



2019 Minerals Yearbook

REPUBLIC OF KOREA [ADVANCE RELEASE]

THE MINERAL INDUSTRY OF THE REPUBLIC OF KOREA

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In 2019, the Republic of Korea was the world's second-ranked producer of refined indium, accounting for 23% of global production; the second-ranked producer of refined cadmium (18%; world total excluded the production of the United States); the second-ranked producer of mined zeolites (13%); and the seventh-ranked producer of mined talc and pyrophyllite (5% each). The country was the world's fifth-ranked producer of pig iron and the sixth-ranked producer of raw steel; it was the third-ranked exporter of steel (World Steel Association, 2020, p. 27; Anderson, 2021; Bolen, 2021; Callaghan, 2021; Crangle, 2021; Tuck, 2021).

In the global mineral industry, the Republic of Korea continued to be a consumer rather than a producer of metallic ores and concentrates, particularly copper, iron, lead, and zinc. In 2019, the country was the third-ranked importer of metallic ores, slag, and ash, which together accounted for 6% (by value) of global imports, behind China (61%) and Japan (8%) (United Nations Statistics Division, 2020).

Minerals in the National Economy

In 2019, the Republic of Korea's real gross domestic product (GDP) increased by 2.0% compared with 2.9% (revised) in 2018. The country's nominal GDP was \$1.65 trillion, which ranked it as the world's 12th largest economy. The value of manufacturing activities accounted for 25% of the GDP; construction, 5.5%; and mining and quarrying, 0.1%. Within the manufacturing sector, the output values of fabricated metal products and basic metals decreased by 3.1% and 0.6%, respectively. The output of the construction sector decreased by 3%. The mining sector employed 6,088 people (a decrease from 6,381 in 2018) and accounted for 0.02% of total employment in the country (total employment was about 27.123 million people). Limestone accounted for 78% (by value) of domestic mineral production, followed by anthracite (12%), quartzite (2.2%), and kaolin (1.4%) (Bank of Korea, 2020a, p. 16, 18; 2020b, p. 11, 122; Korea Institute of Geoscience and Mineral Resources, 2020, p. 14, 34; World Bank, The, 2020).

The country's outward foreign direct investment toward the mining and quarrying sector (mostly mineral fuels) increased to \$2.51 billion in 2019 from \$2.12 billion in 2018. The leading recipients were the British Virgin Islands (\$584 million), Madagascar (\$481 million), Canada (\$294 million), Australia (\$226 million), and Peru (\$209 million) (Export Import Bank of Korea, 2020).

Government Policies and Programs

The Ministry of Trade, Industry, and Energy (MOTIE) is responsible for implementing the country's mineral laws and policies. The Coal Industry Act (No. 14476 of 2016), the Petroleum and Alternative Fuel Business Act (No. 15179 of 2017), and the Mining Industry (Amendment) Act (No. 16127

of 2018) provide the basic guidelines for the country's mineral resource extraction (National Law Information Center, 2020).

Under the third master plan for overseas natural resources development in 2007, the Republic of Korea designated the following six minerals as strategic: bituminous coal, copper, iron, nickel, zinc, and uranium. The country defined strategic mineral commodities as those minerals for which imports accounted for more than 90% of the country's consumption, whose annual import value exceeded \$100 million, and that could be refined in the country. Rare-earth elements and lithium were added into the list of strategic minerals in 2010 (Ministry of Commerce, Industry, and Energy, 2007, p. 30; Ministry of Knowledge Economy, 2010; Ministry of Trade, Industry, and Energy, 2020, p. 15).

To secure its mineral supply, Korea Resources Corp. (KORES) maintained stockpiles of 10 rare metals (antimony, chromium, gallium, molybdenum, niobium, rare earths, selenium, titanium, tungsten, and zirconium) in Gunsan. KORES maintained a 64.5-day supply of these metals, which were important to the country's manufacturing industry and were mostly from imports. For price stabilization, the Public Procurement Service maintained stockpiles of six nonferrous metals (aluminum, copper, lead, nickel, tin, and zinc) and other rare metals (bismuth, cobalt, indium, lithium, manganese, silicon, strontium, tantalum, and vanadium) at nine sites (Korea Resources Corp., 2019a; Public Procurement Service, 2019).

Production

In 2019, the Keum-sung Mine (formerly Moland Mine) in Jecheon resumed operations and extracted 266 metric tons (t) of molybdenum (Mo content); operations had been suspended since 2016. Other significant changes in production included that of marble (crushed), which increased by 50%; mica, 42%; talc and titanium, 39% each; zeolites, 38%; smelted copper (secondary), 14%; and mined zinc, 12%. Notable decreases in mineral production included that of gallium, by 33% (estimated); mined silver, 26%; mined gold, 24%; liquefied natural gas (LNG), 21%; crude petroleum, 18%; mined lead, 17%; fuel oil, 16%; kaolin, 14%; quartzite (for silica), 11%; refined cadmium (estimated), clinker, and mined iron (Fe content), 10% each. Data on mineral production are in table 1.

Structure of the Mineral Industry

In 2019, there were 330 active mines owned by private- or state-owned companies (310 for industrial materials, 16 for metals, and 4 for anthracite) compared with 354 active mines (334, 15, and 5, respectively) in 2018. The country's major smelting companies included Korea Zinc Co. Ltd., LS-Nikko Copper Inc., POSCO Ltd., and Young Poong Corp. Table 2 is a list of major mineral industry facilities (Korea Institute of Geoscience and Mineral Resources, 2020, p. 34).

The Korea Institute of Geoscience and Mineral Resources (KIGAM) reports annual data on the country's mineral industry. Korea Coal Corp. (KOCOAL), Korea Gas Corp., Korea National Oil Corp. (KNOC), and KORES are state-owned under the MOTIE. As of 2019, KNOC was involved in petroleum exploration, development, and production projects in oilfields in the North Sea and in shale gasfields in North America; the reserves and production totaled nearly 1.4 billion barrels (Gbb) and 170,000 barrels per day, respectively. KORES analyzes the country's mineral reserves biannually and provides support for the development of domestic, North Korean, and overseas mineral resources and industries. As of 2017 (the latest year for which data were available), KORES had foreign investments in 26 projects across 15 countries to supply high demand minerals to the Republic of Korea, including coal from Australia, copper from South America, and nickel from Africa (Korea National Oil Corp., 2019; Korea Resources Corp., 2020).

Mineral Trade

In 2019, the Republic of Korea's exports and imports totaled \$542.2 billion and \$503.3 billion, respectively. Exports of metallic concentrates increased by 11% to \$321 million, whereas those of industrial minerals and coal decreased by 19% to \$175 million and by 81% to \$299,000, respectively. Imports of metallic concentrates increased by 1% to \$14.9 billion, whereas those of coal (mostly bituminous) decreased by 15% to \$14.1 billion owing to the decrease in the average import price of bituminous coal (\$98 per metric ton in 2019 and \$112 per metric ton in 2018), and industrial minerals decreased by nearly 1% to \$751 million. Imported metallic ore concentrates, by value, accounted for 99.6% of domestic consumption; coal, 98.8%; and industrial minerals, 27.4% (Korea Institute of Geoscience and Mineral Resources, 2019, p. 24–25; 2020, p. 20, 24–25; Bank of Korea, 2020a, p. 22–23).

In 2019, the Republic of Korea's leading mineral commodity import, by value, was crude petroleum, which was \$70.3 billion (or 1.07 Gbb), followed by bituminous coal [\$13.1 billion, or 132.7 million metric tons (Mt)]. The leading suppliers of crude petroleum were, by value of the imports they supplied, Saudi Arabia (28%), Kuwait (14%), and the United States (13%); the leading supplier of bituminous coal was Australia (41%). Imports of major metallic ore concentrates included \$7.0 billion (or 75 Mt) of iron, of which Australia supplied 68% (by value); \$3.45 billion (1.73 Mt) of copper (of which Chile supplied 43%); \$268 million (1.0 Mt) of manganese (Australia, 60%); \$264 million (41 t) of silver (Mexico, 45%); and \$233 million (3.2 Mt) of nickel (New Caledonia, 99%) (Korea Energy Economics Institute, 2020, p. 38; United Nations Statistics Division, 2020).

In 2019, the Republic of Korea's exports to the United States totaled \$77.5 billion, of which petroleum products exports, which increased by 26% to \$4.9 billion, were the leading mineral commodity exports. Imports from the United States totaled \$56.5 billion, of which crude petroleum, which increased by 61% to \$9.2 billion, was the leading import of all goods (U.S. Census Bureau, 2020a, b).

Commodity Review

Metals

Cadmium.—In June 2019, Young Poong decided to close its cadmium plant at the Seokpo (or Sukpo) refinery in North Gyeongsang Province. The reason was to eliminate any possible sources of cadmium contamination. Earlier in May, the local government had ordered a 4-month shutdown at the refinery for environmental violations. Young Poong had produced cadmium as a byproduct of smelting imported zinc concentrates. The plant had an output capacity of 1,750 metric tons per year (t/yr) of cadmium for batteries (table 2; H. Kim, 2019; Young Poong Corp., 2020, p. 6, 31).

Copper.—The Republic of Korea relied on imports of copper concentrates for copper- and copper-byproducts-refining companies; byproducts included gold, palladium, platinum, rhenium, and silver. The amount of imported copper concentrates was closely related to the global price of gold and the domestic demand from the construction sector. The copper concentrate imports decreased to 1.73 Mt (\$3.45 billion) in 2019 from 1.82 Mt (\$4.05 billion) in 2018 owing mostly to decreased copper consumption in the domestic construction sector; the major suppliers were Chile (735,000 t), Peru (279,000 t), and Canada (212,000 t) (Kim and others, 2020, p. 81–82; United Nations Statistics Division, 2020).

The country's leading copper refiner was LS-Nikko, which accounted for 96% of the domestic refined copper production. In September, LS-Nikko signed a contract with Teck Resources Ltd. of Canada to purchase a total of 1 Mt of copper concentrate between 2022 and 2031. The deal enabled LS-Nikko to secure 100,000 t/yr of the concentrate (30% Cu) from Teck's Quebrada Blanca Mine in Chile. In October, LS-Nikko signed a 15-year contract with First Quantum Minerals Ltd. (FQM) of Canada to receive 120,000 t/yr of copper concentrate from FQM's Cobre Panama Mine starting in 2020 (tables 1, 2; Joo, 2019; NewsWorld, 2019).

Iron and Steel.—The Sinyemi Mine in Jeongseon was the country's leading iron ore mine. Sinyemi's iron ore production capacity increased to 1.5 million metric tons per year from 600,000 t/yr after the completion of the second vertical shaft in May; however, the mine output decreased by 11% to 342,000 t in 2019 owing to low profitability (tables 1, 2; Kim and others, 2020, p. 113).

In September, POSCO and Hyundai Steel Co. Ltd.—the country's first- and second-ranked steelmakers, respectively—were approved by the Ministry of Environment to continue their operations conditionally. The companies were required to report the opening time of their blast furnace bleeder valves to the provincial governments and to submit the modified operational plans on the valves. Previously, in June, the Ministry asked the local governments to postpone their orders to shut down the blast furnaces of POSCO (in Gwangyang and Pohang Provinces) and Hyundai (in Dangjin Province) for 10 days owing to air pollution. The Korea Iron & Steel Association asserted that other global steelmakers had also adopted regular valve opening and that blast furnaces should continue to work to prevent molten metal from hardening. Hyundai estimated that the order could cause \$700 million in revenue loss

because 3 months would be needed to restart the blast furnaces (Argus Media, 2019b; Lim, 2019).

The country's steel product exports to the United States decreased by 10% to 2.46 Mt in 2019 owing to an export quota imposed by the United States. Earlier in 2018, the U.S. Government imposed additional 25% tariffs on steel imports, based on Section 232 of the Trade Expansion Act of 1962. For the exemption from the 25% tariffs, the Republic of Korea accepted an export quota of 2.68 Mt, which is equal to 70% of the annual average exports to the United States (3.83 Mt) from 2015 through 2017 (U.S. International Trade Administration, 2020; Yoo, 2020).

Tungsten.—In May, Almonty Industries Inc. of Canada signed a power supply and consumption agreement with Korea Electric Power Corp. for construction of a power line to supply electricity to the Sangdong Mine project in Yeongwol. The construction will be completed by June 2020. Proven and probable reserves at the mine were estimated to be 5.8 Mt of ore grading 0.49% WO₃ (22,450 t of W content). Almonty expected to reopen the mine in early 2021 and to produce up to 2,400 t/yr of WO₃. The Sangdong Mine stopped operations in 1992 and had been closed since 1993 owing to low commodity prices (Gleeson, 2018; Almonty Industries Inc., 2019, p. 14, 24; Moore, 2019).

Vanadium.—KIGAM designated vanadium as a key research mineral in 2019, as the demand for vanadium redox batteries was expected to increase. The agency aimed to prepare a vanadium resource map and develop new technologies for extracting and utilizing vanadium by 2023. Based on preliminary exploration results, the titaniferous magnetite deposits at Poncheon, Gyeonggi Province, were estimated to contain 0.8% to 1% vanadium (Yoon, 2019).

The Republic of Korea relied on imports of vanadium. In 2019, the country imported 4,522 t (\$108.4 million) of vanadium oxide and hydroxides and 1,748 t (\$64.4 million) of ferrovandium, making it the world's third-ranked importer (by quantity) of vanadium oxide and hydroxides (accounting for 14% of global imports) and the world's fifth-ranked importer of ferrovandium (6%) (United Nations Statistics Division, 2020).

Industrial Minerals

Cement.—The country's cement producers decided to replace imported coal ash with coal ash from domestic thermal powerplants and (or) to use alternative raw materials from clay mines, as announced by the Korea Cement Association in August. The decision followed a political and trade dispute with Japan. In 2018, the country consumed 3.15 Mt of coal ash and imported 1.29 Mt (\$53 million), of which 1.26 Mt (\$44 million) was imported from Japan. In 2019, coal ash imports from Japan decreased to 0.95 Mt (\$35 million) (Global Cement, 2019; United Nations Statistics Division, 2020).

Pyrophyllite.—In 2019, pyrophyllite production decreased by 6% to about 328,000 t owing to decreased domestic consumption by cement companies, which resulted from contraction in the construction industry. The decreased consumption led to the suspension of operations at the HyunMoo Mine in 2019. The country's export of pyrophyllite decreased by 6% to about 100,000 t in 2019; Japan was the leading export destination (62,000 t, which it purchased for use in glass fiber products),

followed by Taiwan (23,000 t) and Malaysia (5,500 t), purchased by both the countries for use in ceramic products (table 2; Kim and others, 2020, p. 194–195, 202).

Mineral Fuels and Other Sources of Energy

Nuclear energy has been a major electric power source in the Republic of Korea. The new Government elected in May 2017 planned to phase out nuclear power over decades; 24 active nuclear reactor units as of 2019 would be reduced gradually to 18 units by 2029, 7 units by 2051, and 1 unit by 2083. The plan included reducing the dependence on coal and increasing the usage of renewable energy and LNG. In 2018 (the latest year for which data were available), LNG accounted for 26.8% (compared with 22.2% in 2017 and 22.4% in 2016) of the 571 terawatt-hours of electricity generated in the country during the year; nuclear energy, 23.4% (compared with 26.8% in 2017 and 30.0% in 2016); and renewable energy, 5.6% (5.0% in 2017 and 4.2% in 2016) (Korea Energy Economics Institute, 2019, p. 184, 185; Ministry of Culture, Sports, and Tourism, 2020; World Nuclear Association, 2020).

Coal.—As of yearend 2018, the country had 307 Mt of anthracite reserves but lacked bituminous coal deposits. The Government continued to restructure the country's coal industry and downsize KOCOAL owing to declining domestic coal consumption and environmental concerns. In 2019, anthracite production from four active mines decreased to about 1.1 Mt from 1.2 Mt in 2018 owing partially to the halted operations of Taebaek Mining Corp.'s mine in Taebaek. The mine production had decreased significantly after a flooding incident in 2011, and the mine had remained inactive owing to financial distress since September 2018. The 2011 flooding originated from a coalfield managed by Mine Reclamation Corp. In 2019, MOTIE was looking at whether to shut down the mine (table 2; W. Kim, 2019; Korea Coal Corp., 2019; Korea Resources Corp., 2019b, p. 6).

Natural Gas, Petroleum, and Petroleum Refinery Products.—In 2019, the Republic of Korea produced 184,000 t of LNG and 155,000 barrels of crude petroleum and consumed 41 Mt of LNG and 1.08 Gbbl of crude petroleum. The country was the world's sixth-ranked petroleum refiner; four major petroleum refinery companies (SK Energy, GS-Caltex Corp., S-Oil Corp., and Hyundai Oil Refinery Co., in order of capacity) had a combined throughput of about 2.92 million barrels per day (table 2; BP p.l.c., 2020, p. 28; Korea Energy Economics Institute, 2020, p. 38, 57).

Outlook

The Republic of Korea is expected to continue to rely on imports of ore concentrates, such as copper, iron, lead-zinc, and nickel, and to remain the world's third-ranked importer for those commodities. In the short and medium terms, the declining construction activity after 2017 will likely lead to a decreased output of industrial minerals, such as cement, limestone, and pyrophyllite. This situation in the construction industry and tightened environmental regulations may cause adverse conditions, driving the domestic smelting companies to reduce the amounts of ore concentrates imports and metal output. However, refined gold output will be more influenced

by the global gold price; thus, imports of copper and lead-zinc concentrates for refining gold and the production of such metals may be determined by the global gold price (Lee and Kim, 2020, p. 9–13).

To meet the growing demand for electric vehicle batteries, the country may increase domestic production of nickel sulfate, lithium carbonate, and lithium hydroxide. In the long term, domestic vanadium extraction would begin if the project is successful. As the Government proceeds with reducing nuclear and coal-fired powerplants, the use of LNG and renewable energy is expected to increase. Production of anthracite, which is used for residential heating, is expected to continue to decrease as the energy transition from anthracite to LNG proceeds, and the domestic demand subsequently keeps diminishing (Argus Media, 2019a; Korea Energy Materials Co., 2020).

References Cited

- Almonty Industries Inc., 2019, Almonty Industries & Sangdong Mine project: Toronto, Ontario, Canada, Almonty Industries Inc., October, 30 p. (Accessed December 4, 2020, at http://www.almontykorea.co.kr/skin/pdf/Almonty_IR_OCT2019.pdf.)
- Anderson, C.S., 2021, Indium: U.S. Geological Survey Mineral Commodity Summaries 2021, p. 78–79.
- Argus Media, 2019a, POSCO to start on Argentina demonstration lithium plant: Argus Media, July 24. (Accessed December 10, 2020, at <https://www.argusmedia.com/metals-platform/newsandanalysis/article/1945392-Posco-to-start-on-Argentina-demonstration-lithium-plant>.)
- Argus Media, 2019b, South Korea blocks shutdowns of blast furnaces—Update: Argus Media, June 13. (Accessed December 9, 2020, at <https://www.argusmedia.com/news/1920692-south-korea-blocks-shutdowns-of-blast-furnaces-update>.)
- Bank of Korea, 2020a, Annual report—2019: Seoul, Republic of Korea, Bank of Korea, March, 141 p. (Accessed November 12, 2020, at http://www.bok.or.kr/ucms/cmnn/file/fileDown.do?menuNo=400221&atchFileId=FILE_00000000018320&fileSn=1.)
- Bank of Korea, 2020b, Economic statistics yearbook—2020: Seoul, Republic of Korea, Bank of Korea, June 23, 322 p. (Accessed November 12, 2020, at https://www.bok.or.kr/portal/cmnn/file/fileDown.do?menuNo=200641&atchFileId=FILE_00000000018248&fileSn=1.)
- Bolen, W.P., 2021, Talc and pyrophyllite: U.S. Geological Survey Mineral Commodity Summaries 2021, p. 162–163.
- BP p.l.c., 2020, Statistical review of world energy: London, United Kingdom, BP p.l.c., June, 65 p. (Accessed December 4, 2020, at <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf>.)
- Callaghan, R.M., 2021, Cadmium: U.S. Geological Survey Mineral Commodity Summaries 2021, p. 40–41.
- Crangle, R.D., Jr., 2021, Zeolites (natural): U.S. Geological Survey Mineral Commodity Summaries 2021, p. 188–189.
- Export Import Bank of Korea, 2020, Statistics of foreign direct investment: Seoul, Republic of Korea, Export Import Bank of Korea. (Accessed November 12, 2020, at <https://stats.koreaexim.go.kr/en/enMain.do>.)
- Gleeson, Daniel, 2018, Almonty starts drift development at Sangdong tungsten mine in Korea: Hertfordshire, United Kingdom, International Mining, November 28. (Accessed November 22, 2019, at <https://im-mining.com/2018/11/28/almonty-starts-drift-development-sangdong-tungsten-mine/>.)
- Global Cement, 2019, South Korean cement producers reduce coal ash imports from Japan: Surry, United Kingdom, Pro Global Media Ltd., August 20. (Accessed December 4, 2020, at <https://www.globalcement.com/news/item/9744-south-korean-cement-producers-reduce-coal-ash-imports-from-japan>.)
- Joo, Kyoung-don, 2019, LS-Nikko Copper signs 15-year deal to buy copper concentrate from FQM: Yonhap News [Seoul, Republic of Korea], October 30. (Accessed December 8, 2020, at <https://en.yna.co.kr/view/AEN20191030009000320>.)
- Kim, Hyounmok, 2019, Bonghwa Young Poong Seokpo smelter, wastewater spill: Kyongbuk Ilbo [Daegu, Republic of Korea], May 14. (Accessed February 9, 2021, at <https://www.kyongbuk.co.kr/news/articleView.html?idxno=2002355>.) [In Korean.]
- Kim, Wooyeol, 2019, Government looking to shut down Taebaek Mining with financial difficulty: Gangwon Domin Ilbo [Chuncheon, Republic of Korea], October 30. (Accessed December 4, 2020, at <http://www.kado.net/news/articleView.html?idxno=994427>.) [In Korean.]
- Kim, Y., Lee, H., Yu, O., and Kim, D., 2020, 2019/2020 mineral commodity supply and demand: Daejeon, Republic of Korea, Korea Institute of Geoscience and Mineral Resources, November, 265 p. (Accessed December 7, 2020, at https://www.kigam.re.kr/galleryDownload.es?bid=0025&list_no=2916&seq=1.) [In Korean.]
- Korea Coal Corp., 2019, Domestic coal industry: Wonju, Republic of Korea, Korea Coal Corp. website. (Accessed December 4, 2020, at https://www.kocoal.or.kr/eng/manage.php?f_id=sub2_1_1.)
- Korea Energy Economics Institute, 2019, Yearbook of energy statistics: Ulsan, Republic of Korea, Korea Energy Economics Institute, December, 371 p. (Accessed December 4, 2020, at http://www.kesis.net/FileDownloadAction.do?file=/admin/admin_RegList.jsp/20200918/450781600402542171_01.pdf&oldFile=%EC%97%90%EB%84%88%EC%A7%80%ED%86%B5%EA%B3%84%EC%97%B0%EB%B3%B4 2019.pdf.)
- Korea Energy Economics Institute, 2020, Monthly energy statistics—August: Ulsan, Republic of Korea, Korea Energy Economics Institute, November, 106 p. (Accessed December 4, 2020, at http://www.kesis.net/FileDownloadAction.do?file=/admin/admin_RegList.jsp/20201118/898881605674335706_01.pdf&oldFile=%EC%97%90%EB%84%88%EC%A7%80%ED%86%B5%EA%B3%84%EC%9B%94%EB%B3%B4(2020.11)_pdf.)
- Korea Energy Materials Co., 2020, Overview: Seongnam, Gyeonggi, Republic of Korea, Korea Energy Materials Co. (Accessed December 10, 2020, at http://www.koreaenergymaterials.com/eng/s1/s1_1.asp.)
- Korea Institute of Geoscience and Mineral Resources, 2019, Yearbook of minerals statistics 2018: Daejeon, Republic of Korea, Korea Institute of Geoscience and Mineral Resources, May, 213 p. (Accessed November 12, 2020, at https://www.kigam.re.kr/galleryDownload.es?bid=0026&list_no=2295&seq=1.) [In Korean.]
- Korea Institute of Geoscience and Mineral Resources, 2020, Yearbook of minerals statistics 2019: Daejeon, Republic of Korea, Korea Institute of Geoscience and Mineral Resources, May, 213 p. (Accessed November 12, 2020, at https://www.kigam.re.kr/galleryDownload.es?bid=0026&list_no=2845&seq=1.) [In Korean.]
- Korea National Oil Corp., 2019, About us: Ulsan, Republic of Korea, Korea National Oil Corp., January 7. (Accessed November 12, 2020, at http://www.knoc.co.kr/ENG/sub01/sub01_1_1.jsp.)
- Korea Resources Corp., 2019a, Business overview—Stockpile: Wonju, Republic of Korea, Korea Resources Corp. (Accessed November 25, 2019, at <https://www.kores.or.kr/views/cms/hkor/bi/bi04/bi0401.jsp>.)
- Korea Resources Corp., 2019b, Mineral reserves of Korea—As of December 31, 2018: Wonju, Republic of Korea, Korea Resources Corp., October 30, 79 p. (Accessed December 4, 2020, at https://www.kores.or.kr/common/download.do?fid=bbs&bbs_cd_n=269&bbs_seq_n=2&file_seq_n=1.)
- Korea Resources Corp., 2020, Business overview: Wonju, Republic of Korea, Korea Resources Corp. (Accessed November 12, 2020, at <https://www.kores.or.kr/views/cms/eng/bu/bu01.jsp>.)
- Lee, H., and Kim, Y., 2020, Korea mineral information 2019: Daejeon, Republic of Korea, Korea Institute of Geoscience and Mineral Resources, August, 80 p. (Accessed December 10, 2020, at https://www.kigam.re.kr/galleryDownload.es?bid=0026&list_no=2915&seq=1.)
- Lim, Chang-won, 2019, Steel industry gets conditional approval to use blast furnace bleeder valves: Aju Business Daily [Seoul, Republic of Korea], September 4. (Accessed December 9, 2020, at <https://www.ajudaily.com/view/2019090415327596>.)
- Ministry of Commerce, Industry, and Energy, 2007, The 3rd master plan for overseas natural resource development: Seoul, Republic of Korea, Ministry of Commerce, Industry, and Energy, August 14, 81 p. (Accessed September 20, 2021, via http://www.motie.go.kr/motie/in/ay/policynotify/announce/bbs/bbsView.do?bbs_seq_n=22392&bbs_cd_n=6.)
- Ministry of Culture, Sports, and Tourism, 2020, Energy transition policy: Sejong, Republic of Korea, Ministry of Culture, Sports, and Tourism, March 11. (Accessed February 9, 2021, at <https://www.korea.kr/special/policyCurationView.do?newsId=148864795>.)

TABLE 1
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, gross weight, unless otherwise specified)

Commodity ²	2015	2016	2017	2018	2019
METALS					
Bismuth, refinery, Bi content ³	500	700	900	880	930 ^c
Cadmium, refinery, primary	5,600 ^c	5,273	4,960	4,905	4,400 ^c
Copper:					
Mine, concentrate, Cu content	--	108	7	--	--
Smelter:					
Primary	511,200	510,000	510,000	530,000	520,000
Secondary	125,000	125,000	125,000	140,000	160,000
Total	636,000	635,000	635,000	670,000	680,000
Refinery:					
Primary	515,300	522,400	501,300	500,500	473,600
Secondary	134,400	124,800	163,000	174,000	189,400
Total	650,000	647,000	664,000	675,000	663,000
Ferrous alloys:					
Ferromanganese	500,000	425,000	360,000	374,000 ^f	366,000
Ferro-nickel:					
Gross weight	195,000	228,000	237,000	228,000 ^f	230,000
Ni content	39,005	45,600	47,400	45,631 ^f	46,000
Silicomanganese	175,000	135,000	117,000	164,000 ^f	162,000
Gallium ^c kilograms	2,500	3,000	3,000	3,000	2,000
Gold:					
Mine, Au content do.	269	205	361	238	181
Refinery do.	55,963	59,411	52,768	48,626	48,000 ^c
Indium, refinery, primary, In content do.	195,000	210,000	225,000 ^c	235,000 ^c	225,000 ^c
Iron ore, mine:					
Gross weight thousand metric tons	445	445	311	383	342
Fe content do.	249	249	174	214	192
Iron and steel:					
Pig iron do.	47,639	46,336	47,071	47,124	47,537
Steel:					
Raw steel do.	69,670	68,575	71,030	72,463	71,421
Products, rolled do.	67,756	67,131	69,557	69,785	69,000 ^c
Lead:					
Mine, Pb content	2,921	2,839	3,762	2,341	1,933
Refinery:					
Primary	291,000	441,000	423,320	410,295 ^f	404,000
Secondary	350,000	390,000	380,000	390,000	390,000
Molybdenum, mine, Mo content	259	--	--	--	266
Rhenium, refinery, NH ₄ ReO ₄ , Re content kilograms	2,500	2,600	2,600	2,700	2,800
Silver:					
Mine, Ag content do.	4,586	6,579	8,788	7,090	5,245
Refinery, primary, metal do.	2,967,119	3,270,000	2,642,007	2,653,486	2,692,154
Titanium, titaniferous magnetite	204,082	166,903	223,039	213,184	295,987
Zinc:					
Mine, Zn content	2,070	2,257	3,321	3,656	4,106
Smelter, primary	934,949	1,012,763	970,455	988,695	986,291
INDUSTRIAL MINERALS					
Cement:					
Clinker thousand metric tons	47,015	49,148	48,657	45,351 ^f	41,000
Hydraulic do.	52,044	56,747	57,400	52,093 ^f	50,000 ^c
Clay:					
Bentonite	78,439	63,834	47,306	31,824	32,000 ^c
Fuller's earth	87,094	81,688	115,568	118,177	120,000 ^c
Kaolin	356,866	366,511	416,648	369,274 ^f	317,626
Pottery	230,921	220,840	307,546	237,242	220,000 ^c
Unspecified	862,339	773,381	1,013,026	533,661	530,000 ^c

See footnotes at end of table.

TABLE 1—Continued
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, gross weight, unless otherwise specified)

Commodity ²	2015	2016	2017	2018	2019
INDUSTRIAL METALS—Continued					
Diatomite, diatomaceous earth	15,310	20,564	133,741	25,902	26,000 ^e
Feldspar	601,030	654,398	717,177	617,166	620,000 ^e
Lime ^e thousand metric tons	5,100	5,100	5,200	5,200	5,200
Mica, all grades	17,405	12,934	14,567	16,559	23,433
Salt, sea salt	332,000	323,000	308,847	283,000	261,970
Sand and gravel, industrial, silica:					
Quartzite thousand metric tons	3,569	3,778	4,334	3,247	2,880
Sand do.	661	682	952	1,048	1,000 ^e
Stone:					
Crushed:					
Dolomite do.	2,626	2,593	3,021	3,374	3,300 ^e
Limestone do.	88,199	91,241	92,276	86,255	83,769
Marble do.	5	13	5	2	3
Other, size and shape unspecified, calcite do.	2,221	2,051	2,431	2,462	2,400 ^e
Sulfur, byproduct of natural gas and petroleum, S content	1,450,000	2,000,000	2,000,000	2,000,000 ^e	2,000,000 ^e
Talc and related minerals:					
Pyrophyllite	596,860	590,000	431,458	346,761	327,624
Talc	6,371	2,247	2,834	1,887	2,626
Zeolites	191,207	121,730	127,685	144,330	199,777
MINERAL FUELS AND RELATED MATERIALS					
Coal, anthracite thousand metric tons	1,764	1,727	1,486	1,202	1,084
Coke, metallurgical do.	17,521 ^r	15,924 ^r	16,020 ^r	16,000 ^e	16,000 ^e
Liquefied natural gas	144,000	118,000	261,000	234,000	184,000
Petroleum:					
Crude thousand 42-gallon barrels	115	104	217	189	155
Refinery:					
Diesel do.	333,421 ^r	338,517	344,882 ^r	358,780 ^r	366,864
Fuel oil do.	57,972 ^r	70,694	67,961 ^r	68,967 ^r	57,787
Gasoline do.	157,326 ^r	153,557	157,908 ^r	167,195 ^r	168,229
Kerosene do.	18,493 ^r	19,520	19,896 ^r	21,125 ^r	20,717
Liquefied petroleum gas do.	25,366 ^r	26,026	31,612 ^r	33,900 ^r	32,889
Naphtha do.	249,931	259,814	307,635	313,839	312,445
Other ⁴ do.	274,461	289,214	297,822	296,545	291,284
Total do.	1,120,000	1,160,000	1,230,000	1,260,000	1,250,000

^eEstimated. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through November 24, 2020. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²In addition to the commodities listed, carbon black, ferrosilicon, lithium compounds, palladium-platinum (refined), phosphate rock, secondary iron, sulfur (byproduct of metallurgy), and thorium may have been produced, but available information was inadequate to make reliable estimates of output.

³Refined bismuth was produced as a byproduct of zinc production.

⁴Includes bitumens, fuel oil byproducts, jet fuel, lubricants, paraffin waxes, petroleum coke, refinery gas, and solvents.

TABLE 2
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2019

(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 refinery, Ulsan	950
Cadmium	do.	do.	do.	5,100
Do.	do.	Young Poong Corp.	Seokpo refinery, ¹ North Gyeongsang Province	1,750
Cement		Asia Cement Co. Ltd.	Plants in Daegu and Jecheon	4,600
Do.		Daehan Cement Co. Ltd. (Ssangyong Cement Co. Ltd., 100%)	2 plants in Gwangyang	1,600
Do.		Halla Cement Corp.	Plants in Gwangyang and Okkye	9,500
Do.		Hanil Cement Manufacturing Co.	Plants in Tanyang and other three cities	7,200
Do.		Hankook C&T Co. Ltd.	Plant in Pohang	4,700
Do.		Hyundai Cement Co. Ltd.	Plants in Tanyang and Yongwol	8,600
Do.		Korea Cement Co. Ltd.	Plant at Jangsung, South Jeolla Province	2,300
Do.		Sampyo (formerly Tong Yang) Cement	Plants at Pukpyong and Samchok	11,600
Do.		Ssangyong Cement Industrial Co. Ltd.	Plants at Tonghae, Gwangyang, Munhyung, Pukpyong, and Yeongwol	16,749
Do.		SungShin Cement Manufacturing Co. Ltd.	Plant at Tanyang	13,700
Coal		Korea Coal Corp. (Government, 100%)	Mines at Dogye, Hwasoon, and Jangsung	1,100
Do.		Kyungdong Co. Ltd.	Sangduck Mine, Dogye, Samcheok	800
Do.		Taebaek Mining Corp.	Mine ² in Taebaek	132
Copper, metal, primary		Korea Zinc Co. Ltd.	Onsan refinery, Ulsan	25
Do.		LS-Nikko Copper Inc. (LS Holdings, 50.1%, and Japan Korea Joint Smelting Co. Ltd., 49.9%)	Plant at Onsan, Ulsan	680
Do.		Young Poong Corp.	Seokpo refinery, North Gyeongsang Province	5
Gallium	kilograms	Korea Zinc Co. Ltd.	Onsan refinery, Ulsan	10,000
Gas, natural	thousand cubic meters per day	Korea National Oil Corp.	Donghae-1 gasfield in Ulleung Basin	1,300
Gold:				
Concentrate, Au content	kilograms	GoldenSun Co. Ltd. (Sun Cement Co. Ltd.)	Eunsan and Gasa-do mines, Haenam, South Jeolla Province	500 ^e
Refined	do.	Korea Zinc Co. Ltd.	Onsan refinery, Ulsan	50,000
Do.	do.	LS-Nikko Copper Inc. (LS Holdings, 50.1%, and Japan Korea Joint Smelting Co. Ltd., 49.9%)	Plant at Onsan, Ulsan	60,000
Ferroalloys:				
Ferronickel, Ni content		SNNC Co. Ltd. (SMSP S.A., 51%, and POSCO Ltd., 49%)	Gwangyang ferronickel plant, Gwangyang	54
Ferrosilicon		LS-Nikko Copper Inc. (LS Holdings, 50.1%, and Japan Korea Joint Smelting Co. Ltd., 49.9%)	Plant at Onsan, Ulsan	3
Indium, metal	kilograms	Korea Zinc Co. Ltd.	Onsan refinery, Ulsan	200,000
Do.	do.	Young Poong Corp.	Seokpo refinery, North Gyeongsang Province	110,000 ^e
Iron ore, mine, gross weight		Handok Iron & Steel Co. Ltd. (SM Group)	Sinyemi Mine, Jeongseon, Gangwon Province	1,500
Iron and steel, raw steel		Dongkuk Steel Mill Co. Ltd.	Inchon Works, Inchon	1,450
Do.		do.	Pohang Works, Pohang	3,600
Do.		Hyundai Steel Co. Ltd.	Dangjin plant, Dangjin	23,000
Do.		do.	Inchon plant, Inchon	4,800
Do.		do.	Pohang plant, Pohang	3,200
Do.		Korea Iron and Steel Co. Ltd.	Masan and Changwon Works	1,200
Do.		POSCO Ltd.	Gwangyang Works, Gwangyang	21,200
Do.		do.	Pohang Works, Pohang	17,400
Lead:				
Concentrates, gross weight		Shin DongYang Corp.	Guk-jeon Mine, South Gyeongsang Province	1
Do.		SungAn-Jawon Corp.	Kumho Mine, North Gyeongsang Province	5
Refined		Korea Zinc Co. Ltd.	Onsan refinery, Ulsan	423
Lithium:				
Carbonate	metric tons	POSCO Ltd.	Gwangyang Works, Gwangyang	1,000
Hydroxide	do.	do.	do.	1,500

See footnotes at end of table.

TABLE 2—Continued
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2019

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Molybdenum:				
Mine, Mo content	metric tons	Korea Resources Corp. (KORES) (Government, 99.85%, and Korea Development Bank, 0.14%)	Keum-eum Mine, ³ Uljin	260
Do.	do.	Samyang Resources Corp. (formerly Dongwon Resources Corp.)	Keum-sung (formerly Moland) Mine, ⁴ Daejang-ri, Jecheon, North Chungcheong Province	300
Refined	do.	SeAH M&S Corp.	Smelter in Yeosu, South Jeolla Province	6,000
Nickel:				
Metal		Enertec Co. Ltd.	Refinery at Haman, South Gyeongsang Province	6
Do.		Korea Nickel Corp. (Vale Canada Ltd., 25%; Korea Zinc Co. Ltd., 19%; POSCO Ltd., 14%)	Onsan nickel refinery at Onsan, Ulsan	30
Sulfate		Korea Energy Materials Co. (KEMCO) (Korea Zinc Co. Ltd., 55%; Young Poong Corp., 15%; LG Chem, 10%; others, 20%)	Onsan plant at Onsan, Ulsan	50
Palladium, refined	kilograms	LS-Nikko Copper Inc. (LS Holdings, 50.1%, and Japan Korea Joint Smelting Co. Ltd., 49.9%)	Plant at Onsan, Ulsan	1,300
Petroleum:				
Crude	42-gallon barrels per day	Korea National Oil Corp.	Donghae-1 oilfield in Ulleung Basin	600
Refinery products	thousand 42-gallon barrels per day	GS Caltex Corp.	Refinery in Yeosu	785
Do.	do.	Hyundai Oil Refinery Co.	Daesan plant, Seosan	520
Do.	do.	SK Energy Corp.	Refineries in Ulsan and Incheon	1,115
Do.	do.	S-Oil Corp.	Refinery at Onsan, Ulsan	669
Platinum, refined	kilograms	LS-Nikko Copper Inc. (LS Holdings, 50.1%, and Japan Korea Joint Smelting Co. Ltd., 49.9%)	Plant at Onsan, Ulsan	600
Pyrophyllite		Hankook Mineral Powder Co. Ltd.	Chin-do, Dae-do, Hwangsan, Okmesan Sungsan, and Wan-do mines in Haenam	400 ^e
Do.		HyunMoo Mining	HyunMoo Mine, ⁵ Danyang, North Chungcheong Province	100
Do.		Jinhae Pyrophyllite	Gyeongnam, Kimhae, Nilyang, Pusan, and Yangsang mines in Dong-Nae	50 ^e
Do.		Minkyong Corp.	Nohwa-do Mine, South Jeolla Province	100
Rhenium, refined	kilograms	LS-Nikko Copper Inc. (LS Holdings, 50.1%, and Japan Korea Joint Smelting Co. Ltd., 49.9%)	Plant at Onsan, Ulsan	3,000
Silver:				
Concentrate, Ag content	do.	GoldenSun Co. Ltd. (Sun Cement Co. Ltd.)	Eunsan Mine and Gasa-do Mine, Haenam, South Jeolla Province	9,000 ^e
Refined	metric tons	Korea Zinc Co. Ltd.	Onsan refinery, Ulsan	2,400
Do.	do.	LS-Nikko Copper Inc.	Plant at Onsan, Ulsan	1,200
Talc		Ilshin Dongyang Stone Co.	Dongyang Mine, Chungju	4 ^e
Do.		Private owner	Sangbo Mine, Cheongpung, Jecheon	1 ^e
Do.		do.	Pyongan Mine, Gongju	1 ^e
Titanium, ore		Dongwon Resources Corp.	Gwan-in Mine, ⁶ Pocheon, Gyeonggi Province	250
Zeolites		Dong-sin Co. Ltd.	Dong-sin Zeo Mine, Gyeongju, North Gyeongsang Province	150
Do.		Private owner	Guryong Baekto Mine, Pohang	50
Do.		do.	Woo-il Zeolite Mine, Pohang	21

See footnotes at end of table.

TABLE 2—Continued
 REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2019

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Zinc:			
Concentrates, gross weight	Shin DongYang Corp.	Guk-jeon Mine, South Gyeongsang Province	1
Do.	SungAn-Jawon Corp.	Kumho Mine, North Gyeongsang Province	7
Smelter, primary	Korea Zinc Co. Ltd.	Onsan refinery, Ulsan	700
Do.	Young Poong Corp.	Seokpo refinery, North Gyeongsang Province	400

⁶Estimated. Do., do. Ditto.

¹Closed in June 2019.

²Production suspended since September 2018.

³Production suspended since August 2015.

⁴Production suspended in 2016 and resumed in 2019.

⁵Production suspended in 2019.

⁶Titaniferous magnetite.