

THAILAND

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Thailand, which borders the Andaman Sea and the Gulf of Thailand to the north, Burma to the east, Cambodia and Laos to the west, and Malaysia to the north in Southeast Asia, was a middle-income developing country with a per capita gross domestic product (GDP) of about \$2,000 in 2002 (Bank of Thailand, 2003b¹). Thailand's identified mineral resources were antimony, ball clay, barite, bentonite, copper, diatomite, dolomite, feldspar, fluorite, gold, gypsum, iron ore, kaolin, lead, limestone, manganese, marl, phosphate, potash, quartz, rock salt, silica sand, tin, tungsten, and zinc (Department of Mineral Resources, 1998, p. 18).

On the basis of reserves quantity, diatomite, dolomite, gypsum, kaolin, limestone, marl, potash, and silica sand were more abundant than other identified minerals. The resources of barite, copper, fluorite, gold, gypsum, iron ore, lead, quartz, tin, tungsten, and zinc, however, were more important because of their higher economic value. All identified nonfuel minerals except copper and potash have been developed and produced for domestic consumption and export. Thailand also has small resources of mineral fuels, which included coal (lignite), natural gas, and crude petroleum.

Recent exploration by the Government and private companies for nonfuel minerals in Thailand focused mainly on copper, gold, and potash. As a result of exploration during the past 10 years, the development of the country's first medium-scale gold mine that will use modern mining and mineral-processing technology was completed by an Australian company at the Chatree Mine in Pichit Province in late 2001 and completed a full-year operation in 2002. The development of Udon Thani Potash Project by a Canadian company at Somboon in northeastern Thailand suffered a major setback in 2002 after hundreds of local residents protested against the mining project because of the concern about the potential environmental and social impacts of the potash mine (Mining Journal, 2002a). A feasibility study for the development of Puthep Copper Project by an Australian company in Loei Province will require the approval of the Thai Cabinet for land access to a gazetted watershed that is in most of the Puthep I deposit area.

In 2002, Thailand was one of the world's top producers of feldspar and gypsum (Olson, 2003; Potter, 2003). Most of the mineral production in Thailand was for domestic consumption. The country, however, exported a large percentage of the production of fluorite, gypsum, tin, and byproducts of tin mining and smelting, such as ilmenite, monazite, and tantalum. Thailand's requirements for such ferrous and nonferrous metals as iron and steel, primary aluminum, refined copper, refined lead, precious metals, and other minor metals were largely met by imports.

¹References that include a section mark (§) are found in the Internet References Cited section.

According to the National Account Division of the Office of the National Economic and Social Development Board, the output of the mining and quarrying sector, which grew by 10.4% in 2002 compared with only 0.6% in 2001, contributed 2.2% to the country's GDP. The higher growth rate of the mining and quarry sector in 2002 was the result of increased production of gold; such construction materials as dolomite, limestone and marble; natural gas; and crude petroleum. In 2002, Thailand's economy, as measured by the GDP, increased by 5.3% compared with 1.9% in 2001. The GDP, in 1988 constant dollars, was estimated to be \$75 billion in 2002. The 2002 higher growth in the country's economy was a result of increased output in every major economic sector especially in the manufacturing sector, which grew by 7.7% in 2002 compared with 1.5% in 2001. Thailand's total labor force increased to 34.3 million in 2002 from 33.9 million in 2001, and the rate of unemployment decreased to 2.2% in 2002 from 3.2% in 2001. Inflation rate, as measured by change in the Consumer Price Index, eased to 0.7% in 2002 from 1.6% in 2001. The country's merchandise trade surplus rose to \$3.4 billion in 2002 from \$2.5 billion in 2001. The total external debt decreased to \$59.4 billion in 2002 from \$67.5 billion (Bank of Thailand, 2003b§).

Government Policies and Programs

Thailand's mineral resources are owned by the State. Mineral exploration and development are governed by the Minerals Act of 1967, the Mineral Royalty Act No. 4, and the Tin Control Act of 1977. The Minerals Act of 1967, which had been amended in 1973, 1979, and in 1991 (by Mineral Act No. 4), controlled onshore and offshore exploration, mineral production, mineral trading, ore dressing, transport, and export of minerals except petroleum. The Minerals Act of 1967 was amended again in 2002 to bring the Act in line with modern international practices for underground mining that permit mining at depths of greater than 100 meters (m) below surface without requiring the specific consent of the holder of the surface right (Mining Journal, 2002b). The Mineral Royalty Rates Act of 1966 prescribes the rates of royalties to be assessed for different kind of minerals. The Tin Control Act of 1977 controlled mining, purchase, sale, and export of tin and contributions of tin to buffer stock.

The Environmental Act and the Forestry Act govern environmental protection and management of the mining industry. The Enhancement and Conservation of National Environmental Quality Act of 1992 controlled issues related to mining. The Forestry Act controlled mining in general forest areas.

Under the Minerals Act of 1967, the Ministry of Industry was appointed the principal Government agency to regulate the mining sector, and the Department of Mineral Resources (DMR), which is under the Ministry, is responsible for the administration of exploration and production activities

in accordance with geoscience and with requirements in environmental protection. The DMR also is responsible for supervising the coastal zone management program, petroleum development, mineral exploration, environmental protection in offshore areas, and the formulation of a viable program for the inspection of all petroleum and mining operations to ensure enforcement of applicable regulations. It conducts research on such environmental issues as mined land rehabilitation and the effect of offshore mining on coral reefs, mangroves, recreation areas, and shorelines. It also provides consulting services to the mining companies concerning technologies and equipment to be used to prevent environmental pollution (Dheeradilok, 1998).

Environmental Issues

In response to the Udon Thani Environmental Conservation Group (UTECEG), the Ministry of Natural Resources and Environment was expected to demand a new environmental impact assessment (EIA) for the development project of a potash mine in Udon Thani Province under the newly amended Minerals Act of 2002. The ministry was expected to request the Office of Environmental Policy and Planning, which is the sole authority to review EIAs, to ask the project developer, Asia Pacific Potash Corp. of Canada, to prepare a new EIA, which would be more comprehensive and in line with the newly amended Minerals Act of 2002. The UTECEG's major concerns were land subsidence and salinity from potash mining; the major concern of local villagers, however, concerned the difficulty in growing rice and raising cattle on their lands because of the potash saline left over from the drill test run by the project developer in 1993 (Bangkok Post, 2002b).

Production

Thailand produced a wide variety of minerals and processed mineral products in 2002. The country's important minerals products were barite, coal, dolomite, feldspar, natural gas, gemstones, gypsum, kaolin, limestone, crude petroleum, rock salt, silica, tin, tungsten, and zinc. The important processed mineral products were cement, fluorite (metallurgical grade), refined lead, refined petroleum products, steel, refined tin, and refined zinc. Thailand also produced tantalum metal powder and oxides, which were processed from such domestic and imported raw materials as struverite, tantalum-bearing scrap, and tin slag from tin smelting.

In 2002, production of most industrial minerals except fluorspar, perlite, quartz, and talc increased. Production of all metallic minerals except antimony, tin, and tungsten increased substantially; production of manganese ceased in 2002. Production of coal remained steady. Production of crude petroleum and natural gas condensate increased considerably, and production of natural gas increased slightly. Production of all processed minerals except refined lead and zinc slab increased because of the continued economic recovery (table 1).

Trade

Exports increased to \$66.8 billion in 2002 from \$63.4 billion in 2001, and imports also increased to \$63.4 billion from \$60.7

billion in 2001. As a result, the Thai merchandise trade surplus increased to \$3.4 billion in 2002 from \$2.5 billion in 2001, and the Thai baht appreciated against the U.S. dollar by 3.45% to 43.00 baht against US\$1.00 in 2002 from 44.48 baht in 2001. On the basis of two-way merchandise trade, Japan and the United States were the two major trade partners of Thailand in 2002 (Bank of Thailand, 2003a\$, b\$).

In the minerals trade, Thailand was a net importer of mineral commodities mainly because of its large import bills for coal, crude petroleum, iron and steel, and nonferrous metals. According to Thailand's Custom Department, exports of major crude and intermediate mineral products totaled \$708 million in 2002, of which gypsum [4.7 million metric tons (Mt)] was valued at \$54 million; refined tin [2,836 metric tons (t)], valued at \$53 million; and other mineral products, valued at \$601 million. Exports of major processed mineral commodities were base-metal products, \$2.2 billion; precious stones and jewelry, \$1.8 billion; and refined petroleum products, \$1.4 billion in 2002 (Bank of Thailand, 2003a\$).

In 2002, imports of major mineral fuel commodities were as follows: coal (5.6 Mt) was valued at \$199.5 million; crude petroleum [266 million barrels (Mbb)], \$6.7 billion; and refined petroleum products (6.2 Mbb), \$171.9 million (Energy Policy and Planning Office, 2003a\$, b\$). Imports of major nonfuel minerals were as follows: base-metal products were valued at \$4.6 billion; iron and steel products, \$3.0 billion; other intermediate metal products, 1.6 billion; jewelry and silver bar, \$1.1 billion; gold ingots, \$655 million; and crude minerals, \$395 million (Bank of Thailand, 2003a\$).

Structure of the Mineral Industry

The structure of the mineral industry remained unchanged in 2002. Thailand's mineral industry consisted of a large mining and mineral-processing sector of industrial minerals and a small mining and mineral-processing sector of ferrous and nonferrous metals. The energy sector, which included the production of coal, natural gas, and crude petroleum, was small but growing. Most of nonfuel minerals mining and mineral-processing businesses were owned and operated by private companies incorporated in Thailand. Coal exploration and mining were operated principally by the state-owned Electricity Generating Authority of Thailand (EGAT) and several small local private coal mining companies. Oil and gas exploration and production were by the state-owned Petroleum Authority of Thailand (PTT) and several joint ventures of the PTT and foreign oil companies.

Commensurate with the Government's mineral policy to focus on the development of minerals for the domestic market, the production capacity of industrial minerals continued to increase in 2002. The cement industry, which had expanded by more than 40% of its capacity during the 1990s, had a production capacity of about 53 million metric tons per year (Mt/yr). The production capacity for exported minerals, such as antimony, fluorite, kaolin, and tungsten, however, had been reduced considerably in the past 5 years. In 2002, Thailand's first modern gold mine started its first full-year operation. Construction of Thailand's first copper smelter, which was halted in March 1998, was expected to resume in 2003 and to be completed by the first quarter of 2004. The country's

production capacity of tantalum metal powder remained steady after the prices of tantalum stabilized in the world market in 2002. The capacity, however, could be expanded if the worldwide demand for tantalum should rise again.

Commodity Review

Metals

Copper.—To develop Thailand's first modern copper mine, Pan Australian Resources N.L. (PAR) of Australia completed its prefeasibility study in 2001 and confirmed the economic viability of developing the PUT 1 deposit where the potential open pit ore reserve is 44 Mt at a grade of 0.5% copper with a heap-leach and solvent extraction-electrowinning processes that could produce 30,000 metric tons per year (t/yr) of refined copper in the Puthep area of Loei Province (Pan Australian Resources N.L., 2003§).

In July, PAR announced that the Ministry of Industry had signed the submission by Puthep Company Ltd. (a wholly owned subsidiary of Padaeng Industry Pcl) for land access to complete the feasibility study on the Puthep Copper Project. The ministerial signing of the submission was an important step in the approval process. Most of the PUT 1 deposit, however, is located under a ridge line that had been zoned as a watershed by the Government. PAR and Puthep Company needed to obtain approval of the Thai Cabinet before proceeding with the feasibility study. PAR was expected to earn 51% interest by funding a feasibility study on the PUT 1 deposit (Pan Australian Resources N.L., 2002§).

Thai Copper Industries plc. (TCI), which suspended construction of its 165,000-t/yr copper smelter in March 1998 because of the Southeast Asia financial crisis in 1997, was expected to resume construction of its 70% complete Rayong Copper (smelter and refinery) Project in Rayong Province in eastern Thailand in 2003 and to complete construction by 2004. The construction work would be undertaken by Aker Kvaerner of Norway, which would provide \$40 million in fresh capital in exchange for taking a substantial equity share in TCI. Other Thai equity shareholders would provide an additional \$40 million in fresh capital. TCI planned to raise \$120 million in new credit for completing the smelter and an additional \$50 million as working capital from local bank and financial companies. The revival of the copper project was largely the result of the debt reduction by state-owned Thai Asset Management Corp. (TAMC), which restructured TCI's debt to \$90 million from \$200 million and an agreement by TCI's creditors to convert one-half of their remaining \$110 million debt to equity and to write down capital to \$20 million from \$120 million (Metal Bulletin, 2002c).

Gold.—In 2002, Akara Mining Ltd. (90% owned subsidiary of Kingsgate Consolidated N.L. of Australia) successfully completed its first full-year operations at the Chatree gold mine, which is located about 280 kilometers (km) north of Bangkok and 45 km southeast of the provincial capital of Pichit on the border of Petchabun and Pichit Provinces.

At the Chatree mining and mineral-processing complex, the initial open pit mining operations in 2002 were at the Tawan

(Sun) pits, which cover the C and H ore bodies. The Chantra (Moon) pits, which cover the D prospect, would be mined starting in 2003. For the first 7 months ending June 30, 2002, the ore-processing throughput exceeded the plant capacity of 1 Mt/yr by 17% and produced 91,185 ounces [2,836 kilograms (kg)] of gold and 353,146 ounces (10,984 kg) of silver at a cash cost of \$61 per ounce (\$1,961.19 per kilogram). According to the forecast by Kingsgate Consolidated, Chatree's first full-year production would be about 160,000 ounces (4,980 kg) of gold and 450,000 ounces (13,997 kg) of silver for fiscal year 2002/2003 (Kingsgate Consolidated N.L., 2002§).

In implementing its \$1 million plant expansion program, Kingsgate Consolidated completed its ore-processing plant expansion in mid-December by adding three carbon-in-leach (CIL) tanks to increase the capacity of the cyanide detoxification circuit, which would increase the residence time of the ore in the plant. The company reportedly was considering a further expansion plan to add more CIL tanks and grinding capacity to raise the capacity of the ore-processing plant's throughput to more than 1.5 Mt/yr in 2003 (Kingsgate Consolidated N.L., 2002§).

The company resumed its brownfield exploration in two prospects adjacent to its mining leases. In 2002, the company drilled 119 holes at Prospect A, which is located about 1 km north of Tawan Pit at the Chatree Mine. Mineralization at Prospect A is similar to that being mined at the Chatree Mine. The first independent estimate of gold and silver resources in Prospect A by Hellman & Schofield Pty. Ltd of Australia in July 2002 was 14,120 t of ore at a grade of 1.6 grams per metric ton (g/t) gold and 20 g/t silver (cutoff grade of 0.7 g/t gold). The estimated resources in Prospect A would result in a 59% increase in total resources of the Chatree Mine. In 2002, one small drilling program was completed at Prospect K, which is located between Prospect A and the Chatree Mine; minor mineralization was intersected in a number of holes. A larger drill program was scheduled for Prospect K in fiscal year 2002/2003 (Kingsgate Consolidated N.L., 2002§).

Iron and Steel.—Iron ore production increased sharply to 570,110 t in 2002 from only 50 t in 2001. The reason for the large increase in 2002 was unknown. The country, however, continued to rely on imports of such raw materials as ferroalloys, pig iron, and steel scrap and such intermediate steel products as billet, slab, and ingots to meet the requirements for its rolling steel mill sector.

In 2002, Thailand's crude steel production increased by 19% to 2.5 Mt. According to the Iron and Steel Institute of Thailand (ISIT), the country's production of carbon steel increased by 45% to 6.75 Mt, imports of carbon steel increased by 4.9% to 4.54 Mt, and exports of carbon steel decreased by 15.4% to 1.25 Mt in 2002. Apparent consumption of carbon steel increased by 33.7% to 10.0 Mt in 2002 and surpassed the prefinancial crisis record level of 9 Mt in 1995. Thai steel consumption was projected to grow by 6% to 7% in 2003 and 2004. The ISIT expected that the rising costs of raw materials, however, would pose major problems for the domestic steelmakers in terms of their competitiveness against imports, even though the domestic demand for their product would remain strong (Metal Bulletin Monthly, 2003).

According to the Bangkok Post (2002§), the substantial increase in the production of steel in 2002 was largely attributed to the stronger domestic demand because of domestic construction recovery and import surcharge in the first half of the year followed by the long-term antidumping measures implemented by the Ministry of Commerce in 2002.

In an effort to protect domestic flat steel producers, the Government of Thailand, through its Board of Investment, applied a surcharge of 25% to imports of such flat products as hot- and cold-rolled sheet, 15% to stainless sheet, and 5% to galvanized sheet effective from January 28 until July 28. These surcharges were in addition to the existing import duties of 10% on hot- and cold-rolled sheets, 12% on stainless sheet, and 15% on galvanized sheet (Metal Bulletin, 2002d).

To prevent domestic producers and importers from raising prices, the Government, through its Ministry of Commerce, also imposed price controls of the four steel products from January through July. The prices of four steel products had been set by the Government as follows: \$1,650 per metric ton for stainless steel, \$468 per ton for coated steels, \$363 per ton for cold-rolled sheet, and \$260 per ton for hot-rolled sheet (Metal Bulletin, 2002a).

After the surcharge expired on July 29, 2002, the Ministry of Commerce started to impose antidumping measures on hot-rolled stainless and carbon steel. The new antidumping tariffs on hot rolled sheet at a rate of 30% of cost, insurance, and freight (c.i.f.) price applied to imports from Algeria, Argentina, India, Indonesia, Japan, Kazakhstan, the Republic of Korea, Romania, Russia, Slovakia, South Africa, Taiwan, Ukraine, and Venezuela until November 29, 2002. Preliminary antidumping measures were applied to 47 categories of cold-rolled stainless sheet. Japanese steelmakers were subject to between 18.67% and 52.03% import duties; European steelmakers, between 10.05% and 51.12%; Taiwanese steelmakers, between 7.77% and 60.19%; and the Republic of Korea's steelmakers, a flat rate of 51.54% (Metal Bulletin, 2002b).

In 2002, many Thai steelmakers still faced debt problems. Of \$2.1 billion of nonperforming loans in the steel industry during 2002, state-owned Thai Asset Management Corp. (TAMC) was to restructure up to \$466 million. TAMC urged steelmakers to consolidate and restructure their debt. Without consolidation, most steelmakers would not be able to recover because commercial banks and new investors would not be willing to provide new funding to the steel industry, which was still faced with the problems of overcapacity. In response to TAMC's urgent call, NTS Steel Groups Public Co., Siam Construction Steel Co. Ltd., and Siam Iron and Steel Co. Ltd. formed Millennium Steel in July with a combined rolling capacity of 1.7 Mt/yr (Metal Bulletin, 2002f).

Lead.—Lead was mined by Kanchanaburi Exploration and Mining Co. Ltd. (KEMCO) at the Song Tho Mine in Kanchanaburi Province. KEMCO operated three mines in this Province with a combined capacity of about 30,000 t/yr of concentrate prior to 2001; the company produced between 24,000 and 25,000 t/yr of concentrate in 1998 and 1999. According to the DMR, lead was not produced in 2000 and 2001 from the Kanchanaburi area. According to a local press reports in 1999, lead mining operations contaminated Klity Creek in

the Tung Naresuan Wildlife Sanctuary in Kanchanaburi. Karen villagers living along the highly contaminated lower Klity Creek in the wildlife sanctuary reportedly had been exposed to lead contamination from the creek they relied upon for their daily water. In 2002, the Karen Studies & Development Center alleged that lead pollution from the mines was behind the hospitalization of seven children in the Kanchanaburi area in September and urged the Forest Department to discontinue KEMCO's lead mining rights in the Khao Phra Ruesi-Khao Borae Forest (Metal Bulletin, 2002e).

Rare Earths.—According to the DMR, Thailand ceased mine production of monazite in Prachuap Kiri Khan Province in 1997. Since 1998, monazite had been produced by processing tin tailings imported from Burma and Vietnam (Wichian Plodpradista, Director, Technical and Planning Division, Department of Mineral Resources, oral commun., 2002). Exports of monazite resumed in 1998 with 120 t, steadily increased to 1,294 t in 1999 and 2,401 t in 2000, but decreased to 1,036 t in 2001; all went to China. Exports of monazite increased by 48.4% to 1,537 t and were valued at \$472,100 in 2002 (Department of Mineral Resources, 2003).

In November, Exchequer Resources Corp. of Canada reportedly reached an option agreement with Geotai Exploration & Mining Co. Ltd. (GE&MC) of Thailand to acquire a 70% interest in a rare-earth project that would evaluate and put into production certain mining tailings located in Kanchanaburi Province. To earn its interest, Exchequer Resources must provide \$58,672 for testing and \$782,075 to establish commercial production. The company also must issue 3 million equity shares to GE&MC and a finder fee of 300,000 shares (Exchequer Resource Corp., 2002).

Zinc.—Mine production of zinc ore was mainly by Padaeng Industry Public Co. Ltd. (PDI) at the Padaeng Mine, which is located 12 km southeast of Mae Sot in Tak Province. According to PDI, the Padaeng Mine produced 112,779 t of zinc silicate ore at a grade of 22.18% zinc that contained 25,011 t zinc metal in 2002. Padaeng Industry (Laos) Co. Ltd. (a subsidiary of PDI), which obtained a mining lease from the Laotian Government, mined only 1,000 t of zinc ore at a grade of 27.6% zinc from the Kaiso deposit in Laos in 2002. All zinc ore and concentrate, which included the Laotian ore, was delivered to the zinc smelting and refining facilities in Tak Province for zinc metal production. As of December 31, 2002, total mineral resources of the Padaeng Mine were estimated to be 4.82 Mt at a grade of 12% zinc that contained 578,400 t of zinc metal. At the Hualon Mine in the Mae Sot area, total mineral resources were estimated to be 295,000 t at a grade of 6.0% zinc. The new mining leases, which covered an area of 39.38 hectares that adjoined the existing mining leases to the northwest, was approved by the DMR in July 2002. According to PDI, the granting of the new mining leases would enable PDI to access a large amount of the mineral resources that had been identified beneath the existing pit (Padaeng Industry Public Co. Ltd., 2002§).

PDI's zinc plant in Tak (Tak zinc smelter), which is located 96 km from the Padaeng Mine, consumed about 341,000 t of ore and concentrate, 116,816 t of which was imported from overseas mainly from Australia, Peru, and the United States in 2002.

The overall zinc production was 105,148 t, of which 72,502 t was ingot and 32,646 t was zinc alloy (Padaeng Industry Public Co. Ltd., 2002§).

In 2002, domestic demand for zinc increased by 17.1% to 85,037 t, of which 62,535 t was zinc ingot and 22,502 t was zinc alloy. Exports of zinc ingot and alloy decreased by 15.8% to 20,467 t because of increased domestic consumption in 2002. The major buyers of zinc ingot were, in decreasing order, Taiwan, Hong Kong, Burma, and Indonesia. The principal buyers of zinc alloy were, in decreasing order, Hong Kong and China (Department of Mineral Resources, 2003).

Industrial Minerals

Barite.—Barite mining was mainly in the Provinces of Loei and Mae Hong Son in the northern Thailand and in the Provinces of Nakhon Si Thammarat and Satun in southern Thailand. Of the 2002 barite production, 5% was chemical grade; 12%, drilling mud grade; and 83%, not ground. Domestic demand totaled 55,957 t, of which 6.5% was chemical grade; 5.7%, drilling mud grade; and 87.7%, not ground in 2002. Thailand exported 17,011 t of barite in 2002, of which 6.4% was chemical grade; 93%, drilling mud grade; and 0.5%, not ground (Department of Mineral Resources, 2003).

P & S Barite Mining Co. Ltd. (a member of Pands Group Mining and Milling Company) mined barite in Nakhon Si Thammarat Province and exported all the crude barite products to oil-well-drilling companies mainly in Indonesia and Malaysia. According to a local press report in October 2002, a local association alleged deforestation and water pollution from barite mining. The Friends of Luang Mountain Group filed a petition against barite mining in Nop Phitam subdistrict where about 100 families complained to the Group and alleged that about 100 rai (16 hectares) of the community's abundant forest was ruined and that water in a canal was fouled by P&S Barite Mining Co. (Bangkok Post, 2002a).

Cement.—Thailand's clinker output increased by 13.0% to 37.9 Mt in 2002 following a 14.2% increase in 2001. Cement production increased by 13.5% to 31.7 Mt in 2002 following a 9.5% increase in 2001 because of the stronger domestic demand for cement in 2002. The higher domestic demand for cement in 2002 reflected the upturn in the residential construction and the property sector that resulted from effective Government measures to stimulate the real estate sector through lower interest rates and lower cement prices.

According to the Thailand Fellowship of Cement Manufacturers (2002§), the industry comprised 7 companies that operated 13 plants and 35 kilns and employed 10,777 workers at the plants. The industry's kiln capacity was 47.17 Mt/yr, and cement capacity was 53 Mt/yr in 2002. Domestic demand jumped 21.3% to 22.2 Mt in 2002 from 18.3 Mt in 2001. Exports of clinker and cement were 10.07 Mt and 6.44 Mt, respectively, in 2002 compared with 9.45 Mt and 7.20 Mt, respectively, in 2001. The country's per capita cement consumption rose to 364 kg in 2002 from 294 kg in 2001 (Bangkok Post, 2003§).

The industry association estimated that cement production was expected to increase in 2003 because of continuing

increases in Government spending on public works and major infrastructure projects, as well as residential housing and office building projects (Somthida Piyapana, Office Manager, Thailand Fellowship of Cement Manufacturers, oral commun., 2002).

The country's largest cement producer was Siam Cement Industry Co. Ltd. (SCC). It operated at 70.3% of its capacity of 23.2 Mt/yr and produced about 16.3 Mt of cement in 2002. SCC planned to raise its capacity utilization rate to 80% to accommodate a projected 10% to 15% growth in demand for cement in 2003. In 2003, the company's cement sales in the domestic market were projected to increase from 9 Mt to 10 Mt, and exports, to remain at 7 Mt (Bangkok Post, 2003§).

In 2002, the country's second largest cement producer was Siam City Cement Public Co. Ltd. (SCCC). It operated at about 81.3% of its capacity of 12.3 Mt/yr, produced about 10 Mt, and exported about 4.5 Mt. SCCC planned to reduce its export portion of sales from about 45% to 25% (about 2.5 Mt/yr) but to keep its production at 10 Mt in 2003. The third largest cement producer was TPI Polene Co. Ltd. (TPIPL), which operated at full capacity of 9 Mt/yr. It was still embroiled in a 4-year struggle between the founder and creditors. Siam City Cement reportedly agreed to buy more than 1.7 billion shares, or a 77% stake, in TPIPL for \$375 million in February 2002. The success of the bid would require 95% or more of TPIPL's creditors' votes in favor of the plan (Bangkok Post, 2003§).

Potash.—Thailand was not a potash producer in 2002, but could become an important producer in Asia and the Pacific region within the next 3 years. In early 2002, Asia Pacific Resources Ltd. (APR) reportedly was finalizing the studies required to complete its application for a mining lease for its 90%-owned Asian Pacific Potash Corp. Ltd.'s Somboon potash project in Udon Thani Province in the northern Thailand. In August 2002, the Lower House of the Parliament of Thailand approved Amendments to the Minerals Act that would have positive impacts for APR's Somboon potash deposits, which are typically 350 m below the surface. Additionally, the maximum size of an underground mining license would no longer be limited to 300 rai (48 hectares), but would be increase to 10,000 rai (1,600 hectares), and an EIA must accompany the application for a mining lease (Industrial Minerals, 2002; Mining Journal, 2002b).

In November, according to APR, the DMR informed APR that the Thai Constitution Court had ruled by a vote of 12 to 2 that the Mineral Resources Bill is not in breach of the Constitution. After the Senate and the Lower House approved the Bill, a minority group of Senators petitioned the Constitution Court to test the constitutionality of the Bill. The Bill was to be submitted to the King of Thailand for endorsement, after which it would become law. APR indicated that the signing into law of the Bill would be a major step toward the development of an underground mining industry in Thailand and that the law would permit APR to apply formally for a mining lease (Asia Pacific Resources Ltd., 2002§).

According to a local press report, about 400 villagers from the Udon Thani area staged a protest against the Somboon potash development. The villagers from Huay Sampad and Namuang asked the Provincial governor to review the impact of the APR's proposed potash development. Local communities reportedly

were concerned about salt, subsidence, and water contamination of their farmland and stressed that potash mining would result in a large area being covered with salts and seasonal floods that could potentially wash the material into surrounding farmland, forests, and waterways and that dust could be blown onto neighboring fields (Mining Journal, 2002a).

In December, in response to a request by the UTECG, the Minister of Natural Resources and Environment reportedly was to use the newly passed Mineral Act of 2002 to demand a new EIA from the Somboon potash project, thus delaying the issuance of its mining lease. The Minister indicated that the Ministry would request the Office of Environmental Policy and Planning (OEPP), which oversees EIAs, to ask Asia Pacific Potash to conduct a new EIA that should be more comprehensive and in line with the new Mineral Act of 2002. The UTECG, which submitted a list of 5,000 project opponents, called on the Ministry to scrap the old EIA report and to set up a new specialist committee to approve a new EIA. The mining lease to be issued by the Ministry of Industry would need an OEPP-approved EIA report (Bangkok Post, 2002b).

Mineral Fuels

Coal.—Coal (lignite) production held steady at 19.6 Mt in 2002. About 77% of the lignite was produced by EGAT, which operated the Mae Moh, Sop Prap, and Muang mines in the Provinces of Lampang and Krabi; the remaining 23%, by Lanna Resources Public Co. Ltd., which operated the Li, Nong Ya Plong, and Chiang Muan mines in the Provinces of Lamphun and Phetchaburi and several other coal mining companies that operated in the Provinces of Lampang, Phayao, and Phetchaburi. To meet the overall coal demand, Thailand imported 5.6 Mt of coal in 2002. Of that total, 4.9 Mt was bituminous, which had risen by 4.3% from 4.7 Mt in 2001; 581,260 t was anthracite; and 70,650 t was coking coal, which had risen by 23.8% from 57,060 t in 2001 (Energy Policy and Planning Office, 2003a§, b§).

In late 2001, EGAT was permitted by Cabinet resolution to develop the Wiang Haeng coal basin in Chiang Mai Province for power generation on the condition that an EIA of the project be approved by the Government. Chiang Mai University was appointed to conduct the EIA. Additionally, EGAT was also granted a permit for the development of the Saba Yoi coal basin in Songkhla Province (Electricity Generation Authority of Thailand, 2002).

Demand for domestically produced lignite totaled 19.6 Mt in 2002, of which about 77% was consumed by EGAT in power generation at the 2,625-megawatt Mae Moh lignite-fired powerplant and 23% was consumed as energy by the manufacturers of cement, fiber, lime, and paper; tobacco curers; and other users. Demand for imported coal (mostly anthracite, bituminous, and coking coal), which totaled 5.6 Mt, was consumed mainly by the manufacturers of cement and ferrous and nonferrous metals and by other end users (Energy Policy and Planning Office, 2003a§, b§).

Natural Gas and Petroleum.—Thailand's natural gas production increased by 4.1% to an average of 56 million cubic meters per day in 2002 from an average of 53.8 million cubic

meters per day in 2001. In 2002, natural gas was produced from 20 gasfields, mostly offshore. About 53% of Thailand's natural gas was produced by Unocal Thailand Ltd. (UT) from 11 offshore gas and condensate fields (Baanpot, Erawan, Funan, Gomin, Jakarawan, Pailin, Platong, Satun, South Satun, and Trat); the remaining 47% was produced by PTT Exploration and Production (PTTEP) (the upstream subsidiary of PTT), ChevronTexaco Corp., and other companies, from eight offshore gasfields (Benjamas, Bong Kot, Maliwan, Plamuk, Plandaeng, Surat Thani, Tantawan, and Yala) and two onshore gasfields (Nam Phong and Sirikit) (Energy Policy and Planning Office, 2002d§).

UT, which operated 100 platforms in the central Gulf of Thailand, supplied natural gas for power generation to meet about 30% of Thailand's demand for power in 2002. Of UT's natural gas production, 75% was for power generation, and 25% was consumed as fuel for cooking, manufacturing, and transportation and as feedstock for petrochemicals. In 2002, the national oil company Petroleum Authority of Thailand (PTT) Plc and UT reached an agreement to extend the gas sales contract for UT's Erawan field for 5½ years to 2012, and gas prices under three gas sales agreements with PTT, which accounted for 82% of UT's daily contract minimum for its operating fields in Thailand, were discounted by 2% of prevailing wellhead prices (Kositchothethana, 2002§; Unocal Thailand Ltd., 2003§).

According to the Energy Policy and Planning Office (2002a§), consumption of natural gas, which included domestic and imported natural gas, for power generation increased by 8.5% to 46.2 million cubic meters per day in 2002 from 42.6 million cubic meters per day in 2001. In 2002, natural gas consumption for the first 9 months increased by 8.5% to 372,500 barrels of oil equivalent per day. The continued growth in consumption of natural gas was mainly the result of the continued surge in demand for power generation. In 2002, about 90.1% of total natural gas consumption was for power generation. Consumption of electricity in Thailand rose by 4.5% in the first 9 months of 2002 to 79,715 gigawatthours. According to an estimate by the Energy Policy and Planning Office, the country's electricity demand was to grow at 4.7% in 2002 and between 3.5% and 4% between 2003 and 2005 (Kositchothethana, 2002§).

Production of crude petroleum increased by 22.4% to an average of 74,550 barrels per day (bbl/d), and that of condensate, by 3.8% to an average of 53,720 bbl/d in 2002. In 2002, crude petroleum was produced from 12 oilfields. The newly developed offshore Benjamas, which was the largest offshore oilfield and gasfield, was operated by Chevron Offshore (Thailand) Ltd. and produced 46.5% of the total output. The Sirikit, which was Thailand's largest onshore oilfield and gasfield, was operated by Thai Shell Exploration and Production Co. Ltd. and produced 27.2%. The Plamuk, which was Thailand's second largest offshore oilfield and gasfield, was operated by UT and produced 15.4%. The Tantawan, which was Thailand's third largest offshore oilfield and gasfield, was operated by Chevron Offshore (Thailand) and produced 7.5% in 2002. The remaining 3.4% was produced from eight smaller oilfields and gasfields (Energy Policy and Planning Office, 2002b§).

UT started its crude petroleum production in the Gulf of Thailand in August 2001. Crude petroleum production from UT's Plamuk Oilfield increased to 17,000 bbl/d in October 2002 and reached to 18,008 bbl/d in December 2002. As the operator, UT had a 71.25% working interest; other partners in the field included Mitsui Oil Exploration with 23.75% and PTTEP with 5%. Condensate was produced from 11 offshore gasfields that were operated by PTTEP and UT. PTTEP's Bong Kot gasfield and condensate field accounted for 30% of the total condensate production in 2002 followed by UT's Pailin gasfield and condensate field, which accounted for 21.1% (Energy Policy and Planning Office, 2002c§, d§).

To meet its overall demand for crude petroleum, Thailand imported 728,532 bbl/d of crude petroleum, which accounted for about 91% of total crude petroleum supply in 2002. Thailand's petroleum refining industry had a total crude capacity of 703,100 bbl/d. Shell Co. of Thailand Ltd. (formerly the Refinery Company) had a 275,000-bbl/d-crude-capacity refinery in Map Ta Phut, Rayong Province; Thai Oil Co. Ltd. had a 192,850-bbl/d-crude-capacity refinery in Sriracha, Chonburi Province; Esso Standard Thailand Ltd. had a 173,500-bbl/d-crude-capacity refinery in Sriracha, Chonburi Province; and PTT Plc had a 61,750-bbl/d-crude-capacity refinery in Bang Chak, Bangkok (Oil & Gas Journal, 2002).

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Bank of Thailand:
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Economic report, annual.
Economic condition and economic data.

TABLE 1
THAILAND: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1998	1999	2000	2001	2002
METALS					
Antimony:					
Ore:					
Gross weight	442	130	178	40	3
Sb content	199	59	84	18	1
Metal, smelter	242	40	16	12	--
Cadmium	-- ^r	-- ^r	-- ^r	-- ^r	--
Gold kilograms	--	--	--	320	4,950
Iron and steel:					
Iron ore:					
Gross weight	90,700	122,633	100	50	570,110
Fe content ^c	45,000	61,000	50	25	285,000
Crude steel thousand tons	1,814	1,532	2,100	2,127	2,540
Lead:					
Ore					
Gross weight	15,346	23,783	24,760	800	6,500
Pb content	6,700	11,900	15,600	500	3,200
Metal, refined:					
Primary	3,219	3,025	3,390	3,500	3,500
Secondary	18,906	23,741	23,803	26,500	23,200
Total	22,125	26,766	27,193	30,000	26,700
Manganese ore:					
Battery- and chemical-grade, 75% MnO ₂	26	46	225	45	--
Metallurgical-grade, 46% to 50% MnO ₂	26	675	--	--	--
Total, gross weight	52	721	225	45	--
Total Mn content ^c	25	360	110	23	--
Silver kilograms	--	--	--	1,159	18,018
Tantalum, metal and oxide powder	56	98	210	150	200
Tin:					
Concentrate:					
Gross weight	2,028	3,400	2,363	2,383	1,384
Sn content	1,656	2,712	1,930	1,950	1,130
Metal, smelter, primary	15,353	17,306	17,076	22,387	17,548
Tungsten concentrate:					
Gross weight	61	54	54	92	53
W content ^c	35	30	30	53	30
Zinc:					
Ore:					
Gross weight	195,122	185,752	159,093	88,664 ^r	151,575
Zn content ^c	25,000	24,000	27,000	15,300 ^r	33,600
Metal, primary	75,904	75,639	77,525	74,129	72,502
Alloy, Zn content	15,076	21,653	23,617	30,668	32,646
Zirconium concentrate, gross weight	--	--	100	--	--
INDUSTRIAL MINERALS					
Barite	105,221	76,092	56,180	23,559	137,469
Cement, hydraulic thousand tons	22,722	25,354	25,499	27,913	31,679
Clays:					
Ball clay	206,349	317,877	394,154	341,272	450,818
Kaolin, marketable:					
Beneficiated, washed	248,461	113,005	201,226	168,063	127,132
Nonbeneficiated, unwashed	154,511	243,213	286,912	125,133	168,883
Filler	14,398	14,765	19,836	13,520	3,150
Diatomite	912	2,332	390	720	780
Feldspar	440,288	626,415	542,991	710,543	783,733
Fluorspar, crude, metallurgical-grade	3,743	13,005	4,745	3,020	2,270
Gemstones thousand carats	1,010	1,267	928	1,071	1,597
Gypsum thousand tons	4,334	5,005	5,830	6,191	6,326
Mica	18	78	107	72	--
Perlite	3,600	5,800	6,000	9,915	7,600
Phosphate rock, crude	3,029	3,880	3,260	2,359	3,680

See footnotes at end of table.

TABLE 1--Continued
THAILAND: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1998	1999	2000	2001	2002
INDUSTRIAL MINERALS--Continued					
Salt:					
Rock	546,096	739,502	792,250	852,565	908,968
Other ^c	100,000	100,000	100,000	100,000	100,000
Sand, silica, glass	323,937	531,588	471,547	513,880	781,014
Stone:					
Calcite	12,250	72,130	87,100	159,050	172,760
Dolomite	520,826	485,393	625,127	871,308	933,209
Granite	9,493	6,190	7,595	6,659	7,597
Industrial rock	2,480	2,139	2,154	2,546	3,370
Limestone:					
For cement manufacture only	36,593	48,306	43,492	46,984	53,670
Construction and other uses	19,068	35,853	37,017	38,130	54,490
Marble, dimension stone and fragment	394,419	294,337	270,036	314,445	461,272
Marl for cement manufacture only	6,995	32,044	7,290	7,755	83,135
Quartz	3,730	3,760	5,177	48,908	32,954
Shale for cement manufacture only	2,704	3,223	3,110	3,364	5,017
Talc and related materials:					
Pyrophyllite	40,241	38,053	46,011	59,602	103,496
Talc	2,172	4,960	7,390	6,838	1,702
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite	20,162	18,266	17,714	19,617	19,602
Natural gas, gross production	17,550	19,307	20,190 [†]	19,637 [†]	20,451
Petroleum:					
Crude	10,738	12,412	20,883 [†]	22,226 [†]	27,209
Natural gas condensate	16,914	18,115	19,114 [†]	18,999 [†]	19,609
Refinery products:					
Liquefied petroleum gas	25,962	28,853	32,511	37,067	37,069
Gasoline	55,353	54,290	50,862	52,376	51,896
Jet fuel	22,438	25,908	27,347	26,651	29,373
Kerosene	723	2,181	3,090	3,693	3,457
Distillate fuel oil	49,351	49,242	43,970	40,669	37,610
Residual fuel oil ^c	22,000	22,000	22,000	22,000	22,000
Unspecified ^{c, 2}	3,500	3,500	3,500	3,500	3,500
Total ^c	179,000	186,000	183,000	186,000	185,000

^cEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [†]Revised. -- Zero.

¹Includes data available through September 19, 2003.

²Includes refinery fuel and refinery gains or losses.

Sources: Department of Mineral Resources, Mineral Statistics of Thailand, 1998-2002 and Metal Statistical Yearbook, 2002; Ministry of Commerce, Energy Policy and Planning Office, Energy Data Notebook, 1988-2002, 15-year Series Report.

TABLE 2
THAILAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Barite		Asian Mineral Resources Co. Ltd.	Loei, Mae Hong Son, Nakhon Si Thammarat, and Satun Provinces	140
		P & S Barite Mining Co. Ltd.	Nop Phitam, Nakhon Si Thammarat Province	1,400
Cement		Asia Cement Co. Ltd.	Pra Phutthabath, Saraburi Province	4,800
Do.		Jalapathan Cement Co. Ltd. (Cements Franciais S.A., 37%; Veatprapat Holding Co. Ltd., 19%; others, 44%)	Takli, Nakhorn, Sawarn Province; and Cha-Am, Petchburi Province	2,350
Do.		Samukee Cement Ltd.	Pakchong, Nakhon Ratchasima Province	125
Do.		Saraburi Cement Co. Ltd. (CEMEX Asia Holdings Ltd., 99%)	Chalerm Phrakiat, Saraburi Province	700
Do.		Siam Cement Industry Co. Ltd. (Bureau of the Crown Property, 30%; Thai Security Depository Co. Ltd., 6.94%; CPB Equity Co. Ltd., 5.6%; other financial institutions and the general public, 57.46%)	Kaeng Khoi, Phabudhabat, and Khao Wong, Saraburi Province; Chae hom, Lampang Province; Thung Song, Thammarat Province; and Ta Luang, Ayutthaya Province	23,200
Do.		Siam City Cement Co. Ltd. (Holcim Ltd. of Switzerland, 33.7%; Rattanak family, 27%; other investors, 39.3%)	Kaeng Khoi, Saraburi Province	12,300
Do.		TPI Polene Co. Ltd.	Kaeng Khoi, Saraburi Province	9,000
Coal, lignite		Electricity Generating Authority of Thailand	Mae Moh, Lampang Province; Li, Lamphun Province	20,000
Do.		Lanna Resources Public Co. Ltd.	Baan Pa Kha, Lampang Province; and Nong Ya Plong, Petchburi Province	1,800
Fluorspar, concentrate		Asian Mineral Resources Co. Ltd.	Mae Hong Son Province	14
Gas, natural	million cubic meters per day	Esso Exploration and Production Khorat Inc.	Namphong, Khon Kaen Province	4
Do.	do.	TOTAL Exploration and Production (Thailand)	Bongkot in the Gulf of Thailand	15
Do.	do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Kaphong, Pladang, Satun, Paili, Trat, all in the Gulf of Thailand	33
Gold	kilograms	Akara Mining Ltd. (subsidiary of Kingsgate Consolidated N.L. of Australia, 90%)	Chatree, Pichit Province	5,000
Gypsum		Thai Gypsum Products Pcl. (Thaigips Holdings Ltd., 40.75%; BPB Gypsum B.V., 30%; others, 29.25%)	Nong Bau, Nakhon Sawan Province; Ban Munnak, Phichit Province	2,000
Do.		Vanich Gypsum Co. Ltd.	Khlong Prab, Mai Rieng, and Thoong Yai Mai, Nakhon Si Thammarat and Surat Thani Provinces	2,000
Lead, in concentrate		Kanchanaburi Exploration and Mining Co. Ltd.	Song Toh, Nong Phai, and Bo Ngam, Kanchanaburi Province	30
Petroleum, crude included condensate	thousand 42-barrels per day	Chevron Offshore (Thailand) Ltd.	Benjamas, Tantanwan, offshore in the Gulf of Thailand	35
Do.	do.	Tah Shell Exploration and Production Co. Ltd.	Sirikit, Kamphaenghet Province	24
Do.	do.	TOTAL Exploration and Production (Thailand)	Bongkot, offshore in the Gulf of Thailand	12
Do.	do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Gomin, Jakrawan, Kaphong, Pailin, Platon, Satun, Surat, and Trat Plamuk, offshore in the Gulf of Thailand	38
Steel, rolled		The Bangkok Iron and Steel Works Co. Ltd.	Phrapradaeng, Samutprakarn Province	120
Do.		Bangkok Steel Industry Public Co. Ltd.	do.	300
Do.		Millenium Steel Co. Ltd. (Siam Cement Public Co. Ltd., 45%; NTS creditors, 44.65%; McDonald Investments, 6.58%; NTS shareholders, 3.77%)	Chon Buri, Muang Rayong, and Saraburi Provinces	1,700
Do.		Namheng Steel Co. Ltd.	Lopburi Province	350
Do.		Sahaviriya Group Corp. Ltd.	Bang Saphan, Prachuap Khiri Khan Province	2,400
Do.		Siam United Steel Co. Ltd.	Rayong Province	1,000
Do.		Siam Yamato Steel Co. Ltd.	Muang, Rayong Province	600
Tantalum, metal powder and oxides	metric tons	H.C. Starck (Thailand) Co. Ltd. (H.C. Starck GmbH, 94.98%; others, 5.02%)	Map Ta Phut, Rayong Province	250

TABLE 2--Continued
 THAILAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Tin:			
Concentrate	Numerous small companies	Nakhon Si Thammarat, Phangnga, Phuket, and Ranong Provinces	3
Refined	Thailand Smelting and Refining Co. Ltd. (Amalgamated Metal Corp., 72.25%; others, 24.75%)	Phuket, Phuket Province	30
Zinc:			
In concentrate	Padaeng Industry Public Co. Ltd. (Umicore SA of Belgium, 44.77%; Ministry of Finance, 13.81%; others, 41.42%)	Mae Sot, Tak Province	30
Refined	do.	Tak, Tak Province	105