



2011 Minerals Yearbook

VIETNAM

THE MINERAL INDUSTRY OF VIETNAM

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In 2011, Vietnam ranked seventh in the production of crude petroleum in the Asia and the Pacific region. The country also produced chromium ore, coal, natural gas, ilmenite, lead, lime, crude petroleum, phosphate rock, salt, steel, and zirconium. As for major processed minerals, Vietnam produced cement, refined copper, rolled steel, refined tin, and zinc (table 1; U.S. Energy Information Administration, 2011).

Minerals in the National Economy

According to the General Statistics Office of Vietnam, the output value of the mining and quarrying sector (which included mineral fuels and nonfuel minerals) in 2011 decreased by about 7.6% to an estimated \$1.065 billion¹ (in 1994 constant dollars) from \$1.15 billion in 2010. The mining and quarrying sector made up 3.7% of the country's total estimated gross domestic product of \$28.6 billion (in 1994 constant dollars) compared with about 4% in 2010 (General Statistics Office of Vietnam, 2011b).

Government Policies and Programs

In 2010, the Government of Vietnam created and approved several decisions and decrees to attract international interest in the country's potential for the production of nuclear energy. Vietnam's interest in pursuing nuclear energy was mainly to meet the country's growing demand for reliable sources of energy. In June 2010, the Government issued Decree 70/2010/ND-CP (Decree 70), which was implemented on August 10 of the same year. Decree 70 provides guidance for the implementation of the Law on Atomic Energy, which mainly regulates the construction, decommissioning, emergency response, operation, and safety of nuclear power plants. Decree 70 requires interested investors to comply with the country's master plan on electricity development, which is reviewed every 10 years, to acquire the necessary permits to start a business in Vietnam. Under this decree, the Ministry of Construction is the Government entity in charge of regulating the construction of nuclear power turbine units; the Ministry of Industry and Trade (MOIT) is in charge of drafting and enforcing all technical regulations pertaining to nuclear power turbine units; and the Ministry of Science and Technology (MST) is in charge of regulating nuclear power safety in the construction, design, dismantlement, selection of location, and operation of the nuclear power turbine units. In addition, the MST coordinates with the Ministry of Natural Resources and Environment (MONRE) for contingency planning for the control of radiation in an emergency and creates standards for radioactive emissions and management of radioactive waste and spent nuclear fuel. The MST issues construction licenses,

and the MOIT issues licenses for trial operations as well as the final operation licenses (electricity activity license) for nuclear powerplants (Mayer Brown JSM, 2010b).

In August 2010, under Decision 906/QĐ-TTg [(Decision 906), which was originally signed on June 17, 2010], the Government announced its plans to build 14 nuclear power reactors by 2030. The plants would have a total combined capacity of between 15,000 megawatts (MW) and 16,000 MW, which was equivalent to 10% of the country's current total electricity capacity. The plants would be built in various locations in central Vietnam; construction of the first one was scheduled to start in 2015, and the plant would be commissioned by 2020. Subsequent plants were planned to be in construction simultaneously after 2020 and to commence operations by 2030. Decision 906 proposes the creation of a nuclear safety agency and encourages the participation of local companies to fulfill the demand for construction materials and equipment; it also encourages local companies to participate in the construction, inspection, installation, and supervision stages of the project. The Government announced that the first four nuclear turbine units, collectively called the Ninh Thuan Nuclear Power Project, would be built in Ninh Thuan Province and that the investor would be the Electricity of Vietnam Group. Subsequent nuclear plants were planned to be located in the following Provinces: Binh Dinh, Ha Tinh, Phu Yen, and Quang Ngai, with each site hosting between four and six nuclear turbine units (Mayer Brown JSM, 2010a).

In September 2010, the Government announced its plans to continue collaboration with its Chinese counterparts for the purchase of electricity as part of the country's efforts to secure dependable energy sources for its future demand. On behalf of the Vietnamese Government, Electricity of Vietnam Group negotiated contracts for the purchase of electricity until 2015. In addition, as a member of the Association of Southeast Asian Nations (ASEAN), the Government negotiated the purchase of power from other countries in the region. Vietnam is part of the ASEAN power grid plan, which was initiated in 2000 to help provide a continuous power supply in the region by creating a power network among Southeast Asian countries. By the end of 2010, Vietnam had power grid connections with Cambodia and Laos, and links with the power grids of Burma and Thailand were in the development stage (no further details were available as to when the projects would be commissioned) (Thanh Nien News, 2010).

In November 2010, the National Assembly of Vietnam passed the 2010 Mineral Law, which became fully effective on July 1, 2011. The new mineral law replaces the 1996 Mineral Law, as amended in 2005. The new law protects unexploited minerals and regulates geologic surveys for mineral resources, mineral exploration and mining, and the management of minerals located within all the territory under the control of Vietnam, including its islands, onshore bodies of water, sea

¹Where necessary, values have been converted from Vietnam dong (VND) to U.S. dollars (US\$) at the rate of VND20,454=US\$1.00 for 2011 and VND18,921=US\$1.00 for 2010.

territory, contiguous zones, exclusive economic zones, and the continental shelf. To promote sustainable development and ensure that mined products are used in a cost-effective and efficient way, the Government has begun developing mineral master plans and a new mineral strategy every 10 years that includes an outlook that covers 20 years into the future. The MONRE oversees and coordinates with other Ministries to prepare the mineral strategy and then submits it to the Prime Minister for approval. The Government assigned MONRE as the authority to regulate all minerals throughout the country (Mayer Brown JSM, 2011).

The new mineral law implements changes to the existing legal framework for mineral exploration and exploitation, including reforming the process for acquiring mining licenses and requiring financial commitments on the part of the license holder. The license holder is required to have equity equivalent to at least 50% of the total proposed capital investment for an exploration project and at least a 30% equity interest for a mining project. The law contains new provisions regarding the auctioning of mining rights and the fees involved in the acquisition of the mining rights. The Government is in charge of collecting all fees related to the acquisition of mining licenses, and rates are based on the quality and type of the minerals to be mined, the mining conditions, the reserves, and the value of the property. Under the new law, previous prerequisites for the acquisition of mining licenses are changed or eliminated. The requirement for a prospecting license is eliminated; under the new law, the interested party (which must be eligible to conduct mineral exploration in the country) is required only to have written permission from the Provincial government to conduct field surveys and collect surface samples for exploration purposes at the location of the proposed exploration area. Under the new law, the Government encourages the export of minerals as long as domestic needs are met (Mayer Brown JSM, 2011).

The new law also requires that the issuance of mineral mining rights to be conducted through auction as a way to enhance the transparency of the process. Two types of mineral licenses that may be auctioned are the mineral exploration license and the mineral mining license. To acquire a mining license, a mining investment project must be proposed during the term of the mineral exploration license. Mineral exploration licenses and mining licenses for construction materials, peat, and minerals obtained through small-scale mining are issued by the Provincial People's Committee, which is the authority in each of the country's Provinces. The committee also issues licenses for individual or artisanal mining. Licensing for exploration and mining of larger scale mining is managed by the MONRE. The same licensing body that issued a license also has the authority to extend, suspend, transfer, or withdraw the license (Mayer Brown JSM, 2011).

The issuance of a mineral exploration license requires the applicant to satisfy certain conditions, including but not limited to being selected by the state or winning an auction to work on an unexplored area; submitting a proposal for mineral exploration that is consistent with the country's mineral master plan; and having equity equivalent to at least 50% of the total investment capital needed to implement the proposed project. The mineral exploration license carries a maximum duration of

48 months, with the possibility for extension for periods not to exceed 48 months per extension. In each subsequent extension, the license holder is subject to surrender at least 30% of the exploratory site under the license. The issuance of a mineral mining license requires the applicant to have a mineral mining investment project for an area that has been explored and for which exploration studies have yielded positive results for mineral reserves that have been approved for consistency with the country's mining master plan. In addition, the applicant must have an environmental impact assessment report that is consistent with the country's legislation on environmental protection and have equity equivalent to at least 30% of the total investment capital needed for the mining project. All mining licenses are granted for a maximum of 30 years and may be extended for a period not to exceed an additional 20 years (Mayer Brown JSM, 2011).

On April 29, 2011, the General Department of Vietnam Customs and its counterpart, the General Department of Customs and Excise of Cambodia, reached a cooperation agreement to facilitate trade between the countries and counter cross-border smuggling and illegal transportation and exchange of goods and information (Vannak, 2011).

In August 2011, the Ministry of Finance of Vietnam issued Circular 111, which stipulates a 10% tax on the export of jewelry containing 80% or more gold content. Before the release of the circular, the tax was imposed only on jewelry containing 99% gold content. The tax also applies to such items as articles made of gold and of metal clad with gold, silver, or precious metals with gold content of 80% or more. Other articles, such as gold-plated pieces with unwrought platinum, gold in semimanufactured forms, and gold powder with gold content of 99.9% or less will also be taxed (Ministry of Finance of Vietnam, 2011b).

On September 11, 2011, the Ministry of Finance of Vietnam issued Circular 108/2011/TT-BTC (Circular 108), which regulates primarily the export tax on minerals and metals and the import tax on mainly manufactured commodities. Under this circular, export taxes charged to aluminum and lead ingots increased to 15% from 5%; coal, copper alloys, refined copper, and silica, to 20% from 15%; and tin and zinc ingots, to 10% from 5%. On September 15, the Ministry of Finance issued Circular 129/2011/TT-BTC (Circular 129), which puts forth the regulations for the collection, payment, and usage of all fees accrued from mineral activities in the country. The Ministry collects the fees per exploration license based on the size of the property. For areas that are less than 100 hectares (ha) [1 square kilometer (km²)] in size, the fee is about \$200 (reported as 4 million dong); for areas between 100 ha and 50,000 ha (500 km²), the fee is about \$490 (reported as 10 million dong); and for areas greater than 50,000 ha, the fee is about \$730 (reported as 15 million dong). Circular 129 also establishes the fees for mining licenses, which are a minimum of about \$49 (reported as 1 million dong) per license for the extraction of commodities, such as gravel, from streams and sand and a maximum of about \$4,890 (reported as 100 million dong) per license for the extraction of other minerals. The circular did not include other details regarding the fees established for other specific minerals (Ministry of Finance of Vietnam, 2011a, c).

On December 28, Circular 197/2011/TT–BTC (Circular 197), which provides the guidelines for the preferential import duty that applies to gasoline and aviation fuels, came into effect. The applicable import fees for such commodities went from 0% to 4% (Ministry of Finance of Vietnam, 2011d).

Production

In 2011, mineral production increased mainly for zirconium (by about 103%), antimony (18%), iron ore (12%), phosphate rock (10.2%), and cement (about 6%). Production decreased for natural gas (by 9.8%), titanium (6.4%), sand and gravel (about 6%), and rolled steel (by about 5%). Data on mineral production are in table 1.

Structure of the Mineral Industry

According to the General Statistics Office of Vietnam, the number of employees working in the mining and quarrying sector in 2011 was approximately 279,100, which accounted for less than 1% of the total number of employed people in the country. Investments in the mining and quarrying sector for 2011 accounted for about \$1.14 billion (in 1994 constant dollars), which represented about 6.4% of the total investments in the country (General Statistics Office of Vietnam, 2011a, c). Table 2 is a list of major mineral industry facilities.

Mineral Trade

In 2011, total trade in Vietnam increased by approximately 30% to \$203.7 billion from \$157 billion in 2010. The total value of exports in 2011 was about \$97 billion compared with \$72.2 billion in 2010 (an increase of about 34%). Exports of coal decreased by about 14% to approximately 17.2 million metric tons (Mt) from about 20 Mt in 2010; exports of crude oil increased by 2% to 60.6 million barrels (Mbbbl) from 59.4 Mbbbl (revised) in 2010. In 2011, the total value of imports increased by about 26% to \$106.7 billion from \$84.8 billion in 2010. State companies have a large role in the country's mining industry, which has the effect of limiting the availability of mining statistical data and mineral trade information (General Statistics Office of Vietnam, 2011d, g).

Vietnam's main trading partners in 2011 were Australia, Cambodia, China, Germany, Japan, the Republic of Korea, Malaysia, Singapore, Taiwan, Thailand, and the United States. The United States was Vietnam's leading export partner; the United States imported \$16.9 billion in Vietnamese goods (which was equivalent to 17.4% of Vietnam's total exports), followed by China, which imported \$11.1 billion (11.4% of Vietnam's total exports), and Japan, which imported \$10.8 billion (11.1% of Vietnam's total exports). Vietnam's imports came mainly from China (which supplied 23% of Vietnam's total imports valued at an estimated \$24.6 billion), the Republic of Korea (12.4% of total imports valued at an estimated \$13.2 billion), and Japan (9.7% of total imports valued at about \$10.4 billion) (General Statistics Office of Vietnam, 2011e, f).

Commodity Review

Metals

Antimony.—The Khe Chim deposit is part of the Khe Chim-Duong Huy mineralization zone in Quang Ninh Province. The deposit is located in the town of Cam Pha, which is about 30 kilometers (km) northeast of Ha Long City. A total of 12 ore bodies have been discovered in the deposit, which measures about 710 meters (m) long and 0.5 m to 2.8 m thick, and has a content of 6.62% to 24.35% antimony. The estimated antimony reserve in this deposit is 35,000 metric tons (t) of antimony content (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

The Lang Vai deposit, which is located in Tuyen Quang Province, is considered the largest antimony mineralization deposit in the country. The deposit was discovered in 1962 and was explored until 1968. The antimony reserve in this deposit has been estimated to be 11,750 t of ore, and resources have been estimated to be 98,000 t with a content of 15% antimony. This deposit also had the potential to produce gold as a byproduct, given the gold content of 2.24 grams per metric ton (g/t) of ore. Six ore zones of commercial significance had been identified and explored: Cang Coc, Coc Tay, Hoa Phu, Khuon Phuc, Lang Vai, and Long Can. The ores had a surface area of between 600 m and 1,200 m in length and a few hundred meters in width (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

The Mau Due deposit was named after the Mau Due commune, which is located in the Yen Minh District about 120 km northeast of the town of Ha Giang in Ha Giang Province. The deposit was discovered by local people in 1992, and had been mined ever since. The facility included a processing factory and a refining furnace. The Mau Due deposit has reserves of up to 60,000 t of antimony ore. Other antimony occurrences in Vietnam have been identified in the areas of Na Bac (located in Lac Son District, Hoa Binh Province) and Yen Ve (Nho Quan District, Ninh Binh Province) and in the Provinces of Lai Chau, Nghe An, Quang Ninh, and Thanh Hoa (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

Bauxite and Alumina and Aluminum.—In October 2010, the state-owned holding company Vietnam National Coal and Mineral Industries Group (VINACOMIN) announced that the company was planning to start exporting alumina by mid-2011 from its Tan Rai alumina and bauxite complex, which is located in the Bao Lam District in Lam Dong Province in the country's Central Highlands. Later, the company announced that it would delay such plans until the second quarter of 2012, mainly because of frequent electricity supply interruptions in the project area, the slow delivery of imported equipment, the lack of laborers, a shortage of capital to finalize road infrastructure needed for transportation purposes, and constant unfavorable weather. Despite all the difficulties encountered in 2011, construction of the Tan Rai complex was 90% completed. In March 2011, Ha Tu Coal Joint Co. (a subsidiary

of VINACOMIN) started some mining work at the complex's Tan Rai bauxite mine. VINACOMIN, which had invested about \$700 million in the Tan Rai complex, estimated that the plant would have a production capacity of 600,000 metric tons per year (t/yr) of alumina when completed; the company was planning to increase the output capacity to 1.2 million metric tons per year (Mt/yr) of alumina by 2015. The estimated life of the project was 30 years. The Tan Rai complex was to include a bauxite ore sorting plant, a coal gasification plant, a powerplant, and a water treatment plant (Minh, 2010, p. 8–9; Mining Journal, 2010; Aluminum International Today Journal, 2011; Vietnam National Coal Mineral Industries Holding Co. Ltd., 2012).

In Dak Nong Province, VINACOMIN was also building another bauxite project to be commissioned by 2013 at a cost of \$665 million. The Nhan Co mining and refinery complex would include an alumina refinery and a bauxite ore sorting plant. The capacity of the project was estimated to be 650,000 t/yr of alumina. VINACOMIN also announced that the majority of the production would be exported owing to the lack of interest from domestic industries to buy the locally produced product. With the commissioning of the Tan Rai and Nhan Co projects, the country was expected to produce about 1,250,000 t/yr of alumina at full capacity, from which between 600,000 t/yr and 900,000 t/yr would be sold to the Yunnan Metallurgical Group of China in a 30-year sales agreement. Vietnam's bauxite ore reserves were estimated to be between 5.6 billion metric tons (Gt) and 8.3 Gt, which could potentially place the country as the world's third ranked producer after Australia and Guinea (Minh, 2010, p. 8–9; Mining Journal, 2010; Vietnam National Coal Mineral Industries Holding Co. Ltd., 2012).

In May 2011, Vietnam's Department of Geology and Minerals announced that it would start a study of bauxite and laterite deposits in the country at a cost of \$19.8 million. The study, which was to cover a total area of 14,000 km², was proposed to last from October 2011 to September 2015. The area to be studied is located in the Central Highlands of the country and covers the areas of Binh Dinh, Binh Phuoc, Binh Thuan, Dak Lak, Dak Nong, Dong Nai, Gia Lai, Kon Tum, and Lam Dong. These plans followed an earlier announcement from the Government concerning its plans to conduct a broader general assessment of the country's geology and its mineral resources; the plan was expected to be finalized by 2020 (Lismore, 2011).

Bismuth, Copper, Fluorspar, Gold, and Tungsten.—The Nui Phao Mine is an open pit mine located in the Dai Tu District of Thai Nguyen Province in northern Vietnam. The mine contains bismuth, copper, fluorspar, gold, and tungsten. The Nui Phao deposit stretches 2 km east to west, that measures 200 by 400 m in width, and is 159 m thick on the east side and 43 m thick on the west side. The Masan Group of Vietnam acquired the Nui Phao mining project in 2010, and since then it had identified 52.5 Mt of ore with an average content of 0.21% tungsten trioxide equivalent. The company had also estimated the Nui Phao deposit's grades to be 8% fluorspar, 0.22 g/t gold, 0.21% copper, and 0.10% bismuth. The company was expecting the project to be commissioned in 2013 (Masan Group, 2012a–c; Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

VINACOMIN announced in September 2010 the discovery of a copper ore reserve estimated to be 50 Mt located in the northern part of the country. With this finding, the company doubled its estimate of reserves in Lao Cai Province, which had been 56 Mt, to more than 100 Mt of ore. The new reserves were identified in the Sin Quyen Mine (20 Mt), which was operated by Sin Quyen Copper Co., and Vi Kem Hamlet, which is also located in the Bat Xat District (30 Mt). The Sin Quyen Mine processed 1.2 Mt/yr of ore. The company was planning to increase the Lao Cai copper complex mining capacity to 3 Mt/yr from 1.2 Mt/yr by the end of 2012 (Thomson Reuters, 2010, p. 8).

Gold.—In April 2011, Triple Plate Junction Plc (TPJ) of the United Kingdom announced the start of a 3,000-m diamond-core-drilling program in its Pu Sam Cap gold project Lai Chau Province in northwestern Vietnam, specifically in the Bai Bang prospect. The company budgeted \$1.65 million for the drilling program, which would include core drilling and soil sampling to define high-grade near-surface gold resources. TPJ held a 70% interest in the project, and the Vietnamese Government and Province-owned companies held the remaining 30%. In December 2010, under the new Mineral Law, the Government issued a new exploration license to TPJ covering a total area of 27 km² of the Pu Sam Cap gold project (Triple Plate Junction Plc, 2011, undated).

Iron and Steel.—In June 2010, the Vietnam Shipbuilding Industry Group (VINASHIN) reported that it had produced the first batch of steel plate made locally at its Cai Lan steel plate hot-rolling plant. The steel plates were in high demand and consumed mainly by the local ship building industry, which used to import the commodity from China, Japan, and the Republic of Korea. VINASHIN invested \$153.2 million (reported as 2.9 trillion Dong) in the business, which had an estimated production capacity of 1 Mt/yr of steel products (SteelGuru.com, 2010).

In July 2010, Kobelco Iron Nugget Vietnam Ltd. (a subsidiary of Kobe Steel Group of Japan) started the construction of the first sponge iron plant in Vietnam at a cost of \$1 billion. The plant was located in Hoang Mai Industrial Zone in Quynh Luu District, Nghe An Province. The project was proposed to be built in two phases; the first phase was expected to be commissioned by 2013 and would have the capacity to produce 1 Mt/yr of sponge iron. The company planned for 50% of the production to be for local consumption, and the rest would be exported to Japan. The Thach Khe iron mine located in Ha Tinh Province would be the main source to feed for the sponge iron plant (Sai Gon Giai Phong Daily, 2010).

In December 2010, Formosa Plastics Group of Taiwan announced its plans to invest \$8 billion in a carbon steel plant in Vietnam. The company planned for the project to be commissioned in 2014. No further details were offered regarding the location and capacity of the plant, although the company mentioned that this project could potentially become the second largest carbon steel plant in the Asia (Vietnam Business Times, 2010).

Titanium.—Vietnam has a coastline that extends for 3,260 km with sand deposits that contain ilmenite, rutile, zircon and other heavy minerals. About 40 coastal placers hosted by

Quaternary sediments have been discovered along the country's coastline, from the Mong Cai area (Quang Ninh Province) to the Ham Tan area (Binh Thuan Province). The main groups of deposits are concentrated on the coast of central Vietnam from Cua Hoi (Ha Tinh Province) to Vung Tau (Ba Ria-Vung Tau Province). Four deposit groups that were of economic value had been identified: Cat Khanh (Binh Dinh Province), Ham Tan (Binh Thuan Province), Ky Anh (Ha Tinh Province), and Thuan An (Thua Thien-Hue Province). The average content of ilmenite in mineral sands is about 50 to 100 kilograms per cubic meter, and in some areas, the content can be as high as 700 to 800 kilograms per cubic meter. In most placer deposits, about 80% of the material consists of fine-grain fractions of 0.05 to 0.5 millimeter. Based on discovered coastal placer deposits in Vietnam, estimates of the total titanium mineral reserves were 26.5 Mt of ilmenite, 600,000 t of zircon, and 37,000 t of REOs (monazite) (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

Industrial Minerals

Barite.—Vietnam's Institute of Geosciences and Mineral Resources had identified and assessed more than 20 deposits and occurrences of barite with total reserves of 6.2 Mt. Vietnam's primary barite resources are located in three areas in the northern part of the country near the borders with China and Laos and near the coast of the Bac Bo Gulf (Gulf of Tonkin) in North Trung Bo, specifically in the regions of northeastern and northwestern Bac Bo and in north Trung Bo. In 2010, the Ao Sen deposit located in the northeastern Bac Bo region, Son Duong District, Tuyen Quang Province, produced the most barite of all the deposits being mined. This deposit had the capacity to produce about 80,000 t/yr and had estimated reserves of about 394,000 t of barite. Most of the barite produced from the Ao Sen deposit was used by the chemical and oilfield industries. Vietnam had developed plans to expand its barite mining industry, which included projects to be commissioned by 2015, such as an expansion project to increase the production of barite to 10,000 t/yr in the Lang Cao deposit in Bac Giang Province, and the construction of two barite processing plants—one in Cao Bang Province with a capacity of 50,000 t/yr of barite and another in Lai Chau Province with a capacity of about 42,000 t/yr of barite. By 2025, the Government expected the country to be producing about 350,000 t/yr of barite ore (Phuong, 2011).

Cement.—In early 2010, the Ministry of Construction requested the People's Committees of the cities of Can Tho, Danang, Ha Noi, Hai Phong, and Ho Chi Minh City to halt all approvals for permits for the construction of new cement plants in these cities until 2020. The request came as a result of the forecast of an oversupply of cement for 2011 and 2012 mainly owing to the continuous commissioning and expansion of new and existing cement plants, respectively. The Government urged the state-run Vietnam National Cement Corp. (VICEM), which was the main cement producer in the country, and other manufacturers to increase their exports of cement to deal with the forecasted oversupply. In November 2010, to back

up its request that the Government suspend the licensing of new cement production projects, the Ministry of Construction indicated that the cement sector had put stress on the country's fragile energy infrastructure (as many plants were not energy efficient) and caused power shortages in many regions of the country. In late 2010, the Building Materials Department under the Ministry of Construction announced that it was developing a master plan to restructure the cement industry to 2015 and beyond (with a forecast to 2025) to be submitted to the Government for evaluation. As of December 2009, there were 97 cement plants in operation in Vietnam, for a total production capacity of 57.4 Mt/yr of cement; 13 plants were commissioned through 2010 for an additional 11.7 Mt/yr of cement production capacity. In 2011, the country expected the commissioning of another 12 plants for an additional 9.35 Mt/yr of cement production capacity, and 8 more plants were planned for 2012, which would provide an additional 6.9 Mt/yr of capacity (International Cement Review, 2010a, b; World Cement, 2010, p. 40, 42; GlobalCement.com, 2012).

In December 2010, VICEM's cement plant, Bim Son, which was located in Thanh Hoa Province, started operation at its second production line, which boosted the plant's capacity to a total of 3.8 Mt/yr of cement. In January 2011, VICEM's But Son cement plant, which was located in Ha Nam Province, was commissioned; the plant had a total production capacity of 1.6 Mt/yr of cement (World Cement, 2011, p. 24).

In July 2011, Quan Trieu Cement Joint Stock Co. (Viet Bac Mining Industry Corp. and VINACOMIN) announced the commissioning of the Quan Trieu cement plant located in Thai Nguyen Province. The cement plant had a designed production capacity of 820,000 t/yr of cement (Vietnam National Coal Mineral Industries Holding Co. Ltd., 2011).

In 2011, the cement industry in the country had an oversupply of cement and sought to export the extra cement to neighboring countries. According to the Vietnamese Cement Association, the country's cement production for 2012 was estimated to be 60 Mt/yr, from which a little more than 50 Mt/yr was for domestic consumption. In recent years, VICEM had been exporting cement to Cambodia, China, India, Laos and South Africa, but given Vietnam's infrastructure, it had struggled to ship cement overseas mainly because of high costs, making the exportation less profitable (World Cement, 2010, p. 42; GlobalCement.com, 2012).

Fluorspar.—The Binh Duong fluorspar deposit is located in Nguyen Binh District, Cao Bang Province, and had a proved reserve of 5,341 t with an average of 30% contained CaF₂, although calcium fluoride content in alluvial ores can vary from 41.57% to 79.64% (with an average of 51.11%). The fluorspar produced in this deposit was used in various cement plants in northern Vietnam as catalysts to decrease the portland cement clinker calcination temperature. The product had proven to decrease the calcination temperature by between 20 to 50 degrees Fahrenheit compared with the case without calcium fluoride (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

At the Dong Pao deposit located in Lai Chau Province, the fluorspar is associated with other minerals, such as rare earths and barite. The reserve is estimated to be about 1 Mt;

however, the mining in this deposit had proven to be difficult because of its location (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

The Xuan Lanh fluor spar deposit is located in Phu Yen Province in central Vietnam. The proven reserve of fluor spar was about 277,500 t, and the probable reserve was estimated to be about 105,500 t. The average content of calcium fluoride in this deposit was 53.5%, whereas the CaF_2 content of the rich-grade ores was as high as 67.7%, and that of the medium-grade ores was as high as 46.4%. In the past, mined fluor spar from this deposit was exported to Japan (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

Rare Earths.—In October 2010, Toyota Tsusho Corp. of Japan announced that it had entered into a joint-venture agreement to develop a rare-earth minerals project in Vietnam along with partners Sojitz Corp. of Japan and VINACOMIN. The Dong Pao project, which included a mine and a refining plant, is located in the northwestern part of the country in Lai Chau Province and was planned to be commissioned by 2013. Toyota Tsusho said that the project would produce light rare-earth oxides (REOs), which are used mainly in the production of batteries, catalysts used for oil refining, ceramics, glass, lasers, and magnets. During 2011, Toyota Tsusho was working toward acquiring the mining rights for the project. By 2012, the company was planning to start preparations for the development of the refining plant, which, according to plans, would start up with a production of about 3,000 t/yr of REOs, with the potential for an increase to 6,000 t/yr of REOs at full capacity (Watts, 2010; 2012, p. 21; Watts and others, 2011; Toyota Tsusho Corp., 2012).

In the past few years, exploration had been centered in Lai Chau Province (at three fluorocarbonate primary ore deposits in Dong Pao, North Nam Xe, and South Nam Xe) and Yen Bai Province (at the Yen Phu deposit). The ore in the deposits located in Lai Chau Province are mainly composed of bastnaesite and associated minerals, such as barite, fluor spar, and strontium. Most of Vietnam's rare earths are primary ore with a complex composition of minerals of the rare-earth carbonate group; specifically, bastnaesite and parisite. In addition to the occurrence of light rare-earth elements, it was thought that other elements could also be present, such as barium, fluorine, niobium, strontium, titanium, uranium, and some of the heavy rare-earth elements. This is the case for the Yen Phu deposit, which is located approximately 200 km northwest of Ha Noi; it has a reserve of about 5,000 t of heavy rare earths containing 30% to 40% REOs (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

The two rare-earth deposits in the Nam Xe area are located to the north and south of the banks of the Nam Xe River. The deposits are located approximately 500 km to the northwest of Ha Noi and are accessible by rail from Ha Noi to the town of Lao Cai, followed by roads from Lao Cai to Nam Xe. In the North Nam Xe deposit, rare earths are formed in nests, lenses, and veins or are disseminated in ore hosted in the

crushed zones of the Carboniferous-Permian age limestone that has been chemically altered by a hydrothermal process (metasomatism process). The ore composition consists mainly of apatite, barite, bastnaesite, fluor spar, galenite, magnetite, parisite, pyrite, and uranopyrochlore. Two types of ore can be identified in the North Nam Xe deposit; they are (a) weathered ore with an average content of 4% to 5% REO located at a depth of 20 m in the weathered zone, and (b) primary ore with an average content of 1.4% REO at a depth of 20 m. Three independent studies performed in the area showed that both ores (weathered and primary deposits) could be mined using open pit mining methods and recovered using a combination of techniques that include chemical processing, electromagnetic processing, flotation, and gravimetric and magnetic processing for a possible recovery rate of up to 75%. Estimates indicated total reserves of 7.7 Mt of REOs and that 1.75 Mt was proven reserves distributed as follows: 76,000 t of U_3O_8 , 59,000 t of ThO_2 , and 38,000 t of Nb_2O_5 . The rare-earth deposit in North Nam Xe also includes many light rare-earth elements, with REO content of between 0.8% and 36.2% and averaging 10.6%. In North Nam Xe, proven and probable reserves were estimated to be 940,000 t of REO and possible reserves were estimated to be 3.135 Mt of REO (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

The South Nam Xe deposit ore bodies are hosted in basic volcanic rocks from the late Permian age. The ore bodies measure from 200 to 1,000 m in length and range from 0.3 to 2.5 m thick. The REO content in the South Nam Xe deposit varies from 0.8% to 36.2% and averages 10.6%. The probable reserves were estimated to be 199,300 t of REO and the possible reserves were estimated to be 3.0 Mt of REO (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

The Dong Pao deposit is located in the Phong Tho District about 40 km south of the Nam Xe deposits. The ore bodies are of irregular shapes with nests, lenses, and veins hosted in the shear zone of the Paleocene-age layer. The rare-earths deposit at the Dong Pao deposit is similar to deposits found in the Nam Xe area, which have barite, bastnaesite, fluor spar, and parisite as the main ore minerals. Proven and probable reserves at Dong Pao were estimated to be 645,000 t of REO. Additionally, proven and probable reserves of fluor spar were 1 Mt of ore (at 33% to 80% calcium fluoride), and those for barite were 2.88 Mt of ore grading 6% to 41% barium sulfate (Dr. Tran Kim Phuong, Representative for Vietnam Institute of Geosciences and Mineral Resources, written commun., June 28, 2011).

Outlook

During 2010 and 2011, the mineral industry of Vietnam went through many changes, including the approval of the new Mineral Law in November 2010. The new law became fully effective in July 2011. In recent years, the country has seen an increase in foreign investments in the mineral industry, which has resulted in new exploration drilling, resource discoveries, and expansions and commissioning of many projects in the bauxite, cement, copper, gold, and other sectors.

In the next 5 years and beyond, the production of metals and industrial minerals is expected to increase as the development of the projects that started in 2010 and 2011 progress and mines and plants start being commissioned. Among these projects are the Tan Rai alumina and bauxite complex, which is expected to be completed by the second quarter of 2012, with a capacity 600,000 t/yr of alumina, and a further expansion to 1.2 Mt/yr of alumina by 2015. Many mining projects are expected to be commissioned in 2013, including the Dong Pao rare-earths project; the Nhan Co bauxite mining and refinery complex; the Nui Phao polymetallic mining project; and the first sponge iron plant in the country. In addition, Vietnam has planned for the expansion of its barite mining industry, which is expected to include an increase in the production of barite from the Lang Cao deposit and the construction of two barite processing plants to be commissioned by 2015. In the cement sector, for 2012, the Ministry of Construction forecasted an excess of cement production (compared with the country's consumption), which followed the trend the sector showed in 2011. The Government is taking measures to counteract the effects of the cement surplus by encouraging cement manufacturers to increase exports.

The country is also likely to increase its mineral trade with neighboring countries, as demand for mineral and metals increases in the region, although the demand will also be dependent on the world market and the economic conditions of neighboring countries.

References Cited

- Aluminum International Today Journal, 2011, Work begins on bauxite deposits in Vietnam: Aluminum International Today Journal, March 18. (Accessed September 4, 2012, at <http://www.aluminumtoday.com/news/view/work-begins-on-bauxite-deposits-in-Vietnam/>.)
- General Statistics Office of Vietnam, 2011a, Investments—Investment at constant 1994 prices by kinds of economic activity, *in* Statistical Yearbook of Vietnam: General Statistics Office of Vietnam. (Accessed September 24, 2012, at http://www.gso.gov.vn/default_en.aspx?tabid=471&idmid=3&ItemID=13126.)
- General Statistics Office of Vietnam, 2011b, National accounts—Gross domestic product—Constant 1994 prices by types of ownership and by kinds of economic activity, *in* Monthly statistical information: General Statistics Office of Vietnam. (Accessed September 24, 2012, at http://www.gso.gov.vn/default_en.aspx?tabid=468&idmid=3&ItemID=12976.)
- General Statistics Office of Vietnam, 2011c, Population and employment—Employed population at 15 years of age and above as of annual 1 July by kinds of economic activity, *in* Statistical Yearbook of Vietnam: General Statistics Office of Vietnam. (Accessed September 24, 2012, at http://www.gso.gov.vn/default_en.aspx?tabid=467&idmid=3&ItemID=12892.)
- General Statistics Office of Vietnam, 2011d, Trade, price and tourism—Exports and import of goods in 2011, *in* Statistical Yearbook of Vietnam: General Statistics Office of Vietnam. (Accessed September 24, 2012, at http://www.gso.gov.vn/default_en.aspx?tabid=472&idmid=3&ItemID=13217.)
- General Statistics Office of Vietnam, 2011e, Trade, price and tourism—Exports of goods by country group, by country and territory, *in* Statistical Yearbook of Vietnam: General Statistics Office of Vietnam. (Accessed September 24, 2012, at http://www.gso.gov.vn/default_en.aspx?tabid=472&idmid=3&ItemID=13214.)
- General Statistics Office of Vietnam, 2011f, Trade, price and tourism—Imports of goods by country group, by country and territory, *in* Statistical Yearbook of Vietnam: General Statistics Office of Vietnam. (Accessed September 24, 2012, at http://www.gso.gov.vn/default_en.aspx?tabid=472&idmid=3&ItemID=13210.)
- General Statistics Office of Vietnam, 2011g, Trade, price and tourism—Some main goods for exportation, *in* Statistical Yearbook of Vietnam: General Statistics Office of Vietnam. (Accessed September 24, 2012, at http://www.gso.gov.vn/default_en.aspx?tabid=472&idmid=3&ItemID=13213.)

- GlobalCement.com, 2012, Vietnam overcapacity to worsen in 2012: GlobalCement.com, January 31. (Accessed February 13, 2012, at http://www.globalcement.com/news/itemlist/tag/GCW34?utm_source=newsletter&utm_medium=email&utm_campaign=gcw34.)
- International Cement Review, 2010a, Vietnam—Approval blocks: International Cement Review, February, p. 8.
- International Cement Review, 2010b, Vietnam—Curb on production: International Cement Review, November, p. 16.
- Lismore, Siobhan, 2011, Vietnam to invest heavily into bauxite study: Industrial Minerals, May 9. (Accessed May 9, 2011, at <http://www.indmin.com/Print.aspx?ArticleId=2821079>.)
- Masan Group, 2012a, Nui Phao—Highlights: Masan Group. (Accessed September 9, 2012, at <http://www.masangroup.com/masanresources/en/projects/nui-phao/highlights>.)
- Masan Group, 2012b, Nui Phao—Overview: Masan Group. (Accessed September 9, 2012, at <http://www.masangroup.com/masanresources/en/about-us/overview>.)
- Masan Group, 2012c, Nui Phao—Resources and reserves: Masan Group. (Accessed September 9, 2012, at <http://www.masangroup.com/masanresources/en/projects/nui-phao/resources-reserves>.)
- Mayer Brown JSM, 2010a, Vietnam—Decision 906 approving Vietnam's master planning for development of nuclear power: Mayer Brown JSM, August 25. (Accessed August 26, 2010, at http://www.mondaq.com/article.asp?articleid=108584&email_access=on.)
- Mayer Brown JSM, 2010b, Vietnam—Decree 70 on nuclear power plants: Mayer Brown JSM, November 11. (Accessed November 11, 2010, at http://www.mondaq.com/article.asp?articleid=115314&email_access=on.)
- Mayer Brown JSM, 2011, Vietnam's 2010 mineral law: Mayer Brown JSM. (Accessed January 19, 2012, at <http://www.mayerbrown.com/publications/article.asp?id=10599&nid=6>.)
- Minh, H.B., 2010, Vietnam set to export alumina from March 2011: Metals Insider, October 6, 20 p.
- Mining Journal, 2010, Exploration and development—Vietnam's bauxite reserves may total 11 billion tonnes: London, United Kingdom, Mining Journal. (Accessed December 16, 2010, at <http://www.mining-journal.com/exploration-and-development/vietnams-bauxite-reserves-may-total-11-billion-tonnes>.)
- Ministry of Finance of Vietnam, 2011a, Circular 108—To increase tax rate for coal 20%: Ministry of Finance of Vietnam, September 11. (Accessed August 28, 2012, at http://www.gdt.gov.vn/wps/wcm/connect/GDT+Content/english/news/taxpolicy/100240_167002?presentationTemplate=Web Content/pt_new_detail_print_english.)
- Ministry of Finance of Vietnam, 2011b, Circular 111—To tighten export tax for gold: Ministry of Finance of Vietnam, August 2. (Accessed August 28, 2012, at http://www.gdt.gov.vn/wps/wcm/connect/GDT+Content/english/news/taxpolicy/100240_167006?presentationTemplate=Web%20Content/pt_new_detail_print_english.)
- Ministry of Finance of Vietnam, 2011c, Circular 129—New points in mineral activities fee: Ministry of Finance of Vietnam, September 15. (Accessed January 16, 2012, at http://www.mof.gov.vn/portal/page/portal/mof_en/dn?pers_id=0&item_id=46543396&p_details=1.)
- Ministry of Finance of Vietnam, 2011d, Circular 197—Preferential import duty applicable to gasoline and aviation fuel to increase from 0% to 4%: Ministry of Finance of Vietnam, December 28. (Accessed August 28, 2012, at http://www.mof.gov.vn/portal/page/portal/mof_en/dn&p_itemid=52560786&p_siteid=53&p_persid=2420240&p_language=en.)
- Phuong, T.K., 2011, Sun rises on Vietnam's barytes: Industrial Minerals, no. 525, June, p. 44–51.
- Sai Gon Giai Phong Daily, 2010, Work starts on Vietnam's first sponge iron plant: Sai Gon Giai Phong Daily, July 25. (Accessed July 28, 2010, at <http://www.saigon-gpdaily.com.vn/Business/2010/7/84182/>.)
- SteelGuru.com, 2010, First made in Vietnam steel plates rolled out at Cai Lan plant: SteelGuru.com, June 4. (Accessed June 30, 2010, at http://www.steelguru.com/international_news/First_made_in_Vietnam_steel_plates_rolled_out_at_Cai_Lan_plant/149072.html.)
- Thanh Nien News, 2010, Vietnam plans power purchases from China through 2015: Thanh Nien News, September 3. (Accessed September 7, 2010, at <http://www.thanhniennews.com/2010/pages/20100903171334.aspx>.)
- Thomson Reuters, 2010, Vietnam finds 50 mln T copper reserves: Metals Insider, September 9, 21 p.
- Toyota Tsusho Corp., 2012, Working on rare earths business—Vietnam, building a supply chain spanning rare earth mine development to production plants: Toyota Tsusho Corp. (Accessed March 2, 2012, at <http://www.toyota-tsusho.com/english/csr/business/case01.html>.)

- Triple Plate Junction Plc, 2011, Drilling commences at Bai Bang, Pu Sam Cap in Vietnam: Triple Plate Junction Plc, April 11. (Accessed January 20, 2012, at <http://www.tpjunction.com/news/131.pdf>.)
- Triple Plate Junction Plc, [Undated], Projects—Pu Sam Cap: Triple Plate Junction Plc. (Accessed August 28, 2012, at <http://www.tpjunction.com/template.php?menuid=30>.)
- U.S. Energy Information Administration, 2011, International energy statistics from 2007–2011—Production of crude oil, NGPL, and other liquids: U.S. Energy Information Administration. (Accessed September 10, 2012, at <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5&pid=55&aid=1&cid=r7,&syid=2007&eyid=2011&unit=TBD>.)
- Vannak, Chea, 2011, Cambodia, Vietnam sign customs cooperation agreement: Agence Kampuchea Presse [Phnom Penh, Cambodia], April 29. (Accessed January 25, 2012, at <http://www.akp.gov.kh/?p=5659>.)
- Vietnam Business Times, 2010, Formosa plastics plans \$11.3 billion investment in Ningbo, US, and Vietnam: Vietnam Business Times, December 10. (Accessed December 16, 2010, at <http://businesstimes.com.vn/formosa-plastics-plans-11-3-billion-investment-in-ningbo-us-and-vietnam/>.)
- Vietnam National Coal Mineral Industries Holding Co. Ltd., 2011, Quan Trieu cement plant starts operation: Vietnam National Coal Mineral Industries Holding Co. Ltd., July 21. (Accessed September 4, 2012, at <http://www.vinacomin.vn/en/news/News-and-Event/Quan-Trieu-cement-plant-starts-operation-12.html>.)
- Vietnam National Coal Mineral Industries Holding Co. Ltd., 2012, Ore-bauxite factory to open in April: Vietnam National Coal Mineral Industries Holding Co. Ltd., February 28. (Accessed September 4, 2012, at <http://www.vinacomin.vn/en/news/News-and-Mining/Ore-bauxite-factory-to-open-in-April-93.html>.)
- Watts, Mark, 2010, Japan takes action to avert rare earth supply crisis: Industrial Minerals, December, no. 519, p. 11.
- Watts, Mark, 2012, New players emerge to challenge China rare earth dominance: Industrial Minerals, February, no. 533, p. 20–22.
- Watts, Mark, Lismore, Siobhan, and Smith, Jo, 2011, Mixed fortunes for rare earth projects: Industrial Minerals, December, no. 531, p. 11.
- World Cement, 2010, Expansion, overcapacity—Vietnam’s cement industry: World Cement, v. 41, no. 4, p. 39–44.
- World Cement, 2011, The ASEAN industry drivers—Vietnam: World Cement, v. 42, no. 4, p. 19–26.

TABLE 1
VIETNAM: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

| Commodity ² | 2007 | 2008 | 2009 | 2010 ^e | 2011 ^e |
|--|----------------------------|------------------------|------------------------|--------------------------|------------------------|
| METALS | | | | | |
| Antimony ore | NA | 540 | 664 | 608 ³ | 717 ³ |
| Bauxite ^e | 80,000 | 80,000 | 80,000 | 80,000 | 100,000 |
| Chromium ore, gross weight | 103,830 | 55,880 | 37,105 | 40,000 | 40,000 |
| Copper: | | | | | |
| Mine output, Cu content | 12,500 | 11,000 | 11,300 | 11,300 | 11,000 |
| Metal, refined | 11,000 | 2,200 | 6,000 ^e | 8,000 | 8,000 |
| Gold ^e | kilograms | 3,000 | 3,000 | 3,000 | 3,500 |
| Iron and steel: | | | | | |
| Iron ore, Fe content | 530,000 ^e | 1,371,600 ^r | 1,904,500 ^r | 1,972,100 ^{r,3} | 2,209,200 ³ |
| Metal: | | | | | |
| Pig iron | thousand metric tons | 790 ³ | 800 | 800 | 800 |
| Steel, crude | do. | 2,024 | 2,250 ^e | 2,700 | 4,314 ³ |
| Steel, rolled | do. | 4,612 | 5,001 | 6,531 | 7,910 ^{r,3} |
| Lead, mine output, Pb content ^e | | 19,200 | 14,200 | 7,700 | 7,400 |
| Manganese: | | | | | |
| Gross weight | | 77,800 ^r | 62,300 ^r | 92,200 ^r | 82,700 ^r |
| Mn content (43%) | | 33,500 | 26,800 | 39,600 | 35,600 |
| Pyrite, gross weight ^e | thousand metric tons | 500 | 500 | 500 | 500 |
| Tin: | | | | | |
| Mine output, Sn content ^e | | 5,400 | 5,400 | 5,400 ³ | 5,400 |
| Metal, smelter | | 3,369 | 3,583 | 2,747 | 3,042 ³ |
| Titanium concentrate, gross weight ⁴ | | 653,500 | 709,500 | 698,700 | 912,000 |
| Zinc: ^e | | | | | |
| Mine output, Zn content | | 45,600 | 42,000 | 38,000 | 36,000 |
| Metal, powder | | 23,000 | 23,000 | 23,000 | 23,000 |
| Slab | | 10,000 | 12,000 | 17,000 | 16,000 |
| Zirconium, gross weight ^{e,5} | | 22,000 | 22,000 | 6,800 | 6,900 |
| INDUSTRIAL MINERALS | | | | | |
| Barite | | 120,000 | 90,000 | 75,000 | 85,000 |
| Cement, hydraulic | thousand metric tons | 37,102 | 40,009 | 48,810 | 55,801 ^{r,3} |
| Clays, kaolin ^e | | 650,000 | 650,000 | 650,000 | 650,000 |
| Fluorspar ^e | | 4,000 | 4,000 | 4,000 | 4,000 |
| Graphite ^e | | 2,000 | 2,000 | 2,000 | 2,000 |
| Gypsum ^e | thousand metric tons | 5,000 | 5,000 | 5,000 | 5,000 |
| Lime | do. | 1,438 | 1,619 | 1,584 | 1,454 ³ |
| Nitrogen, N content of ammonia | | 300,000 | 300,000 | 300,000 | 300,000 |
| Phosphate rock: | | | | | |
| Gross weight | thousand metric tons | 1,523 | 2,101 | 2,047 | 2,325 ^{r,3} |
| P ₂ O ₅ content ^e | do. | 460 | 630 | 614 | 680 |
| Pyrophyllite ^e | | 30,000 | 30,000 | 30,000 | 30,000 |
| Salt | thousand metric tons | 857 | 717 | 679 | 975 ^{r,3} |
| Sand and gravel | do. | 117,000 | 112,000 | 123,000 | 110,300 ^{r,3} |
| Silica sand ^e | do. | 200 | 200 | 200 | 200 |
| Stone, building stone | do. | 241,379 | 317,429 | 355,932 | 381,828 ^{r,3} |
| Sulfur ^e | | 22,000 | 22,000 | 22,000 | 22,000 |
| MINERAL FUELS AND RELATED MATERIALS | | | | | |
| Coal, anthracite | thousand metric tons | 42,483 | 39,777 | 44,078 | 44,835 ^{r,3} |
| Gas, natural, gross | million cubic meters | 7,080 | 7,499 | 8,010 | 9,402 ^{r,3} |
| Petroleum, crude | thousand 42-gallon barrels | 116,741 | 109,291 | 119,968 | 110,098 ^{r,3} |

^eEstimated; estimated data are rounded to no more than three significant digits. ^rRevised. do. Ditto. NA Not available.

¹Table includes data available through September 30, 2012.

TABLE 1—Continued
VIETNAM: PRODUCTION OF MINERAL COMMODITIES¹

²In addition to the commodities listed, bentonite, refractory clay, construction aggregates, gemstones, granite, lignite, marble, rare earths, silver, and tungsten were mined but not reported. Available information is inadequate to make reliable estimates of output. Tungsten concentrate was produced by Vietnam Youngsun Tungsten Industry Co. at the Thienke tungsten mine in Tuyen Quang Province and in Philieng tungsten mine in Lam Dong Province. Ferrotungsten was produced by Vietnam Youngsun Tungsten Industry Co. at the Quang Ninh pant in Halong, Quang Ninh Province.

³Reported figure.

⁴Estimated figures based on Vietnam's inferred exports of titanium ores to China, Japan, the Republic of Korea, Malaysia, and the United States.

⁵Estimated figures based on Vietnam inferred exports of zirconium ore to China.

Sources: Vietnam's General Statistics Office, 2009–11; World Steel Association, Steel Statistical Yearbook, 2008; World Metal Statistics, December 2009; South East Asia Iron and Steel Institute, Crude Steel Production, Annual Statistics, 2009–11; The Barytes Association, World Barytes Production 2000–10; International Lead and Zinc Study Group, Lead and Zinc Statistics, Monthly Bulletin of the International Lead and Zinc Study Group, February 2007; Copper Bulletin of the International Copper Study Group, 2012; International Chromium Development Association, Statistical Bulletin-2010–11; U.S. Geological Survey, Minerals Questionnaire, 2004–7.

TABLE 2
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2011

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|-----------|---|--|-----------------|
| Alumina | Vietnam National Coal and Mineral Industries Group (VINACOMIN) | Tan Rai alumina complex in Lam Dong Province | 600. |
| Barite | NA | Ao Sen deposit located in Son Duong District, Tuyen Quang Province | 80. |
| Cement | An Giang Cement Co. | An Giang cement plant, An Giang Province | 400. |
| Do. | Binh Phuoc Cement Co. | Binh Phuoc cement plant, Binh Phuoc Province | 2,000. |
| Do. | Building Materials Corp. No. 1 | Fico Tay Ninh cement plant, in Tan Chau District, Tay Ninh Province | 2,000. |
| Do. | Cement X18 Factory Co. | Cement X18 plant, Lang Son Province | 100. |
| Do. | Chin Fon Cement Co. | Chin Fon cement plant, Ha Giang Province | 1,400. |
| Do. | Chinfong Hai Phong Cement Corp. [Chingfong Group of Taiwan, 70%; Hai Phong Municipal Government, 15.56%; Vietnam National Cement Corp. (VICEM), 14.44%] | Min Duc cement near Hai Phong City | 1,400. |
| Do. | Cong Thanh Cement Joint Stock Co. | Cong Thanh cement plant, Thanh Hoa Province | 1,000. |
| Do. | Cao Ngan Cement Co. | Cao Ngan cement plant, Thai Nguyen Province | 600. |
| Do. | Dong Banh Cement Co. | Dong Banh cement plant, Lang Son Province | 1,000. |
| Do. | Dong Son Cement Co. | Dong Son cement plant, Thai Nguyen Province | 1,500. |
| Do. | Dong Thanh Cement Co. | Dong Thanh cement plant, Dong Nai Province | 1,000. |
| Do. | Ha Long Cement Co. | Ha Long cement plant, Ho Chi Minh City | 2,000. |
| Do. | Ha Tien Kien Giang Cement Co. | Ha Tien Kien Giang cement plant, Binh Duong Province | 200. |
| Do. | Lafarge (Vietnam) Cement | Cement grinding station in Dong Nai Province | 500. |
| Do. | La Hien Cement Co. | La Hien cement plant, Thain Nguyen Province | 600. |
| Do. | Langbang Cement Co. | Langbang cement plant, Quang Ninh Province | 1,500. |
| Do. | Luckvaxi Cement Co. | Luckvaxi cement plant, Thien Hue Province | 1,200. |
| Do. | Luck's Group (Vietnam Holdings) Co. Ltd. | Kim Dinh cement plant and Ninh Thuan grinding plant, in Thua Thien-Hue Province | 2,800. |
| Do. | Lucky Group Ltd. and Phuc Son Cement Corp. | Phuc Son cement plant, Hai Duong Province | 4,000. |
| Do. | Mai Son Cement Co. | Mai Son cement plant, Son La Province | 1,200. |
| Do. | Midland Construction Corp. (COSEVCO) | Song Gianh cement plant, Quang Binh Province | 1,400. |
| Do. | Morning Star Cement Ltd. [Holcim Group, 65%, and Vietnam National Cement Corp. (VICEM), 35%] | Cat Lai grinding plant, Hiep Phuoc grinding plant, Thi Vai grinding plant Hon Chong, Kien Giang Province | 4,700. |

See footnotes at end of table.

TABLE 2—Continued
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2011

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|-------------------------|---|--|-----------------|
| Cement—Continued | Nghi Son Cement Corp. [Taiheiyō Cement Corp., 45.5%; Mitsubishi Materials Corp., 19.5%; Vietnam National Cement Corp. (VICEM), 35%] | Nghi Son cement plant, Thanh Hoa Province | 4,300. |
| Do. | Quang Ninh Cement and Construction Joint Stock Co. | Quang Ninh cement plant, Ha Long, Quang Ninh Province | 1,200. |
| Do. | Quan Trieu Cement Joint Stock Co. (Viet Bac Mining Industry Corp. and VINACOMIN) | Quan Trieu cement plant, Thai Nguyen Province | 820. |
| Do. | ROLI-Quang Tri Cement Co. | ROLI-Quang cement plant, Quang Tri Province | 600. |
| Do. | Song Thao Cement Co. | Song Thao cement plant, Phu Tho Province | 1,000. |
| Do. | Thai Nguyen Cement Co. | Thai Nguyen cement plant, Thai Nguyen Province | 1,400. |
| Do. | Thang Long Cement | Thang Long cement grinding plant in Hiep Phuoc Industrial Zone | 2,300. |
| Do. | Tuyen Quang Cement Group 1 | Tuyen Quang cement plant, Tuyen Quang Province | 600. |
| Do. | Vietnam Construction and Import-Export Joint Stock Corp. (VINACONEX) | Cam Pha cement grinding plant in Phu Tau Province | 2,300. |
| Do. | do. | Luongson cement plant, Hoa Binh Province | 1,200. |
| Do. | do. | Yen Bai cement plant, Yen Bai Province | 200. |
| Do. | Vietnam National Cement Corp. (VICEM) (100% state owned) | Bim Son cement, Thanh Hoa Province | 3,800. |
| Do. | do. | But Son cement, Ha Nam Province | 1,600. |
| Do. | do. | Hai Phong cement, Ha Giang | 1,700. |
| Do. | do. | Ha Tien I, Ho Chi Minh City | 1,500. |
| Do. | do. | Ha Tien II, Kien Giang Province | 1,200. |
| Do. | do. | Hai Van cement, Da Nang City | 600. |
| Do. | do. | Hoang Mai cement, Nghe An Province | 1,400. |
| Do. | do. | Hoang Thach cement, Hai Duong Province | 2,300. |
| Do. | do. | Tam Diep cement, Ninh Binh Province | 1,400. |
| Do. | Vietnam Industrial Construction Corp. (VINAINCON) | Quang Son cement factory, in Quang Son Commune, Dong Hy District, Thai Nguyen Province | 1,500. |
| Chromite, gross weight | Thai Nguyen Nonferrous Metal Co. [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)] | Nui Nua, Thanh Hoa Province | 10. |
| Coal, anthracite | Vietnam National Coal Corp. (VINACOAL) (100% state owned) | Cam Pha, Cao Son, Coc Sau, Vang Danh, Dong Trieu, Ha Lam, Ha Tu, Hong Gai, Khe Cham, Mao Khe, Mong Duong, Deo Nai, Cua Ong, Uong Bi in Quang Ninh Province | 42,000. |
| Copper: | | | |
| Concentrate, Cu content | Lao Cai Copper Complex [wholly owned subsidiary of Vietnam National Minerals Corp. (VIMICO)] | Sin Queyen, Lao Cai Province | 11. |
| Refined | Tang Loong Lao Cai Copper Smelting Enterprise [wholly owned subsidiary of Vietnam National Coal and Mineral Industries Group (VINACOMIN)] | Tang Loong Long Commune, Bao Tang District, Lao Cai Province | 10. |

See footnotes at end of table.

TABLE 2—Continued
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2011

(Thousand metric tons unless otherwise specified)

| Commodity | | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|-----------------------------------|------------------------------------|--|--|-------------------------|
| Fertilizer: | | | | |
| Nitrogen, ammonia | | Vietnam National Chemical Corp. (VNCC) (100% state owned), and Phyl My Nitrogenous Fertilizer and Chemical Joint Stock Corp. | Ha Bac, northern Vietnam Phu My, Ba Ria-Vung Tau Province | 375. |
| Superphosphate | | do. | Lam Thao, Phu Tho Province | 800. |
| Gas, natural | million cubic meters per day | VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubezhneft), and the joint venture of PetroVietnam, BP p.l.c., Oil and Natural Gas Co., and ConocoPhillips Co. | Offshore Bach Ho oilfield, Rang Dong oilfield, and Lan Tay and Lan Do gasfields | 20. |
| Gold, gold content of mine output | kilograms | Bong Mieu Gold Mining Company Ltd. [Bong Mieu Holdings Ltd. (a wholly owned subsidiary of Olympus Pacific Minerals Inc.), 80%; Mineral Development Co., 10%; Quang Nam Mineral Joint Stock Co., 10%] | Quang Nam Province Ho Gan open pit and Nui Kem underground mines | 400. |
| Iron ore, gross weight | | Thai Nguyen Iron and Steel Corp. [wholly owned subsidiary of Vietnam National Steel Corp. (VNSTEEL)] | Trai Cau and Tein Bo in Thai Nguyen Province; Thach Khe in Ha Tinh Province | 850. |
| Petroleum, crude | thousand 42-gallon barrels per day | VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubezhneft) | Offshore Bach Ho, Rong, Rang Dong, Ruby, Bunga Kekwa, Dai Hung, and SuTu Trang oilfields | 320. |
| Do. | thousand 42-gallon barrels | Vietnam Government | Dung Quat refinery, in Quang Ngai Province | 6,500. |
| Phosphate rock, gross weight | | Vietnam Apatite Limited Co. [Vietnam National Chemical Corp. (VNCC), 100%] | Cam Duong and Tang Loong, Lao Cai Province | 1,250. |
| Salt | | Vietnam National Salt Corp. | Nam Dinh, Nghe An, and Hai Tin Provinces | 12,000. |
| Steel: | | | | |
| Crude | | Vietnam National Steel Corp. (VNSTEEL) | Cai Lan, Thai Nguyen Province, and Phu My, Ba Ria-Vung Tau Province | 2,000. |
| Products | | Shengli (Vietnam) Special Steel Co. Ltd., established by Shengli Group Corp., and Guangdong Metals and Minerals Import & Export Corp. | Cau Nghin Industry billets plant, in Quynh Phu, Thai Binh Province | 500. |
| Do. | | do. | Bar & wire rod plant, in Quynh Phu, Thai Binh Province | 600. |
| Rolled | | Lotus Group | Cold rolled steel plant in Phu My Industrial Park in Ba Ria-Vung Tau Province | 1,000. |
| Do. | | POSCO-Vietnam, 100% owned by POSCO Group | POSCO Special Steel, in Phu My Industrial Park in Ba Ria-Vung Tau Province | 700 cold-rolled steel. |
| Do. | | do. | do. | 3,000 hot-rolled steel. |
| Do. | | Vietnam Shipbuilding Industry Group (VINASHIN) | Cai Lan steel plate hot rolling plant in Ha Long City, Quang Ninh Province | 1,000. |
| Do. | | Viet Steel Corp. | Bar mill in Ba Ria-Vung Tau Province | 450. |
| Tin: | | | | |
| Concentrate, Sn content | | Cao Bang Nonferrous Metal Co. and Nghe Tinh Nonferrous Metal Co. [wholly owned subsidiaries of state-owned Vietnam National Minerals Corp. (VIMICO)] | Pia Oac, Cao Bang Province; Quy Hop, Nghe An Province; and Tam Dao, Tuyen Quang Province | 4. |
| Refined | | Thai Nguyen Nonferrous Metal Co. | Thai Nguyen, Bac Thai Province | 2. |

See footnotes at end of table.

TABLE 2—Continued
 VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2011

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|--------------------------------------|--|--|-----------------|
| Titanium, ilmenite | Bimal Minerals Co. Ltd. (Malaysia Mining Corp. and Syarikat Pendorong Sdn. Bhd., 60%, and Binh Dinh Minerals Co., 40%) | Cat Khanh, Qui Nhon, and Binh Dinh Provinces | 70. |
| Do. | Ha Tinh Minerals and Trading Co. | Cam Hoa, Ky Annh-Cam, Xuyen, Ky Khan, and Ky Ninh, Ha Tinh Province | 450. |
| Do. | Mineral Development Co. No. 4 and No. 5 [wholly owned subsidiaries of Vietnam National Minerals Corp. (VIMICO)] | Vinh City, Nghe An Province; Tuy Hoa, Dong Xuan in Phu Yen Province; and Quang Ngai, Vinh My in Thua Thien-Hu Province | 50. |
| Tungsten, concentrates | Vietnam Youngsun Tungsten Industry Co. | Thienke tungsten mine in Tuyen Quang Province | 1.5. |
| Do. | do. | Philieng tungsten mine in Lam Dong Province | 1.2. |
| Tungsten Ferrotungsten, W content | do. | Quang Ninh pant in Halong, Quang Ninh Province | 3. |
| Zinc: Concentrate, Zn content | Thai Nguyen Nonferrous Metal Co. [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)] | Cho Dien, Bac Can Province | 50. |
| Refined | The Ta Pan Zinc-Lead Plant (a Chinese private firm, 70.2%, and Ha Giang Mineral Exploiting and Engineering Co., 29.8%) | Lung Vay, Bac Me District, Ha Giang Province | 6. |
| Do. | Thai Nguyen Zinc Refinery [wholly owned subsidiary of state-owned Vietnam National Minerals Corp. (VIMICO)] | Thai Nguyen City, Thai Nguyen Province | 10. |

Do., do. Ditto. NA Not available.