



2009 Minerals Yearbook

UNITED ARAB EMIRATES

THE MINERAL INDUSTRY OF THE UNITED ARAB EMIRATES

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In 2009, the United Arab Emirates (UAE)¹ was the world's eighth ranked producer of crude oil and accounted for 3.2% of world crude oil production. The UAE held 97.8 billion barrels of proved crude oil reserves, or 7.3% of the world's total reserves. The country was responsible for 1.6% of the world's supply of natural gas; it held 6.43 trillion cubic meters of proved natural gas reserves, or 3.4% of the world's total, and was ranked seventh in the world in terms of its proved natural gas reserves. The UAE was a major supplier of aluminum foundry alloy, extrusion billet, and high-purity aluminum to more than 44 countries in Africa, Asia, Europe, and North America and accounted for about 2.6% of the world's aluminum smelter output in 2009. In addition, the UAE produced cement, chromite, gypsum, lime, nitrogen fertilizer, refined petroleum products, sand, steel, and sulfur (BP p.l.c., 2010, p. 8, 9, 22, 25; Bray, 2010; Dubai Aluminium Company Ltd., 2010).

Government Policies and Programs

According to "Abu Dhabi Economic Vision 2030," Abu Dhabi, which is the largest of the seven Emirates that make up the United Arab Emirates, set an ambitious economic diversification target that, by 2015, one-half the Emirate's gross domestic product (GDP) would come from non-oil economic activity. Abu Dhabi identified metals as one of 12 engines for its future growth. Abu Dhabi was interested in producing aluminum, iron and steel, other base metals, and advanced materials. Abu Dhabi does not have huge ore reserves of metals, and it depended on its low energy costs, its transport system, and the infrastructure of its industrial cities to give the Emirate the competitive edge it needs for its downstream metal industries. The UAE has become one of the world's top markets for hydrocarbon projects. Abu Dhabi planned to invest \$30 billion between March 2009 and March 2010 to maintain its status as a world energy hub and to benefit from the expected decrease in the cost of engineering works and construction materials. Abu Dhabi pushed ahead with oil and gas development projects aimed at increasing the volume of its crude oil production to 3.5 million barrels per day (Mbbbl/d) by the end of 2010. In addition to its focus on hydrocarbon activity, Abu Dhabi had been developing its nuclear and solar energy programs to meet the high demand for electricity in Abu Dhabi, Dubai, and the other Emirates in the UAE. In December, the President of the UAE issued a decree that established the Emirates Nuclear Energy Corp. (ENEC) to run its proposed nuclear program to produce electricity to meet an expected need for an additional 40,000 megawatts (MW) of power. The United States officially signed a civilian nuclear cooperation agreement with the

¹The United Arab Emirates is a federation of seven Emirates: Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaimah, Sharjah, and Umm Al Quwain.

UAE that contained commitments by the UAE not to use U.S. technology to develop nuclear weapons or to assist other countries in the region do so (Government of Abu Dhabi, 2008, p. 13, 113; Emirates Nuclear Energy Corp., 2009).

In 2009, the UAE was elected to host the headquarters of the International Renewable Energy Agency (IRENA) at Masdar City near Abu Dhabi. IRENA was mandated by 148 member countries to encourage greater adoption and sustainable use of renewable energy. IRENA was reportedly the first global international organization to be headquartered in a developing country. Abu Dhabi Future Energy Co. (Masdar) organized the World Future Energy Summit, which was held in Abu Dhabi and was attended by 24,792 delegates from 148 countries (Stanton and Habboush, 2009; Abu Dhabi Future Energy Co., 2010).

Minerals in the National Economy

In 2009, the UAE's economy contracted in real terms, by 2.5% compared with a 5.1% expansion in 2008. The contraction of the economy in 2009 was owing to the decrease in world oil prices and to the adverse effects of the global financial crisis. The value of the hydrocarbon sector activity decreased by 9.7% compared with an increase of 1.6% in 2008 and that of the nonhydrocarbon sectors increased by 1.8% compared with 6.3% in 2008. The contribution of the crude oil and natural gas sector in 2009 decreased to 28.9% of the GDP from 33.5% of the GDP in 2008. The share of nonfuel mining was 0.3% of the GDP in 2009, which was identical to the sector's contribution in 2005-08. The contribution of the manufacturing sector, which included aluminum, fertilizer, and iron and steel, was 16.2% of the GDP compared with 15.1% of the GDP in 2008. The construction sector's contribution to the GDP increased by 1% in 2009 to 10.7% of the GDP from 9.7% in 2008. Notwithstanding the sharp decline in real estate and building activity, the construction sector in the UAE grew by 7.9% to \$25.6 billion in 2009 (International Monetary Fund, 2010, p. 56, 58; National Bureau of Statistics, 2010, p. 22).

The flow of foreign direct investment (FDI) to the UAE decreased by about 71% to \$4.0 billion in 2009 from \$13.7 billion in 2008. Similarly, the flow of foreign direct investment from the UAE to the rest of the world decreased by about 83% to \$2.7 billion in 2009 from \$15.8 billion in 2008 (Arab Investment and Export Credit Guarantee Corp., 2010, p. 34, 60).

Production

In 2009, the production of chromite ore decreased by about 29% owing to reduced demand for chrome by the international market. Crude oil production decreased by about 13% owing to lower demand by the world market and UAE compliance

with the Organization of the Petroleum Exporting Countries (OPEC)'s decision to reduce production. Cement production decreased by 13% compared with that of 2008 despite the increase in production capacity. The decrease in cement production was owing to lower demand for cement by the local market because of Dubai's financial crisis. Aluminum production increased by 6.5% to 955,000 metric tons (t) for the first time (table 1).

Structure of the Mineral Industry

The governments of the individual Emirates of the UAE maintained majority interest in the country's mineral industry. The Supreme Council of Petroleum was the highest government body that made policies and set goals for the hydrocarbon sector. Abu Dhabi was responsible for almost all the crude oil and natural gas produced by the UAE through the 14 subsidiaries of Abu Dhabi National Oil Co. (Adnoc). Abu Dhabi Company for Onshore Oil Operations (Adco), Abu Dhabi Marine Operating Co. (Adma-Opco), and Zakum Development Co. (Zadco) also carried out exploration for and production of oil and gas. 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). Oil and gas processing was conducted by Abu Dhabi Gas Industries Ltd. (Gasco), Abu Dhabi Gas Liquefaction Company Ltd. (Adgas), and Abu Dhabi Oil Refining Co. (Takreer). Chemical and petrochemical manufacturing companies included Ruwais Fertilizer Industries (Fertil) and Abu Dhabi Polymers Co. Ltd. (Borouge). The distribution of refined petroleum products was the responsibility of Adnoc-Distribution. Abu Dhabi National Tanker Co. (Adnatco) and National Gas Shipping Company (NGSCO) carried out maritime transportation (Abu Dhabi National Oil Co., 2010).

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 the Abu Dhabi government-owned Mubadala Development Co. (Mubadala) in Emirates Aluminium Co. (Emal). Emal was building the country's second primary aluminum smelter at the Khalifa Port and Industrial Zone (KPIZ) in Abu Dhabi. Individual Emirate governments owned some of the cement companies, such as the governments of the Emirate of Ras Al Khaimah and the Emirate of Sharjah. Private and joint-venture companies owned other cement plants.

General Holding Corp. (GHC) was the UAE's leading industrial investment instrument to implement Abu Dhabi's industrial diversification policy. GHC has a number of subsidiaries, which included Abu Dhabi Basic Industries Corp. (Adbic), Arkan Building Materials Co. (Arkan), Dubai Cable Co. (Pty) Ltd. (Ducab), Emirate Cement Factory, and Emirates Steel Industries (ESI). Adbic was established in 2007 as a catalyst for building an internationally competitive core of commercially feasible industrial activity through public-private partnerships across the industrial sector that would link upstream industries with the midstream and downstream industrial sectors. The company 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. Ras Al Khaimah Minerals and Metal Investment (RIMMI), which was a subsidiary of Ras Al Khaimah Investment Authority (RAKIA), invested in minerals production locally and abroad (Abu Dhabi Basic Industries Corp., 2010; Dubai Cable Company (Pty) Ltd., 2010; RAK Minerals and Metals Investments, 2010).

Abu Dhabi Future Energy Co. (Masdar), which was a wholly owned subsidiary of Mubadala, was created as a global company to find solutions to problems related to climate change, energy security, and sustainable energy. Masdar teamed up with academic and business institutions to apply the latest technologies in carbon management, solar and hydrogen-based energy, and other clean energy technologies (Abu Dhabi Future Energy Co., 2010).

Abu Dhabi Water & Electricity Authority (Adwea) was responsible for the development and planning of, business support for, and privatization of electricity and water projects in the Emirate of Abu Dhabi. Adwea became a model for private power development in the Gulf region because of the success of seven independent water and power projects that it implemented and owned along with 10 international companies in the past decade. In 2009, Abu Dhabi's installed electricity generating capacity was 10,100 MW, and its estimated additional capacity requirements by 2019 were 14,735 MW (MEED, 2010a, p. 21).

Dubai Water & Electricity Authority (Dwea) was in charge of satisfying the increasing demand for electricity and water for the Emirate of Dubai from its power and desalination stations at Aweer and Jebel Ali. In 2009, Dwea had an installed electricity generating capacity of 6,997 MW, and it was estimated that it would require an additional 7,843 MW by 2019 (MEED, 2010a, p. 22).

Mineral Trade

In 2009, the UAE was ranked 19th (13th when excluding intra-European trade) in the world in terms of the value of its exports of goods, which totaled \$192.2 billion and accounted for 1.4% of the world's total goods exports. The country was ranked 24th (16th when excluding intra-European trade) in the world in terms of the value of its imports of goods, which totaled \$170.5 billion and accounted for 1.1% of the world's total goods imports. The value of UAE petroleum exports, which was 33.5% of total exports, decreased by 42.6% to \$58,656 million compared with \$102,073 million (42% of total exports) in 2008. Much of the decrease in the value of petroleum exports was owing to the decrease in the price of crude oil, which, for the UAE, averaged \$63.07 per barrel in 2009 compared with \$99.54 per barrel in 2008. The value of natural gas exports decreased to \$7.8 billion in 2009 from \$10.8 billion in 2008, and refined petroleum products exports decreased to \$5.4 billion from \$6.0 billion. Iron and steel products exports were 34% of Abu Dhabi's total non-oil exports in 2009 (World Trade Organization, 2010b).

The UAE was the leading export market for the United States in the Middle East in 2009. The United States was the third ranked exporter to the UAE after China and India. U.S. exports to the UAE, which were valued at \$9.5 billion, accounted for 8.6% of the UAE's total imports. Primary imports included chemicals, computer and electronic products, machinery, primary metal, and transport equipment (Embassy of the United Arab Emirates in Washington DC, 2010; World Trade Organization, 2010a, p. 19-20).

Dubai Multi Commodities Centre (DMCC) traded with base metals, colored stones and pearls, diamond, energy, gold and precious metals, petrochemicals, plastics, and steel. The value of the diamond trade, which included both rough and polished diamond, at the DMCC decreased by 48% in 2009 to about \$2.7 billion compared with a value of \$5.2 billion in 2008 and by 44% compared with a value of \$4.8 billion in 2007. Diamond exports by the UAE accounted for 9% of the volume and 8% of the value of the world's total diamond exports whereas diamond imports accounted for 9% of the volume and 5% of the value of the world's diamond imports. The country exported about 29.7 million carats of diamond valued at about \$2.1 billion in 2009 compared with 35.6 million carats valued at about \$3.1 billion in 2008 and 42.2 million carats valued at \$2.8 billion in 2007. The UAE imported about 29.2 million carats valued at about \$1.4 billion in 2009 compared with 38.8 million carats valued at about \$2.2 billion in 2008 and 42.6 million carats valued at \$1.9 billion in 2007 (Kimberley Process Certification Scheme, 2010).

The value of gold trade at Dubai Gold Center for 2009 was \$29.3 billion, which was slightly more than that in 2008 despite the global economic downturn. In 2009, the volume of gold imports decreased by about 15% to 576 t from the record of 674 t achieved in 2008. The volume of gold exports increased by 9% in 2009 to 403 t from 371 t in 2008. India remained Dubai's leading gold trading partner (Dubai Multi Commodities Center, 2010).

Dubal aluminum products exports included foundry alloy, extrusion billet, and high-purity aluminum to more than 44 countries in Asia (42%), the Middle East (32%), Europe (16%), and Africa and North America (5% each). These exports accounted for about 2.6% of the world's aluminum smelter output in 2009 (Dubai Aluminium Company Ltd., 2010).

Commodity Review

Metals

Aluminum.—In 2009, Dubal maintained its position as the world's seventh ranked producer of aluminum from the largest single-site aluminum smelter operations in the Western World at Jabal Ali in the Dubai Emirate. In 2009, Dubal's production of high-quality hot metal increased to 955,000 t from 945,000 t in 2008. Dubal's output accounted for 2.6% of the world's total aluminum production. More than one-half of the company's output was extrusion billet; 21%, foundry alloy; 5.6%, high-purity aluminum; and 22.6%, other products. The company employed 3,923 people in 2009, which was down from 4,166 people in 2008. Dubal consumed 1.93 million metric tons per year (Mt/yr)

of alumina, 300,000 metric tons per year (t/yr) of petroleum coke, and 70,000 t/yr of coal tar pitch (table 1; Dubai Aluminium Company Ltd., 2010).

Dubal and Mubadala founded Emal in 2007 as a 50-50 joint venture to build the world largest capacity smelter (1.4 Mt/yr) at the KPIZ. Emal awarded a joint venture of SNC-Lavalin Group Inc. of Canada and WorleyParsons Ltd. of Australia the engineering, procurement, and construction management (EPCM) services contract for the project. The construction of phase I of the \$8 billion project began in January 2008, and the smelter commenced operations in December. Operations at the full capacity of 750,000 t/yr were scheduled to begin in January 2010. At full operation, aluminum products would include a mix of sow, standard ingot, tee ingot, extrusion billet, and sheet ingot. When phase two is completed, the smelter's total production capacity would increase to 1.5 Mt/yr, which would make Emal the most productive and most efficient single-site aluminum smelter complex in the world. The complex would have its own 2,000-MW powerplant, which would use natural gas supplied by Adnoc through a gas-insulated substation, to generate electricity. Adnoc guaranteed natural gas supply for the project for 30 years. Mubadala raised \$4.9 billion, including a \$2 billion bank loan, a \$2.8 billion bridging loan, and a \$270 million credit facility. In December, Emal, which appointed Citigroup Inc. of the United States as the project's financial advisor, held talks with export credit agencies to finance the remaining cost of the project (MEED, 2009b, p. 18; Emirate Aluminium Co. Ltd., 2010).

In June, Adbic formed a joint venture with Midal Cables of Bahrain to build an aluminum plant at the KPIZ. The plant would cost \$100 million to build, and construction was expected to begin in the first quarter of 2010; the plant would begin operations in the second quarter of 2011. The plant was expected to produce 150,000 t/yr of aluminum products, including aluminum rod and aluminum electrical overhead conductors, and would add to Abu Dhabi's downstream industries. Adbic created a joint venture with Gulf Extrusions Co. L.L.C. to build a \$122 million aluminum extrusion plant at Taweelah that would have a production capacity of 50,000 t of aluminum extrusion and extrusion-based niche-oriented products, such as high-end architectural systems and automotive and engineering extrusions. Aluminum billet and liquid aluminum metal would come from the adjacent Emal smelter, which was under construction in Taweelah (AME Info FZ LLC/Emap Ltd., 2009; MEED, 2010b, p. 14)

Adbic was planning to build a 500,000-t/yr-capacity aluminum rolling mill with an undisclosed joint-venture partner at the KPIZ at a cost of \$1.5 billion. Adbic suspended its plan to build the first phase of the \$5 billion Ruwais aluminum smelter as a joint venture with Comalco Aluminum Ltd. (a subsidiary of Rio Tinto Ltd.) of Australia. Darvesh Group also suspended its plan to establish an \$817 million aluminum processing plant named Nova Aluminium at the Dubai Industrial Zone (ABQ Zawya Ltd., 2010b).

Copper.—In 2009, Ducab produced a wide range of cables and copper wire rod from its copper casting plant. The company had a 110,000-t/yr-capacity copper rod mill that converts copper cathode into 8-millimeter-diameter electrolytic tough-pitch

copper rod. The production capacity was expected to increase to 140,000 t/yr after the Ducab high-voltage cable plant comes online in 2010. Ducab plants are located at Jebel Ali in Dubai and at Mussafah in Abu Dhabi. The Ducab copper rod plant, which was also located in Mussafah, commenced production in 2008. In November, the company broke ground for a plant at Jebel Ali. The plant would manufacture 30,000 t/yr of high-voltage (HV) and extra-HV cables and would be completed in late 2010. Ducab also launched a special cable unit in November for manufacturing cables for oil and gas projects [Dubai Cable Company (Pty) Ltd., 2010].

Iron and Steel.—In 2009, ESI produced 1.6 million metric tons (Mt) of rebar compared with 566,000 t in 2008. Before 2009, following the completion of phase one of its integrated steel complex at Mussafah in Abu Dhabi, ESI's production of rebar was from imported billet. The company was dependent on imported billet up to 2009. In 2009, ESI imported more than 1 Mt of billet and began melting scrap steel. In September, ESI awarded Danieli Corp. of Italy a construction expansion contract to be completed in late 2011 to develop a steel smelter and a reduction unit. The \$2.45 billion expansion plan would increase ESI's capacity to 3 Mt/yr by 2011. The status of the remaining phases of ESI's integrated steel complex project (phase II A, phase II B, phase III, and phase IV) was listed as ongoing as scheduled (ABQ Zawya Ltd., 2010a; Arab Steel, 2010).

Hamriyah Steel FZC, which was a joint venture of Metalloinvest (80%) of Russia and Sheikh Sultan bin Khalifa Al Nahyan (20%), announced that its steel rebar plant in Sharjah would begin initial production of 365,000 t/yr of rebar in January 2010 and would reach full capacity of 1 Mt/yr in February 2011. SMS Meer GmbH of Germany was building the rebar mill, and Metalloinvest would supply the feedstock for rebar production from Russia. Metalloinvest planned to invest \$320 million to build a second plant in the UAE in the next 5 years. The plant would produce direct-reduced iron (DRI) for use in steelmaking (Hamriyah Steel FZC, 2010; Steel Guru, 2010).

The construction of phase I of the cold-rolling and galvanizing plant by Al Ghurair Iron and Steel Co. in Abu Dhabi was completed. The \$85 million plant had the capacity to produce 350,000 t/yr of steel, including 100,000 t/yr of cold-rolled steel coils, 50,000 t/yr of cold-rolled galvanized steel, and 200,000 t/yr of hot-dip galvanized steel. The second phase of the plant was delayed (Kawach, 2008).

Al Nasser Industrial Enterprises LLC (ANIE) had three steel manufacturing subsidiaries in the UAE—Emirates Steel Establishment, Euro Gulf Steel Industries, and Gulf Steel Industries Co. Ltd. Gulf Steel built a rebar mill supplied by Siemens VAI in the Mussafah Industrial Zone in Abu Dhabi. Emirates Steel Co. L.L.C. (a subsidiary of ANIE) completed 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. Gulf Sponge Iron Co. L.L.C. (another subsidiary of ANIE) moved forward with the construction of a DRI plant with an installed capacity of 250,000 t/yr. The plant, which was scheduled to commence production in August 2010, 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 Nasser Industrial Enterprises L.L.C., 2010).

Industrial Minerals

Cement.—The vast demand for cement in the UAE peaked in 2008 at 21.7 Mt, which was more than three-fold larger than the level of consumption of 6.9 Mt in 2003. The per capita consumption, which reached 4,345 kilograms per year, was more than 10 times the global average. Throughout the boom years, supply shortages were common and a source of rapid price inflation as producers sought to capitalize on the scarcity of cement, while the volume of cement and clinker trade increased exponentially. This increase was accompanied by a significant increase in capacity to 34 Mt/yr in 2009 from just 11 Mt/yr in 2003. Annual clinker production was about 18.6 Mt in 2009. At the end of 2008, amidst the global financial crisis and the bursting of Dubai's real estate bubble, the market turned down sharply. Cement demand fell by 13% in 2009 to 19 Mt as about one-half of all construction projects in the UAE ground to a halt. A further double-digit decrease was forecast for 2010. Prices decreased to about \$54 per metric ton in January 2010 from \$136 per metric ton in 2009, and cement imports, which reached 3.6 Mt in 2008, were reduced to zero in 2009. The cement production capacity of the UAE was expected to reach 40.7 Mt by 2011 following the completion of the projects that were started in recent years. This would create a demand-supply gap of about 25 Mt, assuming that demand would stabilize at about 15.5 Mt by 2011. In terms of clinker, the gap could reach 16 Mt by 2011. Cement producers were hoping for a rebound of cement demand when construction of four nuclear reactors begins in Abu Dhabi in 2012 (Baxter, 2010; Hargreaves, 2010).

Construction of new cement plants and capacity expansions at existing plants continued, including at Arkan's lime plant, the Nael Cement Products plant, the Pan Emirates Cement plant, and the Star Cement-Ras Al Khaimah Cement plant. The \$193 million expansion planned at Jebel Ali Cement Factory and the installation of a new 3.5-Mt/yr-capacity cement plant at a cost of \$400 million in the Emirate of Fujairah by JK Cement Ltd. of India, however, were put on hold because of market conditions (ABQ Zawya Ltd., 2010b).

Nitrogen.—Ruwais Fertilizer Industries Ltd. (Fertil), which was a subsidiary of Adnoc, moved forward with its expansion plans for the ammonia and urea complex at the Ruwais refinery. In October, Fertil awarded Samsung Engineering & Construction Co. Ltd. of the Republic of Korea an engineering, procurement, construction, and commissioning contract on a lump-sum turnkey basis. The project (Fertil 2) would increase the plant's capacity to 730,000 t/yr of ammonia and 1.3 Mt/yr of urea (Samsung Engineering and Construction Co. Ltd., 2009).

Silica.—In 2009, Emirates Float Glass LLC (EFG), which was a subsidiary of Glass L.L.C. (the glass arm of Dubai Investments PJSC), announced the second phase of investment in its Float Glass manufacturing facilities to expand the company's existing manufacturing capacity. EGF planned to invest about \$545 million in the next 4 to 5 years under the sponsorship of Dubai Investments to reach 160,000 t/yr of glass products at its plant, which is located in the Industrial City of Abu Dhabi (Emirates Float Glass LLC, 2009).

Guardian Float Glass L.L.C. of the United States supplied more than 174,000 square meters of glass to Burj Khalifa (the world's tallest building) which was opened in Dubai in January 2010. Guardian was a joint-venture partner in Guardian Zoujaj International Float Glass Co. L.L.C. (Guardian RAK) with The National Company for Glass Industries (Zoujaj) of Saudi Arabia. Guardian RAK operated a 700-metric-ton-per-day-(t/d)-capacity float glass manufacturing plant located at Al Jazeera Al Hamra in Ras Al Khaimah. The \$150 million plant was dedicated in October 2008 (Guardian Float Glass L.L.C., 2010).

Sulfur.—Production of sulfur, which exceeded 2.1 Mt in 2009, could undergo a substantial increase if the plans to produce the sour gas reserves in the Bab, the Hail, and the Shah oilfields were to materialize. The presence of high levels of hydrogen sulfide (about 30%) in sour gas fields requires removal of hydrogen sulfide (known as sweetening) from the natural gas, which would result in capturing sulfur as a byproduct. This process, which would be the largest sulfur removal activity in the world, would require a specialized type of steel to store sour gas because of the damaging effect of the gas on regular steel pipes and storage containers. Adnoc estimated that its sulfur production as a byproduct of oil and gas operations could reach 7.1 Mt/yr by 2013. Dodsal PTE Ltd. of India completed a \$272 million contract to provide engineering, procurement, and construction services for expansion of the liquid sulfur production unit at the Ruwais refinery. Dodsal awarded Enersul Limited Partnership of Canada a contract to provide equipment for building two new sulfur granulation units and upgrading the existing facilities, as part of phase III of the Ruwais sulfur handling expansion project (Salisbury, 2010c).

Mineral Fuels and Other Sources of Energy

Coal.—In 2009, the construction of five coal-fired powerplants in the UAE were at different stages of execution. The powerplants would be located in the Emirates of Abu Dhabi, Ajman, Dubai, and Ras Al Khaimah. The Abu Dhabi National Energy Co. (Taqa) was conducting a study to build a 5,000-MW powerplant in Abu Dhabi, which would begin operations in May 2014. Another study was prepared to build a 5,000-MW coal-fired powerplant in Dubai. In 2009, MMC Corp. Bhd (MMC) of Malaysia began construction activity for the \$2 billion coal-fired powerplant in Ajman. The plant was expected to have the capacity to generate 1 gigawatt-hour per year of electricity and to commence production in 2012 (Carlisle, 2008).

Ras Al Khaimah Investment Authority (RAKIA), which was owned by the government of Ras Al Khaimah Emirate, awarded an engineering, procurement, and construction contract to MMC for the Emirate's first coal-fired IWPP to be built at Mina Saqr, which is located 110 kilometers (km) northeast of Dubai and 20 km from the border with Oman. The initial capacity of the plant would be 500 to 600 MW; this amount could increase to 4,000 MW in the final phase of the project (Maree, 2008).

In March, RAKIA announced a plan to build a second coal-fired powerplant in the Emirate in the next 2 years to meet its fast-growing demand for electricity. The plant would be built in two stages; the first stage would include a production unit that would have 400 to 500 MW of capacity. The second stage

included expanding the capacity to 1,000 MW within 5 years. Coal for the plant would be supplied from RAK Minerals and Metals Investments (RMMI)'s production share from a coal mine being developed by RMMI in Indonesia. RMMI's share in the joint venture of PT Trans Kutai Kencana, which was owned by PT Kutai Timur Envestama of Indonesia and RMMI, would amount to 15 Mt/yr in 2014. Ras Al-Khaimah uses coal-based power in cement factories and had a new plant in development (Carlisle, 2009).

Natural Gas.—Gasco operated onshore gas processing plants at Asab, Bab, Habshan, Buhasa, and Ruwais in the Emirate of Abu Dhabi. The company was owned by Adnoc (68% interest), Royal Dutch Shell plc of the Netherlands, and Total S.A. of France (15% interest each), and Partex Oil and Gas Group of Portugal (2% interest). Gasco moved forward with the engineering work needed to produce natural gas from sour gas present in the Shah field. The project involved building a gas gathering system, a gas processing facility, and a sulfur management system. In December, Gasco appointed WorleyParsons to manage the construction of gas processing and transport facilities as part of the work for upgrading the Asab gasfield and oilfield in southwestern Abu Dhabi (Salisbury, 2009c; Abu Dhabi Gas Industries Ltd., 2010).

In August, Gasco awarded contracts worth a total of \$9.2 billion for engineering, procurement, construction, and commissioning works for the integrated gas development projects to be built in Habshan and Ruwais. The works included construction of a processing plant, Ruwais' fourth natural gas liquids train, and storage tanks. The companies that received the contracts were a joint venture of JGC Corp. of Japan and Tecnimont S.p.A. of Italy (\$4.7 billion), Hyundai Engineering and Construction Co., Ltd. of the Republic of Korea (\$1.7 billion), Petrofac Ltd. of the United Kingdom (\$2.1 billion), and Chicago Bridge & Iron Company N.V. of the United States (\$530 million) (Arabian Oil and Gas, 2009).

Adnoc announced its intention to invest \$7 billion to increase natural gas production by 36%. The company, which produced 5.3 billion cubic meters per day in 2009, planned to increase its production to 7.2 billion cubic meters per day. Adnoc focused on the development of sour gas production at the Shah field by dividing the work needed into 10 engineering, procurement, and construction packages that included gas gathering and processing, transportation pipelines, and sulfur recovery and treatment (Salisbury, 2009b).

Although the UAE was the seventh ranked country in the world in terms of its natural gas reserves, the country imported about 16.5 billion cubic meters per year of natural gas from Qatar through the Dolphin Co. pipeline to meet the local demand for natural gas, for which the consumption exceeded the available supply. The Government agreed in principle with Iran for the delivery of 4 billion cubic meters per year of natural gas from offshore Iranian fields. The UAE was working on the construction of a new pipeline to supply gas to the consumption centers at the new power station on the east coast and other locations (Salisbury, 2009b).

In July, Adnoc and ConocoPhillips Co. of the United States signed an agreement to jointly develop the Shah gasfield. The agreement created a new company, Abu Dhabi Gas

Development Co. Ltd., to develop the Arab A, B, C & D sour gas reservoirs of the Shah field onshore Abu Dhabi. The Shah project 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 storing and shipping facility near the plant, and building sulfur-exporting structures at Ruwais Industrial Complex. The project aimed to produce 14.2 million cubic meters per day of network gas, 4,400 t/d of natural gas liquids (NGL), 33,000 barrels per day (bbl/d) of condensates, and 9,200 t/d of granulated sulfur by 2013. In April 2010, ConocoPhillips announced its withdrawal from the \$10 billion Shah Gas development project. The announcement came 4 months after the joint venture halted bids on construction contracts to build sulfur-handling facilities for the project. Conoco did not give a reason for exiting the project, which was a partnership of Adnoc (60% interest) and Conoco (40% interest) (Salisbury, 2009d, 2010b).

Nuclear Energy.—In December, the Emirates Nuclear Energy Corp. (ENEC) announced that it had chosen a consortium of companies led by Korea Electric Power Corp. (KEPCO) to design, build, and help operate four 1,400-MW nuclear reactors 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 value of the contract with KEPCO-led consortium was about \$20 billion, and the consortium expected to receive another \$20 billion by jointly operating the reactors for 60 years. The first reactor was expected to begin supplying electricity to the grid in 2017, and the other three reactors were expected to be completed in 2020 (Emirates Nuclear Energy Corp., 2009).

In May, Thani Holdings started Arabian Uranium Ventures to produce uranium from the Middle East and North Africa. The company was to supply uranium to the planned nuclear reactors in Egypt, Jordan, and the UAE (Bakr, 2009).

Petroleum.—Adco started a multibillion-dollar full-field development program for the Asab, the Bab, the Bida Al Qemzan, the Qusahwira, the Sahil, and the Shah fields. Adco planned to increase Abu Dhabi's onshore crude oil production capacity by 400,000 bbl/d to 1.8 Mbbbl/d by 2015. In September, Adco started CO₂ gas injection for the first time in the Middle East, with the aim of supporting the enhanced oil recovery process and reducing gas emissions. The project was implemented by Adnoc and Masdar. In August, Adma-Opco awarded an engineering and design (FEED) contract to develop the Nasr offshore field to Technip S.A. of France as part of a plan to increase offshore oil production capacity to 1.75 Mbbbl/d from 1.1 Mbbbl/d (MEED, 2009a; Salisbury, 2009a).

Takreer, which had a 490,000 bbl/d nameplate refining capacity at Abu Dhabi and Ruwais in 2009, pursued a \$10 billion plan to implement three large expansion projects for the Ruwais oil refinery. The company awarded a front-end FEED contract for Group III base-oil production facilities at the Ruwais refinery with a capacity of 500,000 t/yr of Group III base oil and 100,000 t/yr of Group II base oil. Group III base oils are advanced formula base oils used as lubricants for automotive engines. In May 2010, Takreer awarded a

\$463 million engineering, procurement, construction, and commissioning contract to Hyundai Engineering Co. Ltd. of the Republic of Korea for the Group III base-oil production facilities at the Ruwais refinery. The projects included installing a new 127,000 bbl/d fluid catalytic cracking unit (which would be the biggest unit in the world), a new lube oil production plant, and utilities (ABQ Zawya Ltd., 2010c).

International Petroleum Investment Co. (IPIC), which was owned by Abu Dhabi's government, planned to develop the petrochemical industry in Abu Dhabi by increasing its investment portfolio to \$20 billion from the current \$15 billion during the next 5 years. In February, the government of Abu Dhabi issued a decree to develop an international petrochemical complex (Chemaweya) by establishing a joint venture of IPCI (40%), Abu Dhabi Investment Council (40%), and Adnoc (20%). The first stage of the Chemaweya project included installing a 1.5-Mt/yr-capacity naphtha cracker and derivatives plant at Chemaweya Taweelah Chemicals Industrial City. The project was expected to cost about \$16 billion and would commence production in 2013-14 (Salisbury, 2010a).

Renewable Energy.—The construction of "Masdar City," which was the world's first neutral carbon and waste-free city and which was planned to be completely powered by renewable energy, moved forward in 2009 and was scheduled to be finished 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, desalinate seawater using reverse osmosis technology to produce 20 million to 25 million gallons 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 Emirates Steel Industries' steel rolling mill at Mussafah (up to 800,000 t/yr); the planned \$2 billion hydrogen powerplant joint venture with BP p.l.c. at Shuweihat; Emal's powerplant at Taweelah; and the independent water and powerplant at Taweelah. Masdar planned to capture and store 5 Mt/yr of carbon dioxide and sell it to Adnoc, which would inject it into its oilfields. The company, which began a project review in 2009, appointed Abengoa Solar S.A. of Spain and Total S.A. of France to develop the 100-MW concentrated solar powerplant, called Shams 1, in Abu Dhabi at a cost of \$600 million. Shams 1 was expected to start commercial operation in 2011. The groundbreaking on Masdar PV's first photovoltaic factory at Taweelah, Abu Dhabi, was delayed because the promised legislation to give financial support to the project had not yet been issued, which, in turn, prevented the creation of a viable market for solar panels (ABQ Zawya Ltd., 2010a; Stanton, 2010).

Outlook

The economy of the UAE is expected to grow at a faster pace than that of 2009 in the next 5 years despite Dubai's default debt problems and the bursting of the real estate bubble. The government of Abu Dhabi is likely to continue to invest in the hydrocarbon sector to increase the production lifetime of its gas and oil reserves, especially in the production of natural gas from the sour gas reserves present in the Shah field. Abu Dhabi

will also likely continue to invest in alternative sources of energy, such as solar, hydrogen, and wind energy. Production of primary aluminum is expected to increase to 1.75 Mt/yr in 2011 and to 2.50 Mt/yr when the construction of the first and second phase of Emal is completed. Iron and steel production by ESI is expected to reach 5 Mt/yr by 2013. Additional increases are expected in the production of crude oil, float glass, natural gas, nitrogen fertilizer, and sulfur.

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TABLE 1
UNITED ARAB EMIRATES: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity ²	2005	2006	2007	2008	2009
METALS					
Aluminum, primary	722	861	890	945 ^r	955
Chromite ore	(3)	(3)	19	34	24
Steel, crude	90	90	90	100	100
INDUSTRIAL MINERALS					
Cement, hydraulic	10,000	11,000	12,000	21,885 ^r	18,997
Gypsum ^e	40 ^r	40 ^r	40 ^r	40 ^r	40
Lime ^e	50	60	60	120 ^r	120
Nitrogen:					
N content of ammonia	360	380	380	380	380
N content of urea	260	270	270	284 ^r	284
Stone, crushed	NA	NA	NA	150,000	150,000
Sulfur ⁴	1,950	1,950	1,950	2,175	2,175
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross					
million cubic meters	70,470	76,194	78,963	80,550	75,840
Dry					
do.	47,790	48,790	50,290	50,240	48,800
Natural gas plant liquids					
thousand 42-gallon barrels	146,000	146,000 ^r	91,000 ^r	91,000 ^r	91,000
Petroleum:					
Crude					
do.	868,000	937,000	923,000 ^r	939,000 ^r	818,000
Refinery products:					
Liquefied petroleum gas					
do.	1,600	1,600	2,000	3,600	5,800
Gasoline					
do.	16,000	22,000	20,000	18,000	16,000
Kerosene and jet fuel					
do.	41,000 ^r	40,000 ^r	31,000 ^r	37,000 ^r	42,000
Distillate fuels					
do.	25,000 ^r	27,000 ^r	20,000 ^r	28,000 ^r	32,000
Residual fuels					
do.	7,000 ^r	5,000 ^r	2,000 ^r	5,000 ^r	7,000
Other					
do.	36,400 ^r	25,400 ^r	23,000 ^r	30,400 ^r	37,200
Total					
do.	127,000 ^r	121,000 ^r	98,000 ^r	122,000 ^r	140,000

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

NA Not available.

¹Table includes data available through November 30, 2010.

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

³Negligible or no production.

⁴Byproduct of petroleum refining and natural gas processing.

TABLE 2
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2009

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Dubai Aluminium Company Ltd. (Dubal) (Investment Corp. of Dubai, 100%)	Jebel Ali, Dubai	950
Do.		Emirates Aluminium Co. (Emal) [Dubai Aluminium Company Ltd. (Dubal), 50% and Mubadala Development Co., 50%]	Taweelah, Abu Dhabi	700 ¹
Cement:				
Portland		Gulf Cement Co. (National Investments Co. of Kuwait, 27%, and Government of Ras Al Khaimah, 8%)	Khor Khuwair, Ras Al Khaimah	3,800
Do.		Sharjah Cement and Industrial Development Co. (private, 70%, and Government of Sharjah, 30%)	Sharjah	3,000
Do.		National Cement Company P.S.C.	Dubai	1,500
Do.		National Cement Factory	Abu Dhabi	2,500
Do.		Union Cement Co. (Government of Ras Al Khaimah, 41%, and Abu Dhabi Investment Authority, 20%)	Khor Khuwair, Ras Al Khaimah	4,800
Do.		Fujairah Cement Industries P.S.C.	Dibba, Fujairah	4,600
Do.		Emirates Cement Factory (General Holding Corp.)	Al-Ain, Abu Dhabi	2,200
Do.		Ras Al Khaimah Cement Co. P.S.C.	Khor Khuwair, Ras Al Khaimah	5,700
Do.		Arabian Gulf Cement Company LLC	Ajman	900
Do.		Jebel Ali Cement Co. (Sharaf Industries, 100%)	Jebel Ali, Dubai	840
Do.		Umm al-Qaywayn Cement Industries Co. P.S.C.	Umm al-Quwain	1,600
White		Ras Al Khaimah Company for White Cement and Construction Materials	Ras Al Khaimah	500
Gold, refined	metric tons	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
Iron and steel:				
Iron, direct-reduced		Emirates Steel Industries (ESI)	Abu Dhabi	1,600 ^P
Do.		Al Nasser Industrial Enterprises LLC	do.	250 ^P
Steel:				
Billet		Emirates Steel Industries (ESI)	do.	1,500 ^P
Do.		Al Nasser Industrial Enterprises LLC	do.	220 ^P
Wire rod		Emirates Steel Industries (ESI)	do.	480 ^P
Rebar		do.	do.	620 ^P
Do.		Alam Steel	Dubai	500
Do.		Al Nasser Industrial Enterprises LLC	Abu Dhabi	90 ^P
Do.		Essar Steel-India	Hamriyah Free Zone, Sharjah	1,000 ^P
Do.		Hamriyah Steel FZC (Metalloinvest and Sheikh Sultan Bin Khalifa Al Nahyan)	do.	1,000 ^P
Do.		Union Iron & Steel Company LLC	Abu Dhabi	500 ^P
Do.		Conares Metal Supply Ltd.	Dubai	400 ^P
Do.		Star Steel International LLC	Jebel Ali, Dubai; Hamriyah Free Zone, Sharjah	360 ^P
Natural gas, liquefied		Abu Dhabi Gas Liquefaction Company Ltd. (Adgas)	Das Island	5,149
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, the 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

See footnotes at end of table.

TABLE 2—Continued
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2009

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum—Continued				
Crude—Continued	thousand 42-gallon barrels per day	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 Co. (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
Refined products	do.	Abu Dhabi Oil Refining Co. (Takreer) [Abu Dhabi National Oil Co. (Adnoc), 100%]	Ruwais refinery, Ruwais, Abu Dhabi	350
Do.	do.	Emirates National Oil Company Ltd. (Investment Corp. of Dubai, 100%)	Jebel Ali refinery, Jebel Ali, Dubai	120
Do.	do.	Abu Dhabi Oil Refining Co. (Takreer) [Abu Dhabi National Oil Co. (Adnoc), 100%]	Abu Dhabi refinery, Umm Al Nar, Abu Dhabi	150
Do.	do.	Sharjah Oil Refining Co. F.Z.C. (FAL Group, 100%)	Sharjah refinery, Hamriyah Free Trade Zone	71
Do.	do.	Inactive refinery, formerly operated by Metro Oil Corp.	Fujairah	90
Salt		Alghaith Industries (Al Ghaith Holding PJSC)	Mussafah, Abu Dhabi	110
Silica, glass	metric tons	Guardian Zoujaj International Float Glass Co. LLC (Guardian RAK)	Ras Al Khaimah	255,500
Do.	do.	Emirates Float Glass LLC (Dubai Investment PJSC, 100%)	Industrial City 1 and 2, Abu Dhabi	440,000
Silver, refined	do.	Emirates Gold (private, 100%)	Dubai	100

^pPreliminary. Do., do. Ditto.

¹Production begins in 2010