

# THE MINERAL INDUSTRY OF REPUBLIC OF KOREA

By Chin S. Kuo

The gross domestic product growth slowed down to around 7% for 1996. The nation's current account had a record deficit, more specifically, the trade deficit topped \$9.72 billion. Prices of the country's major export items fell sharply and the earnings in the petrochemical, steel, and shipbuilding industries were declining. All these were caused by the depreciation of the yen against the won. On the import side, prices remained unchanged and the volume showed a decline of about 11%. The ratio of export and import prices indicated the worst deterioration of terms of trade since the last oil crisis (Far Eastern Economic Review, 1997).

The squeeze on corporate cash flows kept interest rates high; this, along with the dismal economic performance, depressed the stock market. The unemployment rate climbed, the first annual increase in 2 years. The current account deficit also translated into massive foreign debt. At the end of 1996, a debt of over \$100 billion made the country one of the seven most-indebted nations in the world. However, slower economic activities kept inflation at around 5%. Wages, interest rates, and land prices had either risen much faster than or above levels in other developed countries, yet the productivity lagged far behind.

The country was heavily reliant on imports for most of its raw materials such as coal, copper ore, crude oil, iron ore, and zinc concentrate. Nonferrous metal imports included aluminum ingot, copper cathode, refined lead, and refined zinc. The Government moved to crack down on gold arbitrage. Effective July 1, 1996, companies must pay for bullion imports within 30 days instead of the previous 120 days. Only one major correspondent bank can be used for gold trades that must be reported to the Bank of Korea on a quarterly basis.

The Government planned to relax restrictions, making it easier for foreigners to acquire land; invest more in human resources, such as skilled laborers, and in infrastructure projects, such as roads, railways, and ports; and develop service industry including banking. Such infrastructure projects included the new Incheon international airport, the Seoul-Pusan high-speed railway, and several harbor expansion projects. The foreign capital inducement law with a provision to lease state-owned plant sites free was intended to attract more foreign direct investment.

On overseas investment, Samsung Corp. acquired 40% of the state-owned Zhezkazgantsvetmet copper enterprise in central Kazakhstan and would invest \$1.05 billion in the operation over the next 15 years. The investment was to raise the plant's capacity to 200,000 metric tons per year (t/yr). A further \$36 million would be spent on maintaining social services. Samsung took over trust management of the enterprise in 1995 and was

given the right to manage the operation's debt of \$240 million. The plant produced an average of 9,000 metric tons (t) per month of copper cathode, 15,500 t in April, and 18,000 t in May.

Hyundai Group signed a deal with Sonami, a Chilean national mining society, to build a joint-venture copper refinery, 700 kilometers (km) south of Santiago, with an investment of \$300 million. The refinery would have a production capacity of 120,000 to 150,000 t/yr of high-grade electrolytic copper. Hyundai was to hold at least a 50% interest in the project. The conglomerate also was reported to be allocating \$500 million to the purchase of a 5% stake in the mineral interests of Companhia Vale do Rio Doce of Brazil. A mine development project in Peru by Hyundai was to spend \$1 billion.

Young Poong Mining & Exploration Corp. won the right to develop the Gouenso gold project in Mali's Yanfolila region, 250 km southwest of Bamako. The company expected gold reserves at the mine site to be greater than 100 t. Hyundai Group also was considering investing in other gold projects in Mali.

LG International Corp. expressed interest in purchasing a significant quantity of pig iron under long-term contract from the South Australia Steel and Energy Project (SASE). The present equity interests in the SASE project are Meekatharra Minerals Ltd. and Ausmelt Ltd., both of Australia, with 40% each and the South Australian Government, with 20%. Commercial production at the SASE project of 2.5 million metric tons per year (Mt/yr) of pig iron was expected to begin in early 1999.

Pohang Iron and Steel Co., Ltd. (Posco) might topple Nippon Steel Corp. of Japan as the world's largest steelmaker. Nippon Steel was producing steel at far below its capacity, between 25 and 26 Mt/yr. Posco was producing 23 Mt/yr and would maintain its utilization of overcapacity in the near future. Posco would complete a major capacity expansion in 1998 and cut 2,500 jobs and more later in restructuring efforts in the areas of sales, marketing, manufacturing, engineering, and construction.

Hyundai Group's bid to build new steel capacity with an investment of \$5 billion was turned down by the Government. A forecast oversupply of steel in the future and stricter international environmental regulations were the reasons. Increased production of steel from Asian countries, such as China, would cause a supply glut. Tougher environmental regulations would mean that it would be more costly to produce steel domestically and more difficult to compete in the world market. Hyundai was ambitious to become the second largest steelmaker after Posco in the country.

LG International also agreed in principle with the Vietnamese

Government to take part in developing the Dongapo Mine, 450 km northwest of Hanoi, with an initial investment of at least \$11 million. The mine could produce 4 million metric tons (Mt) of cerium, lanthanum, and neodymium ore. A feasibility study was currently being conducted and the company sought to gain a stake of more than 50% in the mine.

Posco signed two joint-venture contracts worth a combined \$239 million to build plants to make stainless steel and galvanized steel sheet in Jiangsu Province, China. Posco would hold an 80% stake in the \$180 million stainless steel plant which, with a capacity of 100,000 t/yr, was due to come on-stream in late 1998. The company also was to hold a 70% interest in the \$59 million galvanized sheet plant having the same annual capacity, which was due to start up in late 1997.

Postrade Inc., a subsidiary of Posco, Samsung Corp., and Samancor Ltd. of South Africa signed an agreement for Samancor to supply Posco with 50,000 t/yr of ferrochrome for Posco's stainless steel operation in the country. Postrade and Samsung would each hold a 25% interest in the venture and Samancor 50%. Under the terms of the agreement, Postrade would upgrade one of Samancor's furnaces at Witbank, east of Johannesburg, and construct pelletizing, sintering, and preheating facilities for ferrochrome production. The investment would amount to an estimated \$40 million.

Korea Zinc Co. Ltd. would build a zinc smelter and refinery on the 800-hectare (ha) site at Townsville, Queensland, Australia, at an estimated cost of \$741 million. Construction was expected to start in mid-1996. The plant would produce 170,000 t/yr of primary metal and be scheduled to come on-stream in 1999. About 70% of the zinc concentrate for the smelter would be sourced from the Carpentaria and Mount Isa areas. The project would create more than 1,500 new jobs in the Townsville area. A new agreement would bind Sun Metals, a partner, to abide by the environmental safeguards stipulated in the impact assessment study. It also confirmed the obligation of the companies to undertake a feasibility study for the second phase of the project, which included an expansion of zinc refinery capacity and a lead smelter.

Korea Zinc also teamed up with two North American companies to develop the New Burgin zinc polymetallic deposit in Utah. It was outlined to have reserves of 1.4 Mt grading 6.7% zinc, 21% lead, and 566 grams per metric ton silver (Mining Journal, 1996a). The consortium planned to invest initially \$6 million in the project. Operation was expected to come on-stream in late 1998 at a mining rate of 7,300 metric tons per day (t/d) with a startup cost of \$40 million. It was expected to produce 140,000 kilograms of silver, 45,400 t of lead, and 9,000 t of zinc annually for 5 years. Chief Consolidated Mining Co. of the United States holds a 50% stake with Korea Zinc and Akiko Gold Resources of Canada holding 25% each. The joint venture is operated through Tintic Utah Minerals. The consortium also was to investigate silver, gold, and polymetallic exploration targets on the 3,600-ha Tintic property in Utah. Korea Zinc also was in the final stages of taking over Big River zinc smelter at Sauget, Illinois, for \$50 million. The facility has a capacity of producing 80,000 t/yr of zinc.

Korea Zinc agreed to take a 30% interest in the Zambian Copperbelt Project which covers a number of mines, 490 km north of Lusaka, Zambia, with an initial investment of \$3 million. The remaining 70% would be held by Anglovaal Ltd. of South Africa. The mines were estimated to contain 28 Mt of ore grading 2.5% copper and 0.17% cobalt (Mining Journal, 1996b).

The Korea Cement Industry Association estimated that cement consumption in 1996 would be close to 58.3 Mt and cement production was expected to reach 56.5 Mt. The country's joint clinker capacity was around 56.9 Mt/yr. Hanil Cement's production capacity was 6 Mt/yr and the company was modernizing one of its existing kilns to increase from 1,900 to 4,300 t/d.

Korea Heavy Industries & Construction Ltd. won a \$280 million cement plant order in Malaysia from Perak Hanjung Simen Sdn Bhd of Malaysia. The Korean company would hold a 40% stake in the project on a turnkey basis. Construction of the 1.5-Mt/yr plant was due to be completed by early 1998. The company currently has a 1.2-Mt/yr cement plant at Perak. Another Korean company, Halla Group, signed a memorandum of understanding with the West Sumatra State Government to participate in a greenfield cement works in Indonesia with a production capacity of 3.5 Mt/yr.

A geological survey discovered large reserves of ilmenite in deposits in Hadong and Sanchong Counties. Proved reserves of 50 Mt and probable reserves of 2,000 Mt were confirmed (Metal Bulletin, 1996). The titanium oxide grade in the deposits ranged between 4% and 6.7% which was low for mining to be viable.

Sam Hwa Chemical Co. Ltd. produced about 55,000 t/yr of dead burned magnesite from its seawater magnesite plant at Pohang. Three primary clinkers were produced in the rotary kiln. Over 80% of the output was used in the production of basic bricks and monolithics. The company also produced a small volume of synthetic dolomite clinker.

A roof collapsed during blasting operations at a coal mine in Taebaek, 200 km east of Seoul, in Kangwon Province in December 1996. The death toll at the time of the incident stood at 4. Eleven miners were trapped for nearly 36 hours and hope to find them alive was run out. They were presumed dead. The Province is the country's major coal mining region.

The country expected to import 7.2 Mt of liquefied natural gas (LNG) in 1996 and 12 Mt by the year 2000. The present suppliers were Brunei, Indonesia, Malaysia, and Qatar. Korea Gas Co. planned to import 2.4 Mt/yr of LNG from Qatar beginning in 1999 under a 25-year contract with an option to increase to 4 Mt/yr. The company also would import 1 Mt/yr of LNG from Indonesia's Bontang Plant in East Kalimantan over 20 years from 1998. The Republic of Korea was building a \$600 million natural gas plant for Malaysia. Daelim Engineering Co. would be responsible for 85% of the project with Marubeni Corp. of Japan supplying some raw materials. The Korea Export-Import Bank would partially finance the cost.

A unit of Daesung Group initially planned to spend \$25 million on the 73,000-ha exploration project in north-central Texas. The country has no oil of its own and imported 1.6

million barrels per day (Mbb/d) of oil. With current rate of economic growth, it was estimated that oil consumption would reach 2.3 Mbb/d by the year 2000.

The country's new oil refining capacity of 620,000 barrels per day (bb/d) was due on-stream in 1996. Hyundai added 200,000 bbl/d to its 110,000-bbl/d refinery in February. Honam and Yukong also expected to add 220,000 and 200,000 bbl/d, respectively, by October.

Yukong Ltd. wanted to build a \$1.5 billion oil refinery at Shenzhen in southern China. The plant would include a crude distillation unit of 110,000 bbl/d and a residual fuel oil cracker of 40,000 bbl/d and be operational by 1998. A nearby port could handle very large crude oil carriers. The company also would build an oil refinery with a capacity of 100,000 bbl/d of crude oil in Shangdong Province with China National Petrochemical Corp. The refinery and petrochemical facilities would cost \$3.7 billion. LG Group planned to invest in a \$1.2 billion oil refinery with a capacity of 130,000 bbl/d in Vietnam.

The Government unveiled a multifaceted incentive package to encourage private companies' participation in national infrastructure projects. Private companies participating in the construction of roads and ports would be allowed to draw on cash loans from abroad; this allowance was restricted to \$100 million per project. Asea Brown Boveri, a Swedish-Swiss conglomerate, signed a contract with Korea Electric Power Co. to install a turbine and other generators at a powerplant at Boryong. The \$409 million plant would have a total generating

capacity of 2,000 megawatts. Construction was slated to start in April 1996.

### References Cited

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### Major Sources of Information

Korea Institute of Geology, Mining, and Materials  
30, Kajungdong, Yusongku, Taejon  
Ministry of Trade, Industry, and Energy  
1, Chungang-dong, Kwach on, Kyonggi, Seoul

### Major Publications

Economic Planning Board, Seoul:  
Monthly Statistics of Korea.  
Korea Energy Economics Institute, Seoul:  
Yearbook of Energy Statistics.

TABLE 1  
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

| Commodity                                 | 1992       | 1993       | 1994      | 1995        | 1996 e/    |
|---|------------|------------|-----------|-------------|------------|
| <b>METALS</b>                             |            |            |           |             |            |
| Bismuth, metal e/                         | 9 2/       | 5          | --        | --          | --         |
| Cadmium, smelter e/                       | 620        | 400        | 400       | 1,665 r/ 2/ | 800        |
| <b>Copper:</b>                            |            |            |           |             |            |
| Mine output, Cu content e/                | 4          | 5          | 5         | 31 2/       | 7 2/       |
| <b>Metal:</b>                             |            |            |           |             |            |
| Smelter e/                                | 210,000    | 220,000    | 224,000   | 223,000     | 225,000    |
| Refined, primary                          | 209,000    | 218,000 e/ | 244,169   | 234,895     | 246,305 2/ |
| Gold, metal kilograms                     | 23,263     | 25,000 e/  | 12,332    | 13,418 r/   | 14,096 2/  |
| <b>Iron and steel:</b>                    |            |            |           |             |            |
| <b>Iron ore and concentrate:</b>          |            |            |           |             |            |
| Gross weight thousand tons                | 222        | 219        | 191       | 184 r/      | 221 2/     |
| Fe content do.                            | 134        | 122        | 107       | 103 r/      | 124 2/     |
| <b>Metal:</b>                             |            |            |           |             |            |
| Pig iron do.                              | 19,323     | 22,000 e/  | 21,169    | 22,344      | 23,010     |
| <b>Ferrous alloys:</b>                    |            |            |           |             |            |
| Ferromanganese                            | 85,867     | 100,630    | 120,020   | 118,798     | 126,000    |
| Ferrosilicon                              | 18,198     | 55         | --        | --          | --         |
| Ferrosilicomanganese                      | 82,582     | 81,996     | 89,023    | 97,785      | 83,000     |
| Other                                     | --         | 2,748      | 3,084     | 3,264       | 3,500      |
| Total                                     | 186,647    | 185,429    | 212,127   | 219,847     | 212,500    |
| Steel, crude thousand tons                | 28,054     | 33,026     | 33,745    | 36,772      | 38,903 2/  |
| <b>Lead:</b>                              |            |            |           |             |            |
| Mine output, Pb content                   | 13,628     | 7,409      | 2,173     | 4,064       | 5,131 2/   |
| Metal, smelter                            | 63,000     | 88,000 e/  | 86,457    | 129,744     | 88,556 2/  |
| Molybdenum, mine output, Mo content e/    | 5 2/       | --         | 2         | 2           | --         |
| Silver, metal kilograms                   | 332,791    | 214,583    | 257,498   | 299,104 r/  | 254,386 2/ |
| Tungsten, mine output, W content          | 247        | 200 e/     | -- e/     | --          | --         |
| <b>Zinc:</b>                              |            |            |           |             |            |
| Mine output, Zn content                   | 21,883     | 13,808     | 7,122     | 7,747       | 8,384 2/   |
| Metal, primary                            | 253,000    | 272,000 e/ | 271,110   | 279,335     | 286,526 2/ |
| <b>INDUSTRIAL MINERALS</b>                |            |            |           |             |            |
| Asbestos e/                               | 2,308 2/   | 2,200      | 2,000     | 1,800       | 1,500      |
| Barite                                    | 40         | --         | 85        | 90 r/       | 80         |
| Cement, hydraulic thousand tons           | 44,444     | 47,313     | 50,730    | 55,130      | 57,334 2/  |
| Clays, kaolin                             | 1,856,157  | 2,328,921  | 2,675,485 | 2,792,139   | 2,800,000  |
| Diatomaceous earth                        | 76,775     | 67,324     | 82,738    | 81,303      | 69,543 2/  |
| Feldspar                                  | 281,083    | 321,964    | 319,658   | 367,578 r/  | 319,112 2/ |
| Fluorspar, metallurgical-grade            | 70         | 50         | 50 e/     | 50 e/       | 50         |
| Graphite, all types                       | 8,412      | 5,910      | 4,300     | 1,938       | 1,113 2/   |
| Kyanite and related materials, andalusite | 38         | 30 e/      | 30 e/     | 20 e/       | 20         |
| Mica, all grades                          | 7,732      | 7,500 e/   | 37,470    | 43,709 r/   | 35,923 2/  |
| Nitrogen, N content of ammonia e/         | 442,482 2/ | 450,000    | 460,000   | 470,000     | 470,000    |
| Salt e/                                   | 771,937 2/ | 750,000    | 760,000   | 770,000     | 770,000    |
| Soda ash, manufactured e/                 | 300,000    | 310,000    | 310,000   | 310,000     | 300,000    |
| <b>Stone, sand and gravel:</b>            |            |            |           |             |            |
| Limestone thousand tons                   | 65,446     | 76,886     | 82,809    | 84,280 r/   | 84,740 2/  |
| Quartzite do.                             | 1,870      | 2,510      | 2,360     | 2,701 r/    | 2,814 2/   |
| Sand including glass sand do.             | 1,266      | 1,117      | 1,452     | 1,718       | 1,690 2/   |
| <b>Sulfur, byproduct: e/</b>              |            |            |           |             |            |
| Metallurgy do.                            | 260 2/     | 263        | 250       | 255         | 260        |
| Petroleum do.                             | 100 2/     | 200        | 200       | 200         | 200        |
| Total do.                                 | 360 2/     | 463        | 450       | 455         | 460        |
| <b>Talc and related materials:</b>        |            |            |           |             |            |
| Pyrophyllite                              | 602,580    | 644,890    | 707,951   | 789,994     | 780,062 2/ |
| Talc                                      | 149,862    | 53,923     | 35,340    | 29,364      | 19,066 2/  |

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

| Commodity                                  | 1992      | 1993    | 1994    | 1995     | 1996 e/  |
|--|-----------|---------|---------|----------|----------|
| <b>MINERAL FUELS AND RELATED MATERIALS</b> |           |         |         |          |          |
| Carbon black                               | 247,936   | 300,133 | 310,564 | 323,409  | 325,000  |
| Coal, anthracite                           | 11,135    | 8,845   | 7,438   | 5,720 r/ | 5,075 2/ |
| Coke e/                                    | 5,600     | 5,800   | 5,700   | 5,700    | 5,800    |
| Fuel briquets, anthracite briquets e/      | 11,069 2/ | 12,000  | 11,000  | 13,000   | 12,000   |
| Petroleum refinery products: e/            |           |         |         |          |          |
| Gasoline                                   | 30,000    | 38,000  | 37,000  | 38,000   | 37,000   |
| Jet fuel                                   | 9,700     | 9,800   | 9,800   | 9,800    | 9,900    |
| Kerosene                                   | 15,000    | 29,000  | 30,000  | 30,000   | 31,000   |
| Distillate fuel oil                        | 130,000   | 165,000 | 170,000 | 160,000  | 165,000  |
| Residual fuel oil                          | 145,000   | 180,000 | 180,000 | 180,000  | 180,000  |
| Lubricants                                 | 7,500     | 4,200   | 4,000   | 4,000    | 4,100    |
| Other                                      | 19,000    | 17,000  | 18,000  | 19,000   | 19,000   |
| Refinery fuel and losses e/                | 4,000     | 4,000   | 4,000   | 4,000    | 4,000    |
| Total e/                                   | 360,200   | 447,000 | 452,800 | 444,800  | 450,000  |

e/ Estimated. r/ Revised.

1/ Table includes data available through June 20, 1997.

2/ Reported figure.

TABLE 2  
 REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1996

(Thousand metric tons unless otherwise specified)

| Commodity         | Major operating companies and major equity owners        | Location of main facilities | Annual capacity |
|-------------------|--|-----------------------------|-----------------|
| Aluminum, primary | Aluminium of Korea Ltd.                                  | Ulsan                       | 18              |
| Bismuth, metal    | Korea Tungsten Mining Co. Ltd.                           | Sangdong                    | 135             |
| Cement            | Ssangyong Cement Industrial Co. Ltd.                     | Yongwol                     | 11,500          |
| Copper, metal     | LG Metals Corp.  | Changhang                   | 50              |
| Do.               | do.  | Onsan                       | 175             |
| Graphite          | Kaerion Graphite Ltd.                                    | Kangwon                     | 25              |
| Do.               | Wolmyong Mining Co.                                      | do.                         | 26              |
| Lead, metal       | Korea Zinc Co. Ltd.                                      | Onsan                       | 135             |
| Nickel, metal     | do.  | do.                         | 18              |
| Steel             | Pohang Iron and Steel Co. Ltd.<br>(35% Government owned) | Kwangyang                   | 11,400          |
| Do.               | do.  | Pohang                      | 9,400           |
| Talc              | Dongyang Talc Mining Co.                                 | Chungju                     | NA              |
| Zinc, metal       | Korea Zinc Co. Ltd.                                      | Onsan                       | 200             |
| Do.               | Youngpoong Corp.   | Sukpo                       | 90              |

NA Not available.