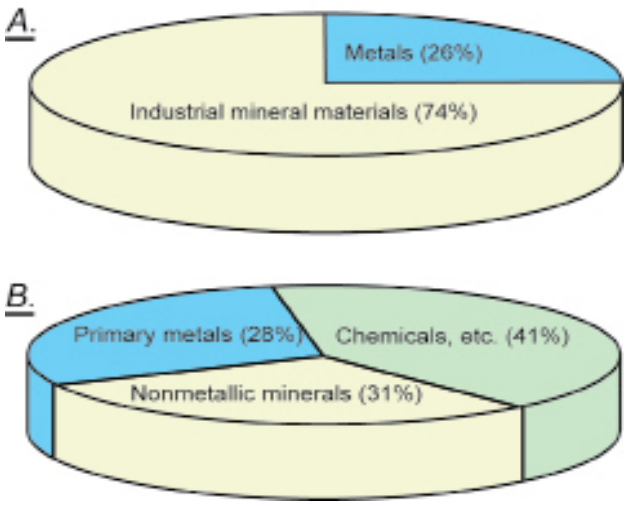
U.S. net import reliance for selected nonfuel mineral materials in 2007.



Commodity	Percent	Major Import Sources (2003-06)[1]
ARSENIC (trioxide)	100	China, Morocco, Hong Kong, Chile
ASBESTOS	100	Canada
BAUXITE and ALUMINA	100	Guinea, Jamaica, Australia, Brazil
CESIUM	100	Canada
FLUORSPAR	100	China, Mexico, South Africa, Mongolia
GRAPHITE (natural)	100	China, Mexico, Canada, Brazil
INDIUM	100	China, Japan, Canada, Belgium
MANGANESE	100	South Africa, Gabon, Australia, China
MICA, sheet (natural)	100	India, Belgium, China, Brazil
NIOBIUM (columbium)	100	Brazil, Canada, Estonia, Germany
QUARTZ CRYSTAL (industrial)	100	Brazil, Germany, Madagascar, Canada
RARE EARTHS	100	China, France, Japan, Russia
RUBIDIUM	100	Canada
STRONTIUM	100	Mexico, Germany
TANTALUM	100	Australia, Brazil, China, Germany
THALLIUM	100	Russia, Netherlands, Belgium
THORIUM	100	United Kingdom, France
VANADIUM	100	Czech Republic, Swaziland, Canada, Austria
YTTRIUM	100	China, Japan, France, Austria
GALLIUM	99	China, Ukraine, Japan, Hungary
GEMSTONES	99	Israel, India, Belgium, South Africa
BISMUTH	95	Belgium, Mexico, China, United Kingdom
PLATINUM	94	South Africa, United Kingdom, Germany, Canada
STONE (dimension)	90	Italy, Turkey, China, Mexico
DIAMOND (natural industrial stone)	88	Botswana, Ireland, Namibia, South Africa
ANTIMONY	86	China, Mexico, Belgium
RHENIUM	86	Chile, Germany
BARITE	83	China, India
TITANIUM MINERAL CONCENTRATES	82	South Africa, Australia, Canada, Ukraine
POTASH	81	Canada, Belarus, Russia, Germany
TIN	79	Peru, Bolivia, China, Indonesia
COBALT	78	Norway, Russia, Finland, China
PALLADIUM	73	Russia, South Africa, United Kingdom, Norway
TUNGSTEN	70	China, Canada, Germany, Portugal
TITANIUM (sponge)	64	Kazakhstan, Japan, Russia, Ukraine
CHROMIUM	62	South Africa, Kazakhstan, Russia, Zimbabwe
PEAT	60	Canada
ZINC	58	Canada, Peru, Mexico, Australia
MAGNESIUM COMPOUNDS	57	China, Canada, Austria, Australia
GARNET (industrial)	56	Australia, India, China, Canada
SILICON (ferrosilicon)	56	China, Venezuela, Russia, Norway
SILVER	55	Mexico, Canada, Peru, Chile
MAGNESIUM METAL	54	Canada, Russia, Israel, China
DIAMOND (dust, grit and powder)	52	China, Ireland, Russia, Ukraine
NITROGEN (fixed), AMMONIA	44	Trinidad and Tobago, Canada, Russia, Ukraine
VERMICULITE	40	South Africa, China
COPPER	37	Chile, Canada, Peru, Mexico
MICA, scrap and flake (natural)	32	Canada, China, India, Finland
PERLITE	30	Greece
ALUMINUM	26	Canada, Russia, Brazil, Venezuela
GYPSUM	26	Canada, Mexico, Spain, Dominican Republic
SULFUR	24	Canada, Mexico, Venezuela
PUMICE	20	Greece, Italy, Turkey
SALT	18	Canada, Chile, The Bahamas, Mexico
CEMENT	17	Canada, China, Thailand, Republic of Korea
NICKEL	17	Canada, Russia, Norway, Australia
PHOSPHATE ROCK	14	Morocco
BROMINE	13	Israel, United Kingdom
IRON and STEEL	12	Canada, European Union, Mexico, Brazil
IRON and STEEL SLAG	7	Canada, Italy, France, Japan
LIME	1	Canada, Mexico

FIG. 4

Percentage of U.S. production workers in (A) mining (111,000) and (B) manufacturing (1.25 million) in nonfuel mineral-based industries in 2007 (U.S. Department of Labor).



ucts were expected to decrease 3 percent compared with 2006. During the same time period, imports of steel mill products decreased by about 25 percent and U.S. steel net import reliance as a percentage of apparent consumption was an estimated 12 percent. U.S. exports of molybdenum, as ferromolybdenum, molybdates, molybdic oxide, scrap and other products, increased marginally in 2007 while domestic consumption of molybdenum continued to increase. End uses for domestic molybdenum, in descending order of consumption, included steel, powder mill products, superalloys and chemicals and ceramics (Fig. 6).

Worldwide iron ore contract prices in 2007 increased by about 9 percent compared with 2006 because of a continuing supply shortfall relative to demand. Projected increases in production capacity in the next few years are expected to bring supply back in line with demand, although supply remains extremely tight in the short term. Growth in iron ore demand continued to be dominated by China's iron and steel industry. China was expected to increase production of mostly low-grade iron ore in 2007 by greater than 40 percent from 2005. Chinese imports of high-grade iron ore, mostly from Australia and Brazil, were estimated to have increased by 17 percent compared with 2006.

In 2007, the annual average prices for most nonferrous metals remained at or above the almost universally high levels established in 2006. While aluminum prices remained essentially unchanged, copper prices rose by about 4 percent, North American lead prices by 60 percent and New York composite tin prices by 59 percent. Although still high by historical standards, zinc prices declined by about 3 percent. Precious metal prices all

Table 1

U.S. mineral related economic trends.

	2003	2004	2005	2006	2007[e]
Gross domestic product (billion dollars)	10,961	11,686	12,434	13,195	13,800
Industrial production (2002=100):					
Total index	101	104	107	111	113
Manufacturing:	101	104	108	113	115
Nonmetallic mineral products	101	104	108	113	110
Primary metals:	99	109	107	112	110
Iron and steel	101	116	110	117	114
Aluminum	96	96	102	99	96
Nonferrous metals (except aluminum)	101	104	103	107	109
Chemicals	101	106	108	110	111
Mining:	100	99	98	100	101
Coal	98	101	102	107	104
Oil and gas extraction	99	96	93	94	97
Metals	94	94	102	103	105
Nonmetallic minerals	101	106	107	104	91
Capacity utilization (percent):					
Total industry:	76	78	80	82	82
Mining:	88	88	88	91	91
Metals	72	72	79	79	81
Nonmetallic minerals	83	86	86	85	73
Housing starts (thousands)	1,850	1,950	2,070	1,810	1,360
Light vehicle sales (thousands)[1]	13,300	13,500	13,500	12,800	12,400
Highway construction, value, put in place (billion dollars)	57	59	64	72	76

[e] Estimated.
[1] Excludes imports.

Sources: U.S. Department of Commerce, Federal Reserve Board, Autodata Corp., and U.S. Department of Transportation.

rose from their already high 2006 levels, with gold increasing by 15 percent, silver by 16 percent, palladium by 11 percent and platinum by 14 percent. Yearend prices for most of the precious metals indicated a continued upward climb.

Domestic primary aluminum production increased substantially owing to smelter restarts after new power contracts were obtained by producers. Domestic smelters operated at about 69 percent of rated or engineered capacity, up from about 62 percent the previous year. World primary aluminum production continued to increase as capacity expansions outside the United States were brought onstream (Fig. 7).

U.S. copper mine production declined slightly owing to lower ore grades at a major mine and continued labor and equipment shortages. In March, Freeport-McMoRan Copper & Gold (New Orleans, LA) acquired Phelps Dodge (Phoenix, AZ) to become the world's leading publicly held copper mining company. Production by domestic brass mills was lower owing to substitution and a weak housing market. Despite lower demand, domestic production of wire rod was essentially unchanged as the weak dollar led to a sharp reduction in imports. In addition to a major new mine-for-leach project in Arizona due onstream in 2008, several companies announced progress toward the startup of new projects in Arizona, Minnesota and Montana that would add 217 kt/a (240,000 stpy) of new mine production capacity by 2009.

U.S. mine production of lead in concentrate remained unchanged during 2007, while production of secondary lead rose slightly. The average price of refined lead rose appreciably from 2006 on the U.S. and

FIG. 5

U.S. steel production by grade and apparent consumption, and production of iron ore through 2007. Steel production and apparent consumption measured in gross weight; iron ore production in contained iron.

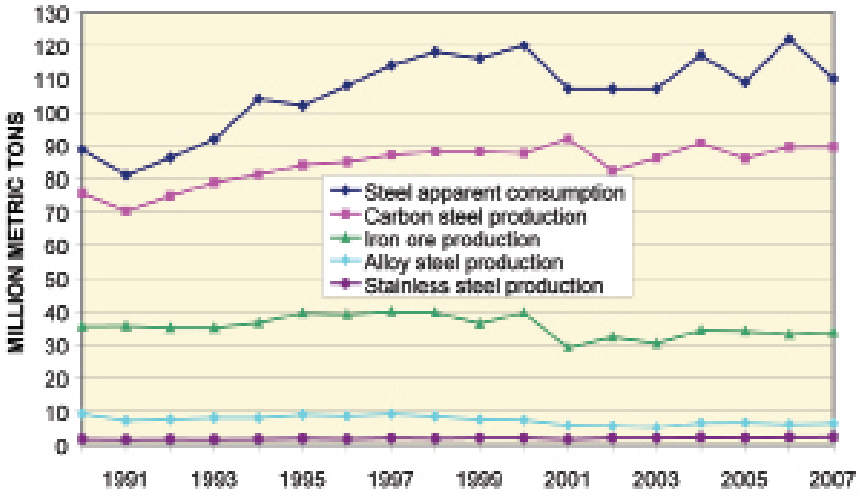


Table 2

U.S. mineral industry trends.

	2003	2004	2005	2006	2007[e]
Total mine production:[1]					
Metals	8,500	12,500	16,500	23,300	24,800
Industrial minerals	30,900	33,600	38,800	42,800	43,200
Coal	19,100	22,200	26,700	29,300	30,100
Employment:[2]					
Coal mining	59	59	61	68	71
Metal mining	20	20	22	26	29
Industrial minerals, except fuels	78	81	84	82	82
Chemicals and allied products	525	520	510	509	510
Stone, clay, and glass products	375	388	387	390	382
Primary metal industries	370	364	363	361	354
Average weekly earnings of production workers:[3]					
Coal mining	963	1,029	1,071	1,093	1,046
Metal mining	957	1,035	1,001	974	1,076
Industrial minerals, except fuels	771	791	830	863	875
Chemicals and allied products	784	820	832	834	820
Stone, clay, and glass products	665	688	701	713	722
Primary metal industries	768	800	816	843	842

[e] Estimated.
[1] Million dollars.
[2] Thousands of production workers.
[3] Dollars.

Sources: U.S. Geological Survey, U.S. Department of Energy, U.S. Department of Labor.

world markets, approaching record high levels as the global supply for refined lead remained tight and stocks continued to decline. Global lead use was estimated to have increased by 4 percent in 2007. Continued strong economic growth in the automotive, telecommunications and information technology sectors in China was the most significant factor influencing increased lead usage. Although global mine production of lead concentrate increased by about 5 percent, Chinese net imports of lead concentrate rose significantly. This, combined with a change in China's export tax regime that led to significantly reduced exports of refined lead, resulted in an appreciable tightness in the global refined lead market.

Table 3

Value of nonfuel minerals production in the United States and principal nonfuel minerals produced in 2006.

State	Value (thousands)	Rank	Percent of U.S total	Principal minerals, in order of value
Alabama	$1,340,000	16	1.97	Cement (portland), stone (crushed), lime, sand and gravel (construction), salt.
Alaska	3,430,000	5	5.04	Zinc, gold, lead, silver, sand and gravel (construction).
Arizona	7,380,000	1	10.85	Copper, molybdenum concentrates, sand and gravel (construction), cement (portland), lime.
Arkansas	913,000	26	1.34	Bromine, stone (crushed), cement (portland), sand and gravel (construction), lime.
California	4,390,000	3	6.45	Sand and gravel (construction), cement (portland), boron minerals, stone (crushed), soda ash.
Colorado	1,940,000	11	2.85	Molybdenum concentrates, sand and gravel (construction), cement (portland), gold, stone (crushed).
Connecticut	181,000	43	0.27	Stone (crushed), sand and gravel (construction), stone (dimension), clays (common), gemstones (natural).
Delaware[2]	33,800	50	0.05	Sand and gravel (construction), magnesium compounds, stone (crushed), gemstones (natural).
Florida	3,190,000	6	4.69	Stone (crushed), phosphate rock, cement (portland), sand and gravel (construction), cement (masonry).
Georgia	2,110,000	10	3.10	Clays (kaolin), stone (crushed), cement (portland), clays (fuller's earth), sand and gravel (construction).
Hawaii	150,000	45	0.22	Stone (crushed), sand and gravel (construction), gemstones (natural).
Idaho	817,000	28	1.20	Molybdenum (concentrates), sand and gravel (construction), phosphate rock, silver, lead.
Illinois	1,220,000	20	1.79	Stone (crushed), cement (portland), sand and gravel (construction), sand and gravel (industrial), lime.
Indiana	997,000	22	1.47	Stone (crushed), cement (portland), sand and gravel (construction), lime, cement (masonry).
Iowa	674,000	32	0.99	Stone (crushed), cement (portland), sand and gravel (construction), gypsum (crude), lime.
Kansas	967,000	24	1.42	Cement (portland), helium (Grade-A), stone (crushed), salt, sand and gravel (construction).
Kentucky	913,000	25	1.34	Stone (crushed), lime, cement (portland), sand and gravel (construction), clays (common).
Louisiana[2]	385,000	38	0.57	Sand and gravel (construction), salt, stone (crushed), clays (common), sand and gravel (industrial).
Maine	156,000	44	0.23	Cement (portland), sand and gravel (construction), stone (crushed), stone (dimension), peat.
Maryland	725,000	29	1.07	Stone (crushed), cement (portland), sand and gravel (con struction), cement (masonry), stone (dimension).
Massachusetts	433,000	37	0.64	Stone (crushed), sand and gravel (construction), stone (dimension), lime, clays (common).
Michigan	1,910,000	12	2.81	Iron ore (usable shipped), cement (portland), sand and gravel (construction), stone (crushed), salt.
Minnesota	2,550,000	8	3.75	Iron ore (usable shipped), sand and gravel (construction), stone (crushed), sand and gravel (industrial), stone (dimension).
Mississippi	257,000	39	0.38	Sand and gravel (construction), stone (crushed), clays (fuller's earth), cement (portland), clays (ball).
Missouri	2,210,000	9	3.25	Stone (crushed), cement (portland), lead, lime, zinc.
Montana	$1,290,000	18	1.90	Copper, molybdenum (concentrates), palladium metal, platinum metal, gold.
Nebraska	214,000	41	0.32	Cement (portland), sand and gravel (construction), stone (crushed), lime, clays (common).

In 2007, domestic gold mine production was estimated to be 6 percent less than in 2006. This, combined with increased output from Australia and China, dropped the United States to the fourth-ranked position among gold producing nations from its second-ranked position in 2006. Production from several mines in Nevada accounted for much of the decrease. This decrease was partially offset by increases in production from Alaskan mines. Despite the decrease in production from Nevada mines, the state was still the leading gold producer, with about 80 percent of the U.S. total. In 2007, the United States was a net exporter of gold.

U.S. production of silver rose by about 7 percent to more than 1.2 kt (386,000 oz). Alaska continued as the

State	Value (thousands)	Rank	Percent of U.S total	Principal minerals, in order of value
Nevada	5,210,000	2	7.66	Gold, copper, sand and gravel (construction), silver, lime.
New Hampshire	115,000	46	0.17	Sand and gravel (construction), stone (crushed), stone (dimension), gemstones (natural).
New Jersey	582,000	33	0.86	Stone (crushed), sand and gravel (construction), sand and gravel (industrial), greensand marl, peat.
New Mexico	1,520,000	15	2.23	Copper, potash, sand and gravel (construction), molybdenum (concentrates), cement (portland).
New York	1,330,000	17	1.96	Stone (crushed), cement (portland), sand and gravel (construction), salt, zinc.
North Carolina	986,000	23	1.45	Stone (crushed), phosphate rock, sand and gravel (construction), sand and gravel (industrial), clays (common).
North Dakota	55,700	48	0.08	Sand and gravel (construction), lime, sand and gravel (industrial), stone (crushed), clays (common).
Ohio	1,240,000	19	1.82	Stone (crushed), sand and gravel (construction), salt, lime, cement (portland).
Oklahoma	678,000	31	1.00	Stone (crushed), cement (portland), sand and gravel (construction), sand and gravel (industrial), iodine (crude).
Oregon	505,000	36	0.74	Stone (crushed), sand and gravel (construction), cement (portland), diatomite, perlite (crude).
Pennsylvania	1,760,000	13	2.59	Stone (crushed), cement (portland), sand and gravel (construction), lime, cement (masonry).
Rhode Island	44,400	49	0.07	Sand and gravel (construction), stone (crushed), sand and gravel (industrial), gemstones (natural).
South Carolina	562,000	34	0.83	Cement (portland), stone (crushed), cement (masonry), sand and gravel (construction), sand and gravel (industrial).
South Dakota	227,000	40	0.33	Cement (portland), sand and gravel (construction), stone (crushed), stone (dimension), lime.
Tennessee	842,000	27	1.24	Stone (crushed), cement (portland), sand and gravel (construction), clays (ball), sand and gravel (industrial).
Texas	2,900,000	7	4.26	Cement (portland), stone (crushed), sand and gravel (construction), lime, salt.
Utah	3,940,000	4	5.79	Copper, molybdenum (concentrates), gold, sand and gravel (construction), cement (portland).
Vermont	92,800	47	0.14	Sand and gravel (construction), stone (dimension), stone (crushed), talc (crude), gemstones (natural).
Virginia	1,100,000	21	1.62	Stone (crushed), cement (portland), sand and gravel (construction), lime, zirconium (concentrates).
Washington	680,000	30	1.00	Sand and gravel (construction), stone (crushed), zinc, cement (portland), lime.
West Virginia	207,000	42	0.30	Stone (crushed), cement (portland), lime, sand and gravel (industrial), cement (masonry).
Wisconsin	552,000	35	0.81	Sand and gravel (construction), stone (crushed), lime, sand and gravel (industrial), stone (dimension).
Wyoming	1,670,000	14	2.45	Soda ash, clays (bentonite), helium (Grade-A), sand and gravel (construction), cement (portland).
Undistributed	435,000	XX	0.64	
Total	**68,000,000**	**XX**	**100.00**	

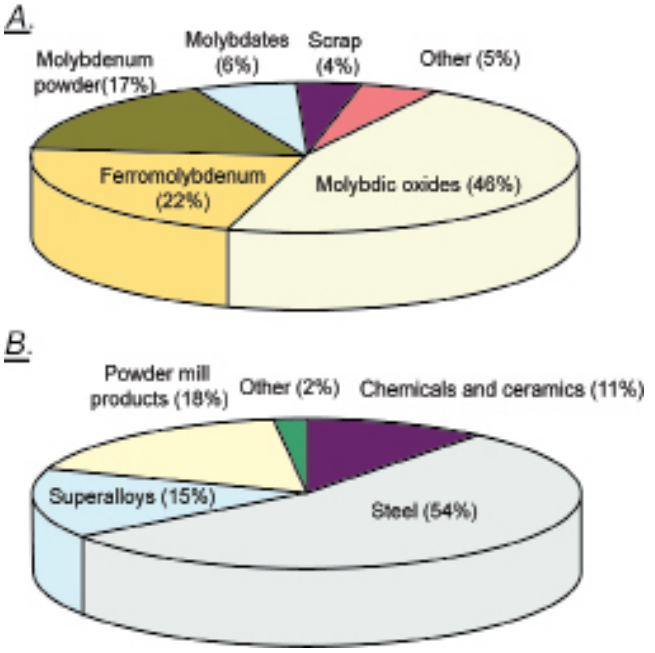
[p] Preliminary. XX Not applicable.

[1] Data are rounded to three significant digits; may not add to totals shown.

[2] Partial total; excludes values that must be concealed to avoid disclosing company proprietary data. Concealed values included with "Undistributed."

FIG. 6

U.S. reported consumption of molybdenum by (A) material form and (B) end use in 2007.



country's leading silver-producing state, followed by Nevada. Silver was recovered from 36 domestic base and precious metal mines. In 2007, silver prices rose to the highest annual average price since 1980. The rise in silver prices corresponded to investment interest in the newly established silver exchange-traded fund (ETF). The ETF, established in April 2006, was modeled after a gold ETF that was started in 2003. Exports of silver from the United States rose dramatically in 2006 owing to movement of physical silver to the ETF inventory agency in London, United Kingdom.

Zinc mine production in the United States, which rose slightly in 2007, was expected to increase during the next few years due to recent mine restarts. Three zinc mines in eastern Tennessee were reopened at mid-year and a zinc mining complex in mid-Tennessee was restarted at yearend. The zinc mines in eastern and mid-Tennessee were previously shut down in 2001 and 2003, respectively, due to low zinc prices.

Industrial minerals

The value of U.S. output of industrial minerals and materials, including nitrogen and sulfur, reached a record-high level of $47 billion, slightly higher than that of 2006. This represented about 65 percent of the value of all nonfuel mineral raw materials produced from domestic operations in 2007.

More than 6,500 companies, operating more than 12,000 mines, quarries and processing facilities contributed to this production. For most industrial minerals, production on a weight basis decreased by varying degrees in 2007, but higher unit prices resulted in increased value of production compared with that in 2006. The major use categories of industrial minerals produced in 2007 are shown in Fig. 8.

Agricultural minerals. U.S. production of mineral fertilizer nutrients was about the same as that in 2006. Domestic consumption of fixed nitrogen, phosphate rock and potash increased (Fig. 9). U.S. nitrogen producers operated at about 86 percent of their rated capacity, the highest level in nearly a decade, although production capacity decreased during that time.

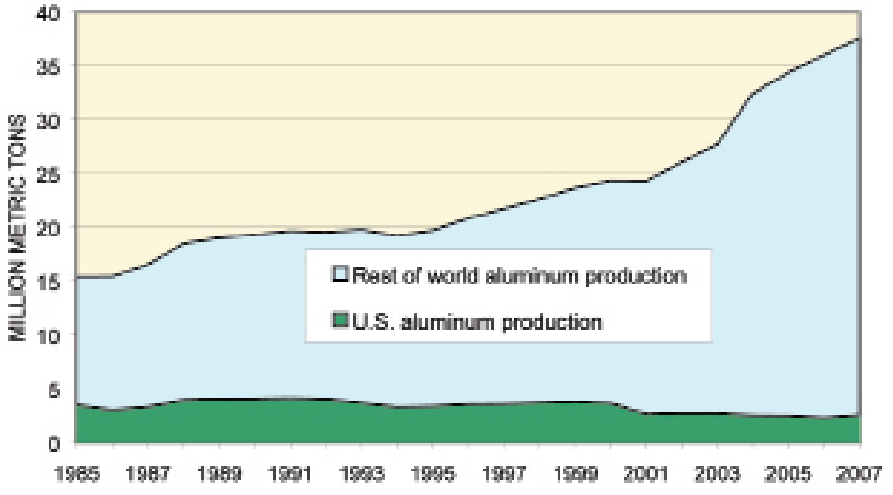
Domestic phosphate rock production fell below 30 Mt (33 million st) for the first time in more than 40 years due to lower production in Florida. Sales and consumption increased and demand was met by stock drawdown by companies in Florida. Potash production increased slightly.

Domestic and global prices for most fertilizer products increased throughout the year as a result of planting more crop acres, owing in part to high grain prices. Initiatives promoting the production of biofuels (transportation fuels made from agricultural products) spurred increased plantings and increased fertilizer consumption.

Global consumption of fertilizer nutrients was expected to increase about 2 percent per year in the future because of the need to increase world food output for the expanding human population. Growth rates will be affected by cost and availability of fertilizer materials, domestic and foreign government policies associated with farming practices and fertilizer subsidies, weather, population growth rates and other factors.

FIG. 7

Aluminum production in the United States and the rest of the world from 1985 through 2007.



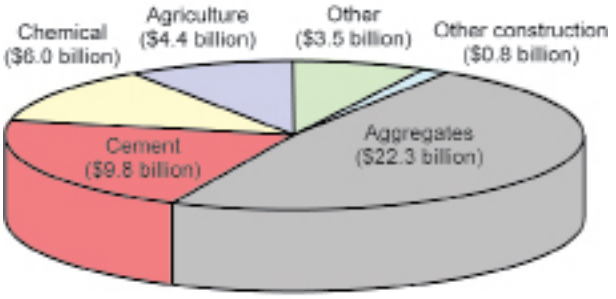
Chemical minerals. The quantities of domestically produced minerals that are used extensively by the chemical industry ranged from a high of 41 Mt (45 million st) of common salt down to some that totaled less than 2 kt (2,200 st). Other domestically produced minerals used by the chemical industry included lime, 20 Mt (22 million st); soda ash, 11.1 Mt (12.2 million st); magnesium compounds, 272 kt (299,000 st) and bromine, 235 kt (259,000 st).

The combined value for all industrial minerals used as the raw material for chemical products, including those for which data were withheld, was about $6 billion in 2007, a 5-percent increase from nearly $5.7 billion in 2006. Lime was valued at $1.8 billion; salt and soda ash, $1.3 billion each and bromine, $470 million.

Many factors affect production and consumption of these mineral materials. In general, domestic demand will be affected by the state of the national economy, which experienced a slowdown in 2007. Because several of these commodities have a significant export component, they respond more quickly to economic conditions in other regions. As Asian and European economies strengthen, U.S. exports are expected to return to or surpass previous levels and production would increase to meet additional demand.

FIG. 8

Value of U.S. production of industrial minerals and material industries in 2007. Agriculture includes fixed nitrogen and sulfur in all forms.



Construction minerals and materials. About 4.4 Gt (4.8 billion st) of industrial minerals and materials was mined and processed in the United States during 2007 for construction applications. They were dominated by cement, construction sand and gravel and crushed stone (Fig. 10). The value of these materials was an estimated $33 billion, about 70 percent of the value of all industrial mineral production. The construction industry led the demand for mineral materials, although this sector was particularly hard hit by the decline in the housing market.

Aggregates (crushed stone, construction sand and gravel, and slag) were mined or processed in all 50 states and were valued at more than $22 billion. More than three-quarters of the aggregates sold were used in road construction. Crushed stone accounted for 57 percent of the tonnage of aggregates used in all construction. Sand and gravel accounted for 42 percent, and slag and other aggregates for 1 percent. Production of natural aggregates (crushed stone and sand and gravel) in 2007 was estimated to be 2.8 Gt (3.1 billion st), 9 percent less than in 2006 (Fig. 10). Slag production was relatively unchanged. It is estimated that aggregates production will remain stable or decline slightly in 2008 compared with 2007, based on an anticipated downturn in the domestic economy.

Cement production (not counting raw materials) accounted for about 30 percent of the value of construction materials in 2007 (Fig. 8). The value of all types of cement production was down slightly. The total volume of cement production was also down slightly, to 95 Mt (105 billion st). Cement consumption decreased by more than 9 percent, indicating that decreased demand had more impact on importers than on producers.

About 41 Mt (45 million st) of all varieties of clays, valued at about $1.8 billion, was mined in the United States. Although not all clays are used in construction (Fig. 11), common clay, the type mostly used in the construction industry, accounted for 58 percent of the tonnage but only 13 percent of the value of all clays. Common clay was used mainly for brick (57 percent), cement (18 percent) and lightweight aggregate (17 percent). Kaolin accounted for 7.3 Mt (8 million st), or 18 percent, of the total clay tonnage and 55 percent of the value.

Other industrial minerals. The United States produced several other industrial minerals that do not fall in the three major categories covered above. Industrial sand and gravel accounted for more than two-thirds of the tonnage and more than one-third of the $2.4 billion production value of the principal minerals that are used in the ceramics, glass and refractory manufacturing industries. Ball clay, feldspar, fire clay, kaolin, kyanite and mullite, soda ash, talc and zirconium are the other main minerals used in these industries.

Some of the other uses for industrial minerals are abrasives, absorbents, catalysts, coatings, cryogenics, fillers and extenders, filtering agents, grinding and polishing materials, optoelectronics and pigments. Minerals used in these applications in 2007 were valued at about $5 billion. Of this total, titanium dioxide accounted for nearly $3 billion and kaolin accounted for $1 million.

FIG. 9

U.S. fertilizer nutrient consumption for crop years 1960 through 2007. Sources: The Fertilizer Institute and the Association of American Plant Food Control Officials. Crop year ends June 30; N is nitrogen, P_2O_5 is phosphorous pentoxide, K_2O is potassium oxide (potash).

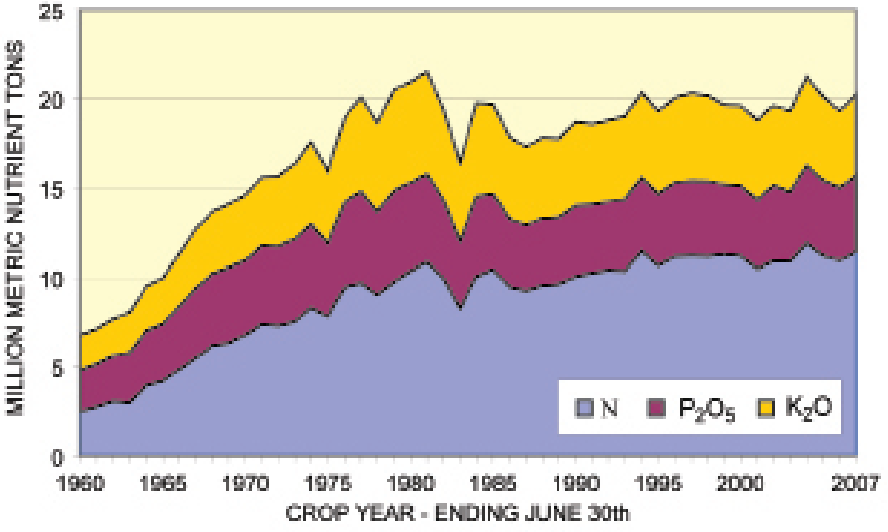
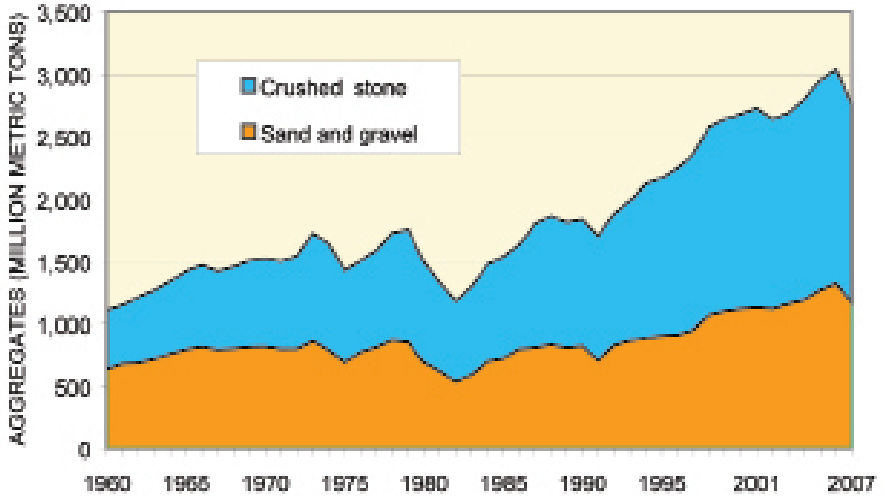


FIG. 10

U.S. production of crushed stone and sand and gravel from 1960 through 2007.



Significant international events

The year 2007 was characterized by a number of continuing trends — rapid economic growth in several populous developing countries, continuing high rates of increase of mineral consumption and continued high levels of mineral prices. The most noteworthy developments in 2007 were the increased concentration of ownership in the mineral industry (as already large companies combined through friendly and hostile acquisitions) and the rise in economic nationalism (resource nationalism) as countries attempted to secure control over a larger portion of the economic rents (financial returns) from mineral production.

Economic conditions. These trends were taking place in a world economy that was beset by growing economic difficulties. As 2007 began, much of the world was experiencing robust economic growth. This was especially true of four developing countries. China and India led the way with growth in the first quarter greater than 11 percent and 9 percent, respectively. Two other populous countries, Brazil and Russia, experienced significant but more moderate economic growth of 4.8 percent and 7.9 percent, respectively.

Economic growth in the developed countries was moderate. In the United States, the rate of economic growth declined from 3.1 percent in the fourth quarter of 2006 to 2.1 percent in the first quarter of 2007. The rate of growth in the European Union (EU) also declined slightly from 3.3 percent to 3 percent during the same period. Japan's real GDP increased slightly in the first quarter of the year from 2.3 percent to 2.6 percent. Chinese growth remained above 11 percent through the first three quarters of the year, but was accompanied by rising inflation as consumer prices increased from a monthly rate of 2.2 percent in January to 6.9 percent in November (*Economist*, 2007b).

To combat rising prices, the Chinese central bank raised interest rates three times during the first six months of the year (*Metals Insider*, 2007). However, interest rate increases barely kept up with the rate of inflation, leading the central bank to announce a new "tight" monetary policy (Batson, 2007) and to raise interest rates yet again (Areddy, 2007). India's rate of economic growth, which some analysts thought was unsustainable, cooled slightly to 8.9 percent in the third quarter (*Economist*, 2007c). India's monthly rate of increase in consumer prices, which was 6.7 percent in January, declined to 5.5 percent in October. Brazil's GDP grew at an estimated 5.3 percent for the entire year. However, Brazil, like China, faced increasing inflation concerns. Russia's rate of economic growth slowed slightly to 7.6 percent. And, like Brazil and China, Russia faced rising consumer prices and inflation. The EU and Japan experienced decreasing rates of economic growth in the second half of the year. The EU also experienced moderate but rising consumer prices. The EU and Japan were highly dependent on imports of mineral commodities as inputs to their manufacturing sectors and concerns about high prices were expressed at several conferences during the year.

In the United States, two factors threatened to reduce the rate of economic growth. The first factor was high oil prices. Rapid economic growth has led to increased consumption of petroleum in developing countries. Oil consumption in 2007 increased twice as fast as it had in 2006 (Bahree, 2007). However, a report by the International Energy Agency showed that, when adjusted for inflation, investment in oil and natural gas development was essentially at the same level as in 2000, notwithstanding a 9.3-percent increase in world oil consumption between 2000 and 2005 and a doubling of prices (Bahree, 2006).

The second factor was a shortage of credit that resulted from the downturn in the housing market. This threatened the soundness of subprime loans that had been issued on residential real estate (*Economist*, 2007a). Problems with subprime loans in the United States had far-reaching effects, as these loans had been bundled with other loans and sold widely through global financial markets.

In August, mining shares fell sharply on stock markets and base metal prices declined, as fears arose that a deepening credit crunch would curb demand growth (Cornish, 2007b). Stock prices recovered after central banks in the United States, Europe and Japan injected hundreds of billions of dollars of liquidity into the market. Problems with the solvency of loans in the subprime credit market have begun to restrict access of the mining sector to means of financing, according to bankers and analysts. Junior companies have been most affected (Dixon, 2007c).

Minerals markets

Commodity analysts have expressed divergent views on the long-term outlook for metal prices. One group of analysts forecast prices to decline toward long-term average prices. A second group forecast prices to remain at or above current levels due to continued rapid economic growth in developing countries such as China. The prices that mining companies are paying for mineral as-

sets (mineral projects or other companies) indicate that mining companies expect metal prices to remain high (Hinde, 2007b).

Costs of mineral exploration and development have risen dramatically in 2007. In particular, the costs of assaying, drilling, fuel and salaries for geoscientists have risen (Metals Economics Group, 2007). Production and shipping costs have also risen. An index of the cost of shipping bulk commodities has risen 169 percent during the last year. For example, the cost of shipping iron ore from Brazil to China has tripled during the past year. The cost of shipping iron ore, $88/t ($80/st), can sometimes exceed the price of the commodity, $60/t ($54/st)(Matthews, 2007).

Copper projects have been particularly affected by rising development costs. Recently, the Galore Creek project in Canada was canceled because of rising costs (Spicer, 2007). Costs at the nearly completed Cerro Corona and Magistral projects in Peru rose by 25 percent and 55 percent, respectively, and costs at the Tenke Fungurume project in Congo (Kinshasa) have risen by 38 percent. Costs at the large Oyu Tolgoi project in Mongolia have risen by an unstated amount (Dixon, 2007b; *Mining Journal*, 2007e, f, g).

The price of lump iron ore increased in 2007 as consumption of iron ore continued to increase owing to rapidly rising steel production. World steel production increased by about 45 percent from 2000 to 2006. Chinese steel production has more than tripled in the same period and now represents one-third of world production. During the same period, iron ore prices have increased by almost 170 percent.

Limits on access to transportation have affected iron ore production in Western Australia. Future production may be further limited by a recent ruling by the Environmental Protection Authority of Western Australia. It recommended that additional applications for iron ore mining permits in the Banded Ironstone Ranges in the Mount Manning Range be denied due to the exceptional biodiversity of the region (*Mining Journal*, 2007u).

High prices for iron ore are leading steelmakers to secure both supplies of coal and iron ore before they commit to building new plants (Dixon, 2007a; Parjia and Goswami, 2007). In addition, Tata Steel and ArcelorMittal have announced plans to invest in West African iron ore projects. Tata entered into an agreement to develop the Mt. Nimba project in Côte d'Ivoire, while ArcelorMittal was to increase its investment in Liberia (Dixon, 2007d).

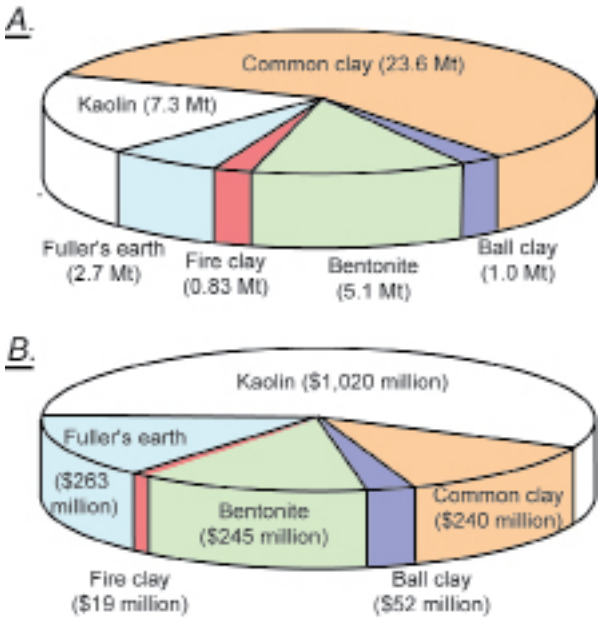
High iron ore prices have led to a major reordering of country costs of production. Production costs of steelmakers in the United States, which have their own sources of iron ore, have dropped relative to production costs in the EU, Japan and China (JP Morgan, 2007).

Indonesia, the second leading tin-producing country, has had problems controlling tin smuggling. A recent report suggests that the government may reduce export quotas from 120 kt to 90 kt (132,000 st to 91,000 st) in 2008 (Dixon, 2007e). Higher tin prices have led to the reopening of two tin mines in the United Kingdom that were forced to close when tin prices plummeted in the mid-1980s (Chadwick, 2007).

Economic development in India helped to increase India's gold consumption by 72 percent (221 t or 243 st) in the first half of 2007 relative to the same period in 2006

FIG. 11

U.S. production of clays by (A) quantity and (B) value in 2007.



(O'Connell, 2007). Gold prices rose to record highs due to high oil prices and the drop in the value of the U.S. dollar relative to other convertible currencies. The drop in the value of the U.S. dollar relative to the Australian dollar led Newmont Mining to announce that it had begun a currency hedging program to protect it from the changing exchange rate between the Australian and U.S. dollars. Newmont sells its product for U.S. dollars but pays its costs in Australian dollars. The increase in value of the Australian dollar relative to the U.S. dollar has reduced company profits (Chandler, 2007b; Hinde, 2007c)

Uranium (U_3O_8) prices rose rapidly during the first half of the year and dropped during the second half of the year. Rapidly increasing demand for uranium and limited supply raised spot prices to record levels several times during the year (*Mining Journal*, 2007o, r, s).

Mergers and acquisitions

The leading story in the mining industry at the end of 2007 was the proposed $142 billion purchase of Rio Tinto by BHP Billiton (BHP), announced in early November. The combination of the leading (BHP) and third ranked (Rio Tinto) mining companies in terms of market capitalization would create the world's leading producer of aluminum and copper, the second ranked iron ore producer and, potentially, the leading uranium producer (Singer and Matthews, 2007). The company also would have significant coal and diamond reserves. The resulting entity could have a market capitalization of about $320 billion. This would rank the company third behind Exxon Mobil ($499 billion) and Gazprom ($327 billion) among mining and oil companies. Traditionally, the mining industry has been considerably smaller than the oil industry.

In proposing the merger, BHP identified $3.7 billion of benefits that would result from the merger. Cost savings of $1.7 billion would result from improved efficiencies in transportation and $2 billion would result from increased production of mineral commodities during the

next seven years (Singer, 2007a). Rio Tinto's board of directors rejected the proposed offer (Hinde, 2007a) and later offered a plan to increase value for its shareholders (Chandler, 2007c; Singer, 2007b).

The proposed merger has caused concern in Asia among Chinese, Japanese and South Korean steel companies, which fear increased prices for iron ore (Hornby, 2007). Although BHP publicly announced its offer, it had not made a formal offer to Rio Tinto. As a result, Rio Tinto went to court and obtained an order that requires BHP to either make a formal offer or to walk away (*Reuters,* 2007a).

In addition to the proposed purchase of Rio Tinto, a number of other noteworthy mergers and acquisitions were initiated in 2007. Some included Rio Tinto's purchase of Alcan. United Company Rusal's purchase of 25 percent of MMC Norilsk Nickel, Lafarge SA's purchase of Orascom Cement, Tata Steel's purchase of the Corus Group and Norilsk Nickel's purchase of LionOre Mining International. There were a number of smaller mergers and acquisitions involving iron ore, nickel and uranium assets and a number of acquisitions involving copper assets in Congo (Kinshasa) and Peru, where Chinese companies obtained rights to two deposits through acquisitions.

Mergers and acquisitions have been proceeding at high levels for the last three years, both in the economy at large and in the minerals sector (Berman, 2007). Among the factors cited for the recent spate of mergers in the minerals industry are the expected metals demand from China and other developing countries, the large amounts of cash that companies are holding as a result of high prices of commodities and increased acquisitions by companies in developing countries, including Brazil, China, India and Russia.

The consolidation that is taking place in the mining industry has been compared with the consolidation that took place in the oil industry in the 1990s (Barta and Matthews, 2007). Like the consolidation in the oil industry, consolidation in the mining industry is unlikely to result in increased mineral exploration, which is conducted largely by junior companies that are funded with speculative capital (Bahree, 2007).

BHP's offer for Rio Tinto has raised concern that the offer may lead other big mining companies to propose additional mergers and acquisitions. As industry consolidation proceeds, policymakers and regulators may review the criteria that are appropriate for determining if and under what conditions proposed actions should take place.

Exploration

Global nonferrous mineral exploration budgets, excluding uranium, were expected to rise to $10.5 billion in 2007 from $7.5 billion in 2006. This is the highest level since the Metals Economic Group (MEG) began surveying companies about their intended expenditures in 1989. MEG estimated that budgeted uranium exploration spending in 2007 was almost $940 million.

Exploration budgets have increased for companies of all sizes. But those for small, or junior, exploration companies have increased the most (Metals Economics Group, 2007). Large companies typically expend only a small portion (1 percent to 2 percent) of their budgets on exploration and one large company actually decreased exploration expenditures recently (*Mining Journal*, 2007b).

Gold continued to attract the largest percentage of exploration budgets (41 percent).But this represented the smallest proportion since surveying began. Latin America continued to draw the largest expenditure of exploration funds.

Environment

Rapid economic development and rising mineral consumption led to growing environmental concern in countries such as China and India, as well as to renewed concerns about global environmental challenges such as the buildup of greenhouse gases in the atmosphere.

Rapid economic growth in China, especially the emphasis upon heavy industry and the use of coal as the country's main energy source, led to increased water and air contamination. Senior government officials called for reduction in industrial contamination. But the government was forced to shelve an attempt to account for the costs of such contamination in measuring the rate of economic growth due to complaints from provincial officials.

An additional problem stems from the fact that many of China's new industrial plants and new commercial and residential buildings do not incorporate or use energy-efficient features (Kahn and Yardley, 2007). Therefore, steel plants in China use more energy to produce a ton of steel than do steel plants in the EU, Japan or the United States. This has led the world's leading steel producer, ArcelorMittal, to call for setting an allowable limit on carbon dioxide emissions for each ton of steel produced, with credits being given to companies that produce below the limit and companies above the limit being forced to purchase credits (Blenkinsop, 2007). China's use of energy is now so great that it may have passed the United States as the leading emitter of carbon dioxide, one of the main greenhouse gases (*Reuters*, 2007b).

With the first commitments of the Kyoto Protocol set to expire in 2012, and rising greenhouse gas emissions from developing countries such as China and India, the EU and the United States have begun to discuss efforts to control emissions of greenhouse gases. In September, the United States convened a conference on global warming (Broder, 2007). Limits on carbon dioxide emissions are of special concern to the coal industry. An Australian court recently ruled against the plaintiff in a case that would have required Xstrata to "avoid, reduce or offset" greenhouse gas emissions from a new coal mining project. But the company remains concerned about the possibility that another court might rule differently on a similar case (Giglio, 2007f).

Government involvement

High mineral prices and mining company profits during the last few years have led host countries to want to capture a larger portion of the rents from minerals development for local and national economies. In some cases, this has resulted in direct expropriation of assets or of shares of companies. In other cases, it has involved the use of license revocation to accomplish the same purpose. Bolivia, China, Russia and Venezuela have been cited as countries in which mineral exploration is particularly risky owing to threats of such actions (*Mining Journal,* 2007d).

Bolivia enacted a new bill to raise taxes on mining companies and announced it was "recovering" the Vinto tin smelter, which had been privatized by a previous government. The owner of the smelter, Glencore International reportedly will fight the Bolivian government's expropriation (*Mining Journal*, 2007k).

Rosprirodnadzor is a Russian environmental agency that has previously revoked environmental permits. It began an examination of Highland Gold Mining's Mayskoye project. The announcement was enough to cause shares of the company to decline sharply (*Mining Journal*, 2007m).

In Venezuela, the Minister of Basic Industries and Mines, in reviewing the announced sale of assets of Gold Fields, stated that one of the assets, the Chaco 10 Mine, was not Gold Fields' asset to sell. Threats to nationalize the mining sector notwithstanding, Venezuela issued the final environmental approval for the Brisas project and the Ministry of the Environment and Natural Resources of Venezuela approved the Environmental Impact Statement (EIS) for Crystallex International's Las Cristinas project. Venezuela was expected to issue a new mining law at the end of 2007 that many feared would nationalize the mining industry (*Mining Journal*, 2007c, h, l).

Similar actions were also taken or proposed in Romania. There, the Minister of the Environment stopped the licensing process for the Rosia Montana project for an indefinite period due to a permit dispute (Giglio, 2007d). In Zimbabwe, a proposed Mines and Minerals Amendment Bill would give the government control of 51 percent of all mining companies. The proposed Zimbabwean bill requires companies to give the government 25 percent ownership allegedly without effective compensation. A further 26 percent interest would be paid for by the government with royalties earned from the first 25 percent (Giglio, 2007g).

Countries used a number of other tactics to increase rents on mineral production. For example, in Africa, reviews of mining deals were especially prevalent in 2007. Guinea and Tanzania began reviews of mining contracts, as did Congo (Kinshasa). The review in Congo (Kinshasa) reportedly was plagued by rumors, charges of conflict of interest on the part of western advisors, missed deadlines and leaked documents, which resulted in share losses for companies rumored to be affected by the review (Giglio, 2007b, e). The review and a $5-billion loan from the Chinese government led miners to question the fairness of the Congo (Kinshasa) government's policies (Chandler, 2007a).

More traditional methods of increasing rents from mineral production were used by Ecuador and Zambia. Ecuador reintroduced mining royalties five years after it eliminated them. Zambia announced that mining royalties were being raised from 0.6 percent to 3 percent, and that it was raising income tax rates on mining companies (Dixon, 2007f; *Mining Journal*, 2007j).

In a number of countries, including Brazil, Ecuador, El Salvador, Honduras, India and the Philippines, mining projects faced opposition from civil society groups.

Several governments rewrote or revised their mining laws. Australia ended a 25-year ban on uranium mining. Indonesia was in the process of revising its mining law and replacing it with a mining license that reportedly will be easier to alter and will be enforced for a shorter period. Nigeria passed new mining legislation and began to process exploration and mining permits. Peru passed a bill to speed up the rate at which 20 projects could proceed (*Mining Journal,* 2007a, i, q, r).

Afghanistan attempted to attract mineral investment by releasing a mineral-resource assessment that it had completed in cooperation with the USGS, and by auctioning the rights to develop the Aynak copper project. The China Metallurgical Group (CMG) won the right to develop the project (Giglio, 2007c).

Outlook

The future of metal prices, which largely hinges on the level of consumption in developing countries and the level of metal production, continues to be a much-debated topic. The USGS published outlooks for the production of a number of mineral commodities (Fong-Sam and others, 2007; Levine and others, 2007; Mobbs and others, 2007; Torres and others, 2007; and Yager and others, 2007). Based on these reports, it appears in the short- to medium-term that world mine capacity of bauxite, copper, iron ore, nickel and zinc will increase by about 8 percent, 3 percent, 4 percent, 7 percent and 2 percent per year, respectively.

An analysis by Credit Suisse (CS) reported that the increase of copper supply for 2008 could be as low as 2.3 percent, resulting in continued tight supply. Longer term, the report identifies 66 projects that could add 8 Mt/a (8.8 million stpy) that could ease supply tightness. Consumption has increased at 3.9 percent per year for the last 10 years. CS expects that projects beyond 2010 will be delayed by a year and will only reach 90 percent of planned capacity. This creates an increase of supply of only 3.6 percent per year. CS expects the increase in world demand, excluding China and India, to be no more than 1 percent per year. This would require annual consumption to increase by 9 percent in China and India to keep markets tight. For the past seven years, copper consumption has increased by an average of 14.3 percent per year in China and 8 percent per year in India (Cornish, 2007a).

Demand from Chinese steelmakers is expected to result in at least a 30-percent increase in iron ore prices in 2008, according to CS. The CS report states that "30-40 percent looks possible" (*Mining Journal*, 2007n). Some consumers have worried that if the BHP-Rio Tinto merger was to take place, prices could increase further. The high iron ore prices are causing steel companies to purchase iron ore resources.

The International Nickel Study Group reported that world consumption of nickel could rise by 10 percent in 2008 due to increasing demand for stainless steel in the United States and China. The group expects increasing consumption of nickel in China to decrease the current high level of stocks by 30 kt (33,000 st) to 100 kt (110,000 st) in 2008 (*Mining Journal*, 2007p).

Gold production is expected to continue to decline rapidly according to a number of large corporations. They note that higher prices could stimulate production (Giglio, 2007a).

This report is based on information prepared for or contained in the USGS Mineral Commodity Summaries 2008, which is accessible online through http://minerals.usgs.gov/minerals. Reference call citations are in the text. The list of references cited is available from the Minerals Information Team (Kathy Keys, kkeys@usgs.gov, 703-648-4961). Robert Callaghan prepared the final figures. More information is available online at the above Web site. ■

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Exploration Review

D.R. WILBURN, U.S. Geological Survey

This summary of international mineral exploration activities for the year 2007 draws upon available information from industry, literature and U.S. Geological Survey (USGS) specialists. The summary provides data on exploration budgets by region and mineral commodity, identifies significant mineral discoveries and areas of mineral exploration, discusses government programs affecting the mineral exploration industry and presents analysis of the mineral industry based upon these data.

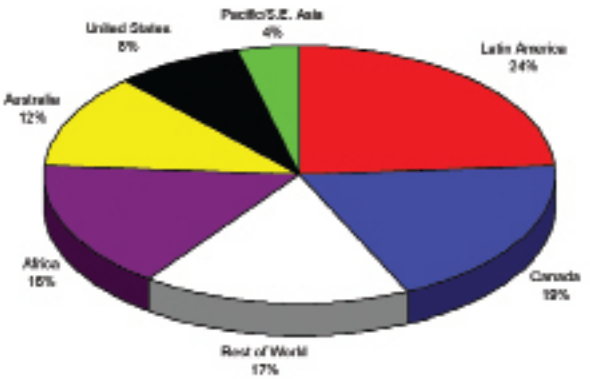
Two types of information are reported and analyzed in this annual review of international exploration for the year 2007: 1) budgetary statistics expressed in U.S. nominal dollars provided by Metals Economics Group (MEG) of Halifax, Nova Scotia, and 2) information on regional and site-specific exploration activities that took place in 2007 and compiled by the USGS.

The MEG information summarizes planned company budgets for worldwide exploration activities in 2007, primarily for precious metals (gold, platinum-group metals and silver) and base metals (copper, lead, nickel and zinc). Mineral exploration generally focuses on commodities that are more sensitive to anticipated demand or supply disruption (platinum-group metals) and/or have a high value per unit weight (gold). MEG includes information on additional mineral commodities only where it is available. Information on uranium exploration was included in the MEG overview for the first time in 2007, although this information was not included in the 2007 analysis. The MEG survey methodology was changed in 1999 to include companies with exploration budgets between $100,000 and $2.9 million, as well as those companies included in prior studies whose anticipated budgets were above $2.9 million. MEG estimates that their post-1999 surveys cover at least 90 percent of world nonferrous nonfuel mineral exploration budgets. The 2007 survey is reported by MEG to cover an estimated 95 percent. Companies who chose not to participate in the MEG study, private companies that do not publish data, and government-funded exploration activities make up the majority of the 5 percent. MEG included about 200 more companies in its 2007 survey than it did in 2006.

The worldwide budget for nonferrous nonfuel mineral exploration was expected to increase by about 40 percent in 2007 to about $10.5 billion from the 2006 budget of about $7.5 billion, according to MEG. This estimate is the highest level for anticipated expenditures in nominal (current) dollars since MEG began collecting such data in 1989. Mineral exploration spending has increased since 2002 because of generally higher metals prices, increased spending by mining companies and an increase in capital available to junior companies. As with previous MEG survey reports, estimates reflect anticipated expenditures rather than actual dollars spent. Caution, therefore, must

FIG. 1

Planned worldwide exploration budgets by region for 2007 (1,821 companies' budgets totaling US$9.99 billion). Source: Metals Economics Group.



be taken when comparing estimates or evaluating the magnitude of regional changes from year to year. Although sample variations and currency exchange rates may influence year-to-year variations of MEG data, it is likely that the climate of generally higher metal prices in 2007 and the limited number of new projects with world-class resources that are being developed have encouraged companies that had previously either discontinued mineral exploration or reduced their exploration activity to once again focus on minerals exploration or increase exploration activity and budgets.

Fluctuations in currency exchange rates and the value of trading currencies over time can influence the business pattern of foreign companies conducting business in other countries. Unless otherwise specified, this analysis does not take currency fluctuations into account and expresses worldwide exploration activity in U.S. nominal dollars to simplify comparisons by commodity and region. Ideally, annual exploration budget figures should be adjusted to an appropriate constant dollar equivalent before year-to-year comparisons are made. Depending upon the index selected, what might appear as an exploration budget increase when expressed in nominal dollars might actually be a decrease if expressed in constant dollars.

Although 2007 MEG budget estimates for reported gold-focused mineral exploration exceed base metal exploration budgets in dollars, the total 2007 budget for base metal exploration increased 56 percent, compared to an increase of 31 percent for gold exploration. Copper accounted for about 58 percent of the 2007 budget for base metal exploration, while the exploration budget for deposits with zinc (lead) as the primary target mineral increased 76 percent from 2006 and exploration budgets for nickel deposits increased about 50 percent from 2006. Budgets for other mineral targets (primarily cobalt, min-

eral sands and other industrial minerals, molybdenum and silver) increased 71 percent over the 2006 MEG estimate to $958 million. Silver accounted for more than 50 percent and molybdenum accounted for more than 20 percent of this estimate.

The 2007 MEG mineral exploration statistics suggest that budgeted expenditures for sites at an advanced stage of exploration accounted for about 41 percent of the total exploration budget for 2007, earlier-stage (grassroots) sites accounted for about 39 percent and deposits associated with established mine sites accounted for about 20 percent. Mine-site allocations in 2007 increased about 57 percent from 2006 estimates at the expense of advanced-stage, nonproducing projects. The increase in near mine site exploration perhaps reflects a focus of many mid- and large-size producers on exploration to replace or increase reserves depleted by mining using existing infrastructure in a climate of high metal prices, acquisition opportunities and a decline in world-class discoveries. Junior exploration companies account for about 60 percent of the budgeted exploration expenditures for grassroots projects and 63 percent for advanced stage exploration project budgets. Major and intermediate companies account for most of the near mine site exploration activity.

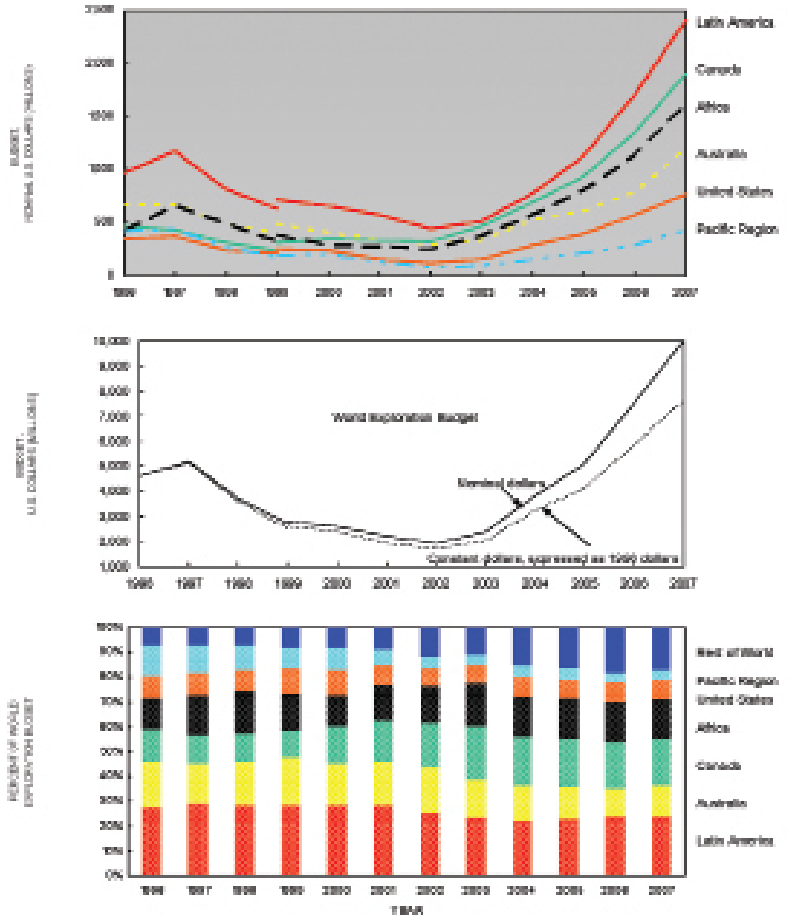
Figure 1 shows the 2007 worldwide minerals exploration budgets allocated by region, based on MEG data. According to MEG, the top three geographic areas for exploration in 2007 (excluding the rest of the world grouping), in decreasing budget order, were Latin America, Canada and Africa. MEG regions reflect a mixture of individual countries, continents and other groupings, but they are reported consistently on an annual basis and provide a means of assessing the flow of budgeted exploration expenditures from year to year. Regional budget allocation estimates derived from MEG data for 2007 were: Latin America, US$2.4 billion; Canada, US$1.9 billion; Africa, US$1.6 billion; Australia, US$1.18 billion; the United States, US$763 million and the Pacific region, US$431 million. Exploration taking place in countries included in the rest of the world category totaled US$1.7 billion. The exploration budget for Russia accounted for more than US$600 million in 2007, a 66-percent increase from 2006. The exploration budget for China accounted for about US$300 million, a 30-percent increase from 2006.

Care should be taken when performing temporal interpretations of the MEG exploration data, such as trend analyses, because the sample of mining companies surveyed by MEG varies with time, companies included in the survey change on a year-to-year basis, and fluctuation of currency exchange rates affect the relative value of budget estimates from year to year. Also, commodity and country coverage may vary from year to year. Post-1999 data reported in this summary differ from prior-year data in that a larger number of companies were included in the more recent survey results. The significant amount of corporate restructuring that took place since 1997 also affected statistical compilations.

USGS site compilations described here primarily include nonfuel minerals, with an emphasis on base metals, diamond and precious metals. Analyses are based on information provided by USGS mineral commodity and country specialists and by other USGS scientists, as well as industry contacts and trade journals.

FIG. 2

Trends in reported exploration budgets for nonfuel minerals in selected regions, 1996 to 2007. The break in the apparent trend in 1999 in the top and center figure reflects a change in data collection methodology. Source: Metals Economics Group.



2007 international mineral exploration budgets

MEG estimated the total 2007 international exploration budget for nonfuel mineral commodities (excluding iron ore and aluminum) to be US$10.5 billion. For the approximately 1,800 companies canvassed by MEG in its 2007 study, the total amount reported as budgeted for exploration in 2007 was about US$9.99 billion — 41 percent for gold, 36 percent for base metals, 10 percent for diamond, 3 percent for platinum-group metals and 10 percent for other mineral commodities.

MEG data illustrated in Fig. 2 indicate that planned exploration budgets (in nominal dollars) for 2007 increased from 2006 levels in all regions of the world. The general increase in spending since 2003 (as expressed in nominal and constant 1996 dollars) is attributed in part to higher metals prices, increased spending by junior

Table 1

Prices for selected base and precious metals, 1997 to 2007.

Commodity	Average price for specified year, in US$										
	1997[1]	1998[1]	1999[2]	2000[2]	2001[2]	2002[2]	2003[2]	2004[2]	2005[2]	2006[3]	2007[3]
Copper[4]	1.07	0.79	0.76	0.88	0.77	0.76	0.85	1.34	1.73	3.15	3.02
Gold[5]	332	295	280	280	272	311	365	411	446	606	675
Lead[6]	0.46	0.45	0.44	0.44	0.44	0.44	0.44	0.55	0.61	0.77	1.24
Nickel[7]	3.14	2.10	2.73	3.92	2.70	3.07	4.37	6.27	6.69	11.00	17.12
Palladium[8]	184	290	363	692	611	340	203	233	204	323	360
Platinum[9]	397	375	379	549	533	543	694	849	900	1144	1260
Silver[10]	4.89	5.54	5.25	5.00	4.39	4.62	4.91	6.69	7.34	11.61	13.45
Zinc[11]	0.65	0.51	0.53	0.56	0.44	0.39	0.41	0.52	0.67	1.59	1.54

[1] U.S. Geological Survey, 1999, Metal Prices in the United States through 1998, based on *Platt's Metal Week* quotations.
[2] Price reported in USGS Minerals Yearbook series for the years 2003, 2004 and 2005.
[3] Price reported in USGS Mineral Commodity Summaries series for the years 2006, 2007 and 2008 or updated based on oral and written communication, USGS mineral commodity specialists.
[4] U.S. producer cathode (99.99 percent-pure copper), reported in $/lb..
[5] Reported in $/oz.
[6] North American producer price, delivered (minimum 99.97 percent pure), in $/lb.
[7] London Metal Exchange cash price for primary nickel (minimum 99.80 percent pure), in $/oz.
[8] Unfabricated palladium, reported in $/oz.
[9] Unfabricated platinum, reported in $/oz.
[10] New York price (99.9 percent pure silver), reported in $/oz.
[11] North American dealers special high grade zinc (99.99 percent pure) delivered price, reported in $/lb.

companies driven by these higher prices and fueled by renewed investor confidence, and increased spending by the senior companies as they observed that only a limited number of new large-scale projects were in the development stage. Exploration allocations increased in 2007 from the 2006 level. In order of percentage change, the Pacific region (when Australia is excluded) increased 51 percent, Australia increased 50 percent; Africa, Canada and Latin America increased 40 percent; the United States increased 34 percent; and other regions, including mainland Asia, the Commonwealth of Independent States, Europe and the Middle East, together increased 33 percent.

In terms of nominal dollars budgeted for exploration, the largest regional budget increase of approximately US$690 million from 2006 to 2007 took place in Latin America, followed by an increase of US$540 million for Canada and US$460 million for Africa.

The data shift seen in Fig. 2 for 1999 reflects the previously mentioned change in MEG data reporting methodology. Companies individually budgeting between US$100,000 and US$2.9 million in annual exploration were included in the MEG survey for the first time in 1999.

Most metals prices in 2007 were higher than in 2006. The average 2007 lead price in nominal dollars increased 60 percent from the average price in 2006. The average nickel price increased 56 percent and the average silver price increased 16 percent. Gold, palladium and platinum prices increased about 11 percent over this same period. Average nominal prices for copper and zinc decreased about 4 percent and 3 percent, respectively, between 2006-2007, after a significant increase during the 2005-2006 period. Mineral prices have generally increased as a result of increased costs of acquiring mineral resources, increased demand for minerals, and the weakening of the U.S. dollar when compared with other international currencies. Table 1 shows the average prices of selected metals for the years 1997 through 2007.

Figure 3 illustrates the 2002-2007 distribution of reported mineral exploration budget estimates by mineral commodity grouping. Gold continued to draw the largest amount of the total exploration budget, about 41 percent of budgeted exploration funding in 2007. The amount budgeted for gold exploration (US$4.2 billion) based on MEG data is 31 percent higher in nominal terms than that budgeted for gold in 2006. But Fig. 3 shows that the amount budgeted for gold exploration targets has decreased as a percentage of the total exploration budget for each of the last three years, in spite of rising gold prices for that period.

Exploration budgets for base metal projects increased from US$2.29 billion in 2006 to US$3.57 billion in 2007 based on MEG data. Copper, at US$2.06 billion, accounts for approximately 58 percent of this total. The 2007, exploration budget for nickel projects was reported to be US$830 million, a 50-percent increase from 2006. The 2007 exploration budget for zinc exploration projects was US$680 million, up 76 percent from 2006. This increase for base metal exploration budgets primarily reflects the overall rise in base metal prices strengthened by increased Chinese demand for base metals.

Diamond exploration budgets increased 15 percent from US$860 million in 2006 to US$985 million in 2007, based on MEG data. But the total exploration budget for diamond projects dropped from 12.1 percent of the total mineral exploration budget in 2006 to about 10 percent in 2006. Activity was focused in Africa and Canada.

Exploration budget allocations for platinum-group metals increased about 35 percent to US$288 million in 2007, based on MEG data. As a percentage of overall spending, however, platinum-group metal exploration remained at about 3 percent for the second consecutive year. About 57 percent of this allocation was planned for South Africa, 14 percent for Canada and 13 percent for Russia.

The 2007 budget for silver exploration was estimated at US$520 million and the budget for molybdenum exploration was anticipated to approach US$200

million in 2007. The exploration budget allocated for mineral commodities other than gold, base metals, diamond and platinum-group metals involves the search for a variety of commodities, including cobalt, manganese, mineral sands, potash, tantalum, tin, tungsten and vanadium.

MEG provided separate estimates of uranium exploration budgets from 363 companies in 2007. The total amount allocated for uranium exploration in 2007 was US$936 million. MEG reported that uranium ex-

Table 2

Selected noteworthy exploration sites for 2007.

Location	Type[1]	Site	Commodity	Company	Resource[2] notes
Africa					
Botswana	E	Dukwe	Au	African Copper	580,000 oz Au
Congo (Kinshasa)	D	Tenke Fungurume	Cu, Co	Phelps Dodge	2.2Mt Cu, 310 kt Co
Congo (Kinshasa)	F	Twangiza	Au	Banro	3.9 Moz Au
Egypt	F	Sukari	Au	Centamin Egypt	7.5 Moz Au
Ghana	E	Ayanfuri	Au	Perseus Mining	640,000 oz Au
Guinea	E	Krouba	Au	Wega Mining ASA	Data not released.
Ivory Coast	E	Tengrela	Au	Perseus Mining	Data not released.
Ivory Coast	E	Tongon	Au	Randgold Resources	2.3 Moz Au
Mali	P	Loulo	Au	Randgold Resources	3.6 Moz Au
Senegal	D	Sabodala	Au	Mineral Deposits	2.7 Moz Au
Sierra Leone	E	Baomahun	Au	Cluff Gold	110,000 oz Au
South Africa	E	Kalahari	PGM	Platinum Australia	3.4 Moz 3PGE+Au
South Africa	E	Sedibelo	PGM	Barrick Gold	3.8 Moz Pt, 1.7 Moz Pd
South Africa	F	Spitzkop	PGM	Eastern Platinum	11 Moz 3PGE+Au
South Africa	F	Western Bushveld	PGM	Platinum Group Metals	7.3 Moz 3PGE+Au
Tanzania	F	Buckreef	Au	Iamgold	1 Moz Au
Tanzania	E	Kabanga	Ni, Cu, Co	Barrick Gold	230 kt Ni, 31kt Cu, 18 kt Co
Zambia	E	Kangaluwi	Cu	Zambezi Resources	Data not released.
Zambia	E	Mkushi	Cu	African Eagle Resources	78 kt Cu
Australia					
Northern Territory	E	Manbarrum	Zn, Pb, Ag	Tennant Creek Gold	310 kt Zn, 77 kt Pb, 1.8 Moz Ag
Queensland	E	Mt. Carlton	Au, Ag, Cu	Conquest Mining	1 Moz Au, 33 Moz Ag, 56 kt Cu
Queensland	E	Rocklands	Cu	Cudeco	510 kt Cu equivalent
South Australia	E	Carrapateena	Cu, Au	Teck Cominco	Data not released.
Western Australia	E	Cape Lambert	Fe	Cape Lambert Iron Ore	307 Mt Fe
Western Australia	E	Leonora area	Au	Navigator Resources	567,000 oz Au
Canada					
British Columbia	E	Copper Mountain	Cu	Copper Mountain Mining	841 kt Cu
British Columbia	E	Mt. Milligan	Cu, Au	Terrane Metals	700 kt Cu, 4.3 Moz Au
British Columbia	E	Storie	Mo	Columbia Yukon Explorations	68 kt Mo
British Columbia	E	Turnagain	Ni, Co	Hard Creek Nickel	800 kt Ni, 59 kt Co
Newfoundland/Labrador	E	Central Mineral Belt	U	Crosshair Exploration & Mining	Data not released.
Northwest Territories	E	Eldorado - Contact Lake	Cu, Au	Alberta Star Development	Data not released.
Northwest Territories	E	Prairie Creek	Pb, Zn, Ag, Cu	Canadian Zinc	See footnote 3.
Northwest Territories	E	WO	Diamond	Peregrine Diamonds	Data not released.
Nova Scotia	E	Jubilee	Zn, Pb	Merrex Gold	120 kt Zn, 27 kt Pb
Nunavut	E	Darby	Diamond	Teck Cominco	Data not released.
Nunavut	F	Hope Bay	Au	Miramar Mining	3.7 Moz Au
Nunavut	F	Meliadine West	Au	Comaplex Minerals	1.8 Moz Au
Ontario	E	Detour Lake	Au	Pelangio Mines	4.8 Moz Au
Ontario	E	Madsen	Au	Claude Resources	Data not released.
Ontario	D	Marathon	Pd, Pt, Au, Cu, Ag	Marathon PGM	See footnote 4.
Ontario	D	Podolsky	Cu, Ni, PGM	FNX Mining	26 kt Cu, 2.1 kt Ni, 55,000 oz PGM
Ontario	E	Rahill-Bonanza	Au	American Bonanza Gold	Data not released.
Ontario	E	Upper Beaver	Au, Cu	Queenston Mining	Data not released.
Quebec	E	Malartic	Au	Osisko Exploration	8.4 Moz Au (inferred)
Quebec	E	Westwood	Au	Iamgold	3.3 Moz Au
Saskatchewan	F	Fort à la Corne/Star	Diamond	Shore Gold	158,000,000 t kimberlite
Saskatchewan	P	Seabee/Santoy	Au	Claude Resources	211,000 oz Au (reserves)
Yukon Territory	E	Keno Hill	Au	Claude Resources	Data not released.
Yukon Territory	P	Minto	Cu, Au, Ag	Sherwood Copper	260 kt Cu, 300,000 oz Au, 3.2Moz Ag
Yukon Territory	E	Selwyn	Zn, Pb	Selwyn Resources	8.3 Mt Zn, 2.9Mt Pb

[1] D-Approved for development; E-Active exploration; F-Feasibility work ongoing/completed; P- Exploration at producing site.
[2] Based on 2007 data reported from various sources. Sites reflect measured + indicated resources unless otherwise noted.
[3] PGE+AU - Includes Pd, Pt, Rh, and Au; oz-troy ounce; Moz - million troy ounces; Mt - million metric tons; t- metric tons.
[4] Resource includes 2.2 Moz Pt, 670,000 oz Pd, 26,000 oz Rh, 240,000 oz AU, 240,000 t CU, 4.5 Moz Ag.

ploration has increased tenfold from a US$92-million estimate in 2003.

Analysis of exploration activity

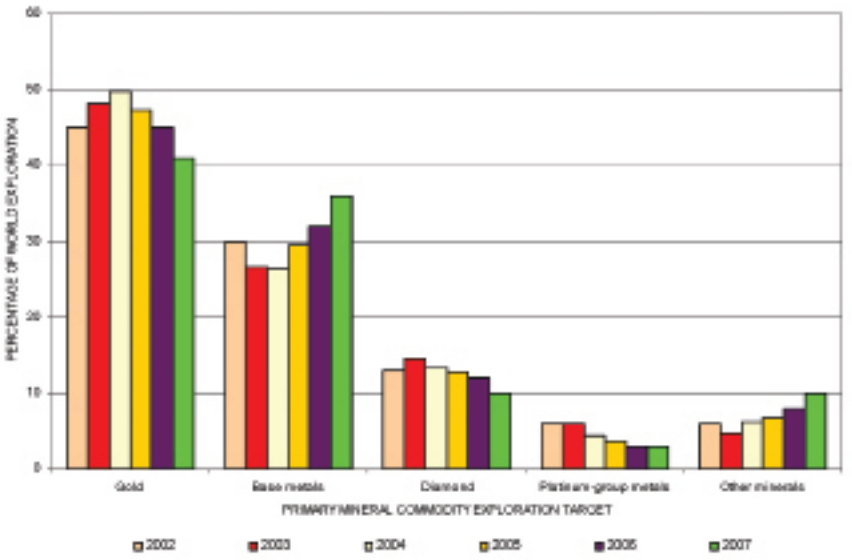
The worldwide exploration budget in nominal dollars during the last decade peaked in 1997 (Fig. 2) with increased exploration spending, primarily in Latin America and Africa. As shown in Fig. 4, about 63 percent of the total worldwide exploration budget in 1997 was allocated for generally less mature exploration provinces

Location	Type[1]	Site	Commodity	Company	Resource[2] notes
Latin America					
Brazil	E	Santa Fé/Iporá	Ni, Co	Int'l. Nickel Ventures	410 kt Ni, 29 kt Co
Chile	E	Relincho	Cu, Mo	Global Copper	2.6 Mt Cu, 120 kt Mo
Chile	E	Volcan	Au	Andina Minerals	2.9 Moz Au
Colombia	F	Angostura	Au, Ag	Greystar Resources	10 Moz Au, 53 Moz Ag
Dominican Rep.	E	Pueblo Viejo	Au, Ag	Barrick Gold	2.1 Moz Au, 7.6 Moz Ag
Ecuador	F	Gaby	Au	International Minerals	Data not released.
Guyana	E	Tassawini	Au	Stratagold	210,000 oz Au
Mexico	P	Bolivar	Cu, Zn	Dia Bras Exploration	16.6 kt Cu, 18.6 kt Zn
Mexico	E	Cusi	Ag, Au, Cu	Dia Bras Exploration	Data not released.
Mexico	E	Guadalupe	Au, Ag	Palmarejo Silver & Gold	49,000 oz Au, 3.8 Moz Ag
Mexico	E	Juanicipio	Au, Ag	Mag Silver	Data not released.
Mexico	F	Morelos	Au	Teck Cominco	Data not released.
Mexico	E	San Anton	Au, Ag, Cu	San Anton Resources	3.3 Moz Au, 135 Moz Ag, 320 kt Cu
Mexico	E	San Miguel	Au	Paramount Gold Resources	35 Moz Au (inferred)
Mexico	E	Tres Marias	Zn, Ge	War Eagle Mining	Data not released.
Mexico	E	Velardeña	Au, Ag	ECU Silver Mining	64,000 oz Au, 8 Moz Ag
Panama	E	Molejon (Petaquilla)	Au	Petaquilla Minerals	910,000 oz Au
Peru	E	Antapacca	Cu	Xstrata Copper	3.5 Mt Cu
Peru	E	Constancia	Cu, Mo, Ag	Norsemont Mining	370 kt Cu, 9.1 kt Mo, 9 Moz Ag
Peru	E	Galeno	Cu, Au, Ag, Mo	Northern Peru Copper	See footnote 5.
Peru	E	Las Bambas	Cu, Mo, Au	Xtrata	See footnote 6.
Peru	P	Marcona	Cu	Chariot Resources	2.5 Mt Cu
Peru	E	Pinaya	Au, Cu	Acero-Martin Exploration	500,000 oz Au, 122 kt Cu
Peru	E	Pukaqaqa	Cu, Au, Mo, Ag	Tiomin Resources	See footnote 7.
Venezuela	E	Increible 6	Au	Rusoro Mining	1.7 Moz Au
Pacific region (Including Southeast Asia)					
Korea, South	E	Sangdong	W, Mo	Oriental Minerals	17.7 kt WO3, 2.3 kt MoS2
Papua New Guinea	E	Mt. Kare	Au, Ag	Madison Minerals	1 Moz Au, 6.2 Moz Ag
Papua New Guinea	E	Solwara 1	Cu, Au, Ag, Zn	Nautilus Minerals	See footnote 8.
United States					
Alaska	F	Donlin Creek	Au	NovaGold Resources	29.4 Moz Au
Alaska	E	Pebble East	Au, Cu, Mo	Northern Dynasty Minerals	40 Moz Au, 19 Mt Cu, 1.2 Mt Mo
California	D	Mesquite	Au	Western Goldfields	3.6 Moz Au
Michigan	E	Back Forty	Zn, Au, Ag	Aquila Resources	350 kt Zn, 490,000 oz Au, 6 Moz Ag
Minnesota	E	Birch Lake	Cu, Ni	Franconia Minerals	380 kt Cu, 130 kt Ni
Nevada	D	Cortez Hills	Au	Barrick Gold	11 Moz Au
Nevada	D	Hycroft	Au	Allied Nevada Gold	1 Moz Au
Nevada	E	Pumpkin Hollow	Cu, Au, Ag	Nevada Copper	2 Mt Cu, 630,000 oz Au, 27 Moz Ag
Rest of the world					
China	E	Dachang	Au	Inter-Citic Minerals	2 Moz Au (Inferred)
China	E	Fuwan	Ag, Au	Minco Silver	71 Moz Ag, 80,000 oz Au
China	E	Tanjianshan (TJS)	Au	Eldorado Gold	1.4 Moz Au
China	E	Yellow Mountain	Ni, Cu, Co	GobiMin Inc.	53 kt Ni, 35 kt Cu, 3.1 kt Co
China	E	Zheng Guang	Au, Ag, Zn	Leyshon Resources	890,000 oz Au, 2.5 Moz Ag, 64 kt Zn
Mongolia	E	Javkhlant (Heruga)	Cu, Au	Ivanhoe Mines	Data not released.
Pakistan	E	Reko Diq	Au, Cu	Barrick Gold	9.6 Moz Au, 6.8 Mt Cu
Romania	E	Rovina/Colnic	Au, Cu	Carpathian Gold	1.5 Moz Au, 340 k Cu (inferred)
Russia	E	Federova	PGM	Barrick Gold	6.5 Moz Pt, 600,000 oz Pd
Russia	E	Prognoz	AgHigh	River Gold Mines	71 Moz Ag
Turkey	E	Agi Dagi	Au, Ag	Fronteer Development	1.1 Moz Au, 6.5 Moz Ag
Turkey	F	Cöpler	Au, Ag	Anatolia Minerals	2.8 Moz Au, 7.3 Moz Ag
Turkey	F	Efemçukuru	Au	Eldorado Gold	1.4 Moz Au
Turkey	E	Kirazli	Au, Ag	Fronteer Development	350,000 oz Au, 1.9 Moz Ag

[5] Resource includes 3,800,000 t Cu, 2.9 Moz Au, 66 Moz Ag, 110,000 t Mo.
[6] Resource includes 5,800,000 t Cu, 110,000 t Mo, 1/8 Moz Au.
[7] Resource includes 550,000 t Cu, 290,000 oz Au, 10,000 t Mo, 5.4 Moz Ag..
[8] Resource includes 59,000 t Cu, 130,000 oz Au, 640,000 oz Ag, 3,500 t Zn.

FIG. 3

Worldwide exploration budgets by primary target, 2002 to 2007. Source: Metals Economics Group, 2006.



(areas where the geology and mineral potential are less well known) in Africa, Asia, Europe, Latin America, the Pacific and the Commonwealth of Independent States, including Russia. From 1998 to 2003, exploration in these less mature areas decreased in favor of areas that have undergone intensive past exploration, such as Australia, Canada and the United States.

After 2003, the general trend again appears to favor less mature areas, whose share of the world exploration increased from about 56 percent of the total exploration budget in 2003 to about 62 percent in 2006, with a corresponding 6 percent decrease in the percentage for more-mature areas over the three-year period. For 2007, the budget allocation for less mature areas totaled 61 percent, while the budget allocation for more mature areas as defined above was 39 percent, or about the same as 2006. Exploration activity in both areas typically includes greenfield and advanced-stage projects. It may be that a greater number of projects in the areas previously considered less mature have now reached an exploration level that justifies the use of more expensive exploration techniques or that more remote areas require larger expenditures for infrastructure development.

It is also possible that there is a correlation between mineral exploration activity, political changes and the knowledge base of the exploration teams. MEG data suggest that since 1991, with the breakup of the Soviet Union and relaxation of some restrictions on foreign company access to mineral data, there was an increase in the number of Russian companies formed to conduct mineral exploration. There has been a similar increase in the formation of Chinese companies since 2001 and Southeast Asian companies since 2005. It would, therefore, seem likely that these exploration companies would focus their efforts in areas where their exploration teams have experience. Thus, an increase in Russian exploration would have taken place in the mid-1990s, an increase in Chinese exploration would have taken place early in the current decade and resurgence in exploration within the Pacific Region may now be taking place.

For 2007, information on about 2,700 exploration sites was gathered from literature, industry and USGS specialists. The regional distribution of these exploration targets is represented in Fig. 5, based on the number of projects reported for each region. The distribution in terms of percent of the total in 2007 was about the same for all regions as the distribution in 2006, with the exception of Australia and Latin America trading places in the second and third spots of the regional ranking based on reported number of exploration sites.

Table 2 presents exploration sites considered most noteworthy in 2007, based on the following criteria:

- The high level of exploration interest at the site, determined either by intensity of drilling activity or level of capital investment. When drilling was used as the sole indicator, a site required a minimum of 19,000 m (62,300 ft) of drilling to meet the selection criteria.
- The magnitude of resource delineated.
- The high potential of near-term development, based on reported tonnage and grade estimates derived from company announcements.

Similar criteria have been applied to previous exploration summaries reported annually in the USGS Minerals Yearbook series and by *Mining Engineering*. Each of these exploration sites represents a new or recent discovery, a delineation of a new ore zone or a significant reported increase in resources in 2007. Sites undergoing preproduction development or currently producing were excluded from this list unless significant reserves/resources were delineated in 2007 by exploration activity.

Gold continued to be the commodity most sought after, as shown in the list of noteworthy exploration sites for 2007. Of the 100 selected sites reported in Table 2, 52 sites are for gold, 32 sites for base metals, six sites for platinum-group metals, four sites for other minerals, and three sites each for silver and diamond. Determination of the primary commodity was based on consideration of the value of the contained resources at each site.

The estimated resources reported in Table 2 reflect various stages of verification, different methodologies and multiple sources of information. Should these resources be confirmed, however, they would add about 53 Mt (58 million st) of copper, about 14 Mt (15.4 million st) of lead and zinc, 1.6 Mt (1.7 million st) of nickel, 17.4 kt (560 million oz) of silver, 6.6 kt (211 million oz) of gold and 1.2 kt (37 million oz) of platinum-group metals to the identified world resources for these mineral commodities. For comparison, the USGS reported a 2007 world reserve base of 940 Mt (1.03 billion st) of copper, 480 Mt (529 million st) of zinc, 150 Mt (165 million st) of nickel, 570 kt (17 billion oz) of silver, 90 kt (2.9 billion oz) of gold and 80 kt (2.5 billion oz) of platinum-group metals and a 2007 apparent consumption of 2.3 Mt (2.5 million st) of copper, 1.18 Mt (1.3 million st) of zinc, 112 kt (123,000 st)

of primary nickel, 8 kt (257 million oz) of silver and 190 t (6.1 million oz) of gold.

A historical summary for exploration activity in selected regions is shown in Fig. 6 for the period 1997-2007. These regions illustrate representative differences between viewing exploration activity in terms of budget allocation and the number of active exploration sites. Data in Fig. 6 are expressed as a percentage of world activity either based on budget allocation share reported by MEG or the number of sites compiled by the USGS from various sources. Latin America's percentage of the world nonfuel minerals exploration budget has leveled off at slightly less than 25 percent of the world's mineral exploration budget since 2003, compared to an average 17 percent share in terms of the percentage of sites being explored for the same period, in spite of growing worldwide exploration activity as indicated by both measures. This suggests that the amount of money spent on a typical Latin American site in 2007, on average, has remained relatively constant since 2003. It also may suggest that some exploration companies are focusing their efforts on re-exploring sites previously identified rather than exploring for new sites, because such efforts have proven to be less costly or more successful. In general, junior companies were exploring at new locations while more senior companies were focusing at established exploration site locations in Latin America.

In the Pacific region (excluding Australia), budget allocation percentages are also higher than the percentage allocation suggested by the number of sites undergoing exploration activity. Since about 2000, however, the percent allocation of the total exploration budget in the Pacific region has decreased from more than 8 percent to about 4 percent, although the percentage allocation of the number of sites being explored has leveled off at or slightly below 4 percent. This suggests that in spite of higher metals prices, exploration companies, on average, are spending less money per typical Pacific region site in 2007 than they were in 2000. The Busang (Bre-X) controversy of 1997, regional unrest and political conditions may have affected investment in the region.

Since 2000, the percent share of the total exploration budget targeted for countries not included in other regional assessments (part of mainland Asia, the Commonwealth of Independent States, Europe and the Middle East) has generally increased from about 8 percent to more than 17 percent in 2007. The share of exploration sites attributed to this region increased steadily from about 7 percent in 2002 to more than 13 percent in 2005. This allocation measure has since decreased to about 10 percent on 2007. Even so, the amount of variation between these two measures continued to increase, suggesting that more money is being allocated on a typical site basis in these countries as a whole in 2007 than in other years since 2000. The expansion of exploration opportunities for foreign investors in the Commonwealth of Independent States during the 1990s and China during the current decade may have affected exploration activity in these regions. The increasing demand for raw materials by China and India also may have affected regional exploration activity.

Table 3 shows the number of noteworthy sites by region for the years 1997 to 2007. In terms of noteworthy sites being explored in 2007, most regions are close to the percentage they were in 2006, with a slight increase in the number attributed to Canada and the United States and a slight decrease in the number of significant projects attributed to Africa and the Pacific region.

General trends in mineral exploration

The MEG data suggest that, while commodity prices and exploration budgets are generally increasing, the overall makeup of exploration spending by the industry is changing. According to MEG, exploration spending by junior companies has increased by 600 percent since 2002, or much of the overall increase in exploration allocations for all companies between 2002 and 2006. Relatively high commodity prices make it easier for smaller companies to obtain exploration capital as financial institutions and other entities are more willing to invest in higher risk projects of less established companies, while larger companies focus on development of larger, more expensive projects with established resources. The acquisition of smaller companies by larger ones in an attempt to increase synergies or combining resources of adjacent mineral holdings to produce a project with a greater likelihood of economic success has increased industry consolidation. MEG's data suggest that consolidation's effect on exploration has reduced the total amount budgeted for mineral exploration, if the sum of the anticipated budgets for the unconsolidated companies is compared to the actual budget of the consolidated company. On average, the actual budget of a consolidated company was found to be less than the sum of the projected budgets reported

Table 3

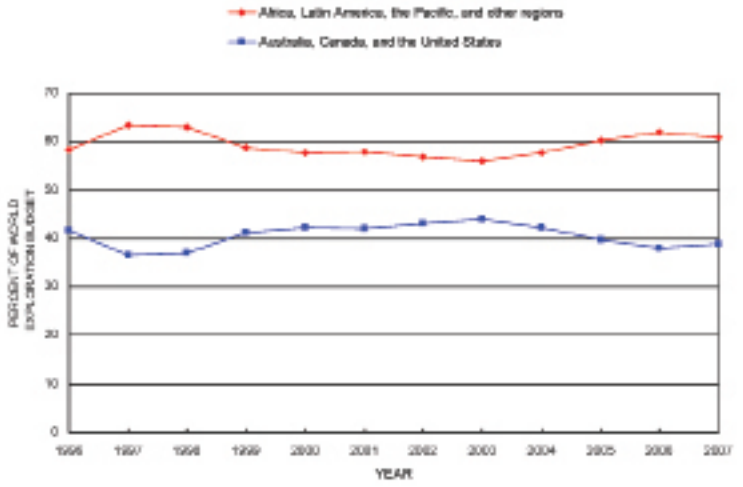
Noteworthy exploration sites by region for the years 1997 to 2007.

Region	1997	1998	1999	2000	2001	2002[2]	2003	2004	2005	2006	2007
Africa	13	20	10	17	11	16	16	20	18	21	19
Australia	8	4	11	12	21	20	10	4	10	6	6
Canada	24	19	20	15	17	19	31	28	22	24	25
Latin America[3]	26	29	27	24	17	15	19	21	29	25	25
Pacific[4]	10	9	7	10	12	4	4	4	4	4	3
United States	13	10	16	14	10	6	12	12	4	6	8
Rest of the world[5]	6	9	9	8	12	10	8	14	13	14	14

[1] Based on data developed by the USGS and appearing in Table 2 of the exploration summary discussion published in the May issue of *Mining Engineering* for the years 1998–2007.
[2] Only 90 noteworthy exploration sites met the selection criteria for 2002.
[3] Including Central America, Mexico and South America.
[4] Including Southeast Asia and islands in the Pacific Ocean.
[5] Including China, the Commonwealth of Independent States, Europe, India, the Middle East, Mongolia and Pakistan.

FIG. 4

Trends in reported exploration budgets, 1996 to 2007. Source: Metals Economics Group.



for the companies that were consolidated.

Even as worldwide exploration allocations have increased, so too have costs associated with mineral exploration. The increased demand for services such as drilling and assaying has led to equipment shortages or processing delays, affecting exploration schedules or development plans. Rising energy, material and personnel costs and changing rates of exchange have also affected the costs of exploration beyond overall inflation. Higher costs make it unlikely that the growth in actual exploration activity has kept up with the substantial increase in exploration budgets over the past few years.

Higher metals prices have or are currently prompting governments in some mineral-rich countries to consider drawing increased revenue from the minerals sector. Specific actions are discussed in the regional analyses, but various forms of increased taxation and industry nationalization are being considered.

Equipment manufacturers are also seeking ways to benefit from increased exploration activity since 2003, to the point of adding exploration-oriented divisions to their existing structures. Because surface and underground drilling accounts for a significant proportion of exploration cost, drilling equipment suppliers, such as Atlas Copco, Boart Longyear and Sandvik, are all expanding their product lines and increasing spending on drill research and design. A recent study compiled by the Canadian government suggests that drilling is the most important cost component in the discovery and delineation of a mineral deposit, accounting for more than 50 percent of the total cost of the exploration phase. This study also suggests that geoscientific surveys (including geochemical, geologic and geophysical surveys) constitute a growing cost component of mineral exploration. In 2006, such surveys accounted for more than 27 percent of the total amount spent in Canada on mineral exploration. There appears to be a growing dependence on remote sensing technology and computer automation and simulation techniques, in part to compensate for increased concern for worker safety and a shrinking experienced workforce. Exploration data collection and management procedures are also receiving increased interest by equipment suppliers, mining companies and regional governments.

Increased exploration activity has been fueled in part by surging industrial demand from China and, to a lesser extent, India and Eastern Europe. China's demand for raw materials has grown as the country moves from an agricultural-based economy to an industrialized one and as the number of Chinese middle class consumers increases. China has been preparing to open its minerals sector with significant resource potential to foreign investment since 2005, but the process began slowly. Chinese companies have attempted to meet increased demand for raw materials, with particular emphasis on copper, iron ore and lead, by acquiring mineral exploration and production companies, establishing supply contracts with mineral producers and expanding exploration activities outside of China. It is not surprising, therefore, that Chinese companies are focusing their efforts on projects in countries in need of capital, those with reliable transportation infrastructure and those willing to establish long-term supply relationships with China. Consequently, new exploration is occurring in areas traditionally perceived by Western companies to have higher political risk, including Afghanistan, the Democratic People's Republic of Korea, Burma (Myanmar) and Pakistan.

Regional exploration activities

Exploration-related activities and events within each region are summarized below. The order of regional and country discussions is based on the amount budgeted for exploration in 2007 from highest to lowest.

Latin America. Latin America continued its leading position as a destination for exploration activity based on MEG budget data and the number of noteworthy sites being evaluated in the region. On the basis of data compiled for this review by the USGS, Latin American countries with the greatest exploration activity were, in descending order by number of sites for which data were compiled, Mexico, Brazil, Peru, Argentina and Chile. Mexico, Peru, Chile and Brazil also were ranked in MEG's top 10 country list for anticipated exploration spending in 2007. Gold attracted about 52 percent of total exploration activity, but interest in base metals reached 24 percent and silver achieved about 14 percent of the total. Investment in 2007 was primarily used to further define newly discovered resources (84 percent), conduct exploration at a producing site (8 percent), conduct feasibility studies of promising discoveries (6 percent) and further explore for resources of deposits under development (2 percent).

Exploration activity in Mexico has focused on gold and silver projects for many years, with more than 70 percent of the currently active exploration projects in Mexico focusing on these precious metals. High base metals prices have increased interest in deposits rich in base metals. Copper deposits account for 13 percent and polymetallic base metal deposits account for an additional 9 percent of the active exploration projects. Precious metal exploration, principally by Canadian junior exploration companies, has in recent years focused on the Sierra Madre mineral belt in central and western Mexico, as evidenced by the many new mines and advanced exploration projects occurring within the region. Of the 210 foreign companies active in the Mexican mining sector,

Canadian companies account for 75 percent.

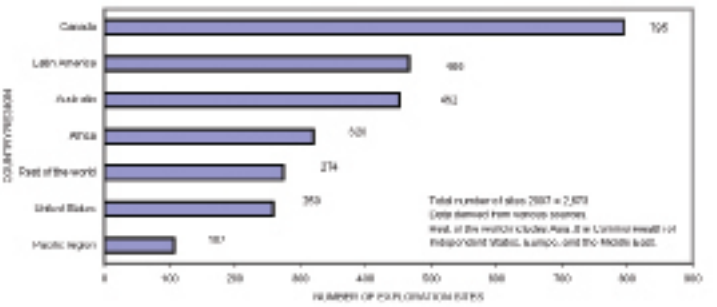
Canada. Statistics as of November 2007, released by the Canadian government, show anticipated 2007 exploration spending at C$2.5 billion (US$2.3 billion), up 33 percent from an expenditure of C$1.9 billion (US$1.7 billion) for 2006. MEG reported budgeted exploration spending in Canada for 2006 at US$1.9 billion, or about 19 percent of the estimated overall worldwide exploration budget. Canadian statistics include expenditures for coal, industrial minerals and uranium exploration, which are excluded from these MEG estimates. It is also important to note that the total revised spending intention for Canada reported by Natural Resources Canada in November was 35 percent higher than its March 2007 estimate. In 2006, precious metals (gold and silver) accounted for C$725 million; base metals, C$412 million; diamond, C$342 million and uranium C$214 million of the C$1.9 billion exploration total. Although data are not yet available, it is anticipated that Canadian coal, industrial mineral and uranium exploration in 2007 surpassed the level of exploration reported for 2006, thereby reducing the anticipated Canadian total (when these commodities are excluded) from the reported C$2.5 billion to about C$2.2 billion (US$2 billion), or within 5 percent of the 2007 value of $1.9 billion reported by MEG.

Exploration spending intentions for 2007 as reported by the Canadian government as of November 2007 were greatest in Ontario (about 20 percent of total exploration and deposit appraisal spending intention of Canada), British Columbia (17 percent), Quebec (15 percent), Saskatchewan (11 percent), Nunavut (10.5 percent), Northwest Territories (7.5 percent) and Newfoundland/Labrador (6 percent). Canadian provinces or territories with a 50-percent or more increase in exploration activity in 2007 from 2006 based on reported November 2007 budget estimates were Nova Scotia (+145 percent), New Brunswick (+128 percent), Manitoba (+95 percent), Newfoundland/Labrador (+59 percent) and Ontario (+50 percent). Alberta (-7 percent) was the only Canadian province for which an estimated reduction in 2007 exploration budget was reported. But this region saw a sizable increase in exploration between 2005 and 2006. Junior exploration companies accounted for about 61 percent of total expenditures in 2007 compared with 41 percent in 2003, 51 percent in 2004, 61 percent in 2005 and 65 percent in 2006. Precious metals received the largest exploration budget, followed by base metals, diamonds and uranium in terms of mineral commodities sought.

Canadian provinces or territories with the greatest exploration activity, in descending order by number of sites as compiled by the USGS, were Ontario, Quebec, British Columbia, Saskatchewan, Yukon Territory and Manitoba. Based on the site data, exploration for gold accounted for approximately 37 percent of 2007 Canadian exploration. Copper accounted for about 15 percent, uranium 14 percent, nickel 10 percent, lead and zinc 8 percent and diamond 6 percent. Approximately 79 percent of all reported exploration sites were considered early-stage sites. Canadian gold exploration activity based on the number of sites in 2007 for which data were collected focused primarily on Ontario, Quebec and British Columbia. Base metals exploration focused on British Columbia, Ontario, Quebec and Manitoba. Diamond exploration focused on Northwest Territories, Nunavut and Ontario. Uranium exploration focused on Saskatchewan, Quebec, Newfoundland, Ontario and Nunavut.

FIG. 5

Number of reported exploration sites compiled by the U.S. Geological Survey.



Africa. According to MEG, African exploration budgets increased from about $1.1 billion in 2006 to $1.6 billion in 2007, a 40-percent increase. The Africa exploration share of total budgeted exploration spending remained at about 16 percent in 2007. In 2007, the principal mineral commodities of interest in Africa were copper, diamond, gold, uranium and platinum-group metals. Gold targets accounted for approximately 48 percent of reported African exploration projects, copper and diamond each represented about 12 percent, uranium made up about 8 percent and platinum-group metals made up about 7 percent. Early-stage projects comprised about 74 percent of the 2007 activity, while feasibility stage projects represented about 16 percent. Exploration was focused primarily in South Africa, Mali, Ghana, Zambia, Congo (Kinshasa), Tanzania, Namibia, Botswana, Guinea and Mozambique, based on the number of sites. But activity also took place in a number of other countries.

The amount of foreign direct investment (FDI) in Africa doubled between 2004 and 2006 as a result of high commodity prices and buoyant demand from emerging economies, much of this owing to increased interest in natural resources in the region. Available data suggest that the pattern of African mineral exploration investment in 2007 varied significantly from country to country.

Data released by Natural Resources Canada suggest that more than 100 Canadian exploration and mining companies were active in projects in 37 African countries. Canadian spending on exploration accounted for more than C$278 million in Africa in 2007 or an estimated 24 percent of all African exploration spending. Canadian-capitalized companies are set to invest an additional C$46 billion into mining ventures in Africa over the next four to five years. Canadian companies have expanded their exploration into countries such as Burkina Faso, Kenya, Madagascar and Tanzania, where technological advances have aided in the discovery of base and precious metals, cobalt, heavy minerals and uranium.

Australian companies have also focused on Africa. BHP Billiton allocated about A$150 million (US$130 million) of its A$800 million (US$670 million) exploration budget to Africa, focusing on Angola, Congo (Kinshasa) and Guinea.

The period 2006-2007 saw an increase in extractive industry investment in Africa's least developed countries, such as Ethiopia and Madagascar, in the amount of US$8 billion in 2006, following two successive years of decline. These countries accounted for about 23 percent of the total FDI inflow to the region. Asian countries accounted for more than half of such investment in Africa. Transnational corporations from Singapore, India, Malaysia, China, the Republic of Korea and Taiwan were the top Asian investors to Africa's least developed countries. Interest in African natural resources also was shown by European and Russian interests. The International Finance Corp. reportedly will spend 75 to 85 percent of its 2007 investments in the mining sector on projects in Africa.

Australia. Exploration budget allocations reported by MEG for Australia showed an increase from $784 million in 2006 to $1.18 billion in 2007, increasing slightly from 11 percent of the world exploration budget in 2006 to 12 percent in 2007. The Australian Bureau of Agricultural and Resource Economics (ABARE) reports minerals exploration (excluding energy) expenditures for the fiscal 2006-2007 year (as of the September quarter, projected for the entire year) of about A$1.4 billion (US$1.2 billion). This was an overall increase of about 38 percent from the A$1 billion (US$800 million) reported for 2005-2006, as compiled by the Australian Bureau of Statistics.

Although the estimated expenditures for gold exploration accounted for 32 percent of the total Australian expenditure for non-energy metals and minerals, gold exploration, in nominal terms, only increased about 14 percent in 2006-2007 to A$460 million (US$390 million). In contrast, the estimated expenditure for copper exploration increased 68 percent to A$230 million (US$200 million) in 2006-2007, exploration expenditures for iron ore increased 77 percent to A$290 million (US$240 million) and exploration expenditures for silver, lead and zinc increased 96 percent to A$140 million (US$120 million). Western Australia's share of the Australian mineral exploration expenditure accounted for 49 percent; Queensland accounted for about 16 percent; South Australia accounted for about 15 percent; New South Wales, 8 percent; Northern Territory, 6 percent; Victoria, 5 percent and Tasmania, 1 percent.

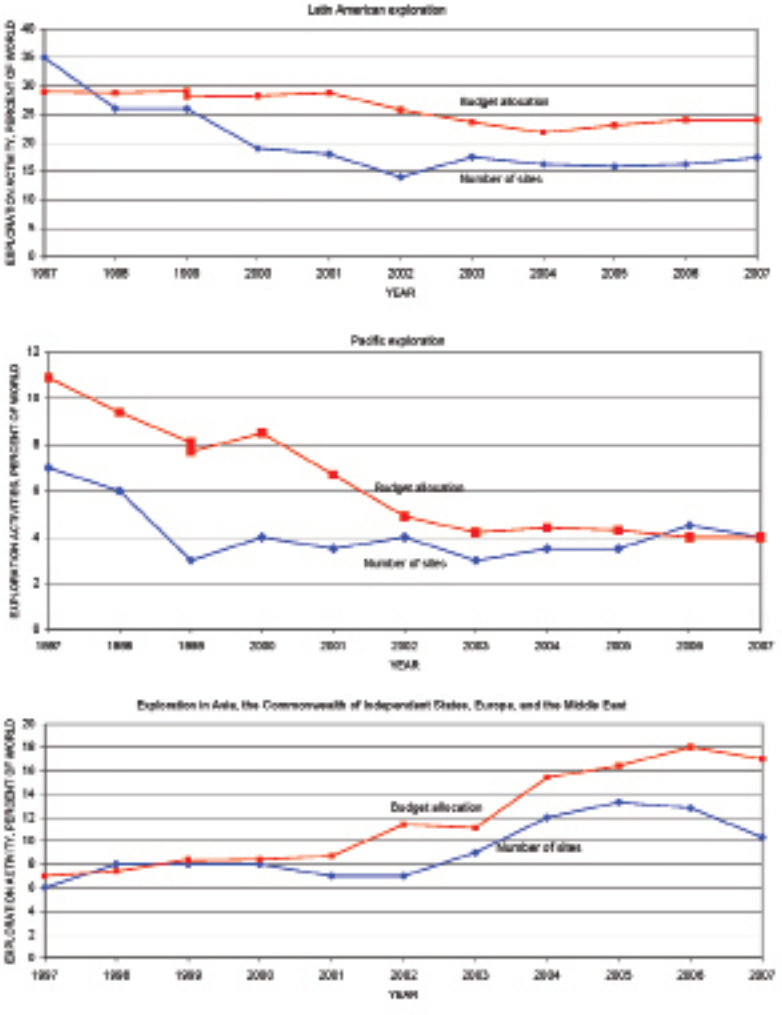
Between 1985 and 2004, gold projects accounted for 60 to 80 percent of mineral exploration activity in Australia. By 2006-2007, however, gold projects accounted for about 33 percent of all activity. The allocation for iron ore, on the other hand, has grown from about seven percent in 2000-2001 to about 32 percent in 2006-2007. The allocation for base metal exploration in Australia has grown from about 18 percent in 2003-2004 to about 27 percent in 2006-2007.

Of the 165 nonfuel mineral exploration projects considered by ABARE up to October 2007, development of 16 projects (10 percent) was completed, 41 projects (25 percent) were considered advanced projects (development funds were committed or the project was under construction) and 108 projects (65 percent) were listed as being at a early stage of development. Of the estimated A$22.8 billion (US$19 billion) being invested in advanced nonfuel related projects, about 85 percent is being spent in Western Australia (24 projects), 5 percent in South Australia (three projects), 3.5 percent in New South Wales (three projects) and 3 percent in Queensland (four projects). Of the 108 less advanced projects, 25 projects are for gold, 22 iron ore, 15 nickel, 12 mineral sands and 10 each for copper and lead-zinc-silver. On the basis of the data on 452 sites evaluated by the USGS, early stage projects accounted for about 77 percent of the 2007 activity, feasibility stage projects accounted for about 10 percent, development projects about 7 percent and sites associated with producing mines about 6 percent.

Australian states and territories experiencing the highest levels of exploration activity in 2007, in descending order based on the number of sites compiled for this annual review, were Western Australia (51

FIG. 6

Exploration activity and budgets for selected regions, 1997 to 2007. The break in the apparent trend for budget allocation in 1999 reflects a change in data collection methodology so that two data points appear for 1999. Source: Metals Economics Group; U.S. Geological Survey.



percent), Queensland (16 percent), South Australia (10 percent), New South Wales (10 percent), Northern Territory (6 percent), Tasmania (4 percent) and Victoria (3 percent).

United States. The U.S. mineral exploration budget was anticipated to increase by about 34 percent from $570 million in 2006 to $763 million in 2007, according to MEG data. Much of this increase is a result of increased gold exploration budgets in Alaska and Nevada. The U.S. percentage of the world exploration budget remained at about 8 percent in 2007. The increase in the U.S. minerals exploration budget in 2007 is likely tied to high commodity prices.

In 2007, data on 259 U.S. exploration projects were collected and reviewed by the USGS; 39 percent were located in Nevada, 20 percent were in Alaska and 8 percent were in Arizona. Of those considered, 167 projects were not in the 2006 review, either because they represented new exploration sites, project names had changed or because public data on 2006 activity were not available. Many of these sites, however, had prior exploration activity. This suggests that economic conditions were such that exploration companies were reevaluating prospects in light of continued improvement in economic conditions such as higher mineral prices and new technology, or because of their proximity or geologic similarity to recent discoveries.

Higher commodity prices are sustaining interest in exploration in Nevada. Based on a 2006 survey conducted by the Nevada Division of Minerals, mineral exploration expenditures in Nevada are reported as $164.9 million in 2006 and were expected to be $179.5 million in 2007. In 2007, about 72 percent of the expenditure was for actual exploration activities, with the remainder used for land holding, permitting, compliance and corporate overhead. As of October 2006, 166,000 active claims were reported for Nevada from Bureau of Land Management statistics. About 98 percent of the Nevada mining claims were held by exploration entities with annual exploration budgets greater than $1 million.

Increased interest in exploration is also reported for Alaska. In a 2007 report prepared for the Alaska Miners Association by McDowell Group, exploration expenditures in Alaska increased about 54 percent from about $179 million in 2006 to about $275 million in 2007. About 69 percent of this estimate was to be spent in southwestern Alaska. In 2007, 29 exploration projects had budgets greater than $1 million and 60 projects reported annual budgets greater than $100,000. Advanced gold exploration projects include Placer Dome's Donlin Creek project and Northern Dynasty Minerals Ltd.'s Pebble project. Drilling continued to expand both the Donlin Creek and Pebble gold deposits.

Pacific region. Based on MEG data, the 2007 exploration budget allocation for the Pacific region and Southeast Asia (excluding Australia) was about $430 million, up in dollar terms from the 2006 level of $285 million but remaining at 4 percent of the world exploration budget. Countries with the most activity in terms of exploration sites included the Philippines (22 percent), Indonesia (22 percent) and Papua New Guinea (16 percent). Reported spending in Papua New Guinea increased from $35 million in 2006 to an estimated $50 million in 2007. In 2007, there was increased exploration interest in New Zealand and Vietnam. Gold targets accounted for approximately 62 percent of all exploration interest in the Pacific region, copper 16 percent, and nickel 9 percent of the reported activity in 2007.

Rest of the world. Exploration budget allocations for the rest of the world (including mainland Asia, the countries of the Commonwealth of Independent States, Europe and the Middle East) increased by 33 percent in the MEG 2007 survey to approximately $1.7 billion from the $1.28 billion budget reported in its 2006 survey, although the percent share decreased from 18 percent in 2006 to 17 percent in 2007. The exploration budget for Russia was reported to account for 6 percent of the world's spending allocation for 2007, and China made up 3 percent. Data suggest a significant increase in reported activity occurred in China, Central Eurasia (primarily Kazakhstan and Russia), Scandinavia (particularly Finland, Greenland and Sweden) and Turkey. MEG reported that exploration budgets for Mongolian projects decreased in 2007, such that this country did not appear on the MEG top-10 list of countries for exploration spending in 2007.

On the basis of exploration site data collected by the USGS for this summary, China accounted for 17 percent of the exploration sites in this group, Russia represented 12 percent, Turkey comprised 10 percent, Finland accounted for 7 percent, Mongolia represented 6 percent, Kazakhstan made up 5 percent, and Sweden and Greenland each accounted for 4 percent. Exploration activity in Asia primarily focused on gold (59 percent of all sites in this group had gold as the primary commodity), copper (15 percent), uranium (7 percent), silver (2 percent) and diamond (1 percent). Exploration activity in the Commonwealth of Independent States focused on gold (65 percent), nickel (7 percent), copper (6 percent), platinum-group metals (6 percent) and silver (4 percent). European mineral exploration focused on base metals (37 percent), gold (33 percent) and uranium (8 percent). Middle Eastern exploration (including Turkey) focused on gold (60 percent) and base metals (30 percent).

Mineral exploration in China has grown since the country opened its mining sector to foreign investment during the 1990s and has been driven by the rapid growth of Chinese minerals consumption. As a result of this strong demand, more than 100 foreign companies have invested in mineral exploration in China, launching more than 400 projects. By the end of 2006, Chinese mining companies had invested $17.9 billion abroad in the search to supplement their mineral resources.

Government programs

Government programs and policies provide the context within which exploration takes place. A regional discussion of government programs and issues affecting mineral exploration follows, ordered by exploration budget estimates.

As mineral exploration becomes more global through multinational corporate acquisitions, as access into areas previously not open for exploration increases, and as more remote areas are accessed, it has become necessary to standardize resource reporting formats to ensure consistency across the worldwide mining industry. In 2006, an international reporting template was developed for the reporting of exploration results, mineral resources,

and mineral reserves by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO), drawing from existing reporting standards for solid minerals. In May 2007, the International Council on Mining and Metals formed a two-year partnership with CRIRSCO to examine mining industry reporting standards on resource estimates and exploration activity.

Latin America. During the past decade, Latin America has been the most popular destination for international exploration investment, in part because of reforms that reduced real and perceived risks to investment. However, there are indications that the investment climate may be changing. A framework for mineral exploration and mining that was developed and implemented in many Latin American countries (Argentina, Chile and Peru, among others), known as the "Latin American Mining Law Model," has been used by the World Bank as a model for mining sector reform in developing countries. Efforts continue to revise this framework or to incorporate other countries within it.

However, growing anti-mining sentiment is also affecting mining and mineral development in Latin America. Increasingly, local and regional governments are enacting legislation governing the conditions under which mineral extraction can occur. For example, the provincial government of Mendoza Province, Argentina, passed legislation banning the use of any chemical substance used in mineral processing, mainly in in situ leach mining of gold and other metals. This legislation has halted the development of two mining projects, causing the companies to place their proposed projects on hold. The Bolivian Mining Law decree 29117 prohibits the granting of any new mining concessions, including those projects that have previously started the filing process. In other areas, mining companies are increasing their efforts to solicit community support for proposed mining projects. In Ecuador, a country with little mining history, companies are required to consult and disclose their plans for the area before a mining concession can be granted, both to meet legislative requirements and to dispel rumors about the effects of mining on the region.

Tax reforms have been enacted in Bolivia that increase the income tax rate, make the Complementary Mining Tax deductible for tax purposes, and adjust the royalty tax to be proportional to mineral prices. The government of Peru has enacted a law that would facilitate the advancement of 20 mining exploration and development projects it has designated as Projects of National Importance.

Canada. Mineral exploration in Canada has been influenced by recent legislation directed at the mining industry. On the positive side, the Canadian government extended its 15 percent nonrefundable Investment Tax Credit for Exploration (ITCE) in its 2007 budget as a means of maintaining revenues generated by the recent high level of mineral exploration investment in the country. Incentives for exploration also have occurred on a regional or local level. Natural Resources Canada was awarded C$6 million (US$5.6 million) to conduct energy and mineral surveys in areas within British Columbia affected by pine beetle infestation. Geoscience BC has launched a C$5-million (US$4.7-million) companion project to conduct large-scale geochemical surveys of the province. A C$1-million (US$930,000) program of mapping, geochemical sampling and airborne geophysical surveys, part two of an ongoing three-part regional exploration program, is to be conducted jointly by the Ontario Prospectors Association and the town of Atikokan. On the other hand, the 2007 Ontario budget contained a provision that would introduce a new tax of up to 13 percent on any diamond mined in Ontario.

First Nation issues continue to affect mineral exploration and development in Canada. Canada's Assembly of First Nations and the Mining Association of Canada signed a letter of intent in November 2007 to collaborate on federal consultation and land claims policy, human resource development, and land-use planning issues to improve continuity and communication among mining companies, government entities and the various First Nation tribes. The Taku River Tingit First Nation has produced a mining policy document describing how it will deal with proposals for mining-related activities on its lands.

The uranium exploration rush generated by high uranium prices is forcing many communities to develop strategies for uranium exploration and development. Across Canada, the debate on whether to permit uranium exploration and mining continues. Efforts in 2007 to ban or limit uranium exploration and mining continue in British Columbia, Labrador, New Brunswick, Northwest Territories, Nova Scotia, Ontario, Quebec and Saskatchewan.

Africa. The AfricaArray project, operated by the South African Council for Geoscience, the Pennsylvania State University and Wits University in South Africa, has established a consortium of scientists from the United States and nine African countries to conduct a four-year seismic study of the African Superplume in Eastern Africa. In addition to collecting geophysical data, this project is designed to provide training on current geophysical techniques to African scientists.

The Nigerian Minerals and Mining Act of 2007 was signed into law in February. The legislation repeals 1999 legislation and reconfigures mining controls, creates certain mining incentives, sets qualifications for minerals exploration, mining and quarrying, and outlines environmental considerations and the rights of host communities. In May, the Nigeria Extractive Industries Transparency Initiative Act 2007 was signed. The act provides for the verification and public release of information related to the oil, gas and mining sectors and provides annual audits of these sectors.

The Zimbabwean government has suspended the issuance of new Exclusive Prospecting Orders to prospective mineral exploration and mining companies. In addition, previous applications for such exploration licenses made as far back to 2003 also have not been processed, and it is presently unclear whether such applications will be approved. A draft bill by the Zimbabwean government to force foreign companies doing business in Zimbabwe to transfer majority shareholdings to local owners is to be debated in early 2008. However, a provision requiring companies to provide the government with a free 25 percent stake was removed from this version of the proposed legislation.

Australia. A review of Queenland's Mineral Resources Act 1989 was initiated in 2007. South Australia has extended its support of the Programme for Accel-

erating Exploration (PACE) program, which provides drilling funds for grassroots exploration, by increasing its budget by A$8.4 million (US$7 million) during two years. A similar program was announced by the Victorian government, in which A$5 million (US$4.2 million) would be set aside during two years to fund a government-run drilling program and the creation of a three-dimensional geologic map of the state. The Queensland government also ended its policy of not allowing uranium mines to be developed in the state. An A$34.6-million (US$29-million), four-year funding program was granted to Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Geoscience Australia by the Australian government to improve pre-competitive geoscience information.

The Western Australian government has committed A$3 million (US$2.5 million) over three years to reduce the backlog of mining tenement applications. In 2006, 2,780 grants were approved, compared to a 1,570-grant per year average over the preceding five years.

United States. The U.S. House of Representatives approved a bill that would amend the Mining Law of 1872 to include in its provisions the creation of a 4-percent gross royalty on current mining operations and an 8-percent royalty of future mines, define categories of federal lands not open to mining and provide overall environmental standards for mining. The U.S. Senate has yet to reach consensus on a companion bill.

Mining claims for metal occurrences in the United States have increased 80 percent in the last four years from 207,000 in 2003 to 377,000 in July of 2007, owing mainly to rising copper, gold and uranium prices. Similarly, uranium claims in Colorado, New Mexico, Utah and Wyoming increased from 4,300 in 2004 to 32,000 in 2006.

In December, Michigan regulators approved construction of a primary nickel mine in northern Michigan. When this project is built, it will be the first project permitted under the state's new mining law.

Pacific region. The Minerals Resources Authority (MRA) of Papua New Guinea, funded by a European Union (EU) grant made under the EU's 8th European Development Fund Special Financing Facility, is now fully funded and operational. Under this program, geological and geophysical data are being compiled and new regional geophysical surveys have begun. A levy of 0.5 percent of mine revenue will be used to fund future activities of the MRA.

Rest of the world. The USGS released a report in 2007 assessing the nonfuel mineral resources of Afghanistan. The report was prepared in cooperation with the Afghanistan Geological Survey under the auspices of the U.S. Agency for International Development. Resource estimates for bauxite, copper, gold, lead/zinc and mercury are reported. Twenty mineralized areas were identified for further study. Assessment results are available at the USGS Afghanistan Web site http://afghanistan.cr.usgs.gov.

On Oct. 31, 2007, with the approval of the State Council, China's National Development and Reform Commission and the Ministry of Commerce announced the 2007 foreign investment guideline catalogue, effective Dec. 1, 2007. The Chinese government encouraged foreign investors to participate in iron ore and manganese exploration, mining and processing. The government also urged foreign investors to form joint ventures with domestic developers in exploring for and producing coalbed methane, oil and natural gas. The government restricted foreign investor participation in the mining of barite, boromagnesite, celestite, diamond, precious metals (gold, silver and platinum group metals) and phosphate rock. Investment in the smelting and refining sectors of such commodities as aluminum, antimony, copper, lead, molybdenum, tungsten and zinc is also restricted. The government banned foreign investor participation in the exploration, mining, and processing of antimony, fluorspar, molybdenum, rare earths, tin, tungsten and radioactive elements. Foreign investors will be allowed to participate by means of the formation of joint ventures with domestic investors in rare earths separation and smelting only.

The Indian Ministry of Mines released a report reviewing the National Mineral Policy 1993 for the purpose of suggesting changes needed to stimulate investment in the Indian mining sector and simplify the regulatory framework. About $2 million is spent annually on mineral prospecting and exploration in India.

In 2006, Mongolia's parliament passed legislation amending the country's mineral law by increasing the minerals royalty to 5 percent from 2.5 percent, increasing licensing fees, reducing tax incentives for mining and changing the terms for exploration and mineral resource licenses. On May 12, 2006, Mongolia's parliament passed legislation that would establish a windfall profits tax to encourage in-country minerals processing. Perhaps as a result of these legislative changes, some foreign companies doing business in Mongolia have suspended exploration and mining operations until they can reassess development plans. While investment from western companies has decreased since 2006, investment in Mongolian mineral exploration by China has increased. In November 2006, Chinese and Mongolian companies signed agreements valued at nearly $100 million for short-term investment.

Pakistan is considering revising its National Steel Policy to allow private domestic and foreign companies to participate in the development of selected iron ore deposits in Balochistan, Punjab and North West Frontier provinces.

Romania is considering legislation that would effectively ban the use of cyanide in mining. Such a ban would have an effect on the Rosia Montana gold project that is currently under development. Future exploration and development activity at this site also may be affected.

The USGS collects and analyzes data on more than 100 mineral commodities in the United States and worldwide. This article draws from public and private sector sources and the knowledge and expertise of USGS mineral commodity, country and mineral-resource specialists. More detailed information on the material covered in this article may be obtained from the author, David Wilburn, U.S. Geological Survey, P. O. Box 25046, MS 750, Denver Federal Center, Denver, CO 80225-0046; telephone 303-236-8747, extension 337; fax 303-236-4208. For additional USGS information on mineral commodities and international mining activities, inquiries may be directed to Kathy Keys, U.S. Geological Survey, 988 National Center, Reston, VA 20192, phone 703-648-4961. ■

Coal Review

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Coal production in the United States in 2007 totaled 1.03 Gt (1,145.6 million st), according to preliminary data from the Energy Information Administration (EIA) (Table 1). This is a decrease of 1.5 percent, or 15.6 Mt (17.2 million st) from the 2006 record level of 1.05 Gt (1,162.7 million st). Although coal production declined in 2007, U.S. total coal consumption increased for the year. Coal consumption in 2007 in the electric power sector was higher by 1.9 percent, while coking coal consumption decreased by 1.1 percent and the other industrial sector declined by 5 percent. (Note: all percentage change calculations are done at the short-tons level.) U.S. coal exports were significantly higher in 2007, while coal imports remained at about the same level. Total coal stocks increased slightly during the year, as some consumers continued to rebuild their stockpiles that had been seriously depleted in 2005 due to transportation issues.

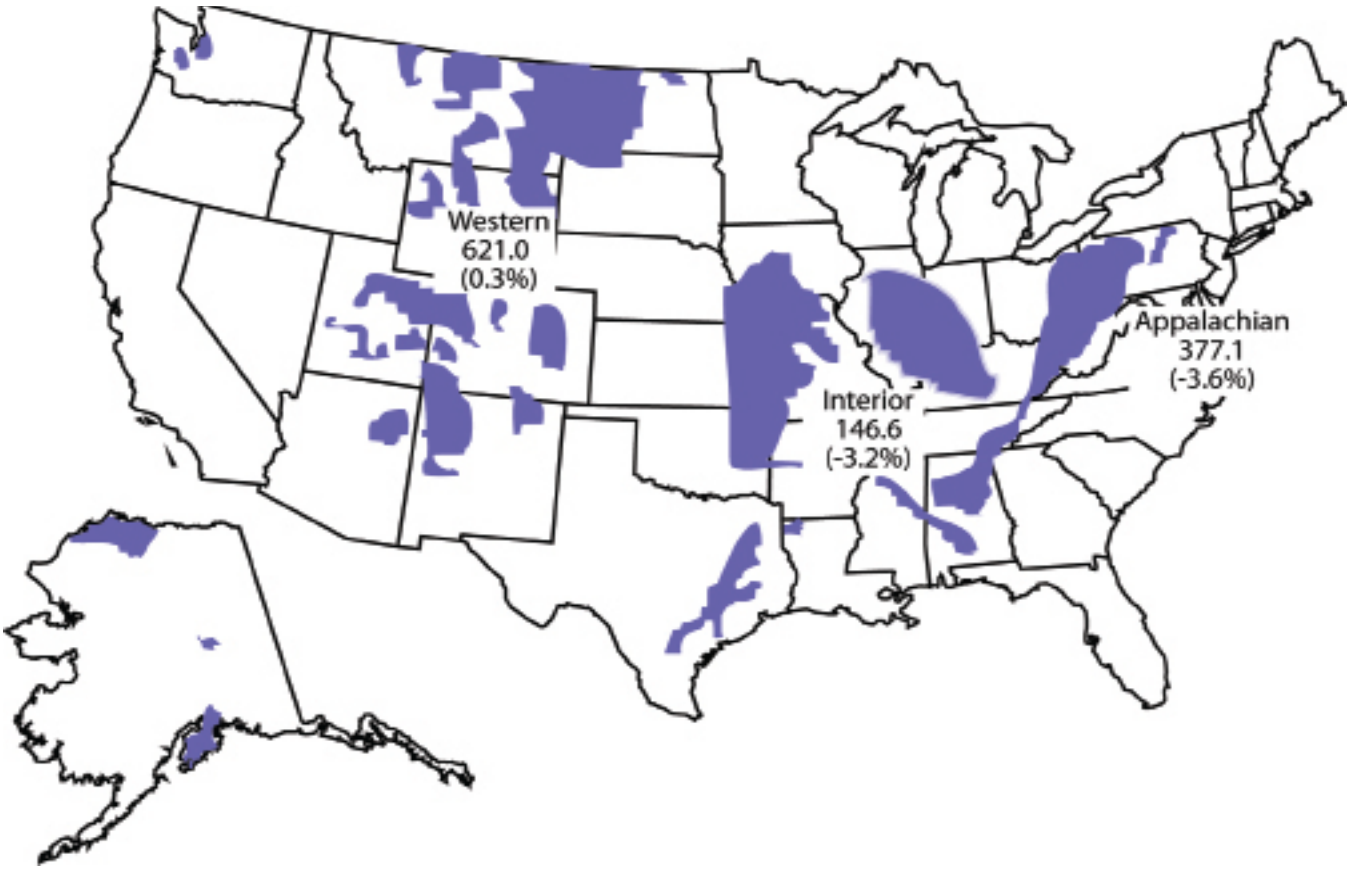
The growth in coal consumption during the year was primarily a result of the weather-related increases in the demand for electricity in 2007. Preliminary data show that total generation in the electric power sector (electric utilities and independent power producers) in the United States grew in 2007. Coal-based generation also increased, resulting in a 17.9-Mt (19.8-million-st) increase in coal consumed in the electric power sector. Coal use in the nonelectricity sector decreased by 3.8 percent to 74.7 Mt (82.4 million st).

In the international markets in 2007, U.S. coal exports increased to levels not seen in recent years while coal imports were mostly static. U.S. coal exports totaled 53.7 Mt (59.2 million st), an increase of 8.6 Mt (9.5 million st) above 2006. Coal imports in 2007 ended the year at 32.9 Mt (36.3 million st), 91 kt (100,000 st) higher than in 2006.

Coal prices in 2007 were split, with most domestic prices higher for the year while the international prices were overall lower. Although the average delivered price of coal increased for most users in the United States in 2007, the increases were smaller than what had been expe-

FIG. 1

Coal production by coal-producing region, 2007. (million st and percent change from 2006). Regional totals do not include refuse recovery. U.S. total: 1,145.6 million st (-1.5%).



rienced in 2006. In the domestic markets, the electric utility price-per-short-ton increase was 5.3 percent, while the increase was only 1.3 percent for independent power producers. Coking coal prices increased by 2.3 percent, while the price for the other industrial sector increased by 5.3 percent in 2007. Coal prices in the coal synfuel sector declined by 3.6 percent in 2007. In the international markets, where most coal prices fell, the average price per ton of export coal, measured in free-alongside-ship (f.a.s.) value, declined slightly by 1 percent in 2007, while the price of coal imported into the United States, measured by the customs-import-value (c.i.v.), dropped by 3 percent.

The coal synfuel industry in the United States processed more coal in 2007, increasing by 33.7 percent, making use of the available tax credits that expired on Dec. 31, 2007. The amount of coal processed in 2007 was 132.9 Mt (146.5 million st).

Production

U.S. coal production decreased in 2007 by 1.5 percent to a level of 1.04 Gt (1,145.6 million st) (Fig. 1 and Table 1), 15.6 Mt (17.2 million st) lower than the 2006 production. Although total U.S. coal production was lower in 2007, only two of the three coal-producing regions had lower production while the other increased, but only marginally. Exclusive of refuse production, the Appalachian and Interior

Regions had a decrease in their production levels in 2007 of 3.6 percent and 3.2 percent, respectively, while the Western Region had an increase in coal production of 0.3 percent (Fig. 2 and Table 2). In the amount of tons of coal produced, the decrease in the Appalachian Region production was 12.7 Mt (14 million st), while the decrease in Interior Region production in 2007 was 4.35 Mt (4.8 million st). Coal production in the Western Region increased by 1.45 Mt (1.6 million st).

Appalachian Region

Coal production in the Appalachian Region declined for the second consecutive year in 2007, decreasing by 12.7 Mt (14 million st), to end the year at 342 Mt (377.1 million st). This was a decline of 3.6 percent, a level only slightly greater than the 2003 production total. The decrease in 2007 in coal production in the Appalachian Region was primarily driven by two different issues. One issue was the production problems at a few of the larger mines

Table 1

U.S. coal supply, disposition and prices 2003-2007 (million st, nominal $/st).

Item	2003	2004	2005	2006	2007
Production by region					
Appalachia	376.1	389.9	396.7	391.2	377.1
Interior	146.0	146.0	149.2	151.4	146.6
Western	548.7	575.2	585.0	619.4	621.0
Refuse recovery	1.0	1.0	0.7	0.8	0.8
Total	**1,071.8**	**1,112.1**	**1,131.5**	**1,162.7**	**1,145.6**
Consumption by sector					
Electric power	1,005.1	1,016.3	1,037.5	1,026.6	1,046.4
Coke plants	24.2	23.7	23.4	23.0	22.7
Other industrial plants	61.3	62.2	60.3	59.5	56.5
Combined heat and power (CHP)	24.8	26.6	25.9	25.3	24.1
Non CHP	36.4	35.6	34.5	34.2	32.4
Residential/commercial users	4.2	5.1	4.7	3.2	3.2
Residential	0.6	0.6	0.4	0.3	0.3
Commercial	3.7	4.6	4.3	2.9	2.9
Total	**1,094.9**	**1,107.3**	**1,126.0**	**1,112.3**	**1,128.8**
Year-end coal stocks					
Electric power	121.6	106.7	101.1	141.0	151.1
Coke plants	0.9	1.3	2.6	2.9	1.9
Other industrial plants	4.7	4.8	5.6	6.5	5.6
Producers/distributors	38.3	41.2	35.0	36.5	30.8
Total	**165.5**	**154.0**	**144.3**	**186.9**	**189.4**
U.S. coal trade					
Exports	43.0	48.0	49.9	49.6	59.2
Steam coal	20.9	21.2	21.3	22.1	27.0
Metallurgical coal	22.1	26.8	28.7	27.5	32.2
Imports	25.0	27.3	30.5	36.2	36.3
Steam coal	23.3	25.1	28.7	34.6	34.7
Metallurgical coal	1.7	2.2	1.8	1.7	1.7
Net exports	18.0	20.7	19.5	13.4	22.8
	Average prices				
Domestic					
Average delivered price					
Electric utilities[1]	$25.82	$27.30	$31.22	$34.26	$36.08
Independent power Producers[1]	$26.20	$27.27	$30.39	$33.04	$33.47
Coke plants	$50.63	$61.50	$83.79	$92.87	$94.97
Other industrial plants	$34.70	$39.30	$47.63	$51.67	$54.42
International					
Average free alongside ship (f.a.s.) price[2]					
Exports	$35.98	$54.11	$67.10	$70.93	$70.25
Steam coal	$26.94	$42.03	$47.64	$46.25	$47.90
Metallurgical coal	$44.55	$63.63	$81.56	$90.81	$88.99
Average customs import value (c.i.v.) price[3]					
Imports	$31.45	$37.52	$46.71	$49.10	$47.64
Steam coal	$30.24	$36.06	$43.35	$46.15	$45.31
Metallurgical coal	$47.83	$54.27	$101.88	$109.36	$96.05

[1]Average delivered price is through November 2007.

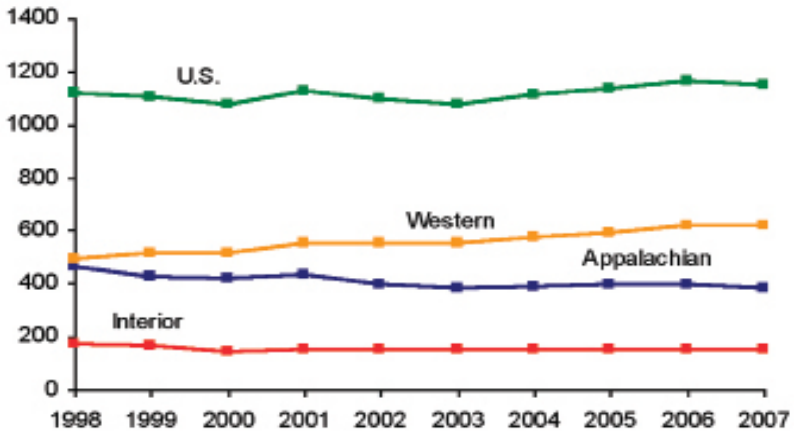
[2]Free-alongside-ship (f.a.s.) is the value of a commodity at the port of exportation, generally including the purchase price plus all charges incurred in placing the commodity alongside the carrier at the port of exportation.

[3]Customs-import-value (c.i.v.) is the price of a commodity when sold for exportation to the U.S., excluding U.S. import duties, freight and insurance.

Notes: Totals may not equal sum of components due to independent rounding. Sum of net exports, stock changes, and consumption may not equal production, primarily because the supply and disposition data are obtained from different surveys. **Sources:** Production, consumption, stocks, and prices: Energy Information Administration, *Quarterly Coal Report,* October-December 2007, DOE/EIA-0121(2007/Q4) (Washington, DC, March 2008); and *Electric Power Monthly*, March 2008, DOE/EIA-0226(2008/03) (Washington DC, March 2008). Exports and imports: U.S. Department of Commerce, Bureau of the Census, "Monthly Report EM 545" and "Monthly Report IM 145."

FIG. 2

Coal production by region, 1998-2007 (million st). Regional totals do not include refuse recovery. Sources: Energy Information Administration, Quarterly Coal Report, October-December 2007, DOE/EIA-0121(2007/Q4) (Washington, DC, March 2008); Coal Industry Annual, DOE/EIA-0584, various issues; *Annual Coal Report 2003*, DOE/EIA-0584(2003), (Washington, DC, November 2004); and *Annual Coal Report 2005*, DOE/EIA-0584(2005), (Washington, DC, November 2006).



in the region. The other was ongoing lawsuits, principally in the central portion of the Appalachian Region, concerning the issuing of federal permits that regulate the excavation and discharge of dredged and fill material into the waters of the United States. As a consequence of these lawsuits, new permits have not been issued as quickly as they had in the past thereby limiting some possible additional production.

West Virginia, the largest coal-producing state in the Appalachian Region and the second largest in the United States, was one of two states in the region to have an increase in coal production in 2007. Total coal production increased slightly in West Virginia, by 0.6 percent, in 2007 to end the year with 139 Mt (153.2 million st) of production, 725 kt (800,000 st) above 2006. Increases in coal production at Mettiki Coal's Mountain View Mine (a replacement mine for Mettiki's depleted Maryland Mine) of 2 Mt (2.2 million st) and a full year's production from Frasure Creek Mining's new Mine No. 7 of 998 kt (1.1 million st), helped to offset the declines in production experienced at Alpha Natural Resources' Mountaineer Alma A Mine of 907 kt (1 million st) and Consol Energy's McElroy Mine of 725 kt (800,000 st).

Eastern Kentucky produced 78.7 Mt (86.8 million st) of coal in 2007, a decline of 7.3 percent or 6.2 Mt (6.8 million st). This was the largest tonnage decrease for any state in the Appalachian Region. Although the Locust Grove's Elm Lick Mine had an increase in 2007 of 1.2 Mt (1.3 million st) in its first full year of production and three other mines had increases of more than 453 kt (500,000 st), production decreases by other mines, including the 2007 idling of ICG's Blackberry and Nally & Hamilton Enterprises' Colliers Creek mines resulting in drops of 1.1 Mt and 544 kt (1.2 million and 600,000 st), led to the lower annual production in Eastern Kentucky.

Pennsylvania produced 59 Mt (65 million st), a decrease of 1.5 percent from 2006, or 907 kt (1 million st). There was no single mine that accounted for the majority of the decline in coal production in Pennsylvania for the year. But the slight decreases of less than 272 kt (300,000 st) experienced by Consol's Bailey and Foundation's Cumberland and Emerald mines were more than enough to offset the increases in coal production experienced by Consol's Enlow Fork, Dana Mining's 4 West and Rosebud Mining's Logansport mines.

Coal production in Virginia decreased in 2007 by 4.1 Mt (4.5 million st) to 23 Mt (25.3 million st), a decline of 15 percent. The decrease in coal production in Virginia was primarily a result of the lower production by Consol's Buchanan Mine. It experienced a rooffall in July and was closed for the remainder of the year, thus resulting in a production level for the mine that was 43.7 percent below the 2006 level. Ohio's coal production declined slightly in 2007 by 0.7 percent to end the year at 20.5 Mt (22.6 million st).

Besides West Virginia, Alabama was the only other state in the Appalachian Region to have increased coal production in 2007, with a total of 17.5 Mt (19.3 million st) for the year. The increase of 453 kt (500,000 st), or 2.6 percent, was the result of higher coal production at the Jim Walter Resources' No. 4 Mine. This helped replace the lost coal production from its No. 5 Mine, which was abandoned due to the depletion of its reserves and increased production from Drummond's Shoal Creek Mine. Tennessee had a slight decrease of 181 kt (200,000 st) in coal production in 2007 from its prior year level, resulting in a total of 2.3 Mt (2.6 million st). With the closing of Mettiki Coal's Mettiki Mine (the largest mine in the state) due to the depletion of coal reserves in 2007, coal production in Maryland in 2007 decreased by 54.6 percent to end the year at 2.1 Mt (2.3 million st), the lowest level of any state in the Appalachian Region.

Interior Region

The Interior Region experienced a decrease in coal production in 2007 of 4.3 Mt (4.8 million st), or 3.2 percent, to end the year at a total of 133 Mt (146.6 million st). The decline in coal production in the Interior Region was primarily a result of the lower coal production in Texas, the largest coal-producing state in the region. In 2007, coal production in Texas was 38 Mt (41.9 million st), a decline of 3.2 Mt (3.6 million st) from 2006. Although there was an increase in coal production at Luminant Mining's Tatum Mine of 1 Mt (1.1 million st) for the year, the decline of 2.3 Mt (2.6 million st) at its Three Oaks Mine and the suspension of coal production at its Winfield North Mine resulted in lower coal production in Texas.

Of the two states to register increases in 2007 coal production in the Interior Region, western Kentucky accounted for almost all of the regional increase. Coal production in western Kentucky increased 816 kt (900,000 st) in 2007 to end the year at 25.6 Mt (28.2 million st), an increase of 3.5 percent. Although Armstrong Coal's Big Run Mine was idled at the end of 2006 with a resulting loss of more than 907 kt (1 million st) of coal production, expansions at KenAmerican Resources' Paradise No. 9 Mine of 544 kt (600,000 st) and Hopkins County Coal's Elk Creek Mine of 1 Mt (1.1 million st) was more than

enough to offset that loss. Arkansas, the nation's smallest coal producing state, was the only other state in the Interior Region to have higher production in 2007. Coal production in Arkansas increased to 75 kt (83,000 st), 54 kt (60,000 st) higher than the 2006 level.

Indiana, the second largest coal-producing state in the Interior Region, had a slight decrease of 0.3 percent in 2007 to end the year with a total of 32 Mt (35 million st), 90.1 kt (100,000 st) below 2006. Declines of almost 453 kt (500,000 st) each experienced at Vigo Coal's Cypress Creek Mine and Triad Mining's Patoka Mine were balanced by Sunrise Coal's Carlisle Mine, in its first year of coal production, which produced 907 kt (1 million st) in 2007. Coal production in Illinois also declined slightly by 0.9 percent to end the year at 29.4 Mt (32.4 million st), a decrease of 272 kt (300,000 st). Increases in coal production by Mach Mining's No. 1 Mine of 816 kt (900,000 st) and Vigo Coal's Friendsville Mine of 544 kt (600,000 st) in 2007 were negated by the lower production levels of several mines, including Foundation Coal's Wabash Mine, which was abandoned early in 2007, and the idling of Monterey Coal's No. 1 Mine and Springfield Coal's Crown II Mine. The other states in the Interior Region (Kansas, Louisiana, Mississippi, Missouri and Oklahoma) together produced 8.1 Mt (8.9 million st) of coal. They accounted for 6.1 percent of the entire region's production in 2007. They all had lower coal production from their prior year levels.

Western Region

The Western Region was the only one of the three regions to show an increase in coal production in 2007. Coal production rose by 0.3 percent to reach 563 Mt (621 million st), more than 54 percent of total U.S. coal production for the year. The slight increase of 1.45 Mt (1.6 million st) resulted in another record level for the region, the fourth year in a row. Even though there was a record level of coal production in 2007, only three states in the Western Region had higher production levels from the previous year, Colorado, Montana and Wyoming.

Wyoming is the largest coal-producing state in the United States, a position it has held since 1988. In 2007, Wyoming produced 411.5 Mt (453.6 million st) of coal, an increase of 1.5 percent, or 6.2 Mt (6.8 million st). Although nine of the 21 mines in Wyoming had decreases in coal production in 2007, the increased production levels at the rest of the mines pushed the state to a production record for the year. Wyoming has dominated U.S. coal production since 1995 when it first accounted for more than one-quarter of total U.S. production. Examples of how much

Table 2

U.S. coal production by coal-producing region and state, 2003-2007, (million st).

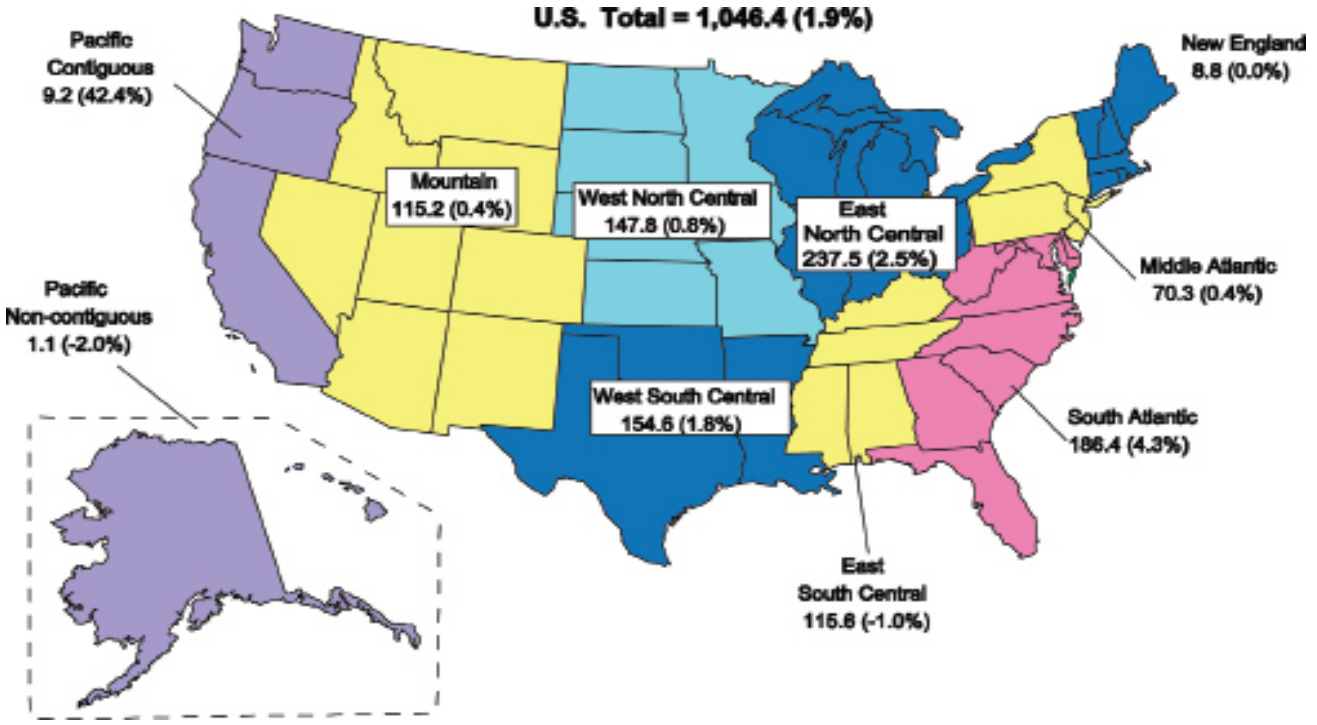
Coal-producing region and state	2003	2004	2005	2006	2007	% change 2006 – 2007
Appalachia total	**376.1**	**389.9**	**396.7**	**391.2**	**377.1**	**-3.6**
Alabama	20.1	22.3	21.3	18.8	19.3	2.6
Kentucky, eastern	91.3	90.9	93.3	93.6	86.8	-7.3
Maryland	5.1	5.2	5.2	5.1	2.3	-54.6
Ohio	22.0	23.2	24.7	22.7	22.6	-0.7
Pennsylvania total	63.7	66.0	67.5	66.0	65.0	-1.5
Anthracite	1.2	1.7	1.6	1.5	1.6	1.4
Bituminous	62.5	64.3	65.8	64.5	63.5	-1.6
Tennessee	2.6	2.9	3.2	2.8	2.6	-5.7
Virginia	31.6	31.4	27.7	29.7	25.3	-15.0
West Virginia total	139.7	148.0	153.6	152.4	153.2	0.6
Northern	34.9	40.6	42.6	42.4	42.0	-1.0
Southern	104.8	107.3	111.0	110.0	111.3	1.2
Interior total	**146.0**	**146.0**	**149.2**	**151.4**	**146.6**	**-3.2**
Arkansas	*	*	*	*	0.1	263.4
Illinois	31.6	31.9	32.0	32.7	32.4	-0.9
Indiana	35.4	35.1	34.5	35.1	35.0	-0.3
Kansas	0.2	0.1	0.2	0.4	0.4	-1.3
Kentucky, western	21.5	23.4	26.4	27.2	28.2	3.5
Louisiana	4.0	3.8	4.2	4.1	3.1	-25.6
Mississippi	3.7	3.6	3.6	3.8	3.5	-6.6
Missouri	0.5	0.6	0.6	0.4	0.2	-40.1
Oklahoma	1.6	1.8	1.9	2.0	1.6	-17.5
Texas	47.5	45.9	45.9	45.5	41.9	-7.9
Western total	**548.7**	**575.2**	**585.0**	**619.4**	**621.0**	**0.3**
Alaska	1.1	1.5	1.5	1.4	1.3	-7.1
Arizona	12.1	12.7	12.1	8.2	8.0	-2.8
Colorado	35.8	39.9	38.5	36.3	36.4	0.2
Montana	37.0	40.0	40.4	41.8	43.4	3.7
New Mexico	26.4	27.2	28.5	25.9	24.5	-5.6
North Dakota	30.8	29.9	30.0	30.4	29.6	-2.6
Utah	23.1	21.7	24.5	26.0	24.3	-6.6
Washington	6.2	5.7	5.3	2.6	0.0	-100.0
Wyoming	376.3	396.5	404.3	446.7	453.6	1.5
Refuse recovery	**1.0**	**1.0**	**0.7**	**0.8**	**0.8**	**11.2**
U.S. tota	**1,071.8**	**1,112.1**	**1,131.5**	**1,162.7**	**1,145.6**	**-1.5**

*Less than 50,000 st.

Source: Energy Information Administration, *Annual Coal Report* 2004, DOE/EIA-0584(2004) (Washington, DC, November 2005); Energy Information Administration, *Annual Coal Report* 2006, DOE/EIA-0584(2006)(Washington, DC, November 2007); and *Quarterly Coal Report*, October-December 2007, DOE/EIA-0121(2007/Q4)(Washington, DC, March 2008).

FIG. 3

Electric power sector consumption of coal by Census Division, 2007 (million st and percent change from 2006). Source: Energy Information Administration, Form EIA-906, "Power Plant Report."



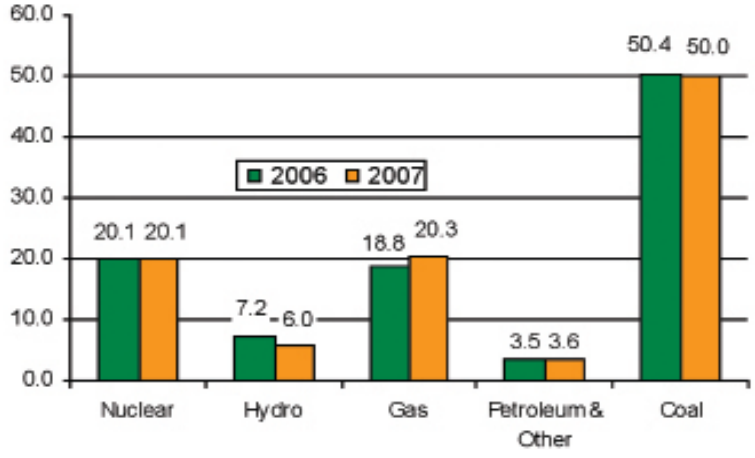
Wyoming dominates the U.S. coal supply include that for 2007, its production accounted for 73 percent of the Western Region production total; was 693 Mt (76.4 million st) more than the entire Appalachian Region production; was more than three times the Interior Region production; and was only slightly less than 40 percent of the total U.S. coal production for the year. Also, if the 25 states that produced coal in 2007 were ranked by descending total production levels, Wyoming produced only 1.3 Mt (1.4 million st) less than the sum of the next six largest coal-producing states (West Virginia, Kentucky, Pennsylvania, Montana, Texas and Colorado) and 197 Mt (217.4 million st) more coal than the summation of the states ranked 8th through 25th. Peabody's North Antelope Rochelle Mine was the largest coal mine in Wyoming and the United States in 2007. It produced a total of 83 Mt (91.5 million st), an increase of 2.7 Mt (3 million st). This one mine produced more coal than 22 of the 24 other coal-producing states in 2007. However, the one mine in Wyoming that had the largest tonnage increase in 2007 was Arch Coal's Coal Creek Mine. It returned to production in mid-2006 after suspending coal production in 2000. Coal Creek increased production in 2007 by 6.4 Mt (7.1 million st) to end the year with a total of 9.25 Mt (10.2 million st).

In 2007, Montana, the second largest coal-producing state in the Western Region, produced 39.4 Mt (43.4 million st), an increase of 3.7 percent. It displaced Texas as the fifth largest coal-producing state in the nation. Although there were decreases in production at four of the six mines in Montana, the increase in coal production at Spring Creek Coal's Spring Creek Mine of 1.1 Mt (1.2 million st) in 2007, to reach a total of 14.2 Mt (15.7 million st), more than offset the declines. Colorado had a slight increase in coal production in 2007, ending the year with a total of 33 Mt (36.4 million st), an increase of 0.2 percent, or 56 kt (62,000 st).

Coal production in North Dakota declined in 2007 by 2.6 percent to end the year at 26.8 Mt (29.6 million st). Declines in production at three of the four mines, the Center, Falkirk and Freedom mines, negated the increase in coal production by the Beulah Mine. New Mexico had a decrease of 1.36 Mt (1.5 million st) in 2007 to end the year with a total of 22.2 Mt (24.5 million st), a decline of 5.6 percent and the second year in a row that production declined in the state. The majority of the decrease in coal production for New Mexico was attributable to the decreased production level at Chevron Mining's McKinley

FIG. 4

Share of electric power sector net generation by energy source, 2006 vs. 2007 (percent). Source: Energy Information Administration, Form EIA-906, "Power Plant Report."



Mine. Coal production in Utah in 2007 declined by 6.6 percent to 22 Mt (24.3 million st). Although there was a more than 907-kt (1-million st) increase in coal production at West Ridge Resources' West Ridge Mine, decreases of more than 907 kt (1 million st) at Arch Coal's Sufco Mine and Andalex Resources' Aberdeen Mine more than offset the increase. In 2007, coal production in Arizona decreased by 2.8 percent to end the year at 7.25 Mt (8 million st), while coal production in Alaska was 1.2 Mt (1.3 million st), slightly below the prior year total. There was no coal production in Washington in 2007 due to the closing of the state's only mine, TransAlta's Centralia Mine, in November 2006.

Consumption

Preliminary data show that total coal consumption rebounded in 2007 increasing by 1.5 percent over 2006. Total U.S. coal consumption was 1.02 Gt (1,128.8 million st), an increase of 15 Mt (16.5 million st). Almost 93 percent of all coal consumed in the United States is in the electric power sector (electric utilities and independent power producers), making it the powerhouse for total coal consumption. Two of the three other coal-consuming sectors, other industrial and coking coal, had declines in their consumption totals. The residential and commercial sector, is the smallest of all coal consuming sectors. It accounted for less than one-third of one percent of total consumption, basically unchanged. The other industrial sector had a decrease in coal consumption in 2007 of 5 percent, while the coking coal sector had a decline of 1.1 percent.

Coal consumption in the electric power sector increased by 1.9 percent or 18 Mt (19.8 million st) to end 2007 at 949 Mt (1,046.4 million st) (Fig. 3). However, coal-based electricity generation increased at a slightly lower 1.6 percent, reflecting increasing volumes of lower-Btu western coals (subbituminous and lignite) to generate electricity. Nationally, total generation in the electric power sector from all fuels increased in 2007 by 2.5 percent, with gains in electricity generation by all sources except the hydroelectric sector in the United States. The decline of 14.6 percent in electricity generation by hydroelectric facilities in the United States was a result of the drought conditions experienced across most the country during the year and resulted in a decrease of its share of total generation to 6 percent (Fig. 4). The increase in electric generation in 2007 by other fuel sources ranged from the aforementioned 1.6 percent for coal to 10.8 percent for natural gas. The large increase in electricity generation by natural gas for 2007 was due, in part, to the numerous new generating facilities that came online during the year that were natural gas fired. In 2007, 64 percent of the new capacity to come online during the year was natural-gas-fired, while new coal-fired capacity was 8 percent. However, the average cost of natural gas delivered to the electric utility portion of the electric power sector through November 2007 compared to 2006 had increased by only 1.1 percent, while the cost of coal had increased by 5.2 percent in the same time period.

Table 3

Electric power sector net generation, 2006-2007 (million kWh).

Census Division	2006	2007	Percent change
New England			
Coal	19,411	19,699	1.5
Total	125,708	127,205	1.2
Middle Atlantic			
Coal	152,454	153,956	1.0
Total	415,192	430,548	3.7
East North Central			
Coal	451,517	458,411	1.5
Total	639,456	658,193	2.9
West North Central			
Coal	228,067	229,977	0.8
Total	301,627	310,069	2.8
South Atlantic			
Coal	423,402	439,781	3.9
Total	788,587	815,984	3.5
East South Central			
Coal	246,322	244,686	-0.7
Total	369,837	377,065	2.0
West South Central			
Coal	226,940	229,707	1.2
Total	544,000	557,711	2.5
Mountain			
Coal	209,239	209,250	0.0
Total	348,918	359,231	3.0
Pacific			
Coal	12,422	16,674	34.2
Total	374,753	370,476	-1.1
U.S. Total			
Coal	1,969,776	2,002,141	1.6
Total	3,908,077	4,006,482	2.5

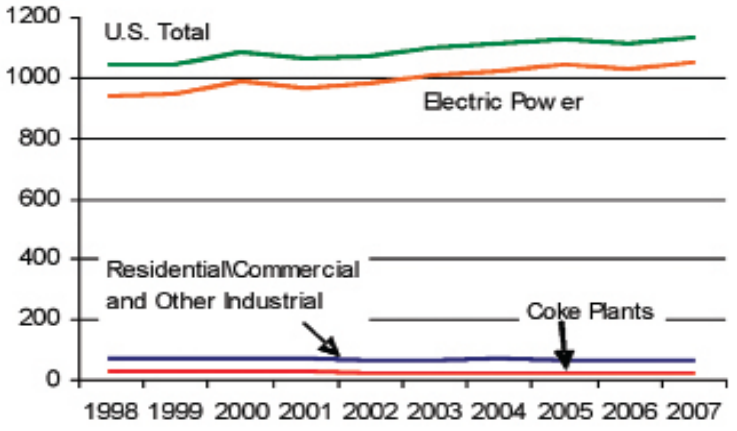
Source: Energy Information Administration, Form EIA-906, "Power Plant Report."

Total electricity generation in the United States is primarily driven by two factors: economic growth and weather (measured by heating and cooling degree-days). Both factors have a positive effect on total generation. Economic growth continued throughout 2007, with the gross domestic product (GDP) of the United States increasing by 2.2 percent for the year. Also in 2007, warmer-than- normal summer weather occurred across most of the country. According to preliminary data from the National Weather Service Climate Prediction Center of the National Oceanic and Atmospheric Administration (NOAA), cooling degree-days in 2007 were higher for the country as a whole than the 30-year average, by 17.9 percent. The warmer summer weather resulted in more electricity generation to power air conditioners across the country. In contrast, the winter weather was somewhat warmer than normal, with the heating degree-days 5.3 percent below normal, lowering the need for electricity for heating, but not enough to offset the generation needed for summer for cooling.

Of the nine Census Divisions, coal is a minor component (less than 20 percent) in the fuel mix for electricity generation in two divisions, New England and Pacific, and a major component (more than 50 percent) in five divisions, East North Central, West North Central, South Atlantic, East South Central and Mountain. In the other two divisions, coal is one of two main fuel sources for the electric power sector. In

FIG. 5

Coal consumption by sector, 1998-2007 (million st). Source: Energy Information Administration, *Monthly Energy Review,* March 2008, DOE/EIA-0035(2008/03) (Washington, DC, March 2008).



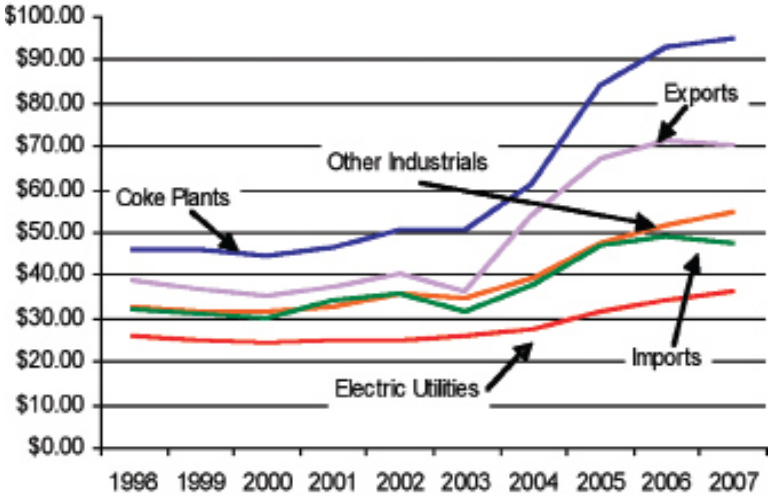
the Middle Atlantic, coal competes with nuclear power for dominance, while in the West South Central coal competes with natural gas.

Eight of the nine Census Divisions had increases in coal consumption in the electric power sector in 2007, with five of those eight having an increase of at least a million short tons. For 2007, two of the Census Divisions accounted for the majority of the increase in total coal consumption in the electric power sector. The South Atlantic Census Division accounted for 39 percent of the increase, while the East North Central accounted for another 29 percent. Total generation in the South Atlantic Census Division increased in 2007 by 3.5 percent (Table 3), while total generation in the East North Central Division increased by 2.9 percent. Coal is the primary fuel for electricity generation in both Census Divisions. Coal generated 53.9 percent of the electricity in the South Atlantic Division and 69.6 percent in the East North Central Division during 2007. The growth in generation from coal in the South Atlantic Division resulted in an increase in coal consumption of 7 Mt (7.7 million st), up 4.3 percent to end the year at 169 Mt (186.4 million st). Coal consumption in the electric power sector in the East North Central Division increased by 2.5 percent to 215.5 Mt (237.5 million st), an increase of 5.2 Mt (5.7 million st) in 2007.

In the West South Central Census Division, coal competes with natural gas as the primary source for electric power generation, both accounting for about 40 percent of the Division's generation. Total generation in 2007 in the electric power sector in the West South Central Census Division grew by 2.5 percent, while coal-based generation grew by 1.2 percent. Total coal consumption in 2007 for the electric power sector in the West South Central Census Division increased by 2.5 Mt (2.8 million st), or 1.8 percent, ending the year at 140 Mt (154.6 million st). Although the Pacific Census Division was the only division to have a decrease (1.1 percent) in total generation in the electric power sector in 2007, it had the fourth largest increase in coal consumption for the year. Even though coal is such a small part of the total generation for the division (usually less than 5 percent), the increase in coal consumption for electric power sector was 2.4 Mt (2.7 million st) to a level of 9.3 Mt (10.3 million st). The substantial decrease in the generation by hydroelectric facilities, which generally account for about 40 percent of total generation, in the Pacific Census Division of 16.6 percent in 2007 helped to increase the need for coal to generate electricity.

FIG. 6

Delivered coal prices, 1998-2007 (nominal $/st). Sources: Energy Information Administration, *Quarterly Coal Report*, October-December 2006, DOE/EIA-0121(2007/Q4) (Washington, DC March 2008); *Coal Industry Annual*, DOE/EIA-0584, various issues; and *Annual Coal Report 2003*, DOE/EIA-0584(2003), (Washington, DC, November 2004); *Annual Coal Report 2005*, DOE/EIA-0584(2005), (Washington, DC November 2006); *Electric Power Monthly*, March 2008, DOE/EIA-0226 (2008/03), (Washington, DC, March 2008).

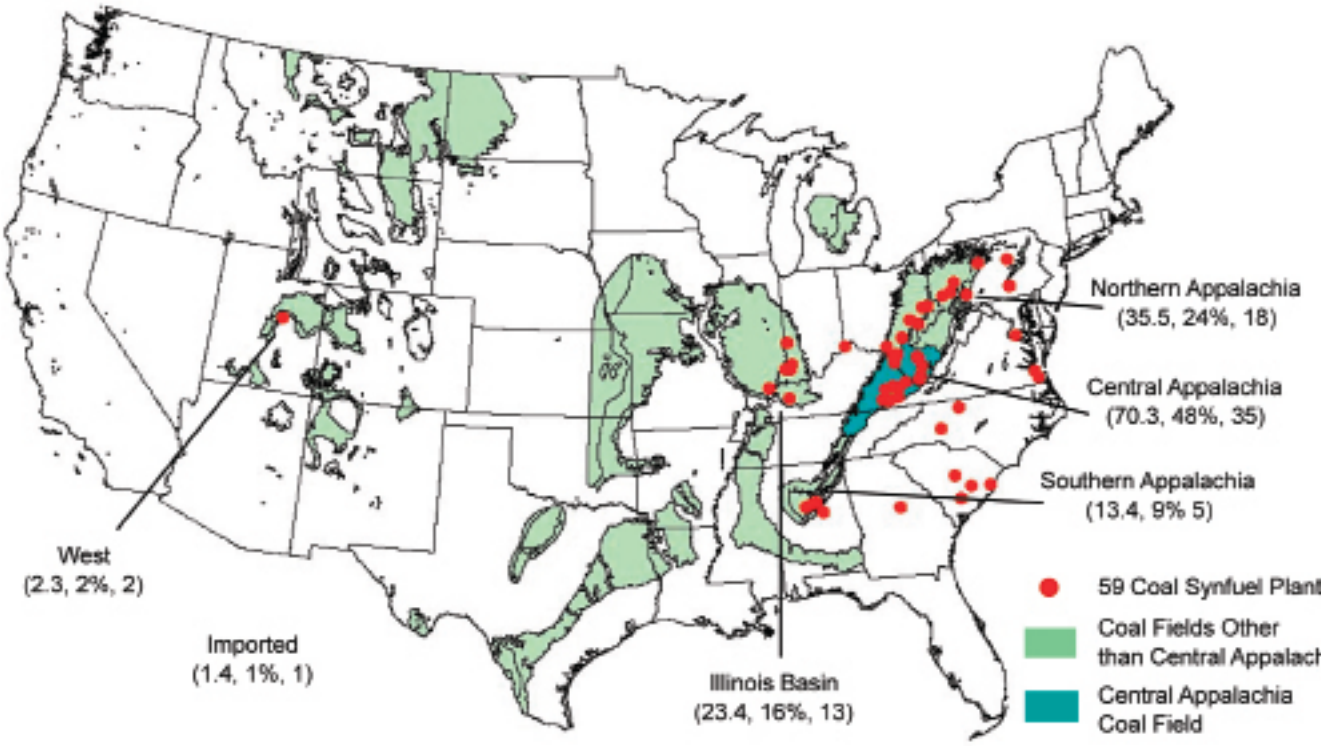


Coal accounts for about three-fourths of generation in the West North Central Census Division. In 2007 total generation increased by 2.8 percent, while generation from coal grew by 0.8 percent. Total coal consumption for the electric power sector in the West

North Central Division rose to 134 Mt (147.8 million st), an increase of 1.1 Mt (1.2 million st). More than half of the electricity generated in the Mountain Census Division is derived from coal. In 2007, total generation in the Mountain Census Division increased by 3 percent, while coal-based generation remained essentially unchanged for the year. Even though coal-based generation was about level, coal consumption in the electric power sector in the Mountain Division increased slightly by 453 kt (500,000 st) to end the year at 105 Mt (115.2 million st). In the Middle Atlantic Census Division, coal competes with nuclear power for the largest share of total generation. In 2007, total generation in the Middle Atlantic Division increased by 3.7 percent, while nuclear power generation increased by 1.2 percent and coal-based generation increased by 1 percent. Total coal consumption for the Middle

FIG. 7

Coal shipments from coal-producing regions to coal synfuel plants, 2007 (million st, percent of U.S. total and number of plants). Note: The numbers of plants inside the parentheses add to 74 rather than 59 plants because seven synfuel plants received coal from two or more coal-producing regions.Source: Energy Information Administration, Form EIA-3, "Quarterly Coal Consumption and Quality Report – Manufacturing Plants."



Atlantic Census Division increased by 272 kt (300,000 st) to 63.7 Mt (70.3 million st). Coal accounts for less than one-sixth of total generation in the New England Census Division, and in 2007, total coal consumption for electricity generation grew by 3.6 kt (4,000 st).

The East South Central Census Division was the only division to have lower coal consumption in the electric power sector in 2007. Coal is the dominant fuel for generation in the East South Central Division, typically accounting for about two-thirds of total generation in a year. Total electricity generation in the East South Central Division increased by 2 percent in 2007. Natural gas generation grew significantly in the Division, increasing by 28.7 percent while coal-based generation decreased by 0.7 percent. The slight decline in coal-based generation resulted in a decrease in coal consumption in the East South Central Census Division of 1 percent to end the year at a total of 105 Mt (115.6 million st).

Coal consumption in the non electric power sector (comprised of the other industrial, coking coal and residential and commercial sectors) declined in 2007 (Fig. 5). Coal consumption at coke plants decreased by 181 kt (200,000 st) to end the year at 20.1 Mt (22.7 million st), a decline of 1.1 percent. The decline in U.S. coke production in 2007 was a result of the decrease in pig iron production that occurred for the year combined with the slight drop in U.S. coke exports.

Although GDP grew by 2.2 percent, the economic growth did not extend into the entire manufacturing sector in 2007. As a result, coal consumption in the other industrial sector declined by 2.7 Mt (3 million st) to end the year at 51.2 Mt (56.5 million st). The broad range of products in the numerous North American Industry Classification System (NAICS) manufacturing plants showed varied changes in coal consumption for 2007. The nonmetallic minerals products and chemical manufacturing segments had no change in coal consumption for the year, while the food manufacturing segment had a slight increase in coal consumption. However, the decrease in coal consumption in 2007 in the other industrial sector was primarily a result of the large decrease in the primary metal manufacturing segment, a decline of 1.9 Mt (2.1 million st). The majority of the decrease in coal consumption in this segment was the result of the closing of a dedicated plant at a primary metals facility at the end of 2006. The plant closed the old facility after securing the necessary power to run a smelter from an independent power source that burns coal to generate electricity. In essence, this is a shift of coal consumption from the other industrial sector to the independent power producers' portion of the electric power sector. Coal consumption in the residential and commercial sector remained basically steady in 2007.

Coal prices

Domestic coal prices continued their increasing trend in 2007 rising for the fourth consecutive year. Although the average delivered prices in the consuming sectors increased for the year, it was at a slower rate than was experienced in 2006. The majority of coal sold in the electric power sector is through long-term contracts, in conjunction with spot purchases to supplement the demand. According to preliminary data through November 2007, coal prices at electric utilities (a subset of the electric power sector) increased for a seventh consecutive year, to $39.77/t ($36.08/st) ($1.78 per million Btu), an increase of 5.3 percent. From the 2006 price. Coal prices

Table 4

Coal statistics for synthetic fuel plants (thousand st, nominal $/st).

Year and quarter	Coal receipts	Average price of receipts	Coal used	Coal stocks
2003				
January - March	26,558	$32.10	26,334	1,210
April - June	31,327	$32.71	31,077	1,455
July - September	27,911	$33.13	28,110	1,287
October - December	29,380	$33.52	29,787	1,132
	115,177	**$32.88**	**115,309**	
2004				
January - March	31,633	$34.39	31,374	1,251
April - June	31,882	$35.99	31,968	1,023
July - September	32,006	$37.46	32,172	810
October - December	30,645	$37.63	30,297	1,072
	126,165	**$36.36**	**125,810**	
2005				
January - March	33,510	$41.82	33,523	1,064
April - June	36,770	$42.60	36,123	1,774
July - September	37,259	$42.44	37,516	1,488
October - December	33,060	$44.33	32,580	1,728
	140,598	**$42.78**	**139,743**	
2006				
January - March	33,677	$46.58	33,468	1,951
April - June	26,061	$47.85	25,492	2,426
July - September	16,847	$52.65	17,007	2,130
October - December	33,397	$46.87	33,636	1,701
	109,982	**$47.90**	**109,603**	
2007				
January - March	36,531	$45.78	35,669	2,486
April - June	39,582	$45.27	39,022	2,764
July - September	39,590	$45.66	40,330	1,839
October - December	30,646	$48.50	31,482	387
	146,350	**$46.18**	**146,503**	

Note: Total may not equal sum of the components because of independent rounding.
Source: Energy Information Administration, Form EIA-3, "Quarterly Coal Consumption and Quality Report - Manufacturing Plants."

at independent power producers through November 2007 increased to $36.89/t ($33.47/st) ($1.73 per million Btu), an increase of 1.3 percent. The average delivered price of coal to the other industrial sector increased by 5.3 percent to an average price of $59.98/t ($54.42/st) in 2007. In 2007, the delivered price of coal to U.S. coke plants increased by 2.3 percent to reach an average price of $104.68/t ($94.97/st) (Fig. 6).

Coal synfuel

The coal synfuel industry in 2007 was not affected by the increases in oil prices that occurred during the year to the extent it was in 2006. In 2007, the amount of coal processed by coal synfuel plants in the United States reached a record level for the short time that EIA has been collecting data on this sector. The tax credits available to coal synfuel producers are subject to a ranged phase-out linked to the average annual domestic wellhead oil price. Most plants ran at full capacity during the year despite the fact that the expiration of those tax credits would occur at the end of the 2007.

According to preliminary data, there were 59 coal synfuel plants in operation in the United States at the end of 2007 (Fig. 7 and Table 4). The amount of coal processed by these plants in 2007 was 132.9 Mt (146.5 million st), an increase of 33.5 Mt (36.9 million st) from the depressed level processed in 2006, which was held done due to the high oil prices. The average price of coal delivered to the coal synfuel plants decreased in 2007 by 3.6 percent to $50.90/t ($46.18/st) making it the only sector to experience lower delivered prices for the year. These plants process run-of-mine and waste coal to produce their end product, typically referred to as coal synfuel, which enters into the supply chain and is consumed by various users in almost all sectors, including the export market. As in the traditional coal industry, more than 90 percent of coal synfuel is distributed to the electric power sector, while smaller amounts are sent to coke plants and other industrial plants, or are exported.

Exports and imports

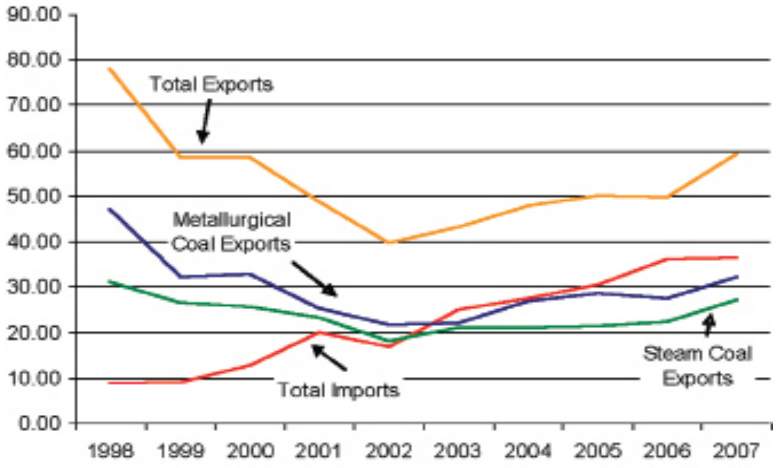
Exports. U.S. coal exports were higher in 2007 by 8.6 Mt (9.5 million st) or 19.2 percent. The substantial increases in shipments in the second half of the year accounted for about 73 percent of the higher level. Total U.S. coal exports in 2007 were 53.7 Mt (59.2 million st), a level higher than any since 1998 (Fig. 8). Although total coal exports were up for the year, the average price per ton decreased slightly by 1 percent to $77.43/t ($70.25/st).

Metallurgical coal exports increased in 2007 to end the year at 29.2 Mt (32.2 million st), an increase of 17 percent. The world metallurgical coal market tightened due to increasing world demand combined with transportation issues experienced during the year in other metallurgical coal-exporting countries. Although the tonnage was up from the prior year, the average price of U.S. metallurgical coal exports declined in 2007 to $98.09/t ($88.99/st), a decrease of $2/t ($1.82/st) from 2006.

Europe is the main destination for U.S. metallurgical coal. The increase in shipments in 2007 accounted for two-thirds of the total increase in metallurgical coal exports. Metallurgical coal exports to Europe were 16.7 Mt (18.4 million st), an increase of 20.6 percent from 2006. In 2007, Italy was the primary European destination of U.S. metallurgical coal exports with a total of 3.1 Mt (3.4 million st), a slight increase of 90.7 kt (100,000 st) from 2006. The average price of metallurgical coal exports to Italy was $104.33/t ($94.65/st) in 2007, a decrease of 63 cents/t (57 cents/st). The Netherlands received 1.8 Mt (2 million st) of U.S. metallurgical coal in 2007 making it the second-largest European destination. The increase of 544 st (600,000 st) was 41.8 percent higher than the prior year, while the average price decreased 89 cents/t (81 cents/st), from $95.44/t to $94.55/t ($86.59/st to $85.78/st). France

FIG. 8

U.S. coal exports and imports, 1998-2007 (million st). Sources: U.S. Department of Commerce, Bureau of the Census, "Monthly Report EM 545" and "Monthly Report IM 145."



and the United Kingdom each received 1.5 Mt (1.7 million st) of U.S. metallurgical coal in 2007. That total was an increase of 23.8 percent for France and an increase of 20 percent for the United Kingdom. The percentage decreases in the average price per short ton of those metallurgical coal exports were 5.8 and 8.1 percent, respectively. The average price for metallurgical coal to France was $96.38/t ($87.44/st) and the price for the United Kingdom was $99.14/t ($90.19/st) in 2007.

Other major European destinations for U.S. metallurgical coal in 2007 were Belgium, Spain, Turkey and Germany. Each received more than 907 kt (1 million st) s of coal. The average price of metallurgical coal exports to these major destinations ranged from $92.85/t ($84.24/st) in Germany to $102.18/t ($92.70/st) in Spain. In 2007, Poland received 363 kt (400,000 st) of U.S. metallurgical coal, the first time any U.S. coal had been shipped to Poland since 1991. In part, this was a response to production issues experienced in its mining industry during the year.

Total U.S. metallurgical coal exports to countries in North America decreased in 2007. Shipments to South America increased substantially. The primary destination for each region being Canada and Brazil, respectively. Canada received 3.2 Mt (3.6 million st) of metallurgical coal from the United States, a decrease of 20.2 percent from 2006. Shipments to Brazil totaled 5.8 Mt (6.4 million st), an increase of 47.7 percent. The average price of metallurgical coal in 2007 decreased to both countries with the price to Canada at $84.83/t ($76.96/st), while the price to Brazil was $97.35/t ($88.32/st), representing declines of 1 and 7.2 percent, respectively.

The Asian market, is supplied primarily by the major metallurgical coal mines of Australia. It accounted for about 3 percent of U.S. metallurgical coal exports in 2007. Total metallurgical coal exports to Asia were 907 kt (1 million st) in 2007, a decline of 29.6 percent from 2006. Both of the Asian countries that were the principal destination of U.S. metallurgical coal exports had decreases in their shipments in 2007, while Japan disappeared from the list of U.S. metallurgical coal destinations. India, the primary Asian destination of U.S. metallurgical coal exports, received less tonnage in 2007, declining 10.1 percent to end the year with a total of 816 kt (900,000 st). South Korea received 130 kt (143,000 st) in 2007, a slight drop of 2.7 kt (3,000 st). The average price for India was $113.17/t ($102.67/st), an increase of $5.25/t ($4.77/st). The average price for metallurgical coal exports to South Korea dropped significantly in 2007 by $20.92/t ($18.98/st) to $81.15/t ($73.26/t).

Metallurgical coal exports to countries in Africa increased in 2007 from 1 Mt (1.1 million st) to 1.9 Mt (2.1 million st). The majority of the metallurgical coal exports to Africa went to Egypt. Total U.S. metallurgical coal exports to Egypt in 2007 were 1.36 Mt (1.5 million st), a level more than double the 2006 total. The average price was $100.02/t ($90.74/st), a decline in price of 7.6 percent from 2006.

U.S. steam coal exports increased in 2007 for the fifth consecutive year. Steam coal exports rose by 21.8 percent to 24.5 Mt (27 million st) in 2007, while the average price per ton increased by 3.6 percent to $52.79/t ($47.90/st).

Canada is the largest market for all U.S. coal exports as well as the primary North American destination of steam coal exports. In 2007, Canada received 13.4 Mt (14.8 million st) of steam coal exports, a slight decrease of 544 kt (600,000 st). U.S. steam coal exports to Canada accounted for 54.7 percent of all of 2007 steam coal exports. The average price of steam coal exports to Canada decreased by only 35 cents/t (32 cents/st) in 2007 to $44.79/t ($40.63/st). Mexico was the second largest North American country to received U.S. steam coal exports in 2007, with a total of 182 kt (201,000 st), a slight increase from the 2006 level.

Europe is the second largest market for U.S. steam coal exports due to the declining coal production in many of the countries combined with the proximity of the major eastern U.S. coal ports. Total steam coal exports to Europe increased in 2007 to 7.9 Mt (8.7 million st), an increase of 57.1 percent from 2006. The average price of steam coal to Europe rose in 2007 by 2.8 percent, increasing to $65.93/t ($59.81/st). More than half of the increase in U.S. steam coal exports to Europe was accounted for by one country, the Netherlands. The increased shipments of steam coal to the Netherlands of 1.7 Mt (1.9 million st) accounted for 58.6 percent of the total increase in steam coal exports to Europe. The average price of steam coal exports to the Netherlands in 2007 was $70.35/t ($63.82/st), an increase of 0.6 percent from 2006. Increases in steam coal exports more than 453 kt (500,000 st) each in 2007 occurred for Germany and the United Kingdom, resulting in total U.S. steam coal exports of 1.1 Mt (1.2 million st) and 1.5 Mt (1.7 million st), respectively. The average price of steam coal exports for Germany and the United Kingdom dropped in 2007. The price for Germany in 2007 was $62.48/t ($56.69/st), a decrease of 10.6 percent. The price for the United Kingdom was $51.34/t ($46.85/st), a decrease of 1.8 percent from 2006. Ireland, which did not receive U.S. steam coal exports in 2006, had a total of 73 kt (81,000 st) in 2007.

U.S. steam coal exports to the African continent increased dramatically by 918 percent in 2007, increasing to 2.3 Mt (2.5 million st). The increase in steam coal exports to Africa is attributable to one country, Morocco. Total steam coal exports to Morocco in 2007 were 2.2 Mt (2.4

million st), well above the 2006 total of 189 kt (209,000 st). The average price of steam coal exports to Morocco in 2007 was $52.16/t ($47.32/st), an increase of 5.6 percent from 2006.

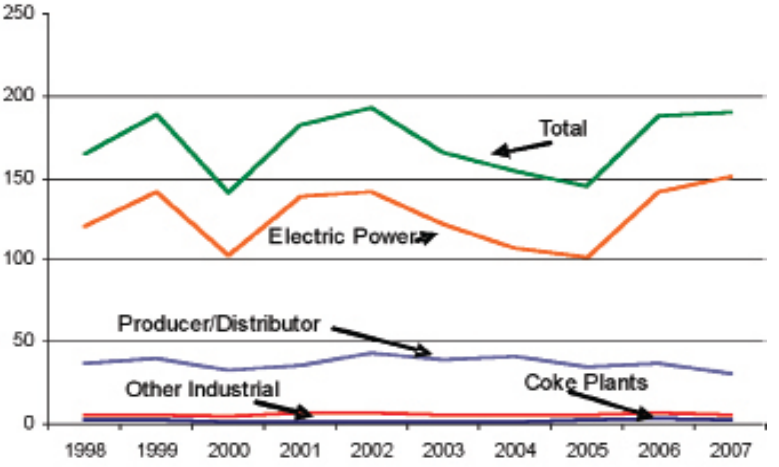
Steam coal exports to South America, the primary source of coal imports for the United States, doubled in 2007 to 451 kt (497,000 st), with the majority of the exports going to Chile, a total of 298 kt (329,000 st). The average price of steam coal exports to South America fell substantially to $56.07/t ($50.87/st) from the 2006 level of $80.93/t ($73.42/st).

Steam coal exports to Asia continued its declining trend in 2007, dropping by 68 percent for the year. Total steam coal exports to Asia were 181 kt (200,000 st) for the year. Although there were slight tonnage increases in a few countries, the decline in U.S. steam coal exports to South Korea accounted for the majority of the drop in steam coal exports to Asia. In 2007, South Korea only received 72.5 kt (80,000 st) of steam coal from the United States, 312 kt (344,000 st) lower than the 2006 total. The average price of steam coal exports to Asia actually increased in 2007 to $58.68/t ($53.24/st), a 14.3-percent increase from the 2006 price of $51.34/t ($46.58/st). The average price of steam coal exports to South Korea increased in 2007 by 35.3 percent to a level of $61.91/t ($56.17/st).

U.S. coke exports declined in 2007 by 10.7 percent to 1.2 Mt (1.4 million st). Most of the coke exports went to Canada, which accounted for 40.8 percent of all coke exports with 544 kt (600,000 st). The other major destination of U.S. coke exports was Mexico with 362 kt (400,000 st), or 29.2 percent of the total coke exports.

FIG. 9

Year-End Coal Stocks, 1998-2007 (million st). Sources: Energy Information Administration, Quarterly Coal Report, October-December 2006, DOE/EIA-0121(2007/Q4). (Washington, DC, March 2008); and Coal Industry Annual, DOE/EIA-0584, various issues.



Imports. Although 2007 was another record year for U.S. coal imports, the fifth in a row, the increase in tonnage was slight. Total coal imports were 32.9 Mt (36.3 million st), an increase of 0.3 percent, or 91.6 kt (101,000 st). Even though imports increased in 2007, they only represented about 3 percent of total U.S. coal consumption.

The average price of imported coal declined in 2007, by 3 percent. The average price of U.S. coal imports was $52.51/t ($47.64/st), down from 2006's $54.12/t ($49.10/st).

Colombia, which dominates the U.S. coal import market, accounted for 73.9 percent of 2007 imports. The United States imported 24.4 Mt (26.9 million st) of coal from Colombia in 2007, an increase of 1.3 Mt (1.5 million st) from the 2006 level. The average price of Colombian coal into the United States was $51.07/t ($46.33/st), a decrease of 1.3 percent from 2006. In 2007, Indonesia surpassed Venezuela to become the second largest supplier of coal imports. Coal imports from Indonesia in 2007 were 3.3 Mt (3.7 million st), an increase of 453 kt (500,000 st), while the average price increased by 14.4 percent to $28.77/t ($26.10/st). Coal imports from Venezuela declined by 18.4 percent to 3.1 Mt (3.4 million st), while the price of the coal imports remained unchanged for the year.

Canada was another major source of U.S. coal imports in 2007 with a total of 1.8 Mt (2 million st), below its 2006 total. Those four countries accounted for about 99 percent of total U.S. coal imports. Although most coal imports are used for electric generation, metallurgical coal imports were 1.5 Mt (1.7 million st) in 2007, almost all from Canada.

U.S. coke imports decreased in 2007 by 39.5 percent to end the year at 2.2 Mt (2.5 million st). A reduction in shipments of coke from China of 1.5 Mt (1.6 million st) in 2007 accounted for most of the decline in coke imports. Although the level of coke imports decreased in 2007, the average price increased for the year by 24.3 percent to $214.38/t ($194.49 st).

Coal stocks

Total coal stocks at the end of 2007 were 172 Mt (189.4 million st), an increase of 2.3 Mt (2.5 million st) from the prior year (Fig. 9). Estimated coal stocks held by producers and distributors were lower by 15.9 percent, as coal producers used stocks to supplement the increasing demand. Industrial users, including coke plants, held a total of 6.9 Mt (7.6 million st) at the end of 2007, 1.7 Mt (1.9 million st) less than the level at the start of the year. Coal stocks in the electric power sector continued to increase in 2007 as plants continued to rebuild stocks that had dropped substantially by the end of 2005 due to transportation problems. The electric power sector ended the year with 137 Mt (151.1 million st), an increase of 9.25 Mt (10.2 million short tons, or 7.2 percent from 2006.

Summary

2007 was another mixed year for the U.S. coal industry. It experienced record consumption but lower coal production. Although coal imports increased slightly, coal exports grew, resulting in an increase in net exports for 2007. Delivered coal prices continued to increase, while coal export prices moderated. Coal stocks continued to recover from their low 2005 levels in the electric power sector.

The outlook for the U.S. coal industry in 2008 is good. Higher coal consumption due to increasing electricity demand and continued growth in U.S. coal exports as the world markets remain tight should combine to increase coal production for the year. (See Energy Information Administration's Short-Term Energy Outlook.) ■