



# 2010 Minerals Yearbook

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UNITED ARAB EMIRATES

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# THE MINERAL INDUSTRY OF THE UNITED ARAB EMIRATES

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In 2010, the United Arab Emirates (UAE)<sup>1</sup> was the world's eighth ranked producer of crude oil and accounted for 3.3% of world crude oil production. The UAE held 97.8 billion barrels of proved crude oil reserves, or 7.1% of the world's total reserves. The country was responsible for 1.6% of the world's supply of natural gas; it held 6.0 trillion cubic meters of proved natural gas reserves, or 3.2% of the world's total, and was ranked seventh in the world in terms of the size of its proved natural gas reserves. The UAE was one of the world's top suppliers of aluminum foundry alloy, extrusion billet, and high-purity aluminum to more than 45 countries in Africa, Asia, Europe, and North America and accounted for about 3.4% of the world's aluminum smelter output. In addition, the UAE produced cement, gypsum, lime, nitrogen fertilizer, refined petroleum products, sand, steel, and sulfur (BP p.l.c., 2011, p. 6, 8, 20, 22; Bray, 2011; Dubai Aluminium Company Ltd., 2011).

## Government Policies and Programs

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 its gross domestic product (GDP) would come from nonoil economic activity. Abu Dhabi identified metals as one of 12 engines for its future growth and embarked on producing advanced materials, aluminum, iron and steel, and other base metals. Abu Dhabi, which does not have significant ore reserves of any metals, 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 oil and gas development projects aimed at increasing the volume of its crude oil production capacity to 3.5 million barrels per day (Mbb/d) and natural gas production capacity to 198 million cubic meters per day by the end of 2018. Abu Dhabi produced 2.39 Mbb/d of crude oil and 148.7 million cubic meters per day of natural gas in 2010 (International Monetary Fund, 2011b, p. 48; Salisbury, 2011).

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), which was established in December 2009, 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. The United States signed a civilian nuclear cooperation agreement with the UAE in December 2009. In April, the U.S. Department of Energy signed a memorandum of understanding with Masdar

(also known as Abu Dhabi Alternative Energy Co.) to advance cooperation on clean and sustainable energy technologies (Masdar, 2010; Emirates Nuclear Energy Corp., 2011).

## Minerals in the National Economy

In 2010, the UAE's economy grew at a rate of 3.2% in real terms compared with a contraction of 3.2% (revised) in 2009. The economic growth in 2010 was attributable to the increase in world oil prices and to the ongoing worldwide recovery from the adverse effects of the global financial crisis in 2008–9. The value of hydrocarbon production increased by about 20% compared with a decrease of 33% (revised) in 2009, and the value of activity in the nonhydrocarbon sector increased by 6% compared with an increase of 3% in 2009. The contribution of the crude oil and natural gas sectors increased to 31.5% of the GDP in 2010 from 28.9% of the GDP in 2009. The share of nonfuel mining averaged 0.15% of the GDP from 2005 through 2010. The contribution of the manufacturing sector, which included aluminum, fertilizer, and iron and steel production, increased to about 24% of the GDP in 2009 and 2010 from 21% of the GDP in 2008. The construction sector's contribution to the GDP decreased slightly to 11.6% from 11.8% in 2009. Notwithstanding the sharp decline in real estate and building activity, the construction sector in the UAE grew by 8.5% to \$34.6 billion in 2010 from a revised \$31.9 billion in 2009 (International Monetary Fund, 2011a, p. 74; b, p. 46, 48).

The inflow of foreign direct investment (FDI) to the UAE decreased slightly, by about 1% to \$3,948 million in 2010 from \$4,002 million in 2009. The outflow of FDI from the UAE to the rest of the world decreased by 26% to \$2.0 billion in 2010 from \$2.7 billion in 2009 and by 87% from \$15.8 billion in 2008 (Arab Investment and Export Credit Guarantee Corp., 2011, p. 245).

## Production

Crude steel production increased by 1,080% compared with that of 2009. The increase was attributable to the commissioning of Emirates Steel's plant at Mussafah, Abu Dhabi. Aluminum production increased by 47% in 2010 compared with that of 2009 owing to the commissioning of Emal's aluminum smelter at the Khalifa Port and Industrial Zone (KPIZ). Crude oil production increased by about 3.6% compared with a decrease of about 11% in 2009. Urea production increased by 11% compared with that of 2009. Sulfur production decreased by 19% compared with that of 2009. No production of chromite was reported in 2010 (table 1).

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

## 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., 2011a).

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. Ltd. (Emal). Emal operated 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 had 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. Adbic 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. RAK Minerals and Metals Investments, which was a subsidiary of Ras Al Khaimah Investment Authority, invested in mineral production locally and abroad (Abu Dhabi Basic Industries Corp., 2010; Dubai Cable Company (Pty) Ltd., 2010; RAK Minerals and Metals Investments, 2010).

Masdar (a subsidiary of Mubadala) was created as a global company to find solutions to problems related to climate change, energy security, and sustainable energy. Masdar comprised five business units—a carbon unit, Masdar City, Masdar Institute, a

power unit, and a venture capital unit. Masdar teamed up with such academic and business organizations 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, 2011).

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 2010, Abu Dhabi's installed electricity generating capacity was 12,100 MW, and its estimated additional capacity requirements by 2019 were 14,735 MW (Redfern, 2011, p. 18).

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 2010, Dwea had an installed electricity generating capacity of 7,361 MW, and it was estimated that it would require an additional 7,843 MW by 2019 (Redfern, 2011, p. 18).

## Mineral Trade

In 2010, 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 \$220 billion and accounted for 1.44% of the world's total goods exports. The country was ranked 26th (16th when excluding intra-European trade) in the world in terms of the value of its imports of goods, which totaled \$160 billion and accounted for 1.04% of the world's total goods imports (World Trade Organization, 2011).

Fuel and mining product exports increased by 12% to \$66.8 billion in 2010 from \$59.6 billion in 2009. Fuel and mining product exports accounted for 30% of total exports compared with 31% of total exports in 2009. 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 \$79.94 per barrel in 2010 compared with \$63.78 in 2009. The value of natural gas exports increased to \$10.7 billion from \$8.6 billion in 2009. The value of nonhydrocarbon exports increased by 21.6% to \$53.5 billion from \$44.0 billion in 2009. The value of reexports, which was estimated to be between 40% and 70% of the UAE's total imports, increased by 13.4% to \$90.8 billion from \$80.1 billion in 2009 (International Monetary Fund, 2011b, p. 66).

The UAE was the leading export market for the United States in the Middle East in 2010. 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 \$11.5 billion, 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. Census Bureau, 2011).

Dubai Diamond Exchange (DDE), which was a subsidiary of Dubai Multi Commodities Centre (DMCC), was the leading

diamond trade center in the world. The value of the diamond trade at DDE in 2010, which included both rough and polished diamond trade, was almost double that of 2009 and amounted to \$35.1 billion compared with \$17.9 billion. The volume of the UAE's diamond trade increased by 51% to 268.7 million carats from 178.1 million carats in 2009. The country exported 73.6 million carats of polished diamond valued at \$14.6 billion in 2010 and imported 90 million carats of polished diamond valued at about \$13.3 billion. The UAE imported 50.4 million carats of rough diamond and exported 54.7 million carats. The UAE's top diamond trade partners included India, Belgium, Hong Kong, and Switzerland, and the remaining trading partners were Angola and the Democratic Republic of Congo [Congo (Kinshasa)] (Dubai Multi Commodities Center Authority, 2011a).

The value of gold trade at the Dubai Gold Center in 2010 was \$41.3 billion, which was 18% more than the value in 2009 of \$35 billion. In 2010, the volume of gold imports increased to 707 metric tons (t) from 576 t in 2009. The volume of gold exports increased to 418 t from 403 t in 2009. India remained Dubai's leading gold trading partner (Dubai Multi Commodities Center Authority, 2011b).

Dubai aluminum products exports included foundry alloy, extrusion billet, and high-purity aluminum to more than 45 countries in Asia (37%), Gulf Cooperation Council countries (23%), Europe (20%), Africa and the Middle East (12%), and North America (8%). These exports accounted for about 2.6% of the world's aluminum smelter output in 2009 (Dubai Aluminium Company Ltd., 2011).

## Commodity Review

### Metals

**Aluminum.**—In 2010, aluminum production in the UAE took place at Dubai's and Emal's smelters. Dubai's smelter produced more than 1 million metric tons (Mt) of hot metal compared with 955,000 t in 2009 whereas the output of Emal's smelter was estimated to be 400,000 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 1.93 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., 2011).

Emal completed the first phase of the construction of its 1.4-Mt/yr aluminum smelter at the KPIZ. Production at the smelter began in January, and full production of 750,000 t/yr was achieved in December. Emal's aluminum products included a mix of extrusion billet, sheet ingot, sow, standard ingot, and tee ingot. In the second phase of the project, Emal planned to increase its production capacity to 1.5 Mt/yr, which would make Emal's smelter the most productive and most efficient single-site aluminum smelter complex in the world. The complex would include an anode rodding shop, a green carbon plant, and a 2,000-MW-capacity powerplant. Adnoc guaranteed to supply natural gas for Emal's smelter for 30 years (Emirate Aluminium Co. Ltd., 2011).

A joint venture of Adbic and Midal Cables of Bahrain began building a \$100 million aluminum plant at the KPIZ in the first quarter of 2010. The plant, which would begin operations in the second quarter of 2011, 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 \$200 million aluminum extrusion plant at Taweelah that would have a production capacity of 50,000 t/yr 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 (MEED 2010; Abu Dhabi Basic Industries Corp., 2011).

**Iron and Steel.**—In 2010, Emirates Steel completed the phase 1 expansion project of its integrated steel complex in Abu Dhabi Industrial City at Taweelah at a cost of \$810 million. The complex included a 1.6-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, a 620,000-t/yr rebar rolling mill, and a 480,000-t/yr wire coil and rod rolling mill. Emirates Steel embarked on constructing the phase 2 expansion plan was expected to cost \$1.5 billion to build and be would completed in 2012. The project would also include a 1.6-Mt/yr direct-reduction plant, a 1.4-Mt/yr steel melt plant with 150-metric-ton-per-heat-capacity 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, 2011).

In January, Hamriyah Steel FZC, which was a joint venture of Metalloinvest of Russia (80%) and Sheikh Sultan bin Khalifa Al Nahyan (20%), commenced initial production at its steel rebar plant in Sharjah. The plant produced 365,000 t/yr of rebar and was expected to reach full capacity of 1 Mt/yr in February 2011. SMS Meer GmbH of Germany built the rebar mill, and Metalloinvest supplied the feedstock for rebar production from Russia. The company sold steel rebar within the UAE and in neighboring Saudi Arabia. Hamriyah Steel expected to export output to Iraq once its plant became operative at full capacity. 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 (Steel Guru, 2010; Hamriyah Steel FZC, 2011).

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 400,000-t/yr-capacity rebar mill supplied by Siemens VAI in the Musaffah 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. In August, Gulf Sponge Iron Co. L.L.C. (another subsidiary of ANIE) completed the construction of a DRI plant with an installed capacity of 250,000 t/yr. The plant included a reactor, a process gas heater, a carbon dioxide (CO<sub>2</sub>) removal system, a process gas compressor, a cement coating

plant, and utility systems (Al Nasser Industrial Enterprises L.L.C., 2011).

In November, Union Iron and Steel LLC put its 300,000-t/yr reinforcing steel bar plant at Mussafah Industrial City in Abu Dhabi up for sale owing to reduced demand for steel and increased competition with government-owned steel companies (such as Emirates Steel). The plant had been producing rebar from imported billet during the past 3 years (Baxter, 2010, p. 10).

### *Industrial Minerals*

**Cement.**—Several cement production projects were either delayed or put on hold because of the market conditions in the country where the production capacity of existing cement plants exceeded the rates of local consumption. These projects included the installation of a new \$400 million 3.5-Mt/yr-capacity cement plant in the Emirate of Fujairah by JK Cement Ltd. of India; a \$272 million Habbab cement plant by Sharaf Group; a \$193 million expansion plan at the Jebel Ali cement plant; a \$136 million Hamriyah cement plant by Al Ruya Cement Co.; and a cement sulfate plant in Abu Dhabi by Al Qudra Holding and Nippon Oil Corp. of Japan (Zawya, 2011).

**Nitrogen.**—Ruwais Fertilizer Industries Ltd. (Fertil), which had the capacity to produce 800,000 t/yr of urea and 460,000 t/yr of ammonia in 2010, had been expanding its ammonia and urea complex at the Ruwais refinery. Samsung Engineering and Construction Co. Ltd. of the Republic of Korea was building the expansion project, which was also known as Fertil 2. When completed in 2013, Fertil 2 would increase the company's capacity to 2 Mt/yr of granulated urea (Abu Dhabi National Oil Co., 2011b).

**Silica.**—Emirates Float Glass LLC (EFG), which was a subsidiary of Glass L.L.C. (the glass arm of Dubai Investments PJSC), and which operated a 600-metric-ton-per-day (t/d)-capacity molten glass plant in the Industrial City of Abu Dhabi, delayed its plan to build a second float glass plant in Abu Dhabi. EFG had announced in 2009 a plan to invest about \$545 million in the next 4 to 5 years under the sponsorship of Glass L.L.C. to reach a capacity 160,000 t/yr of glass products (Emirates Float Glass L.L.C., 2009; Zawya 2011).

**Sulfur.**—Production of sulfur, which amounted to 1.75 Mt in 2010, was expected to increase by more than threefold following the completion of sour gas production from the Bab, the Hail, and the Shah oilfields by 2015. 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 of 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 capacity as a byproduct of oil and gas operations would exceed 7 Mt/yr by 2015 (Salisbury, 2010b; Arab Fertilizers Association, 2011).

### *Mineral Fuels and Other Sources of Energy*

**Coal.**—The project to build a \$2 billion coal-fired powerplant in Ajman by MMC Corp. Bhd (MMC) of Malaysia to generate

1 gigawatt-hour per year of electricity, which had been expected to commence production in 2012, was cancelled in 2009. Similarly, the plan by Ras Al Khaimah Emirate to build its first coal-fired independent water and powerplant at Mina Saqr was also cancelled (Zawya, 2011).

**Natural Gas.**—Although the UAE was the seventh ranked country in the world in terms of its natural gas reserves, the country was facing a challenging task of supplying sufficient quantities of natural gas to meet the increased demand of the local market, which used natural gas as a feedstock for powerplants and for aluminum, fertilizer, and other petrochemical industries. In September, Dubai received its first liquefied natural gas from Qatar in addition to about 16.5 billion cubic meters per year of natural gas that the UAE imported from Qatar through the Dolphin Co. pipeline (Niell, 2010).

Gasco 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 project was expected to cost \$7 billion to build and to be completed in 2013. It would process gas received from the Umm Shaif field at the Habshan and Ruwais facilities, which would include a natural gas liquids (NGL) train with the capacity to produce 27,000 t/d of NGL and liquefied petroleum gas (LPG) (U.S. Energy Information Administration, 2011; Zawya, 2011).

In April, ConocoPhillips Co. 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. ConocoPhillips did not give a reason for exiting the project. In January 2011, Adnoc created a joint venture with Occidental Petroleum Corp. of the United States to develop gas production from the Shah field. Occidental would own a 40% equity share in the project, and Adnoc would own the remaining 60%. 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 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 (Salisbury, 2010a; Mirza, 2011).

**Nuclear Energy.**—In December, the Emirates Nuclear Energy Corp. applied for a construction license to build the country's first nuclear powerplants (Braka 1 and Braka 2), which would be located in the western area of the Emirate of Abu Dhabi. Initial foundation and geochemical work started in April by a consortium of companies led by Korea Electric Power Corp. (KEPCO) that was awarded contracts 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, 2010).

**Petroleum.**—In November, Sharjah Emirate, which was the third largest emirate in the UAE in terms of area, created Sharjah National Oil Corp. The new government-owned but financially independent company took over Crescent Petroleum operations in the Saja field concession, and was expected to carry out new operations in downstream and upstream markets in Sharjah Emirate.

Adco planned to increase Abu Dhabi's onshore crude oil production capacity by 400,000 bbl/d to 1.8 Mbbbl/d by 2015. The company was implementing a multibillion-dollar full-field development program for the Asab, the Bab, the Bida Al Qemzan, the Qusahwira, the Sahil, and the Shah fields (Salisbury, 2011).

The UAE, which had a 780,000 barrel total installed refining capacity in 2010, pursued a \$10 billion plan to implement three large expansion projects for the Ruwais oil refinery. Takreer awarded a front-end and engineering design (FEED) contract for Group III base oils 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, Takreer awarded a \$463 million engineering, procurement, construction, and commissioning contract to Hyundai Engineering Co. Ltd. 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 (Zawya, 2010b).

International Petroleum Investment Co. (IPIC), which was owned by the government Abu Dhabi, 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 4 years. The joint venture of IPCI (40%), Abu Dhabi Investment Council (40%), and Adnoc (20%), which was created in 2009, was building the first stage of the Chemaweya plant. The project involved the installation of a 1.5-Mt/yr-capacity naphtha cracker and derivatives plant at Chemaweya Taweelah Chemicals Industrial City. The plant would cost about \$16 billion to build and would commence production in 2013–14 (Salisbury, 2010a).

**Renewable Energy.**—The Masdar renewable energy initiative moved forward in 2010 and 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, 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 (1) Emirates Steel Industries' steel rolling mill at Mussafah (up to 800,000 t/yr); (2) the planned \$2 billion hydrogen powerplant joint venture with BP p.l.c. at Shuweihat; (3) Emal's powerplant at Taweelah; and (4) 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. Abengoa Solar S.A. of Spain and Total S.A. of France were building a 100-MW-capacity concentrated solar powerplant, called Shams 1, for Masdar in Abu Dhabi at a cost of \$600 million. Shams 1 was expected to start commercial operation in the summer of 2012. Masdar PV's first photovoltaic plant at Taweelah was delayed because of a weak market for solar panels in the Middle East but Masdar confirmed its commitment to the proposed plant (Stanton, 2010; Zawya, 2010a).

## Outlook

The economy of the UAE is projected to grow at a modest rate of more than 3% in the next 5 years. The government of Abu Dhabi planned to invest \$60 billion in the next 5 years 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 nuclear and renewable energy sources and technologies. Production of primary aluminum in the UAE is expected to increase to about 1.80 Mt/yr in 2011 and to 2.50 Mt/yr when the construction of Emal's phase 2 expansion project is completed, which would rank the country fifth in the world in terms of aluminum production capacity. Iron and steel production by Emirates Steel is expected to reach 5 Mt/yr by 2013. Additional increases are expected in the production of crude oil, natural gas, sulfur, and urea.

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TABLE 1  
UNITED ARAB EMIRATES: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Thousand metric tons unless otherwise specified)

Commodity <sup>2</sup>	2006	2007	2008	2009	2010	
<b>METALS</b>						
Aluminum, primary	861	890	945	955	1,400	
Chromite ore	(3)	19	34	24	(3)	
Iron and steel:						
Direct-reduced iron	--	--	--	--	1,180	
Steel, crude <sup>e</sup>	90	90	100	100	100	
<b>INDUSTRIAL MINERALS</b>						
Cement, hydraulic	13,000 <sup>r</sup>	16,000 <sup>r</sup>	21,885	18,997	18,000	
Gypsum <sup>c</sup>	40	40	40	40	40	
Lime <sup>c</sup>	60	60	120	120	120	
Nitrogen:						
N content of ammonia	380	380	380	380	392	
N content of urea	270	270	284	284	316	
Stone, crushed <sup>c</sup>	NA	NA	150,000	150,000	150,000	
Sulfur <sup>4</sup>	1,950	1,950	2,175	2,175	1,763	
<b>MINERAL FUELS AND RELATED MATERIALS</b>						
Gas, natural:						
Gross	million cubic meters	76,194	78,963	80,550	75,840	75,840
Dry	do.	48,790	50,290	50,240	48,800	51,300
Natural gas plant liquids	thousand 42-gallon barrels	146,000	91,000	91,000	91,000	91,000
Petroleum:						
Crude	do.	1,149,000 <sup>r</sup>	1,114,000 <sup>r</sup>	1,127,000 <sup>r</sup>	1,004,000 <sup>r</sup>	1,040,000
Refinery products						
Liquefied petroleum gas	do.	2,000 <sup>r</sup>	2,000	4,000 <sup>r</sup>	6,000 <sup>r</sup>	7,000
Gasoline	do.	22,000	20,000	18,000	16,000	18,000
Kerosene and jet fuel	do.	40,000	31,000	37,000	42,000	45,000
Distillate fuels	do.	27,000	20,000	28,000	32,300	35,000
Residual fuels	do.	5,000	2,000	5,000	7,000	6,000
Other	do.	24,000 <sup>r</sup>	24,000 <sup>r</sup>	30,000 <sup>r</sup>	36,100 <sup>r</sup>	43,000
Total	do.	120,000 <sup>r</sup>	99,000 <sup>r</sup>	122,000 <sup>r</sup>	139,400 <sup>r</sup>	154,200

<sup>c</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>r</sup>Revised. do. Ditto. NA Not available. -- Zero.

<sup>1</sup>Table includes data available through December 31, 2011.

<sup>2</sup>In addition to the commodities listed, 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.

<sup>3</sup>Negligible or no production.

<sup>4</sup>Byproduct of petroleum refining and natural gas processing.



TABLE 2  
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(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%]	Taweelah, Abu Dhabi Khalifa Port and Industrial Zone (KPIZ)	750
<b>Cement:</b>				
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
<b>Iron and steel:</b>				
Iron, direct-reduced		Emirates Steel	Abu Dhabi	1,600
Do.		Al Nasser Industrial Enterprises LLC	do.	250
<b>Steel:</b>				
Billet		Emirates Steel	do.	1,500
Do.		Al Nasser Industrial Enterprises LLC	do.	220
Wire rod		Emirates Steel	do.	480
Rebar		do.	do.	620
Do.		Alam Steel	Dubai	500
Do.		Al Nasser Industrial Enterprises LLC	Abu Dhabi	90
Do.		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
Natural gas, liquefied		Abu Dhabi Gas Liquefaction Company Ltd. (Adgas)	Das Island	5,149
<b>Nitrogen:</b>				
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

See footnotes at end of table.

TABLE 2—Continued  
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
<b>Petroleum:</b>				
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 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
Sulfur	thousand metric tons	Abu Dhabi National Oil Co. (Adnoc)	Abu Dhabi	1,800
Do., do. Ditto.				