



# 2007 Minerals Yearbook

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REPUBLIC OF KOREA [ADVANCE RELEASE]

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# THE MINERAL INDUSTRY OF THE REPUBLIC OF KOREA

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The Republic of Korea continued to rely on external sources for much of its mineral requirements. The country imported as much as 87% of its mineral needs and a significant percentage of its energy resource requirements to support its robust manufacturing sector, including almost the entire domestic demand for bituminous coal, and ores and concentrates of copper, iron, lead and zinc. However, the country does host small reserves of gold, molybdenum, silver, tin, tungsten and zinc. The mining industry of the Republic of Korea contributed very little to the country's gross domestic product (GDP).

In 2007, the Republic of Korea's economy as measured by the real GDP grew by 6.0% to \$962.7 billion. The population was estimated to be 48.5 million. The country's annual exports were valued at \$371.5 billion, and its annual imports were valued at \$356.8 billion. The country's 2007 foreign exchange reserves were \$262.2 billion (Bank of Korea, 2008, p. 130; U.S. Central Intelligence Agency, 2008).

To compensate for the small amount of mining activity on the domestic front, the Republic of Korea entered into partnerships worldwide to develop mining properties, including a 125-million-metric-ton (Mt) nickel mine in Madagascar. It also signed agreements with the Governments of Côte d'Ivoire, Indonesia, Laos, and Ukraine to use the production from mines in these regions. The country was also building large-scale steel plants in many countries so that they could use iron ore resources around the globe. State-owned Pohang Iron and Steel Co. (POSCO), was planning to build a \$12 billion steel plant in India and a \$4.5 billion steel plant in Vietnam (Business Monitor International, 2008a).

## Minerals in the National Economy

In 2007, the economy grew by 6.0%, the manufacturing sector grew by 5.9%, and the mining and quarrying sector grew by 8.7% (Bank of Korea, 2008, p. 188). The mining and quarrying sector, which was the smallest sector of the Republic of Korea's economy, produced small quantities of anthracite coal and ores and concentrates of ferrous and nonferrous metals; it produced a considerable quantity of industrial minerals for domestic consumption by the manufacturing and construction industries. According to the Bank of Korea, the output of the mining and quarrying sector accounted for only 0.25% of the country's real GDP (in 2000 constant prices) in 2007; the output of the industrial minerals (nonmetal) sector accounted for about 70% of the country's total mineral production (Korea Resources Corp., 2003, p. 9; Bank of Korea, 2008, p. 188).

## Government Policies and Programs

In the first half of 2007, the Government implemented two asset-based programs with the goal of boosting the national economy by encouraging intensive investment in the development of the country's industries (Hankyoreh, 2006;

Ministry of Health and Welfare, 2007). The 17th President of the Republic of Korea was elected to office in December 2007, and the new administration was expected to significantly shift policies regarding North Korea and to strongly support free trade and market-based economics (Korea Culture Services, 2008; Stanford University, 2008).

The Ministry of Commerce, Industry and Energy (MCIE) is the main Government agency responsible for implementing the country's mineral laws and policies. The Korea Mining Act as amended by law No. 6656 of 2002 provides the basic guidelines for the mining industry. In June 1967, the Government established Korea Resources Corp. (KORES) to support the development of the domestic private sector mining industry, to conduct research, and to provide technical assistance in the development and acquisition of overseas mineral resources (Korea Resources Corp., 2003, p. 87, 95).

Because of the country's heavy reliance on imports of raw materials for its manufacturing sector and the lack of a materials stockpiling program to draw upon in the event of a resource crisis, MCIE, through KORES and Korean National Oil Corp. (KNOC), was actively promoting overseas exploration and development of mineral resources and seeking cooperative relations with resource-rich developing countries. As a long-term policy goal, the Government was seeking to secure a stable supply of the mineral resources (including mineral fuels) that were considered essential for stable economic growth. In recent years, KORES had moved toward direct equity participation in overseas mine development, and planned to be importing six strategic minerals from overseas investments owned wholly or in part by KORES in the following percentages by 2010: coal, 30%; copper, 20%; zinc, 20%; iron ore, 10%; uranium, 10%; and rare earths, 5% (Korea Resources Corp., 2003, p. 77; 2005, p. 9).

In September 2007, KORES was restructured into 3 headquarters, 4 departments or divisions, 33 teams, 2 branch offices in the Republic of Korea, 6 branch offices overseas, and 1 branch office in North Korea. The Government envisioned KORES becoming a global top 20 mining company by 2020 (Korean National Oil Corp., 2008a).

## Production

In 2007, production of bismuth, smelter and refined copper, refined gold, iron and steel, and refined zinc all increased; whereas production of cadmium and mined gold, lead, and silver decreased (table 1).

The Republic of Korea's mine production of ferrous and nonferrous metals included copper, gold, iron ore, lead, silver, and zinc. The mine production of industrial minerals included diatomaceous earth, feldspar, graphite, limestone, mica, pyrophyllite, quartzite, salt, sand, talc, and zeolites. Mine production of ferrous and nonferrous metals was very small compared with the country's raw material requirements for its

ferrous and nonferrous metal manufacturing industries. Mine production of industrial minerals was mostly for domestic consumption. Some mine production of industrial minerals, such as pyrophyllite, talc, and zeolites, was exported. The country also produced anthracite coal and a small amount of natural gas from an offshore gasfield, but no crude petroleum.

The country was the world's leading producer of cadmium, the third ranked producer of slab zinc, and the fifth ranked producer of steel (World Steel Association, 2008; World Bureau of Metal Statistics, 2008, p. 34, 129). It was also a major producer of cement, refined copper, pyrophyllite, talc, and zeolites in the Asia and the Pacific region and one of the region's significant consumers and importers of coal, natural gas, and crude petroleum; of ores and concentrates of copper, iron, lead, and zinc; and of nickel oxide sinter.

### Structure of the Mineral Industry

Owing to its small supply of domestic mineral resources, the Republic of Korea relied heavily on imports to meet its domestic demand of most of the raw materials needed to supply its energy and manufacturing industries. The country relied 100% on imports to meet its requirements for bituminous coal, ores and concentrates of copper, and fluorite and phosphate rock. The country relied on imports for about 99% of its domestic requirements for iron ore and most nonferrous metallic minerals, such as lead and zinc. According to KORES, the Republic of Korea has small reserves of antimony, copper, gold, iron ore, lead, molybdenum, silver, tin, tungsten, and zinc. It also has small reserves of coal and offshore natural gas. However, the country has relatively large reserves of such industrial minerals as kaolin, limestone, pyrophyllite, silica stone (quartzite), and talc.

The Republic of Korea's mining and quarrying sector consisted of small mining industries of coal and ferrous and nonferrous metals and a relatively larger industry of industrial minerals. The mineral-processing sector, which consisted of the cement, ferrous and nonferrous metals, and refined petroleum products industries, was much larger than the mining and quarrying sector (table 2). All the country's large coal mining, natural gas, petrochemical, and petroleum refining companies were state owned and under the supervision of MCIE. The rest of the mining, quarrying, and ferrous- and nonferrous-metal-processing companies were privately owned and operated.

In May 2007, the Republic of Korea began commercial production at its first (and the world's seventh ranked) molybdenum smelter at Yeosu in South Jeolla Province. The construction of this 6,000-metric-ton-per-year (t/yr) smelter was aimed at reducing the country's dependence on refined molybdenum imports from Chile and China. The smelter, which was a joint venture between KORES and Seoul-based metals trader KTC Korea Co., would have the capacity to process 670 metric tons (t) of ore from the Uljin molybdenum mine, which is located in North Gyeongsang Province. One-half of its production would be destined for steel manufacturer POSCO. The smelter would initially meet 35% of domestic demand and save the country \$140 million annually on import costs; it was projected to meet 70% of domestic demand when its capacity is doubled at some point in the future (Mineweb, 2007).

### Mineral Trade

In 2007, the value of the Republic of Korea's total annual exports increased by 14.1% to \$371.5 billion from a revised \$325.5 billion in 2006 owing mainly to a 15% increase in exports of heavy industry products to \$311.0 billion from \$270.3 billion (revised). Of this amount, the value of exports of chemicals increased by 17.9% to \$36.8 billion from \$31.2 billion in 2006 and that of iron and steel products increased by 16.3% to \$31.6 billion from \$27.2 billion.

In 2007, the value of the country's total annual imports increased by 15.3% to \$356.8 billion from \$309.4 billion in 2006 owing mainly to a 16.0% increase in imports of crude materials and fuels to \$201.7 billion from \$173.9 billion. Of this amount, the value of imports of fuel (coal, natural gas, and crude petroleum) increased by 10.9% to \$94.6 billion from \$85.3 billion; that of metallic and industrial minerals increased by 22.9% to \$16.0 billion from \$13.0 billion.

The Republic of Korea was a net importer of mineral commodities and depended on imported raw materials to manufacture large quantities of iron and steel and refined petroleum products for domestic consumption and export. It also used mostly raw materials to produce significant quantities of cadmium and zinc and a considerable amount of ferrous and nonferrous metals, including bismuth, copper, gold, lead, and nickel. In 2007, imports of fuels totaled \$94.6 billion, of which \$60.3 billion was crude petroleum. Imports of iron and steel products totaled \$24.1 billion, and those of nonferrous metals, \$14.3 billion. Imports of minerals, which included iron ore and ores and concentrates of copper, lead, zinc, and other minerals, totaled \$16.0 billion (Bank of Korea, 2008, p. 130-131).

In 2007, the Republic of Korea was one of the world's leading importing countries for coking coal, natural gas, and crude petroleum; it was the fifth ranked net importer of petroleum and the second ranked net importer of liquefied natural gas (LNG) in the world. The country relied on imports for all its petroleum needs and imported the bulk of its bituminous coal requirements owing to a lack of high-quality domestic bituminous coal reserves (U.S. Energy Information Administration, 2008).

### Commodity Review

#### Metals

**Aluminum.**—The Republic of Korea relied on imports to meet all its requirements for primary aluminum. In 2007, imports of primary aluminum decreased by 1.2% to 1,190,456 t from 1,204,350 t in 2006, of which 970,120 t was primary aluminum ingot, and 220,336 t, primary aluminum alloys. The major suppliers of primary aluminum ingots and alloys were China (525,786 t, or 44.2% of the amount imported), Russia (247,108 t, or 20.8% of the amount imported), Australia (236,199 t, or 19.8% of the amount imported), the United Arab Emirates (40,734 t, or 3.4% of the amount imported), and Canada (39,957 t, or 3.4% of the amount imported). The country's imports of aluminum and aluminum alloy scrap increased by 23.9% to 467,491 t from 377,178 t in 2006. Domestic demand for primary aluminum decreased by 6.3% in

2007 to 1,080,620 t from 1,153,152 t in 2006 (World Bureau of Metal Statistics, 2008, p. 25). Domestic aluminum products manufacturers were the major consumers. Aluminum production included coil, plate, and sheet; extrusion products; foil; metal powders; wheels for automobiles; and other casting products.

**Copper.**—Mined production of copper was very small, and it was insignificant compared with the country's requirements for copper ore and concentrate of about 1.4 Mt (in gross weight). The country's domestic copper consumption was 419,792 t in 2007, and it was the second ranked consumer and the third ranked producer of refined copper in the Asia and the Pacific region. The country relied on imports of copper ore and concentrate to meet the raw material requirements for its copper smelters, which were located in Changhang and Onsan. In 2007, imports of copper ore and concentrates decreased by 3.7% to 1,402,886 t from 1,457,347 t (revised) in 2006 (World Bureau of Metal Statistics, 2008, p. 71).

In 2007, the Republic of Korea's copper smelters produced about 515,000 t of blister and anode copper and about 581,000 t of refined copper. To meet the domestic raw material requirements for the copper smelters and refineries, the country imported unrefined copper, which included 1,402,886 t (gross weight) of ores and concentrates, and 100,129 t of blister and anode copper. To meet the domestic refined copper requirements, the country imported 419,792 t of refined copper, 362 t of master alloys, 1,621 t of copper alloy ingots, and 221,054 t of copper and copper alloy scrap (World Bureau of Metal Statistics, 2008, p. 71). The Republic of Korea's refined copper consumption increased by 3.6% to 857,647 t from 827,869 t in 2006. Imports of copper cathode increased by 10.4% to 419,792 t from 380,254 t in 2006; exports of copper cathode, however, decreased by 3.1% to 139,776 t from 144,249 t (revised). In the domestic market, most copper cathode was consumed by the manufacturers of brass, cable, plates, sheet, strip, tube, and wire (World Bureau of Metal Statistics, 2008, p. 71).

**Gold.**—The Republic of Korea produced 47,078 kilograms (kg) of refined gold in 2007, of which 3,098 kg was produced from domestic raw materials (which included scrap). Imports of refined gold totaled 60,610 kg, and were valued at \$1,312.6 million; domestic demand for refined gold was 44,527 kg. Exports of refined gold totaled 36,574 kg and were valued at \$678.9 million. The major end users of refined gold were the manufacturers of coins, dental products, electrical communication parts, jewelry, and materials for semiconductors (Ministry of Commerce, Industry and Energy, 2008, p. 9).

**Iron and Steel.**—In 2007, mine production of iron ore, in gross weight, increased by 27.9% to about 290,802 t from 227,437 t in 2006. Domestic iron ore was produced from the Sinyemi Mine. The Republic of Korea relied 99.4% on imports to meet its iron ore requirements in 2007. Imports of iron ore increased by 5.2% to 46,176,285 t from 43,895,431 t in 2006 and were valued at about \$2.86 billion. Imports of iron ore were mainly from Australia, Brazil, India, and South Africa; other suppliers of iron ore were Chile, Peru, and the United States. The average import price of iron ore rose by 14.2% to \$61.85 per metric ton from \$54.16 per metric ton in 2006 (Ministry of Commerce, Industry and Energy, 2008, p. 9).

In 2007, the iron and steel industry consumed 47.78 Mt of iron ore. Pig iron production increased by 6.9% to 29.44 Mt from 27.55 Mt in 2006. Crude steel production increased by 6.3% and reached a new record-high level of 51.52 Mt in 2007, of which 31.1 Mt (60.4%) was produced by POSCO; 10.0 Mt (19.4%), by Hyundai INI Steel Co.; and the remaining 10.48 Mt (20.0%), by all other steel companies, among which were Dongkuk Steel Mill Co. Ltd., Korea Iron and Steel Co. Ltd., SeAH Besteel Corp., and Yamato Korea Steel Corp. (Ministry of Commerce, Industry and Energy, 2008, p. 9; Tex Report, The, 2008c; World Steel Association, 2008).

In 2007, the Republic of Korea was the world's sixth ranked and the Asia and the Pacific region's fourth ranked steel-producing country. The country's crude steel output accounted for about 3.8% of the world's total and about 6.8% of Asia's total. The Republic of Korea's two leading steelmakers—POSCO and Hyundai INI Steel—were the world's 4th and 29th ranked steel-producing companies, respectively, in 2007 (World Steel Association, 2008).

According to the Korea Ministry of Commerce, the country's steel consumption increased by 10.1% to 47.78 Mt in 2007 from about 43.41 Mt in 2006 because of the increasing demand for steel in the manufacturing sector, which was driven by a boom in the automobile and shipbuilding industries (Ministry of Commerce, Industry and Energy, 2008, p. 9). For five consecutive years, the Republic of Korea's steel imports had exceeded its steel exports owing mainly to a steady increase in domestic demand for low-priced steel, especially steel from China.

Hyundai INI Steel invested about \$5 billion in a project for an integrated steel mill that would contain two blast furnaces. Hyundai INI Steel, which was an affiliate of the Hyundai Kia Motor Group, projected that the steel mill would sharply increase the supply of steel and help the nation's automobile manufacturing and shipbuilding industries increase their international competitiveness. In the past, Government control had thwarted the Hyundai Kia Motor Group's efforts to enter the market. When completed, the steel mill was expected to raise the annual steel production of Hyundai INI Steel to 17 Mt from the present 2.9 Mt.

Hyundai INI Steel signed a preliminary deal with BHP Billiton for the procurement of raw materials for the steel mill project. BHP Billiton would supply between 4 Mt and 5 Mt of iron ore and between 2.5 Mt and 3 Mt of soft coal to Hyundai INI Steel for 10 years beginning in 2010.

In 2007, POSCO launched a new 445NF nickel-free stainless steel and replaced the 304-grade stainless steel with the new composition. 445NF contains 20% chrome, 0.3% titanium, and 0.1% niobium. Although 445NF has slightly poorer elongation, the cost for producing it was about one-half the cost of producing the 304-grade stainless steel. The company intended to produce 2,000 metric tons per month (t/mo) of 445NF in 2007 and to increase production to 10,000 t/mo in 2008, which would represent roughly 5% of POSCO's 2008 production. According to Macquarie Bank, this was a potentially significant move in the nickel market as the stainless steel industry accounted for more than 60% of world nickel demand (Mining Journal, 2007).

Seoul-headquartered Dongkuk Steel was a major producer of heavy plate, 70% to 80% of which was supplied to the country's shipbuilding industry. The company had a new 1.5 million-metric-ton-per-year (Mt/yr) plate mill under construction in Dangjin next to Hyundai INI Steel's EAF complex. This new mill would be reliant on imported slab and was expected to increase Dongkuk's total plate capacity to nearly 4.1 Mt/yr (Steel Business Briefing, 2008).

Ferromanganese and ferrosilicomanganese production increased by 23.7% and 12.2%, respectively, and reached 209,321 t and 105,607 t, respectively. Information on the causes of these changes was not available at the time that this report was written (table 1).

**Lead.**—Although lead smelter production increased by 19.4% to 195,022 t from 163,379 t in 2006, lead mine (Pb content) decreased by 41.7% to 12 t from 17 t in 2006, which indicates a large increase in lead ore imports.

**Molybdenum.**—Molybdenum accounts for 1% of the volume of the raw materials used to make stainless steel but 20% of the cost of materials because of its price. In 2007, the Republic of Korea began commercial production at its first molybdenum smelter (the world's seventh largest), which was located at Yeosu in South Jeolla Province. KORES announced the opening of the 6,000-Mt/yr smelter on May 13. The smelter would initially receive and process up to 670 t/yr of molybdenum ore from the Republic of Korea's only molybdenum mine in Uljin, which had estimated reserves of 3.7 Mt. One-half of the smelter's production was destined for POSCO. According to KORES's business development team, smelting molybdenum ore domestically was between 10% and 13% less expensive than buying the refined product. KORES planned to develop more mines in the country. The Republic of Korea hoped to export molybdenum (Mo) metal to Japan and Taiwan and reduce the nation's dependence on refined imports from Chile and China. The smelter was a joint venture of KORES and KTC Korea (Metals Place, 2007).

In April 2007, Oriental Minerals Inc. of Canada announced initial results of a geochemical sampling program from its regional exploration program, the Ogchon Uranium Project, which it had acquired in 2006. Significant molybdenum, uranium, and vanadium mineralization was encountered, including 0.10% Mo, 0.07% U<sub>3</sub>O<sub>8</sub>, and 0.24% V in rock chip surface samples from 11 prospective areas within the company's 39,744-hectare area. The Ogchon Uranium Project encompassed a 90-kilometer (km) trend of radiometric anomalies, as well as four historic uranium deposits (Dukpyoung, Koilnami, Samgoe, and Soryong) that had been drilled previously. Located about 170 km east-southeast of Seoul in Youngwol County, Kangwong Province, the Sangdong molybdenum-tungsten mine had been one of the world's leading tungsten producing mines between 1947 and 1992 but was closed in 1992 owing to low metal prices. Because of the closure of the Sangdong mine, the domestic price of molybdenum sharply increased to about \$38 dollar per pound (about \$76 per kilogram) in 2007 from less than \$2 per pound (about \$4 per kilogram) in 2001 (Yahoo Finance, 2007).

**Nickel.**—In 2007, the Republic of Korea imported 91,183 t of ferronickel (in gross weight), 37,427 t of nickel oxide sinter

(in gross weight), 18,339 t of refined nickel, and 1,187 t of nickel powder and flakes. The major suppliers of ferronickel were Japan (67.2%), Indonesia (19.5%), the Dominican Republic (7.2%), and Colombia (3.3%). The majority of the nickel oxide sinter was imported from Japan (41.4%), Canada (22.5%), Indonesia (20.1%), Australia (13.3%), Austria (1.5%), and Russia (0.8%). The major suppliers of refined nickel were Russia (32.1%), Australia (23.8%), Canada (11.2%), and the Netherlands (6.5%). Canada was the principal supplier of nickel powder and flakes (World Nickel Statistics Monthly Bulletin, 2008, p. B-21).

Korea Nickel Corp. was the sole nickel refining company in the Republic of Korea. The company's nickel refinery in Onsan produced mainly 97% purity nickel for consumption by domestic stainless steel manufacturers. The demand for nickel in the Republic of Korea's domestic market decreased by an estimated 32.8% in 2007 to 62,500 t from 93,000 t in 2006. Nickel ingot exports also decreased by an estimated 55.5% to 6,326 t from 14,210 t in 2006. The major importers in 2007 were Taiwan, 5,343 t (84.5%); China, 279 t (4.4%); and India, 153 t (2.4%) (World Nickel Statistics Monthly Bulletin, 2008, p. A-7, A-11, B-22).

In May 2007, POSCO launched construction of the country's first ferronickel plant. The plant, which was located at POSCO's Gwangyang premises in the Gwangyangman Free Economic Zone, would have a production capacity of 30,000 t/yr of ferronickel and was scheduled to be completed in March 2008. The nickel feedstock would be supplied by Société Minière du Sud Pacific, which was based in New Caledonia (Platts.com, 2008).

The Republic of Korea was among the world's leading consumers of nickel. The main nickel-consuming sectors in the country included electronics manufacturing, stainless steel production, and the automotive sector. Soaring nickel prices reached a record \$32,625 per metric ton in 2006 (Free Press Release Distribution Service, 2006).

**Pyrophyllite.**—In 2007, pyrophyllite production increased by 17.8% to 798,054 t from 667,465 t in 2006, and talc production decreased by 85% to 9,557 t from 64,118 t in 2006. Information on the causes of these changes was not available at the time that this report was written (table 1).

**Zinc.**—The Republic of Korea relied on imports for almost all the raw material requirements of its zinc-refining industry. In 2007, imports of zinc ore and concentrate, in gross weight, increased by 1.9% to 1,333,481 t from 1,308,703 t in 2006; these imports contained about 666,741 t of zinc metal and were valued at \$1.61 billion. The major suppliers were Peru, 381,920 t (28.6%); Australia, 363,775 t (27.3%); Russia, 218,680 t (16.4%); and Bolivia, 119,524 t (9.0%). Exports of slab zinc increased by 19.9% to 257,314 t in 2007 from 214,640 t in 2006. The principal destinations of zinc and (or) concentrate exports were Taiwan (China), 40,741 t (or 3.1% of exports); Indonesia, 33,715 t (or 2.5% of exports); Vietnam, 27,803 t (or 2.1% of exports); Malaysia, 26,347 t (or 2.0% of exports), and India, 19,672 t (or 1.5% of exports). Also in 2007, production of zinc slab increased by about 1.8% to 662,521 t from 674,400 t in 2006. Consumption of zinc ore and concentrate was 1.39 Mt, which was an increase of 11.1%

from that of 2006. Consumption of slab zinc was 485,195 t, which was a decrease of 5.8% from that of 2006 (Ministry of Commerce, Industry and Energy, 2008, p. 9; World Bureau of Metal Statistics, 2008, p. 143).

Mining production of zinc (Zn content) in 2007 increased significantly to 2,034 t from 16 t in 2006, most likely in response to the country's increased demand for zinc imports and exports (table 1).

### **Industrial Minerals**

**Cement.**—The Republic of Korea was the world's fifth ranked producer of cement after China, India, the United States, and Japan, according to the country's National Statistical Office. The national production of portland cement increased by 5.6% to about 57.0 Mt from about 54.0 Mt in 2006 (Korea Development Bank, 2008, p. 185). Cement production, for which mostly domestic raw materials (such as limestone) were used, increased to about 57 Mt in 2007, or by 5.7% compared with that of 2006, owing mainly to stronger domestic demand by the construction industry (table 1).

In 2007, the country's total domestic cement consumption was about 50.8 Mt, which included about 25.0 Mt of imported cement; the country exported about 6.3 Mt cement (China Cement Association, 2008). According to the Korean Cement Industrial Association (KCIA), the Republic of Korea's cement industry comprised 11 companies that operated 51 kilns at 13 kiln plants and 27 grinding plants. Table 2 contains information on the production capacities of seven of these companies—Asia Cement Manufacturing Co. Ltd., Hanil Cement Manufacturing Company Ltd., Hyundai Cement Co. Ltd., Lafarge Halla Cement Corp., Sung Shin Cement Company Ltd., Ssangyong Cement Industrial Co. Ltd., and Tong Yang Major Corp. These companies manufactured and sold cement mainly in China and the Republic of Korea.

Tong Yang Major Corp. was the country's third ranked cement producer and, in 2007, the company's production capacity was about 11.6 Mt of portland cement, about 10 Mt of clinker, and about 1 Mt of slag cement. The company reportedly had overcome the difficulties brought on by the 2007 appreciation of the Korean won and higher oil prices but continued to face the difficulties brought on by the domestic construction industry's slowdown during the past 2 years (Tong Yang Cement Corp., 2008).

### **Mineral Fuels**

**Coal.**—According to the trade statistics of the Republic of Korea, the country's coal imports in 2007 increased by 10.8% to 88.3 Mt compared with those of 2006. Coal imports included 65.6 Mt of thermal coal, 17.2 Mt of metallurgical coal, and 5.4 Mt of anthracite, which increased by 11.1%, 10.7%, and 6.5%, respectively.

The imports were used mainly to meet the country's overall coal requirements for general consumption and for industrial use in the cement, electric power, and iron and steel industries. In 2007, the major suppliers of imported anthracite to the Republic of Korea were China (2.7 Mt), Australia (1.7 Mt), Vietnam (0.7 Mt), and Russia (0.2 Mt). The major suppliers

of thermal coal were Indonesia (25.3 Mt), Australia (17.0 Mt), China (15.9 Mt), Russia (5.6 Mt), and Canada (1.4 Mt). The major suppliers of coking coal were Australia (10.4 Mt), Canada (4.7 Mt), China (1.3 Mt), Russia (0.6 Mt), and the United States (0.2 Mt) (Tex Report, The, 2008b, p. 12).

Anthracite production totaled about 2.9 Mt in 2007 (table 1). The coal industry's ongoing restructuring program was carried out under the Coal Mining Industry Act of 1988, which subsidized a portion of the expenses for mine closures. The Government also continued to support the relatively more-efficient coal mines with funds to modernize their facilities and revamp their development methods. Anthracite coal production was mostly consumed domestically as the main fuel in homes in the country's remote rural areas.

In 2007, the demand for bituminous coal increased by 12.1% to 62.0 Mt from 55.3 Mt in 2006 (Tex Report, The, 2008a, p. 14).

**Natural Gas and Petroleum.**—According to Business Monitor International (BMI), oil usage in the Asia and the Pacific region reached 25.68 million barrels per day (Mbb/d) in 2007. The region consumed 409 billion cubic meters of natural gas and produced 336 billion cubic meters. The Republic of Korea accounted for 8.79% of regional gas consumption in 2007, or about 35.95 billion cubic meters, whereas its share of production was minimal (Business Monitor International, 2008b).

According to KNOC, the Republic of Korea's petroleum demand in 2007 was 1,129.0 million barrels (Mbb), which was a 1.9% increase compared with that of the previous year owing to the consumption by the petrochemical industry and an increase in other domestic consumption.

The country's petroleum supplies in 2007 totaled 1,140.0 Mbb owing to a 9.1% increase in imports of petroleum products (especially naphtha and transport butane). Imports of crude petroleum totaled 873.5 Mbb, which was a decrease of 1.7% from the previous year.

The production of petroleum products was down by 1.1% to about 709.4 Mbb, and exports of petroleum products decreased by 0.9% as exports of gasoline to China and Japan decreased, despite increased exports of naphtha to China and jet oil to the United States and Singapore. Net petroleum imports were 740.2 Mbb, which was a 0.4% increase (table 1).

According to KNOC, the Republic of Korea consumed 794,946 thousand barrels (bbl) (2,178 thousand barrels per day) of petroleum products in 2007, which was a 3.8% increase, in spite of the increase in the international price of crude. The proportion of petroleum products in primary energy consumption fell to 44.6%, as the substitution by other energies, such as LNG, increased. The consumption of gasoline increased by 4.4% to 62,500 thousand bbl, as the number of registered gasoline vehicles increased; the consumption of kerosene decreased by 16.8% to 26,172 thousand bbl, which was the largest decrease among all products. The substitution of kerosene for other energy fuels increased in 2007; the price of domestic kerosene rose, which resulted in decreased demand for kerosene. The consumption of diesel increased by 2.0% to 145,327 thousand bbl owing to an increase in the number of registered diesel vehicles and in domestic consumption; and the

consumption of jet oil increased by 3.6% to 26,147 thousand bbl, as overseas travel increased owing to the strong Korean won against the U.S. dollar. The consumption of naphtha increased by 3.6% to 316,858 thousand bbl, as consumption by the petrochemical industry and transportation sector increased (Korea National Oil Corp., 2008b, c).

## Outlook

According to BMI, the Republic of Korea's real GDP is forecast to grow by 4.7% in 2008, which is down from the 4.9% rate of growth in 2007. BMI forecasts that the Republic of Korea's 5-year mining industry growth rate will be about 3.51% per year from 2008 to 2012 (Business Monitor International, 2008a, b).

The Republic of Korea is planning to start a stockpile program for 13 metals that it considers to be of prime importance for the local economy. Some of these metals are chromium, cobalt, indium, and molybdenum. KORES will be managing the purchase of these metals. To secure its raw material supply, the country also opened the first joint office of Inter-Korea Economic Co-operation with the main objective of promoting trade.

The Republic of Korea was globally known for its impressive mineral commodity refining and processing facilities. Rising costs of imported raw materials could place the Republic of Korea's processing facilities at a competitive disadvantage to processing facilities in countries that both produce and process raw minerals.

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TABLE 1  
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity	2003	2004	2005	2006	2007
<b>METALS</b>					
Bismuth, metal	120	156	231	236	267
Cadmium, smelter	2,175	2,362	2,582	3,320	2,846
Copper:					
Mine output, Cu content	--	2 <sup>r</sup>	4 <sup>r</sup>	3 <sup>r</sup>	2
Metal:					
Smelter, primary and secondary	460,000	442,500	486,500	484,000	515,000
Refined, primary and secondary	510,000	496,000	519,300	575,500	581,000
Gold:					
Mine output, Au content kilograms	166	233	266	277	162
Metal, refined do.	40,262	32,449	42,485	43,505	47,078
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand metric tons	174	226	213	227	291
Fe content do.	97	127	119	155	163
Metal:					
Pig iron do.	27,314	27,556	27,309	27,548	29,437
Ferroalloys:					
Ferromanganese	141,000	165,525	124,000	169,202	209,321
Ferrosilicomanganese	90,942	82,917	74,000	94,119	105,607
Total	231,942	248,442	198,000	263,321	314,928
Steel, crude thousand metric tons	46,310	47,521	47,820	48,455 <sup>r</sup>	51,517
Lead:					
Mine output, Pb content	--	40	50	17	12
Metal, smelter	169,297	173,609	180,784	163,379	195,022
Nickel	31,340	27,200	26,300	25,400	25,500 <sup>e</sup>
Silver:					
Mine output, Ag content kilograms	11,704	5,059	3,515	1,521	1,400 <sup>e</sup>
Metal do.	947,781	1,172,632	1,218,849	1,377,659	1,393,935
Zinc:					
Mine output, Zn content	--	14	77	16	2,034
Metal, primary	647,500 <sup>r</sup>	668,666	644,828	662,521	674,400
<b>INDUSTRIAL MINERALS</b>					
Barite	140	50	--	--	--
Cement, hydraulic thousand metric tons	60,725	56,955	51,391	53,971	57,042
Clays, kaolin do.	3,009	2,780	2,767	2,399	2,630
Diatomaceous earth	15,636	2,441	2,193	3,460	2,360
Feldspar	477,012	541,788	508,644	427,378	398,513
Graphite, all types	58	247	39	68	52
Lime, slaked lime	3,579,000 <sup>r</sup>	3,574,000 <sup>r</sup>	3,600,000 <sup>r,c</sup>	3,600,000 <sup>r,c</sup>	3,600,000 <sup>e</sup>
Mica, all grades	33,651	59,238	36,623	30,356	42,385
Nitrogen, N content of ammonia	118,900	163,400	165,000 <sup>e</sup>	90,000 <sup>e</sup>	110,000 <sup>e</sup>
Salt	800,000 <sup>e</sup>	340,828	378,887	285,568	249,515
Soda ash, manufactured <sup>c</sup>	310,000	310,000	310,000	310,000	310,000
Stone, sand and gravel:					
Limestone thousand metric tons	90,626	87,881 <sup>r</sup>	81,432 <sup>r</sup>	79,404	86,121
Quartzite do.	2,966	2,842	2,868	2,921	3,511
Sand, including glass sand do.	480	554	461	1,437	2,191
Sulfur, byproduct: <sup>c</sup>					
Metallurgy do.	797	796	800	660 <sup>r</sup>	670
Petroleum do.	757	879	900	950	1,000
Total do.	1,554	1,675	1,700	1,610 <sup>r</sup>	1,670

See footnotes at end of table.



TABLE 1--Continued  
 REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity	2003	2004	2005	2006	2007	
INDUSTRIAL MINERALS--Continued						
Talc and related materials:						
Pyrophyllite	912,285	827,895	885,559	677,465	798,054	
Talc	47,911	79,313	83,471	64,118	9,557	
Zeolites	132,760	142,401	173,435	160,056	157,408	
MINERAL FUELS AND RELATED MATERIALS						
Carbon black	464,941	473,788	471,716	484,302	497,191	
Coal, anthracite	thousand metric tons	3,297	3,191	2,832	2,824	2,886
Fuel briquets, anthracite briquets	do.	1,191	1,385	2,010	2,327	2,400 <sup>e</sup>
Petroleum, refinery products <sup>2</sup>	thousand 42-gallon barrels	671,087 <sup>r</sup>	695,652 <sup>r</sup>	727,234 <sup>r</sup>	717,493 <sup>r</sup>	709,474

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>r</sup>Revised. do. Ditto. -- Zero.

<sup>1</sup>Table includes data available through August 29, 2008.

<sup>2</sup>Includes bunker oil C-type, diesel oil, gasoline, kerosene, lubricating oil, and naphtha.

Sources: Ministry of Commerce, Industry and Energy, Korea Institute of Geoscience and Mineral Resources, 2007 supply and demand balance by mineral, p. 9; U.S. Geological Survey Minerals Questionnaire 2003-07. International Copper Study Group, Copper Bulletin, May 2008. Korea Development Bank, KDB Monthly Bulletin, Table 13, Production of major manufacturers, January 2008, p. 254-258; May 2008, p.140-144.

TABLE 2  
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bismuth, metal	metric tons	Korea Zinc Co. Ltd.	Onsan	100
Cadmium	do.	do.	do.	2,000
Cement		Ssangyong Cement Industrial Co. Ltd.	Plants at Tonghae, Kwang Yang, Munhyung, Pukpyong, and Yeongwol	15,040
Do.		Sung Shin Cement Manufacturing Co. Ltd.	Tanyang plant	13,700
Do.		Tong Yang Major Corp.	Plants at Pukpyong and Samchok	11,580
Do.		Lafarge Halla Cement Corp.	Plants at Kwang Yang and Okkye	9,500
Do.		Hyundai Cement Co. Ltd.	Plants at Tanyang and Yongwol	8,600
Do.		Hanil Cement Manufacturing Co.	Plants at Chungbuk and Tanyang	7,200
Do.		Asia Cement Manufacturing Co. Ltd.	Plants at Daegu and Jaechon	4,600
Coal		Korea Coal Corp.	Mines at Changsung, Dogae, and Hwasoor	2,000
Copper, metal, primary		Korea Zinc Co. Ltd.	Onsan	20
Do.		LS-Nikko Copper Inc.	Changhang	60
Do.		do.	Onsan	510
Gas, natural		Korea National Oil Corp. (KNOC)	Ulleung Basin	NA
Gold:				
In concentrate	kilograms	Hangum Co. Ltd.	Haenam, Cholla Province	1,600
Refined	do.	Korea Zinc Co. Ltd.	Onsan	50,000
Do.	do.	LS-Nikko Copper Inc.	do.	60,000
Graphite		Kaerion Graphite Ltd.	Kangwon	NA
Do.		Wolmyong Mining Co.	do.	NA
Indium, metal	kilograms	Korea Zinc Co. Ltd.	do.	55,000
Iron ore		NA	Mines at Sinyemi, Gangwon-do Province	300
Lead, metal, primary		Korea Zinc Co. Ltd.	Kangwon	200
Molybdenum	metric tons	Korea Resources Corp. (KORES)	Mine at Uljin; smelter at Yeosu, South Jeolla Province	6,000
Nickel, metal		Korea Nickel Corp.	do.	48
Petroleum, refinery products	thousand 42-gallon barrels per day	SK Corp.	Ulsan	817
Do.	do.	LG-Caltex Corp.	Yocheon (Yosu)	650
Do.	do.	Hyundai Oil Refinery Co.	Daesan and Incheon	589
Do.	do.	S-Oil Corp.	Onsan	520
Silver:				
In concentrate	kilograms	Hangum Co. Ltd.	Haenam, Cholla Province	3,700
Refined	metric tons	Korea Zinc Co. Ltd.	Onsan	1,000
Do.	do.	LS-Nikko Copper Inc.	do.	370
Steel, crude		Pohang Iron and Steel Co. Ltd.	Kwangyang (Gwangyang) Works	15,000
Do.		do.	Pohang Works	13,000
Do.		Hyundai INI Steel Co.	Incheon plant	4,800
Do.		do.	Pohang plant	3,200
Do.		Dongkuk Steel Mill Co. Ltd.	Incheon Works	1,450
Do.		do.	Pohang Works	3,600
Do.		Korea Iron and Steel Co. Ltd.	Masan and Changwon Works	1,200
Talc		IL Shin Industrial Co. Ltd.	Choong Ju, Chungcheongbuk Province	160
Do.		Korea Zinc Co. Ltd.	Onsan	430
Do.		Young Poong Corp.	Sukpo	280

Do., do., Ditto. NA Not available.