



2012 Minerals Yearbook

UNITED ARAB EMIRATES

THE MINERAL INDUSTRY OF THE UNITED ARAB EMIRATES

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The United Arab Emirates (UAE)¹ was the world's seventh-ranked producer of crude oil and accounted for 3.7% of world crude oil (and condensate) production in 2012. The UAE held 97.8 billion barrels of proved crude oil reserves, or 5.9% of the world's total reserves, as well as 6.1 trillion cubic meters of proved natural gas reserves, or 3.3% of the world's total at the end of 2012. The UAE accounted for 1.5% of the world's supply of natural gas and was ranked seventh in the world in terms of the volume of both its proved crude oil reserves and natural gas reserves. The country has been an increasingly significant world supplier of aluminum foundry alloy, extrusion billet, and high-purity aluminum to countries in Africa, Asia, Europe, and North America and accounted for about 3.9% of the world's aluminum smelter output in 2012. The UAE was one of the world's top 10 producers of sulfur and accounted for 2.6% of world production of sulfur. The UAE commenced large-scale production of direct-reduced iron (DRI) and steel in 2011 and switched from importer to exporter of some iron and steel products. Other fuel and industrial minerals that were produced by the UAE included cement, gypsum, lime, nitrogen fertilizer, refined petroleum products, and sulfur production facilities (Apodaca, 2013; BP p.l.c., 2013, p. 6, 8, 20, 22; Bray, 2013).

Government Policies and Programs

The Geology and Mineral Resources Department of the UAE's Ministry of Energy completed geologic and geophysical studies and mapping for the entire country in 2012 with the help of the British Geological Survey and companies with expertise in airborne, magnetic, radiometric, and seismic testing and interpretation. Maps were scaled at 1:500,000, 1:250,000, 1:100,000, and 1:50,000. The purpose of the studies was to determine the effects of the tectonic evolution on structure formation, basin development, and hydrocarbon formation and movement (United Arab Emirates Ministry of Energy, 2013).

The Emirate of Abu Dhabi, which is the largest of the seven Emirates that make up the UAE, set forth an ambitious economic diversification target that, by 2015, one-half of the Emirate's gross domestic product (GDP) would come from nonoil economic activity. This target, along with other initiatives, such as the startup of Abu Dhabi Future Energy Co. (Masdar) and Emirates Aluminium Co. Ltd. (Emal), were part of the Abu Dhabi Economic Vision 2030, which aimed to generate new sources of income and enhance the Emirate's knowledge-based economic sectors. Abu Dhabi, which does not have significant reserves of any metals, embarked on producing advanced materials, aluminum, iron and steel, and other base metals using imported ores. Abu Dhabi depended on its low

energy costs, its transport system, and the infrastructure of its industrial cities to support its downstream metal industries. Abu Dhabi moved forward with the development of its oil and gas resources to increase the Emirate's crude oil production capacity to 3.5 million barrels per day (Mbbbl/d) from the current (2012) level of about 2.6 Mbbbl/d, and natural gas production capacity to 198 million cubic meters per day from the current level of production of 148.7 million cubic meters per day by the end of 2018 (Government of Abu Dhabi, 2009, p. 113, 116, 123).

Masdar (a subsidiary of the Abu Dhabi government-owned Mubadala Development Co. P.J.S.C.) was created as a global company to find solutions to problems related to climate change, energy security, and sustainable energy. Masdar comprised three business units—a clean energy complex, an investment company, and an institute for science and technology. Masdar teamed up with academic organizations and renewable energy companies, such as Abengoa Solar Power S.A. of Spain, E.ON AG of Germany, Massachusetts Institute of Technology of the United States, and Mitsubishi Heavy Industries of Japan, to apply the latest technologies in carbon management, solar and hydrogen-based energy, and other clean energy technologies (Masdar, 2013).

The UAE had been developing its alternative energy resources, including nuclear and solar energy, to meet the increased demand for electricity in Abu Dhabi, Dubai, and the other Emirates. The Emirates Nuclear Energy Corp. (ENEC) was responsible for managing the country's nuclear power program, the goal of which was to produce electricity to meet an expected need for an additional 40,000 megawatts (MW) of capacity by 2020. ENEC was building four 1,400-MW-capacity nuclear powerplants in the UAE. The first plant was expected to be in operation in 2017, and the other three plants were anticipated to be completed by 2020 (Emirates Nuclear Energy Corp., 2013c).

Minerals in the National Economy

In 2012, the UAE's economy grew at a rate of 4.4% in real terms compared with a revised growth rate of 3.9% in 2011. The growth rate of the hydrocarbon sector was 6.3% compared with 6.6% in 2011, and that of the nonhydrocarbon sector was 3.5% compared with 2.6% in 2011. The contribution of the hydrocarbon sector increased to 33.9% of the GDP from a revised 30.1% of the GDP in 2011. The share of the mining sector, which employed 11,000 people, was about 0.4% of the GDP in both 2011 and 2012; and that of the manufacturing sector, which included the aluminum, fertilizer, and iron and steel industries, increased to 14.7% of the GDP from 14.5% of the GDP in 2011. The building and construction sector contributed 4.0% of the GDP in 2012 compared with 4.3% of

¹The United Arab Emirates is a federation of seven emirates: Abu Dhabi, Ajman, Dubayy (Dubai), Al Fujairah, Ras Al Khaimah, Ash Shariqah (Sharjah), and Umm Al-Qaywayn.

the GDP in 2011 (International Monetary Fund, 2013, p. 102; United Arab Emirates Ministry of Economy, 2013, p. 29).

In 2012, the flow of foreign direct investment (FDI) into the UAE increased by about 25% to about \$9.6 billion from \$7.7 billion in 2011. The FDI inflow to the UAE had been increasing significantly since 2009 but was still much less than what it was in 2008. The outflow of FDI from the UAE to the rest of the world increased by 14% to about \$2.5 billion from about \$2.2 billion in 2011 (United Nations Conference on Trade and Development, 2013, p. 215).

Production

Production of metals continued its trend upward, especially for DRI and crude steel, which together increased in volume by more than 20% in 2012 compared with that of 2011. Lime output increased by 17% to satisfy the increased demand for lime, including demand from the steel industry. Production of hot-rolled steel increased by 11%. In the case of mineral fuels, output was slightly higher for crude oil and condensate and natural gas but was less for refined petroleum products, the output of which decreased by 9% in 2012 compared with that of 2011 and included a decrease in residual fuels production, by 45%; liquefied petroleum gas, by 18%; and distillate fuels, by 16%. Other production changes of note included decreases in the tonnage of ammonia and urea production, by 14% and 11%, respectively (table 1).

Structure of the Mineral Industry

The governments of the individual Emirates of the UAE maintain majority interest in the country's mineral industry. The Supreme Council of Petroleum is the highest government body that makes policies and sets goals for the hydrocarbon sector. Abu Dhabi Emirate produced 94% of the crude oil and natural gas produced by the UAE, and the other six Emirates accounted for the remaining 6% of hydrocarbon output (table 2).

In Abu Dhabi, Abu Dhabi National Oil Co. (Adnoc) managed all aspects of the hydrocarbon industry through its 16 subsidiaries. Crude oil and gas exploration and production were carried out by Abu Dhabi Company for Onshore Oil Operations (Adco), Abu Dhabi Marine Operating Co. (Adma-Opco), and Zakum Development Co. (Zadco). The companies that provided exploration and production services included Abu Dhabi Petroleum Ports Operating Co. (Irshad), Mussafah Offshore Supply Base (Esnaad), and National Drilling Co. (NDC). Natural gas processing was conducted by Abu Dhabi Gas Development Co. Ltd. (Al Hosn), Abu Dhabi Gas Industries Ltd. (Gasco), Abu Dhabi Gas Liquefaction Company Ltd. (Adgas), and ADNOC Linde Industrial Gases Co. (Elixir). Oil processing was carried out by Abu Dhabi Oil Refining Co. (Takreer) and National Gas Shipping Co. (NGSCO). Chemical and petrochemical manufacturing companies included Abu Dhabi Polymers Co. Ltd. (Borouge) and Ruwais Fertilizer Industries (Fertil). The distribution of refined petroleum products was the responsibility of Adnoc-Distribution, and maritime transportation was the task of Abu Dhabi National Tanker Co. (Adnatco) and NGSCO (Abu Dhabi National Oil Co., 2013).

The Dubai Supreme Council of Energy and Dubai Petroleum Establishment were in charge of the oil and energy sector in Dubai Emirate. Ajman National Oil Co., RAK Petroleum of Ras Al Khaimah, and Sharjah National Oil Corp. were state-owned companies that operated in Ajman, Ras Al Khaimah, and Sharjah, respectively. Al Fujairah Emirate was the site of the UAE's only oil export terminal, which is located on the east coast of the country south of the Strait of Hormuz (U.S. Energy Information Administration, 2013).

The Government of the Emirate of Dubai owned the country's first primary aluminum producer, Dubai Aluminium Company Ltd. (Dubal), and was a partner with Mubadala in Emal. Emal operated the country's second primary aluminum smelter at the Khalifa Port and Industrial Zone (KPIZ) in Abu Dhabi (Dubai Aluminium Company Ltd., 2013; Emirates Aluminium Co. Ltd., 2013).

SENAAT General Holding Corp. was an investment company established to implement Abu Dhabi's industrial diversification policy. SENAAT invested about \$3.4 billion in industrial assets and had seven subsidiaries, among which were Arkan Building Materials Co. (Arkan), Dubai Cable Co. (Pty) Ltd. (Ducab), Emirates Steel Industries, National Petroleum Construction Co. (NPCC), and Taweelah Aluminium Extrusion Co. L.L.C. (TALEX). SENAAT continued to promote the Government's economic diversification policy by investing and creating partnerships with local and international enterprises in the base metals (aluminum, copper, and steel), petrochemical, and other industrial sectors. Ducab owned two plants for producing copper and manufacturing wire cable—one at Jebel Ali in Dubai and one at the industrial city of Mussafah in Abu Dhabi. Arkan was a listed company focused on the manufacturing of cement and other building materials. Arkan's two cement plants were Al Ain Cement Factory and Emirates Cement Factory; the two plants had a combined capacity of more than 4 million metric tons per year (Mt/yr) of clinker and 5.7 Mt/yr of cement (Dubai Cable Company (Pty) Ltd., 2013; SENAAT General Holding Corp., 2013).

Fujairah Natural Resources Corp. (FNRC), which was established in 2009 and later renamed by the Ruler of Fujairah's decree No. 3 of 2011, was the Government agency in charge of the development of mineral production in the Emirate of Fujairah. The Emirate is located in the northeastern part of the UAE on the Gulf of Oman; its terrain comprises mountains, rocky hills, muddy valleys, and sand beaches. Fujairah contains a portion of an ophiolite formation that is known to contain several mineral deposits and extends for more than 500 kilometers (km) into the Oman-UAE Mountains. In 2012, FNRC produced more than 77 million metric tons (Mt) of industrial mineral commodities, including aggregates, asphalt, clays, washed sand, and other building materials (Fujairah Natural Resources Corp., 2013a, b).

Mineral Trade

In 2012, the UAE was ranked 18th (13th when excluding intra-European Union trade) in the world in terms of the value of its total exports, which were valued at \$300 billion and accounted for 1.6% of the world's total. The country was ranked 23th (17th when excluding intra-European Union trade)

in the world in terms of the value of its imports, which totaled \$200 billion and accounted for 1.2% of the world's total imports (World Trade Organization, 2013, p. 33–34).

In 2012, crude oil exports, which accounted for 26.8% of the UAE's total exports by value, increased in value by 3.7% compared with that of 2011. Much of the increase in the value of petroleum exports was owing to the increase in the price of crude oil, which, for the UAE, averaged \$112.10 per barrel in 2012 compared with \$109.60 per barrel in 2011. Natural gas exports, which accounted for 4.1% of total exports, increased in value by 20.4%. The value of refined petroleum products exports accounted for 2.7% of total exports and increased by 7.7%. Nonhydrocarbon exports, which accounted for 13.2% of total exports by value increased by 35.9%. Free zone exports, which accounted for 14.3% of the UAE's total goods exports, increased in value by 26.2%. Reexports, which accounted for 38.8% of the UAE's total exports, increased in value by 13.5%. Similarly, imports increased in value by 13.5%, including nonhydrocarbon imports, which increased in value by 13.9%; free zone imports, by 12.9%; and gas imports, by 9.9% (United Arab Emirates Ministry of Economy, 2013, p. 42).

The United States was the third-ranked exporter to the UAE after China and India. U.S. exports to the UAE increased by about 42% to \$22.5 billion in 2012 from \$15.9 billion in 2011 and accounted for 7% of the UAE's total imports. Primary imports included chemicals, computer and electronic products, machinery, primary metal, and transport equipment. U.S. imports of goods from the UAE decreased by about 8% to \$2.25 billion in 2012 from \$2.44 billion in 2011. The value of U.S. imports of aluminum from the UAE was \$638 million; hydrocarbons, \$394 million; iron and steel products, \$198 million; and diamond, \$157 million (U.S. Census Bureau, 2013).

The UAE was one of the world's top importers of steel. In 2012, the country imported 6.6 Mt of steel and was the world's sixth-ranked importer of steel. The UAE imported about 4.7 Mt (combined) of flat and long steel products compared with about 6.7 Mt in 2011. The apparent steel use and apparent steel use per capita for the UAE was 8.8 Mt and 1,089 kilograms (kg), in 2012 compared with 7.5 Mt and 954 kg, respectively, in 2011. The country's imports of iron ore increased to 3.0 Mt compared with 2.8 Mt in 2011 whereas imports of flat, long, and tabular, ingots; wire rod; and other semifinished steel products had decreased in the past 3 years as the UAE became a producer and exporter of these products, as well as of scrap exports which amounted to 1 Mt in 2012 compared with about 1.3 Mt in 2011 (World Steel Association, 2013).

Although the UAE did not produce any diamond, the country was an important hub for diamond trade. Dubai Diamond Exchange, which was established in 2005 and was a subsidiary of Dubai Multi Commodities Centre, was one of the top diamond trade centers in the world. In 2012, the UAE's diamond exports accounted for 15% (by volume) and 14% (by value) of the total world diamond exports, and its imports accounted for 15% (by volume) and 9% (by value) of the world's total diamond imports. The country exported 60.4 million carats of rough and polished diamond valued at \$6.8 billion compared with 47.4 million carats valued at \$5.9 billion in 2011. The UAE

imported 59.7 million carats of rough and polished diamond valued at about \$4.6 billion compared with 52.4 million carats valued at about \$3.8 billion in 2011. The UAE's leading diamond trade partner was India, followed by Belgium, China (Hong Kong), and Switzerland; the remaining trading partners were Angola and the Democratic Republic of Congo [Congo (Kinshasa)] (Dubai Multi Commodities Center Authority, 2013; Kimberley Process Certification Scheme, 2013).

In 2011 (the latest year for which comprehensive data were available), gold trade at the Dubai Gold Center increased to 1,196 metric tons (t) valued at \$55.9 billion from 1,125 t valued at \$41.3 billion in 2010. Gold exports increased to 451 t valued at \$22.9 billion from 418 t valued at about \$17 billion in 2010. Gold imports increased to 745 t valued at about \$30 billion from 707 t valued at \$24.4 billion in 2010. India remained Dubai's leading gold trading partner (Dubai Multi Commodities Center Authority, 2013).

Commodity Review

Metals

Aluminum.—The UAE's aluminum output was about 1.82 Mt in 2012 compared with 1.80 Mt in 2011. Dubai's smelter in Dubai produced more than 1 Mt of hot metal whereas Emal's smelter in Abu Dhabi produced about 800,000 t. Dubai's product mix included extrusion billet (61%), foundry alloy (30%), high-purity aluminum (6%), and other products (3%). Dubai employed 3,827 people and consumed 1.96 Mt/yr of alumina, 300,000 metric tons per year (t/yr) of petroleum coke, and 70,000 t/yr of coal tar pitch. Dubai had its own powerplant, which had an installed capacity of 2,350 MW as well as a 30-million-gallon-per-day desalination plant (table 1; Dubai Aluminium Company Ltd., 2013).

Work continued in the \$4.5 billion second-phase expansion project throughout 2012, which would increase Emal's production capacity to 1.3 Mt/yr of primary aluminum. The second phase was expected to be completed in December 2014. Once the second phase is completed, Emal's smelter would be the world's largest aluminum smelter in terms of capacity. Emal's aluminum products included a mix of extrusion billet, sheet ingot, sow, standard ingot, and tee ingot. Emal's aluminum complex would include an anode rodding shop, a green carbon plant where carbon dioxide gas emissions would be collected and injected into oilfields, and a 3,000-MW-capacity powerplant. Natural gas would be supplied by Adnoc according to a long-term agreement between Adnoc and Emal (Emirates Aluminium Co. Ltd., 2013).

Dubal and Mubadala were conducting a feasibility study to build an alumina refinery in Abu Dhabi. The refinery would use imported bauxite to produce alumina, which would feed the Dubal and Emal smelters to produce primary aluminum (Watts, 2013).

Antimony.—Tri-Star Union FZ LLC, which was a joint venture of Tri-Star Resources Plc of the United Kingdom and Union International Holdings Group, was building an antimony plant at Al Ghail Industrial Zone in Ras Al Khaimah Emirate. The antimony plant would have the capacity to produce 20,000 t/yr antimony metal and tri-oxide finished products and

would cost \$60 million to build. The Tri-Star Union would treat both Tri-Star concentrates produced in Canada and Turkey as well as third party concentrates to produce finished antimony metal. In 2012, Ras Al Khaimah Holding Co., which was owned by Union International Holdings Group, expressed interest in increasing its equity share in the Tri-Star Union joint venture to 49.99% from 10% by July 2013 (Tri-Star Resources Plc, 2013).

Iron and Steel.—In 2012, Emirates Steel moved forward with construction of its phase 2 expansion project. The \$1.5 billion project would include a 1.6-million-metric-ton-per-year (Mt/yr) direct-reduction plant, a 1.4-Mt/yr steel melt plant with 150-metric-ton-per-heat-capacity electric arc furnace (EAF) and 150-metric-ton-per-heat-capacity ladle furnace, a 1.4-Mt/yr combi-caster, and a 1-Mt/yr heavy section rolling mill (Emirates Steel Industries, 2013).

In addition to Emirates Steel, which was the UAE's leading producer of DRI, steel, and iron and steel products, other companies produced iron and steel products in the country. These included Hamriyah Steel FZC (a joint venture of Metalloinvest of Russia and an Emirati investor), which had the capacity to produce 1 Mt/yr of rebar at its rolling mill in the Sharjah Free Economic Zone. The plant, which was built by SMS Meer GmbH of Germany, received its feedstock for rebar production from Metalloinvest's steel plants in Russia. Another, Al Nasser Industrial Enterprises LLC (ANIE), had four steel manufacturing subsidiaries in the UAE—Emirates Steel Co. LLC, Emirates Steel Establishment, Gulf Sponge Iron Co. LLC, and Gulf Steel Industries Co. Ltd. Gulf Steel built a 400,000-t/yr-capacity rebar mill that was supplied by Siemens VAI in the Musaffah Industrial Zone in Abu Dhabi. Emirates Steel Co. finished building a steel billet plant at the Industrial City of Abu Dhabi in October. The plant had the capacity to produce 360,000 t/yr of billet. Another subsidiary of ANIE, Gulf Sponge Iron Co. L.L.C. completed the construction of a 250,000-t/yr DRI plant in August. The plant included a reactor, a process gas heater, a carbon dioxide (CO₂) removal system, a process gas compressor, a cement coating plant, and utility systems. Al Ghurair Iron and Steel (AGIS), which was owned by Al Ghurair Group (80%) and Nippon Steel & Sumitomo Metal Corp. of Japan (20%), produced iron and steel products at its plant in Mussafah, Abu Dhabi. The company had the capacity to produce 400,000 t/yr of cold-rolled steel and 400,000 t/yr of galvanized steel (Al Ghurair Group, 2013; Al Nasser Industrial Enterprises L.L.C., 2013; Hamriyah Steel FZC, 2013).

Industrial Minerals

Cement.—The UAE was a net exporter of cement in 2012 because of the oversupply of cement on the domestic market. The oversupply was the result of the more than 40 Mt/yr of cement production capacity coupled with an estimated local cement consumption of only 15 Mt/yr. The high nominal cement production capacity, which included 26.8 Mt/yr of clinker, was the result of a wave of greenfield plants and capacity extensions that was completed between 2007 and 2009 during the unprecedented construction boom in the UAE and other Gulf countries. Cement producers exported cement to 11 countries, among which were Iraq, Kuwait, and Oman as well as such

African countries as Djibouti, Ethiopia, Mozambique, Sudan, and Tanzania (Edwards, 2012; Arab Union for Cement and Building Materials, 2013).

Gypsum.—Economic growth in the country had boosted production of gypsum and gypsum products in recent years. Although no comprehensive data on mining and quarrying of gypsum were available, increased quantities of gypsum were produced to meet the demand of cement plants and gypsum wallboard plants. Gypsum wallboard plants in the UAE included Gypsemna Co. plant in Abu Dhabi, which had the capacity to produce 50 million square meters per year; Kunaf RAK plant, 30 million square meters per year; and Sain-Gobain plant, 29 million square meters per year (Global Gypsum Magazine, 2013, p. 22). The UAE had more than thirteen cement plants that produced gypsum for use within their plants in cement manufacturing (Edwards, 2013, p. 22).

Lime.—Ras Al Khaimah Lime Co. (Noora) (a subsidiary of Ras Al Khaimah Company for White Cement and Construction Materials), which was located in Ras Al Khaimah, produced 340,000 t of lime compared with about 339,000 t in 2011 and 174,000 in 2010. The Noora lime plant had the capacity to produce 350,000 t of hydrated lime and quicklime in 2012. Emirates Lime Factory (a subsidiary of Al Jazeera Industrial Group) in Abu Dhabi commenced production in 2012. Emirates Lime had the capacity to produce 1,000 metric tons per day (t/d) of lime (Emirates Lime Factory, 2013; Ras Al Khaimah Company for White Cement & Construction Materials, 2013).

Nitrogen.—Ruwais Fertilizer Industries Ltd. (Fertil) moved forward with expanding the capacity at its ammonia and urea complex at the Ruwais refinery. The expansion project was named Fertil 2 and was being carried out by Samsung Engineering and Construction Co. Ltd. of the Republic of Korea. Fertil 2 would increase the company's capacity to 2 Mt/yr of granulated urea and was expected to be completed in early 2013. The company was looking into producing ammonium sulfate and sulfur-coated urea (Ruwais Fertilizer Industries Ltd., 2013).

Sulfur.—Production of sulfur, which amounted to about 1.9 Mt in 2012, was expected to increase by more than threefold to 7 Mt/yr by 2015 following the completion of natural gas production projects from the Bab, the Hail, and the Shah oilfields by 2015. The presence of high levels of hydrogen sulfide (about 30%) in the Bab, the Hail, and the Shah oilfields requires removal of hydrogen sulfide (a process known as sweetening) from the natural gas, which would result in capturing of sulfur as a byproduct (Al Hosn Gas, 2013; Arab Fertilizers Association, 2013).

Construction work for the Shah-Habshan Ruwais railway project continued in 2012. Transport of the first freight on the \$1.28 billion railway line was expected to begin in 2013. Phase 1 of the Shah-Habshan Ruwais railway project would extend 264 km from Shah and Habshan to Ruwais, to transport the Adnoc's shipments of granulated sulfur from the Shah and the Habshan oilfields to the Port of Ruwais for export. The railway, which is owned by Etihad Rail and operated by Adnoc, would have the capacity to move 8 Mt/yr of sulfur (Railway Gazette, 2011; ConstructArabia, 2013).

Mineral Fuels and Other Sources of Energy

Natural Gas.—Adnoc had been carrying out an integrated gas development project, which would build new onshore and offshore gas processing plants at Habshan and Ruwais in Abu Dhabi. The \$7 billion project was scheduled to be completed in 2013. Gas received from the Umm Shaif field would be processed at the Habshan and the Ruwais facilities, which would include a natural gas liquids (NGL) train with the capacity to produce a combined total of 27,000 t/d of NGL and liquefied petroleum gas (U.S. Energy Information Administration, 2013).

Al Hosn Gas was a joint venture of Adnoc Occidental Petroleum Corp. of the United States that was established in 2011 to manage the Shah Gas Development (SGD) project. Adnoc would own 60% equity share in the project and Occidental would own the remaining 40%. The SGD project, which was divided into eight packages, would entail installing several gas-gathering systems and constructing processing trains to handle 28.3 million cubic meters per day of gas at Shah, constructing a storage and shipping facility near the plant, and building sulfur-exporting structures at the Ruwais Industrial Complex. The project aimed to produce 14.2 million cubic meters per day of network gas, 4,400 t/d of NGL, 33,000 barrels per day (bbl/d) of condensates, and 9,200 t/d of granulated sulfur by 2013 (Mirza, 2011; Al Hosn Gas, 2013).

Nuclear Energy.—In July, the Emirates Nuclear Energy Corp. (ENEC) commenced construction of the country's first nuclear powerplants (Barakah 1 and Barakah 2), which would be located in the western part of the Emirate of Abu Dhabi. Construction work was carried out by a consortium of companies led by Korea Electric Power Corp. (KEPCO) to build and operate four 1,400-MW nuclear powerplants for the UAE nuclear energy program. The KEPCO-led consortium included Doosan Heavy Industries & Construction Co. Ltd., Hyundai Engineering and Construction, Samsung C&T Corp. (all of the Republic of Korea), and Westinghouse Electric Co. LLC of the United States. The Barakah 1 nuclear powerplant was being built by Hyundai Engineering and Construction and was expected to be completed in 2017 at a cost of \$3.1 billion. The main contractor for the construction of the Barakah 2 nuclear powerplant was Samsung C&T Corp. The \$2.5 billion project was expected to be completed in 2018 (Emirates Nuclear Energy Corp., 2013c).

In August, ENEC selected the companies that would supply nuclear fuel for the four proposed energy plants in the UAE. Rio Tinto p.l.c. of the United Kingdom and Uranium One Inc. of Canada would supply natural uranium, ConVerDyn of the United States would provide conversion services, URENCO Ltd. of the United Kingdom would be responsible for enrichment services, and Areva Group of France and TENEX (a subsidiary of the Joint Stock Company Atomic Energy Power Corp. of Russia) would supply uranium concentrates, conversion services, and enrichment services. The enriched uranium would be supplied to KEPCO Nuclear Fuels (KNF), which would manufacture the fuel assemblies for use in the UAE plants. In September, the Export Import Bank of the United States approved a \$2 billion loan to the UAE peaceful nuclear energy program (Emirates Nuclear Energy Corp., 2013a, b).

In September, the Governments of Canada and the UAE signed a memorandum of understanding between the two countries. The cooperation agreement would allow the Canadian nuclear companies to provide products and services for the UAE's civilian nuclear energy program under the guidelines of the International Atomic Energy Agency (World Nuclear News, 2012).

Petroleum.—Adco embarked on increasing Abu Dhabi's onshore crude oil production capacity to 1.8 Mbbbl/d by 2015 from the current (2012) capacity of 1.6 Mbbbl/d. The company was implementing a multibillion dollar fullfield development program for the Asab, the Bab, the Bida Al Qemzan, the Qusahwira, the Sahil, and the Shah fields. Zadco and Adma-Opco were working on increasing offshore production to 1.75 Mbbbl/d from the offshore Satah, Umm al-Dalkh, and Upper Zakum fields (Salisbury, 2011).

The UAE's petroleum refining capacity increased slightly in 2012 to 471,300 bbl/d from 466,300 bbl/d in 2011. Al Ruwais refinery, which was operated by Adnoc, and Emirate Oil Refinery at Jabal Ali, each had 120,000 bbl/d of capacity. Adnoc's Umm Al Narr refinery, 90,000 bbl/d; the Sharjah Oil Refinery at Hamriyah, 71,300 bbl/d; and the Metro Oil Refinery at Fujairah, 70,000 bbl/d. Takreer was implementing a \$10 billion plan that encompassed three large expansion projects for the Ruwais oil refinery. Takreer was building Group III base oils production facilities at the Ruwais refinery with a capacity to produce 500,000 t/yr of Group III base oils and 100,000 t/yr of Group II base oils. Group III base oils are advanced formula base oils used as lubricants for automotive engines (Abu Dhabi Oil Refining Co., 2013; Organization of the Petroleum Exporting Countries, 2013).

The Fujairah Zone for Petroleum Industry (FOZ) completed building a hydrocarbon storage facility with a total of 262 tanks capable of storing up to 7 million cubic meters of crude oil and petroleum products. RAK Petroleum Co. Ltd. and DNO International ASA of Norway, which was a natural gas and oil company with a focus on the Middle East and North Africa and which was listed on the Oslo Stock Exchange, completed the merger of their oil and gas assets (Emirates 24/7, 2011; RAK Petroleum Co. Ltd., 2011).

Renewable Energy.—Masdar's renewable energy project moved forward in 2012. The project was scheduled to be completed by 2014 at a cost of \$22 billion. Masdar planned to build a hydrogen powerplant at Ruwais that would provide 420 MW of electric power-generating capacity, desalinate seawater using reverse osmosis technology to produce 5.3 million to 6.6 million liters per day of water, and have a carbon capture and storage capability. The carbon capture and storage project would involve the building of structures capable of holding carbon dioxide emitted from (a) Emirates Steel's steel rolling mills at Mussafah (up to 800,000 t/yr); (b) the planned hydrogen powerplant joint venture with BP p.l.c. at Shuweihat; (c) Emal's powerplant at Taweelah; and (d) the independent water and powerplant at Taweelah. Masdar planned to capture and store 5 Mt/yr of carbon dioxide and to sell it to Adnoc, which would inject it into Adnoc's oilfields (Masdar, 2013).

In 2012, Shams Power Co. P.J.S.C., which was owned by Masdar (60%) and Total Abengoa Solar Emirates Investment Co. (a 50–50 joint venture of Abengoa Solar S.A. of Spain and Total S.A. of France) (40%) moved forward with building a 100-MW-capacity concentrated solar powerplant called Shams 1 in Abu Dhabi. Shams 1, which would be the region's largest single concentrated solar powerplant, was completed in early 2013. The \$600 million solar powerplant, which used 5 Mt of sand for the manufacturing of solar panels, was designed to displace 175,000 t of carbon dioxide and to supply 20,000 homes with electricity (Shams Power Co. P.J.S.C., 2013).

Outlook

The economy of the UAE is projected to grow modestly in the next 5 years. The Government of Abu Dhabi plans to invest \$90 billion in the next 5 years on infrastructure-related projects that would boost the economy and create jobs. Abu Dhabi also plans to continue to invest in renewable energy sources and technologies within the UAE and around the world. The UAE is expected to become a major producer of aluminum because of the merger of Dubal and Emal in one entity named Emirates Global Aluminium (EGA) in 2013. EGA would be the world's fifth-ranked aluminum company and would be valued at \$15 billion. The new company would have 2.4 Mt/yr of primary aluminum production capacity and a combined power generation capacity of 5,350 MW when the construction of Emal's phase 2 expansion project is completed in 2014. In 2013, Mubadala acquired BHP Billiton of Australia's share of a bauxite deposit owned by Guinea Alumina Corp. and became the sole owner of Guinea Alumina Corp. Guinea Alumina held a 50-year mining concession containing about 1.3 billion metric tons of bauxite in Guinea. Mubadala has also created a joint venture—Jiangsu Suyadi Tancai Company Ltd. (Suyadi)—with Zhenjiang Coking Gas Group Company (ZCGG) of China in 2013 to produce 500,000 t of anode-grade calcined petroleum coke in China; most of the production was to be used to supply Mubadala's aluminum smelters in the UAE (Mubadala Development Company P.J.S.C., 2013).

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TABLE 1
UNITED ARAB EMIRATES: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity ²	2008	2009	2010	2011	2012
METALS					
Aluminum, primary	945	955	1,400	1,800 ^r	1,820
Chromite ore	34	24	-- ^r	-- ^r	--
Iron and steel:					
Direct-reduced iron	--	--	1,180	2,250 ^r	2,720
Steel, crude	100	100	500	2,000	2,408
Hot-rolled long products	1,460	1,170	1,580	1,950	2,156
Concrete-reinforcing bars	--	--	--	--	1,586
INDUSTRIAL MINERALS					
Cement, hydraulic	21,885	18,997	18,000	18,000	17,000
Gypsum ^e	875 ^r	760 ^r	720 ^r	720 ^r	680
Lime	147 ^r	147 ^r	174 ^r	340 ^r	400
Nitrogen:					
N content of ammonia	380	380	392	386	330
N content of urea	284	284	310	324	289
Stone, crushed ^e	150,000	150,000	100,000	100,000	100,000
Sulfur ³	2,175	2,175	1,829	1,885	1,900
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross					
million cubic meters	80,550	75,840	79,778	82,433	85,613
Dry					
do.	50,240	48,800	51,300	52,300	54,308
Natural gas plant liquids					
thousand 42-gallon barrels	91,250	91,250	98,550 ^r	146,000 ^r	146,000
Petroleum:					
Crude and condensate	do.	1,127,120	1,003,750	1,046,455	1,233,700
Refinery products:					
Liquefied petroleum gas	do.	3,577	5,840	6,570	8,103
Gasoline	do.	18,469	23,725	24,090 ^r	33,945 ^r
Kerosene and jet fuel	do.	36,682 ^r	50,370 ^r	55,845 ^r	62,415 ^r
Distillate fuels	do.	27,704 ^r	36,865 ^r	43,435 ^r	46,720 ^r
Residual fuels	do.	4,708 ^r	23,542 ^r	20,184 ^r	22,740 ^r
Other	do.	31,792 ^r	55,042 ^r	970 ^r	76,650 ^r
Total	do.	122,932 ^r	195,384 ^r	151,094 ^r	227,321

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through December 31, 2013.

²In addition to the commodities listed, industrial minerals, such as common clays, diabase, gravel, limestone, marble, sand, salt, and shale presumably are produced, but output is not reported, and available information is inadequate to make reliable estimates of output.

³Byproduct of petroleum refining and natural gas processing.

TABLE 2
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity	
Aluminum	Dubai Aluminum Co. Ltd. (Dubal) (Investment Corp. of Dubai, 100%)	Jebel Ali, Dubai	950	
Do.	Emirates Aluminium Co. Ltd. (Emal) [Dubai Aluminum Co. Ltd. (Dubal), 50% and Mubadala Development Co., 50%]	Khalifa Port and Industrial Zone (KPIZ), Abu Dhabi	800	
Cement:				
Portland	Aditya Birla Star Cement	Grinding plant at Abu Dhabi	1,100	
Do.	do.	Grinding plant at Ajman	1,000	
Do.	do.	Clinker plant at Ras Al Khaimah	2,200	
Do.	Arabian Gulf Cement Company LLC	Ajman	1,100	
Do.	Bin Hamel Nael Cement Co.	Grinding plant at Al-Ain	500	
Do.	Binani Cement Factory LLC	Grinding plant at Jabal Ali	2,000	
Do.	Emirates Cement Factory [Arkan Building Materials Co. (Arkan) a subsidiary of SENAAT General Holding Corp.]	Abu Dhabi	2,300	
Do.	Al Ain Cement Factory [Arkan Building Materials Co. (Arkan), Al-Ain a subsidiary of SENAAT General Holding Corp.]		3,400	
Do.	Cemex Falcon LLC	Grinding plant at Dubai	1,600	
Do.	Fujairah Cement Industries P.S.C.	Dibba, Fujairah	2,800	
Do.	Gulf Cement Co. (National Investment Co. of Kuwait, 27%, and Government of Ras Al Khaimah, 8%)	Khor Khuwair, Ras Al Khaimah	3,800	
Do.	Hamriyah Cement Co. FZC (Bin Kamil Investment Group)	Grinding plant at Sharjah	1,000	
Do.	Jebel Ali Cement Co. (Sharaf Industries, 100%)	Jebel Ali, Dubai	840	
Do.	KCC Co. LLC	Grinding plant at Sharjah	500	
Do.	Lafarge Emirates Cement L.L.L.C.	Fujairah	3,200	
Do.	National Cement Company P.S.C. (Holcim Ltd.)	Sharjah	2,200	
Do.	Pioneer Cement Industries LLC (Raysut)	Ras Al Khaimah	1,200	
Do.	Ras Al Khaimah Cement Co. P.S.C.	Khor Khuwair, Ras Al Khaimah	1,000	
Do.	Sharjah Cement and Industrial Development Co. (private, 70%, and Government of Sharjah, 30%)	Sharjah	3,500	
Do.	Teba Cement Co.	Grinding plant at Abu Dhabi	1,100	
Do.	Umm Al-Qaywayn Cement Industries Co. P.S.C.	Umm al-Quwain	1,600	
Do.	Union Cement Co. (Government of Ras Al Khaimah, 41%, and Abu Dhabi Investment Authority, 20%)	Khor Khuwair, Ras Al Khaimah	4,800	
White	Ras Al Khaimah Company for White Cement and Construction Materials	Ras Al Khaimah	450	
Clay	Fujairah Natural Resources Corp. (FNRC)	Fujairah	2,000	
Gold, refined	metric tons	Al Etihad Gold L.L.C.	Al Quoz, Dubai	200
Do.	do.	Al Etihad Gold Refinery DMCC	Jumeirah Lake Towers, Dubai	200
Do.	do.	Emirates Gold (private, 100%)	Dubai	200
Do.	do.	Al Ghurair Giga Gold (private, 100%)	do.	100
Do.	do.	ARY Aurum Plus (private, 100%)	Sharjah	25
Do.	do.	Al Ghaith Gold (private, 100%)	Dubai	100
Do.	do.	Kaloti Jewellery Group	Sharjah	300
Iron and steel:				
Iron, direct-reduced	Emirates Steel Industries P.J.S.C. (SENAAT General Holding Corp., 100%)	Abu Dhabi	3,000	
Do.	Al Nasser Industrial Enterprises LLC	do.	250	
Steel:				
Billet	Emirates Steel Industries P.J.S.C. (SENAAT General Holding Corp., 100%)	do.	2,000	
Do.	Al Nasser Industrial Enterprises LLC	do.	220	
Wire rod	Emirates Steel Industries P.J.S.C. (SENAAT General Holding Corp., 100%)	do.	480	
Rebar	do.	do.	620	
Do.	Alam Steel	Dubai	500	
Do.	Al Nasser Industrial Enterprises LLC	Abu Dhabi	90	

See footnotes at end of table.

TABLE 2—Continued
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel—Continued:				
Steel—Continued:				
Rebar—Continued		Essar Steel-India	Hamriyah Free Zone, Sharjah	1,000
Do.		Hamriyah Steel FZC (Metalloinvest, 80%; and Sheikh Sultan Bin Khalifa Al Nahyan, 20%)	do.	1,000
Do.		Union Iron & Steel Company LLC	Abu Dhabi	500
Do.		Conares Metal Supply Ltd.	Dubai	400
Do.		Star Steel International LLC	Jebel Ali, Dubai; Hamriyah Free Zone, Sharjah	360
Do.		Al Ghurair Iron and Steel Co.	Abu Dhabi	350
Lime		Emirates Lime factory (AlJazaeera Industrial Group)	Abu Dhabi	350
Do.		Ras Al Khaimah Lime Co. (Ras Al Khaimah Company for White Cement & Construction Materials)	Ras Al Khaimah	350
Natural gas, liquefied		Abu Dhabi Gas Liquefaction Company Ltd. (Adgas)	Das Island	5,149
Nitrogen:				
Ammonia		Ruwais Fertilizer Industries (Fertil) (Abu Dhabi National Oil Co., 66.66%, and Total Group, 33.33%)	Ruwais, Abu Dhabi	460
Urea		do.	do.	800
Petroleum:				
Crude	thousand 42-gallon barrels per day	Abu Dhabi Company for Onshore Oil Operations (Adco) [Abu Dhabi National Oil Co. (Adnoc), 60%; BP p.l.c., 9.5%; Exxon Mobil Corp., 9.5%; Royal Dutch Shell Group, 9.5%; Total S.A., 9.5%; Participations and Explorations Corp., 2%]	Onshore Abu Dhabi oilfields, including the Asab, the Bab, the Bu Hasa, the Jarn Yaphour, the Sahil, the Shah, Abu Al Bukhoosh, and the Arzanah fields	1,300
Do.	do.	Abu Dhabi Marine Operating Co. (Adma-opco) [Abu Dhabi National Oil Co. (Adnoc), 60%; BP p.l.c., 14.67%; Total S.A., 13.33%; Japan Oil Development Corp., 12%]	Offshore Abu Dhabi oilfields, including the Umm Sharif and the Zakum fields	600
Do.	do.	Zakum Development Co. (Zadco) [Abu Dhabi National Oil Co. (Adnoc), 63.36%; ExxonMobil Abu Dhabi Offshore Petroleum Company Ltd., 24.64%; Japan Oil Development Corp., 12%]	Offshore Abu Dhabi oilfields, including the Satah, the Umm Al-Dalkh, and the Upper Zakum fields	518
Do.	do.	Dubai Petroleum Establishment, 100%	Dubai oilfields, including the Margham, the Falah, the Fateh, the Rashid, and the S.W. Fateh fields	100
Do.	do.	Ras Al Khaimah Gas Commission	Ras Al Khaimah oilfields, including the Saleh fields	1
Do.	do.	BP p.l.c. and Crescent Petroleum Company Inc.	Sharjah oilfields, including the Kahaif, the Saja, the Moveyid, and the Mubarek fields	50
Refinery products	do.	Abu Dhabi Oil Refining Co. (Takreer) [Abu Dhabi National Oil Co., (Adnoc), 100%]	Ruwais refinery, Ruwais, Abu Dhabi	120
Do.	do.	do.	Umm Al Nar refinery, Abu Dhabi	90
Do.	do.	Emirates National Oil Company Ltd. (Investment Corp. of Dubai, 100%)	Jebel Ali refinery, Jebel Ali, Dubai	120
Do.	do.	Sharjah Oil Refining Co. F.Z.C. (FAL Group, 100%)	Hamriyah Free Trade Zone, Sharjah	71
Do.	do.	Metro Oil Corp.	Fujairah	70
Salt		Alghaith Industries (Al Ghaith Holding PJSC)	Mussafah, Abu Dhabi	110
Sand		Fujairah Natural Resources Corp. (FNRC)	Fujairah	20,000
Silica, glass		Guardian Zoujaj International Float Glass Co. LLC (Guardian RAK)	Ras Al Khaimah	255
Do.		Emirates Float Glass LLC (Dubai Investment PJSC, 100%)	Industrial City 1 and 2, Abu Dhabi	440
Silver, refined	metric tons	Emirates Gold (private, 100%)	Dubai	100
Sulfur		Abu Dhabi National Oil Co. (Adnoc)	Abu Dhabi	2,000
Do., do. Ditto.				