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The Mineral Industry of Saudi Arabia

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In 2016, Saudi Arabia supplied the world with aluminum, ammonia, copper concentrates, crude petroleum and refined petroleum products, gold, phosphate-based fertilizers, silver, sulfur, urea, and zinc. The country was the world's third-ranked producer of direct-reduced iron (DRI) after India and Iran, according to Midrex Technologies Inc. statistics, and was among the world's top 10 producers of ammonia, bauxite, cement, clinker, phosphate rock, pumice, and sulfur. In 2016, Saudi Arabia also produced bauxite and alumina, cement, dolomite, feldspar, granite, gypsum, iron and steel, kaolin, limestone, magnesite, marble, natural gas, nitrogen, phosphate rock, pozzolan, refined petroleum products, sand and gravel, schist, silica sand, and talc for domestic consumption (table 1; Midrex Technologies Inc., 2017, p. 3; Apodaca, 2018a, b; Bray, 2018; Crangle, 2018; Jasinski, 2018; van Oss, 2018).

Saudi Arabia was the world's second-ranked producer of crude petroleum after the United States in 2016 and, as of yearend, the country held the world's second largest proven crude petroleum reserves, after Venezuela, or 266.5 billion barrels, which was 15.6% of the world's total. Saudi Arabia was the world's seventh-ranked producer of natural gas and the sixth-ranked country in terms of proven natural gas reserves; it held 8.4 trillion cubic meters of proven natural gas reserves, which was 4.5% of the world's total in 2016 (BP p.l.c., 2017, p. 10, 12, 14, 26).

Saudi Arabia was the leading economy in the Middle East and North Africa region and the world's 20th-ranked economy in terms of the value of its nominal gross domestic product (GDP). The country's GDP increased in real terms by 1.7% in 2016 compared with an increase of 4.1% (revised) in 2015 (Saudi Arabian Monetary Authority, 2017).

Minerals in the National Economy

The contribution of the mining and quarrying sector, which included crude petroleum and natural gas and other minerals, to the GDP at current (2016) prices decreased to 22.3% in 2016 from 25.7% in 2015. The contribution of the manufacturing sector, which included aluminum, electricity, fertilizer, natural gas processing, petroleum refining, and steel production, was 12.9% of the GDP, and that of the construction sector was 6.6% of the GDP (Saudi Arabian Monetary Authority, 2017).

Government Policies and Programs

Royal Decree No. 47 M (the mining investment code) of October 4, 2004, regulates the mining and quarrying industry in Saudi Arabia. The Deputy Ministry of Mineral Resources (DMR), which is an agency within the Ministry of Energy, Industry, and Mineral Resources (MEIMR), supervises the country's mining activities, promotes investments, provides services, and issues mining licenses and concessions in the country. The MEIMR manages the petroleum sector in the country through Saudi Arabian Oil Co. (Saudi Aramco) and its subsidiaries. In 2016, the DMR issued licenses for mineral exploration, for reconnaissance, and for four types of mining—building materials quarrying, mining, raw materials quarrying, and small-scale mining. The mining investment code allows for the granting of mining rights to corporations and individuals and for transferring them to other persons with technical and financial competence and expertise. In 2016, the DMR issued 2,141 mining licenses, of which 1,423 were for building materials quarrying; 552 were for exploration; 96 were for the mining of copper, gold, and zinc ores, and industrial minerals, such as clay, dolomite, iron, and schist; and 70 were for small-scale mining (International Mining, 2012; General Authority of Statistics, 2017; Ministry of Energy, Industry, and Mineral Resources, 2017).

Production

Notable increases in Saudi Arabia's mineral commodity production in 2016 compared with that of 2015 included bauxite, which increased by 140%; alumina, by 69%; gold, by 37%; sulfur, by 22%; urea, by 20%; ethane, by 16%; coke, by 15%; and gasoline, by 12%. The increase in bauxite output was attributed to the first full year of metallurgical bauxite production at the Al Ba'itha Mine, and the substantial increase in alumina was the result of the ramping up of production at the Ras Al Khair alumina refinery. The increase in gold output was mainly attributed to the first full year of production at the Ad Duwayhi Mine. Output of marble blocks decreased by 45% in 2016 compared with that of 2015; kerosene, by 39%; naphtha, by 32%; sand, by 30%; magnesite, by 27%; liquefied petroleum gas, by 24%; asphalt, by 18%; kaolin, by 12%; and hydraulic cement, by 10%. The significant decrease in cement production was owing to weak domestic demand caused by slow activity in the country's building and construction sector. Data on mineral production are in table 1.

Structure of the Mineral Industry

In 2016, the Government was the sole owner of Saudi Aramco and had a majority interest in several companies that operated in the mineral fuels sector. The Government played a significant role in supporting the private mineral sector through the Public Investment Fund and the Saudi Industrial Development Fund. Major mining companies that operated in Saudi Arabia in 2016 included Al Masane Al Kobra Mining Co. (AMAK), Al-Ittefaq Group, Saudi Arabian Mining Co. (Ma'aden), Saudi Basic Industries Corp. (SABIC), and United Arabian Mining Co. (Manajem) as well as 15 private cement companies. Table 2 is a list of major mineral industry facilities.

Ma'aden, a joint stock company, was owned by the Public Investment Fund (50%), General Organization for Social Insurance (9.6%), Public Pension Agency (7.45%), and private

investors (32.95%). The company produced, through its subsidiaries and joint ventures, alumina, aluminum, ammonia, copper, gold, kaolin, metallurgical- and low-grade bauxite, magnesite, phosphate rock and phosphate-based fertilizers, silver, and zinc. Ma'aden subsidiaries included three wholly owned companies: Ma'aden Infrastructure Co. (MIC), Industrial Minerals Co. (IMC), and Ma'aden Gold and Base Metals Co. (MGBM). Ma'aden Aluminum Co. (MAC), Ma'aden Bauxite and Alumina Co. (MBAC), and Ma'aden Rolling Co. (MRC) were joint ventures between Ma'aden (74.9%), and Alcoa Inc. of the United States (25.1%). Ma'aden Phosphate Co. (MPC) was a joint venture of Ma'aden (70%) and SABIC (30%). Ma'aden Wa'ad Al-Shamal Phosphate Co. (MWSPC) was a joint venture of Ma'aden (60%), Mosaic Co. of the United States (25%), and SABIC (15%). Ma'aden Barrick Copper Co. (MBCC) was a 50−50 joint venture of Ma'aden and Barrick Gold Corp. of Canada (table 2; Saudi Arabian Mining Co., 2017, p. 44).

Mineral Trade

In 2016, the value of Saudi Arabia's total exports decreased by 9% to $184 billion from $202 billion in 2015. The decrease was attributed to the decline in crude petroleum prices on world markets, which averaged $40.96 per barrel for Saudi Arabia in 2016 compared with $49.85 per barrel in 2015. The value of Saudi Arabia's crude petroleum exports decreased to $136 billion in 2016 from $152 billion in 2015 (Organization of the Petroleum Exporting Countries, 2017, p. 98).

Saudi Arabia's crude petroleum exports averaged 7.5 million barrels per day (Mbbl/d) in 2016 compared with 7.2 Mbbl/d in 2015. Most of these exports went to the Asia and the Pacific region (66%), followed by North America (16%), Europe (12%), the Middle East (4%), Africa (2%), and Latin America (less than 1%). Refined petroleum products exports increased to about 1.50 Mbbl/d in 2016 from 1.16 Mbbl/d in 2015. Forty-six percent of Saudi Arabia's refined petroleum products were shipped to the Asia and the Pacific region, followed by the Middle East (18%), Africa (15%), and Europe (14%). In 2016, Ma'aden's mineral exports included about 2.7 million metric tons (Mt) of diammonium phosphate (DAP), which was received mainly by India and countries in Africa, Latin America, and Southeast Asia; 552,000 metric tons (t) of aluminum, which was shipped to countries in Asia, Latin America, the Middle East and North Africa, and North America; 715,000 t of ammonia, which went to India and countries in East Asia; 23,000 t of unspecified industrial minerals, to countries in the Asia and the Pacific region, Africa, and Europe; and 6,967 kilograms (kg) of gold, to Singapore and Switzerland (Organization of the Petroleum Exporting Countries, 2017, p. 8, 57, 59; Saudi Arabian Mining Co. 2017, p. 112).

The value of Saudi Arabia's imports decreased by 20% to $140 billion in 2016 from $175 billion in 2015. The value of jewelry imports, including those of gold and silver, decreased to about $3.0 billion in 2016 from $5.8 billion in 2015. In 2016, Saudi Arabia imported 57 t of gold ingots valued at $2.2 billion and 176 t of refined copper valued at $856 million. Saudi Arabia was the world's eighth-ranked net importer of steel products in 2016; it imported 7.4 Mt of finished and semifinished steel products compared with 6.5 Mt 2015 (Saudi Arabian Monetary Authority, 2017; World Steel Association, 2017a p. 27; 2017b, p. 57).

Saudi Arabia's exports to the United States decreased to $16.9 billion in 2016 from $22.1 billion in 2015 (or by 23%) and from $47.0 billion in 2014. The decrease was mainly attributed to the decrease in crude petroleum exports, which were valued at about $15.6 billion in 2016 compared with $20.4 billion in 2015. Other mineral exports from Saudi Arabia to the United States included chemicals (valued at $200 million), fertilizers ($181 million), petroleum products ($112 million), aluminum ($101 million), fuel oil ($78 million), and precious metals other than gold ($35 million). Saudi Arabia's imports from the United States decreased to $18.0 billion in 2016 from $19.8 billion (revised) in 2015. The main minerals and mineral-related import categories were finished metals shapes (valued at $196 million), drilling and oilfield equipment ($177 million), petroleum products ($118 million), excavation machinery ($96 million), iron and steel products ($89 million), aluminum and alumina ($23 million), fertilizers ($12 million), and steelmaking materials ($11 million) (U.S. Census Bureau, 2017a, b).

Commodity Review

Metals

Bauxite and Alumina and Aluminum.—In 2016, MBAC produced 3.8 Mt of bauxite at the Al Ba'itha Mine. The mine is located in Qassim Province about 600 kilometers (km) northwest of Ras Al Khair (formerly known as Ras az Zour; the name was changed in 2011) on the Gulf coast, where the alumina refinery and the aluminum smelter also are located. Bauxite ore was crushed at the Al Ba'itha Mine and transported by rail to the alumina refinery, where it was treated with a hot solution of caustic soda (NaOH) to extract alumina (Al_2O_3). At the end of 2016, the Al Ba'itha Mine's total measured, indicated, and inferred mineral resources were 250.3 Mt grading 49.9% total available alumina (TAA). Proven and probable reserves of metallurgical bauxite were 209.5 Mt grading 49.4% TAA. Total metallurgical bauxite mineral resources at the Az Zabirah ML and Az Zabirah Central E exploration permits were 18.4 Mt and 19.0 Mt, respectively, each at a grade of 52% Al_2O_3 (Saudi Arabian Mining Co., 2017, p. 64−65, 79).

The Ras Al Khair alumina refinery, which was commissioned by MBAC in 2014 and had the capacity to produce about 1.8 million metric tons per year (Mt/yr) of alumina, increased its alumina output to 1.4 Mt in 2016 from 846,000 t in 2015. The refinery supplied alumina for the MAC aluminum smelter and MRC rolling mill (table 2; Saudi Arabian Mining Co., 2017, p. 81).

MAC increased its output of aluminum by 4% to 869,000 t in 2016 from 839,000 t in 2015. The company, which was one of the three operating companies at Ras Al Khair, ramped up production of flat-rolled aluminum products to 101,000 t in 2016 from 59,000 t in 2015 (Saudi Arabian Mining Co., 2017, p. 81).

Copper and Zinc.—In 2016, Saudi Arabia's output of copper concentrate increased to 48,500 t from 46,253 t in 2015 and zinc concentrate output increased to 40,950 t from 39,008 t in 2015. Copper and zinc production came solely from the Jabal

Sayid Mine in 2016. Operations at the AMAK Masane Mine were halted throughout 2016 to increase capacity. The Masane Mine is located in Najran Province, 640 km southeast of Jeddah. By the end of June 2016, mineral resources at the mine were estimated to be 8.3 Mt. AMAK had been operating the mine for 3 years and it expected the mine to be in operation for another 10 years. AMAK was a joint venture of local investors (50%), Trecora Resources of the United States (33.4%), and Arab Mining Co. of Jordan (16.6%) (table 1; Al Masane Al Kobra Mining Co., 2017).

MBCC began precommercial production at the Jabal Sayid Mine in late 2015 and shipped its first copper concentrate in early 2016. The Jabal Sayid Mine was expected to ramp up production in 2017 and 2018. At full production, MBCC expected to produce 165,000 metric tons per year (t/yr) of copper concentrate (44,000 t/yr of copper). In addition to copper, of which there was 650,000 t of measured and indicated resources, the Jabal Sayid project was expected to produce unspecified quantities of cobalt, lead, nickel, silver, sulfur, and zinc. The project's mining license permitted further mining exploration in the surrounding licensed area. MBGC sought to extend the mine's life, which was estimated to be 17 years (Barrick Gold Corp., 2016; Saudi Arabian Mining Co., 2016, p. 54, 75).

Gold.—Ma'aden Gold and Base Metals Co. (MGBM) operated seven gold mines in Saudi Arabia. The company mined 36.4 Mt of gold ore in 2016 and produced 7,202 kg of gold, which was a 37% increase compared with the 5,260 kg of gold produced in 2015. Most of the increase was attributed to a full year of production at the Ad Duwayhi Mine, which began production in October 2015 and produced 181 kg in 2016. The Ad Duwayhi Mine, which is located in Makkah Province, was expected to account for 43% of MGBM's gold production during the next 5 years. Joint Ore Reserves Committee (JORC)-compliant reserves at the mine were estimated to be 22.7 Mt grading 2.46 grams per metric ton (g/t) gold at a cutoff grade of 0.4 g/t gold. In 2016, the Bulghah Mine produced the most gold (1,803 kg), followed by the Al Amar Mine (1,409 kg), the Mahd Adh-Dahab Mine (1,023 kg), the As Suq Mine (752 kg), and the Sukhaybarat Mine (390 kg) (Saudi Arabian Mining Co., 2017, p. 63−64, 82−84).

Gold and Minerals Ltd., which was a joint venture of Abdul Rahman Saad Al-Rashid Co. (60%) and Kefi Minerals of Australia (40%), was created to develop gold resources at the Jibal Qutman prospect and copper and gold at the Hawiah permit. The company targeted developing a 311,000-kg (reported as 1-million-troy-ounce) gold-equivalent deposit in Saudi Arabia's underexplored Precambrian shield. Gold and Minerals identified more than 21,800 kg (reported as more than 700,000 troy ounces) of gold resources in 2016. Kefi was also evaluating gold production at the Jibal Qutman site using an opencut, heap-leach operation and exploring for additional shallow gold resources at the site (Kefi Minerals, 2017).

In 2016, AMAK completed 130 diamond drill holes as part of its evaluation study of the mineral resources at the Guyan Gold project, which is located near the AMAK's Al Masane Mine. The company planned to complete its study in 2018 and to commission the Guyan Mine in 2019 (Al Masane Al Kobra Mining Co., 2017; Trecora Resources, 2017).

Iron and Steel.—In 2016, Saudi Arabia's DRI output increased slightly to 5.89 Mt from 5.80 Mt in 2015 and crude steel production increased to 5.5 Mt from 5.2 Mt. Saudi Iron and Steel Co. (Hadeed), which was a wholly owned subsidiary of SABIC, produced most of the country's crude steel and DRI. The other producer was Al-Ittefaq Steel Products Co. (ISPC), which was a subsidiary of Al-Ittefaq Group. ISPC was the leading private steel producer in Saudi Arabia; it comprised Al Faisal Steel Products Co., Arab Steel Co., Direct Reduction Iron Co. Ltd., Metal Recycling Mill, National Steel Co. Ltd., and Tauwarqi Energy, all of which are located in Dammam in eastern Saudi Arabia. ISPC produced billet, DRI, reinforced steel bar, and other semifinished and finished steel products. The company was building a 2.5-Mt/yr iron pelletization plant at its complex in Dammam (tables 1, 2; Al-Ittefaq Steel Products Co., 2017; Saudi Basic Industries Corp., 2017).

Titanium.—A joint venture of the National Industrialization Co. (Tasnee) (32.5%), the National Titanium Dioxide Co. Ltd. (Cristal) (32.5%), and Toho Titanium Co. of Japan (35%) was building a new titanium sponge plant at Yanbu Industrial City on the Red Sea coast in western Saudi Arabia. The plant would have the capacity to produce 15,600 t/yr of titanium sponge. The titanium sponge plant was expected to start production in 2017; it would use titanium tetrachloride ($TiCl_4$) supplied by Cristal as feedstock. Cristal was one of the world's top producers of titanium dioxide and the leading producer of titanium chemicals; it also was the world's leading provider of ultrafine titanium dioxide (TiO_2) products and titanium chemicals. Cristal produced mineral sands, titanium metal, titanium powder, and titanium sponge at eight plants worldwide and was owned by Tasnee (79%), Gulf Investment Corp. of Kuwait (20%), and Al Shair Group (1%) (National Titanium Dioxide Co. Ltd., 2017; Trimble Solutions Corp., 2017).

Industrial Minerals

Cement.—In 2016, Saudi Arabia's cement output decreased by 9% to 55.9 Mt from 61.9 Mt in 2015. Operations at many cement plants in the country slowed in 2016 compared with those of 2015 and 2014. The decrease was mainly attributed to the accumulation of a high quantity of clinker inventory at cement plants, which was estimated to be 22.8 Mt at the end of 2015, owing to reduced activity in the construction sector. Fifteen companies operated 20 cement plants in Saudi Arabia in 2016. The Southern Province Cement Co. was the leading producer of cement in the country in terms of tonnage (7.5 Mt), followed by Saudi Cement Co. (7.4 Mt), Yanbu Cement Co. (6.4 Mt), Yamama Cement Co. (5.4 Mt), and Arabian Cement Co. (4.4 Mt). Production at the Southern Province Cement Co. decreased by 1 Mt to 7.5 Mt in 2016 from 8.5 Mt in 2015, and that of the Saudi Cement Co. decreased by about 300,000 t to 7.4 Mt in 2016 from about 7.7 Mt in 2015 (tables 1, 2; International Cement Review, 2017, p. 295–298).

Clay (Kaolin).—IMC was the main producer of kaolin in Saudi Arabia at its Az Zabirah Mine. IMC's output of kaolin decreased to 106,000 t in 2016 from 120,000 t in 2015. At the end of 2016, the company's total mineral resources of kaolin at the Az Zabirah ML and the Az Zabirah Central EL deposits totaled 386 Mt (table 1; Saudi Arabian Mining Co., 2017, p. 64, 77).

Nitrogen.—MPC produced ammonia at the Ras Al Khair complex for use in the manufacturing of diammonium phosphate (DAP) and for direct sales. The company increased its ammonia production to 1.2 Mt in 2016 from about 1.1 Mt in 2015. Production of DAP fertilizer increased to 2.7 Mt in 2016 from about 2.6 Mt in 2015. This increase was attributed to ramping up production to reach full capacity of 3 Mt/yr (Saudi Arabian Mining Co., 2017, p. 75).

Saudi Arabian Fertilizer Co. (Safco) was a joint venture of SABIC (42.99%) and private investors (57.01%) created to produce, process, manufacture, and market ammonia and urea fertilizers. Safco comprised the National Chemical Fertilizer Co. (Ibn Al Bitar), which produced nitrogen fertilizer at its plant in Jubail Industrial City, and the Safco-5 urea plant, which is located 100 km north of Dammam in eastern Saudi Arabia. Safco-5 had the capacity to produce 1.1 Mt/yr of urea. Safco's total output of urea increased to 5,871 t in 2016 from 4,886 t in 2015 (Saudi Arabian Fertilizer Co., 2017, p. 11).

Phosphate Rock.—In 2016, MPC produced 14.4 Mt of noncommercial phosphate rock and 4.1 Mt of commercial phosphate rock at the Al Jalamid Mine and about 2.7 Mt of phosphate fertilizer at the Ras Al Khair Industrial City. Saudi Arabia holds several undeveloped phosphate rock deposits, which are located in the northern part of the country. Estimates of phosphate rock reserves at the Al Jalamid, the Al Khabra, and the Umm Wu'al deposits increased by 93% to 232.1 Mt of P_2O_5 in 2016 from 120.3 Mt of P_2O_5 in 2015. MWSPC continued the development of the Wa'ad Al Shamal phosphate rock and phosphate-based fertilizer project. The project, which is located about 150 km east of the town of Turaif in northern Saudi Arabia, included the Al Khabra phosphate rock mine and six phosphate manufacturing plants; it was expected to have the capacity to produce 15 Mt/yr of noncommercial phosphate rock, 3 Mt/yr of DAP, and 440,000 t/yr of other downstream products. Production of ammonia, DAP, phosphoric acid, and sulfuric acid was expected to start in 2017 (Jasinski, 2018; Saudi Arabian Mining Co., 2017, p. 13, 62–65, 73).

Sulfur.—Production of sulfur had been steadily increasing since 2013; it increased to 6.0 Mt in 2016 from 3.9 Mt in 2013. Most of the sulfur output, which was produced solely by Saudi Aramco as a byproduct of natural gas and petroleum refining operations, was exported. Sulfur exports increased to 4.0 Mt in 2016 from 3.8 Mt in 2015. K+S Group of Germany acquired a 30% stake of the Al-Biariq for Fertilizer Plant Co., Ltd. (Al-Biariq) in Saudi Arabia. Al-Biariq was a manufacturer of fully soluble potassium sulfate. Al-Biariq had the capacity to produce 20,000 t/yr of soluble potassium sulfate and planned to double the capacity to 40,000 t/yr in 2017 (table 1; K+S Aktiengesellschaft, 2016; Saudi Arabian Mining Co., 2017, p. 75).

Mineral Fuels

Natural Gas.—Production of dry natural gas increased to 109.4 billion cubic meters in 2016 from a revised 104.5 million cubic meters in 2015. Natural gas output came from both onshore and offshore fields. Offshore gasfields included the Arabiyah and the Hasbah fields, and the onshore natural gasfields included the Karan field and other fields associated with major Saudi oilfields, such as the Ghawar, the Safaniya, and the Zuluf fields. Saudi Arabia had been gradually increasing its output of natural gas in recent years and planned to double its output in the next decade to meet increased domestic demand (BP p.l.c., 2017, p, 28; Saudi Arabian Oil Co., 2017, p. 22).

In October 2015, Saudi Aramco completed the construction of the Wasit gas-processing plant, which is located in Jubail Industrial City, and started processing natural gas from two offshore gasfields near the eastern coast of Saudi Arabia. The plant has the capacity to process about 27.8 billion cubic meters per year of nonassociated natural gas and about 88 million barrels per year (Mbbl/yr) of natural gas liquids. Saudi Aramco completed the construction of the Midyan gas plant in the Tabuk region in northwestern Saudi Arabia in 2016. The plant had the capacity to produce 2.1 million cubic meters per day of nonassociated natural gas and 4,500 barrels per day (bbl/d) of condensate. Saudi Aramco planned to build the greenfield Fadhili gas plant, which would be located 30 km west of Jubail in Eastern Province. The plant would process natural gas from offshore and onshore fields to produce 70.8 million cubic meters per day of natural gas by 2019. The Fadhili gas plant would be able to recover 99.9% of the sulfur contained in the natural gas (Saudi Arabian Oil Co., 2017, p. 20−21).

Petroleum.—Saudi Arabia's crude petroleum output increased to 10.5 Mbbl/d in 2016 from 10.2 Mbbl/d in 2015. Saudi Aramco's strategy in 2016 continued to focus on maintaining 12 Mbbl/d of petroleum production capacity and increasing processing capacity for nonassociated natural gas to 141.6 million cubic meters per day by 2019 (Saudi Arabian Oil Co., 2016, p. 15; 2017, p. 14, 23).

In 2016, Saudi Aramco had nine domestic refineries with a combined capacity of 2.9 Mbbl/d. Saudi Aramco produced refined petroleum products through its four wholly owned subsidiaries in Jeddah, Ras Tanura, Riyadh, and Yanbu, and five joint ventures with major international oil companies. These joint ventures were Rabigh Refining & Petrochemical Co. (Petro Rabigh) of Saudi Aramco (37.5%), Sumitomo Chemical Co. of Japan (37.5%), and private investors (25%); Saudi Aramco Mobil Refining Co. Ltd. (SAMREF) of Saudi Aramco (50%) and Mobil Yanbu Refining Co. Inc. (a subsidiary of Exxon Mobil of the United States) (50%); Saudi Aramco Shell Refining Co. (SASREF) of Saudi Aramco (50%) and Shell Saudi Arabia Refining Ltd. (50%); Saudi Aramco Total Refining and Petrochemical Co. (SATORP) of Saudi Aramco (62.5%) and Total S.A. of France (37.5%); and Yanbu Aramco Sinopec Refining Co. Ltd. (YASREF) of Saudi Aramco (62.5%) and China Petrochemical Corp. (SINOPEC) (37.5%) (Saudi Arabian Oil Co., 2017, p. 76).

In 2016, Saudi Aramco continued construction at the Jazan refinery and terminal project at Jazan Economic City in the southwest. The project was designed to build a 400,000-bbl/d-capacity refinery capable of processing Arabian heavy and medium crude petroleum and to install a 4,000-megawatt-capacity integrated gasification combined cycle (IGCC) powerplant. Construction of the Jazan refinery and the IGCC powerplant was expected to be completed in 2018 (table 2; Saudi Arabian Oil Co., 2017, p. 26).

Outlook

Saudi Arabia's GDP growth is expected to decrease by 0.1% in 2017 owing mainly to continued low crude petroleum prices on international markets. Cement production is expected to continue to decrease in 2017 following a sharp decrease in 2016 owing to decreased demand and high clinker inventories at many cement plants. The Government planned to cut export duties on cement by 50% and to eliminate export tariffs on crude steel in 2017. The output of such metal commodities as aluminum, alumina, copper, crude steel, gold, titanium sponge, and zinc as well as such industrial minerals as ammonia, phosphate rock and phosphate-based fertilizers, and sulfur is expected to increase in the short term owing to the ramping up of production at the Ad Duwayhi gold mine, the Jabal Sayid copper mine, and the Wa'ad Al-Shamal phosphate project. Saudi Arabia's exports of aluminum, copper, DAP, gold, sulfur, titanium sponge, urea, and zinc are expected to increase during the next 5 years (Global Cement, 2017, p. 296; International Monetary Fund, 2017, p. 41).

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TABLE 1
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons, gross weight, unless otherwise specified

Commodity[2]		2012	2013	2014	2015	2016
METALS						
Aluminum:						
Alumina		--	--	23 r	846	1,429
Bauxite:						
Metallurgical		--	-- r	879 r	1,600 r	3,843
Low grade		835	934	967 r	1,026 r	1,067
Metal, primary		--	187	662	839	869
Copper, mine:						
Gross weight	metric tons	17,639	41,332	33,116 r	46,253 r	48,500
Cu content, 25% Cu	do.	4,400	10,000	8,300 r	12,000 r	12,000
Ferroalloys, other, unspecified		196	196	196	200 e	200 e
Gold, mine, Au content	kilograms	5,215	4,655	4,954	5,260 r	7,202
Iron and steel:						
Direct-reduced iron		5,660	6,070	6,460	5,800	5,890
Raw steel		5,203	5,471	6,291	5,229	5,461
Lead, mine, Pb content, concentrate	metric tons	396	--	--	--	--
Manganese, silicomanganese	do.	80,000	96,000	60,000	63,000	60,000 e
Silver:						
Mine, concentrate	kilograms	11,000	19,000	22,000	23,000	24,000
Refinery, primary, Ag content	do.	5,212	4,655	4,800 r	4,500 r	4,700
Zinc:						
Mine, concentrate	metric tons	21,213	39,813	37,798 r	39,008 r	40,950
Zinc content	do.	11,200	18,300	17,400	18,800	19,500
INDUSTRIAL MINERALS						
Barite		32	30	32	43	41
Cement, hydraulic		53,332	56,238	57,223	61,900	55,945
Clay and shale:						
Kaolin		137	101	106 r	120	106
Other		8,300	6,880	7,220	7,650	7,400
Feldspar, mine		227	160	194 r	198 r	190
Fertilizers, diammonium phosphate		1,800	1,821	2,301	2,656	2,723
Gypsum		1,700	1,700	1,400 r	1,470 r	1,400
Magnesite		90 r	82 r	101 r	103 r	75
Nitrogen, N content:						
Ammonia		3,250	3,185	3,600	4,100	4,482
Urea		1,600	1,560	2,229	2,248	2,701
Phosphate rock:						
Gross weight		3,000 r	3,262	3,425	4,100	4,100
P_2O_5 content, 32% P_2O_5		960 r	1,000 r	1,100 r	1,300 r	1,300
Pumice and related materials, pozzolan		941	460	480	500	480
Salt		1,611	1,900	1,990	2,080	2,000
Stone, sand, and gravel:						
Sand and gravel, construction:						
Gravel		300,000 r	300,000	315,000	330,000	347,000
Iron sand		897	644	676	708	680
Sand		30,000	29,000	30,400	31,800	22,155
Silica, mine production, unspecified		1,270	1,160	1,230 r	1,270 r	1,220
Stone, crushed:						
Dolomite		153	181	190	199	191
Granite		834	1,100	1,100 r	1,150 r	1,100
Limestone		484	1,200	1,260	1,320	1,270
Limestone, for cement		48,615	56,700	59,500	62,300	59,900
Marble, for industrial use		1,300	3,000	3,150	3,300	3,100
Schist, scoria		683	650	680	710	685
Stone, dimension, marble, block		25	11	12	219	120
Stone, size and shape unspecified, basalt		--	--	--	--	15

See footnotes at end of table.

TABLE 1—Continued
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons, gross weight, unless otherwise specified

Commodity[2]		2012	2013	2014	2015	2016
INDUSTRIAL MINERALS—Continued						
Sulfur, S content, hydrocarbon processing		4,092	3,900	4,400	4,900	6,000
Talc and related materials, pyrophyllite		8	6	7	8	8
MINERAL FUELS AND RELATED MATERIALS						
Natural gas:						
Unspecified	million cubic meters	111,220	114,120	116,720 r	119,830 r	127,183
Dry basis	do.	99,300	100,000	102,400	104,500 r	109,400
Ethane	do.	8,799	8,231	8,365	8,210	9,513
Natural gas liquids:						
Butane	million 42-gallon barrels	123	114	120	120	127
Propane	do.	189	177	181	181	196
Condensate	do.	82	87	84	83	83
Natural gasoline, including other	do.	89	78	87	91	91
Petroleum:						
Crude[3]	do.	3,564	3,518	3,545	3,708	3,828
Crude, including natural gas liquids[4]	do.	4,247	4,158	4,199	4,375	4,507
Refinery production:						
Asphalt	do.	18	20	20	22	18
Coke	do.	--	--	9	27	31
Distillate fuel oil	do.	234	220	275	351	384
Gasoline	do.	145	135	161	180	202
Kerosene	do.	59	77	77	77	47
Liquefied petroleum gas	do.	11	14	16	17	13
Naphtha	do.	64	59	70	69	47
Residual fuel oil	do.	168	166	176	164	168
Total	do.	700 r	690 r	800	910 r	910

eEstimated. rRevised. do. Ditto. -- Zero.

[1]Table includes data available through November 29, 2017. Data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]In addition to the commodities listed, carbon black, caustic soda, lime, and methanol may have been produced in Saudi Arabia, but available information was inadequate to make reliable estimates of output.

[3]Includes blended condensate and Bahrain's share of the Abu Safah field.

[4]Includes crude oil, shale oil, oil sands, and natural gas liquids (NGLs—the liquid content of natural gas where the liquid is recovered separately). Excludes liquid fuels from other sources, such as biomass and derivatives of coal and natural gas.

TABLE 2
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2016

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina		Ma'aden Bauxite and Alumina Company (MBAC) [Saudi Arabian Mining Co. (Ma'aden), 74.9%, and Alcoa Inc, 25.1%]	Refinery at Ras Al Khair, Jubail Industrial City, Eastern Province	1,800
Aluminum:				
Primary		Ma'aden Aluminium Co. (MAC) [Saudi Arabian Mining Co. (Ma'aden), 74.9%, and Alcoa Inc, 25.1%]	Smelter at Ras Al Khair, Jubail Industrial City, Eastern Province	760
Secondary		Ma'aden Rolling Co. (MRC) [Saudi Arabian Mining Co. (Ma'aden), 74.9%, and Alcoa Inc, 25.1%]	Rolling mill at Ras Al Khair, Jubail Industrial City, Eastern Province	430
Bauxite:				
Metallurgical		Ma'aden Bauxite and Alumina Company (MBAC) [Saudi Arabian Mining Co. (Ma'aden), 74.9%, and Alcoa Inc, 25.1%]	Mine at Al Ba'itha, Qassim Province	4,000
Low-grade		Industrial Minerals Co. (IMC) [Saudi Arabian Mining Co. (Ma'aden), 100%]	Az Zabirah Mine, Ha'il Province	1,100
Caustic soda		Sahara and Ma'aden Petrochemical Co. (SAMAPCO) [Sahara Petrochemical Co., 50%, and Saudi Arabian Mining Company (Ma'aden), 50%]	Plant at Ras Al Khair, Jubail Industrial City, Eastern Province	NA
Do.		Arabian Alkali Co. (SODA)	Jubail Industrial City, Eastern Province	55
Do.		Saudi Factory for Chlorine and Alkalies (SACHLO)	Riyadh	NA
Cement:				
Gray portland		Al Jouf Cement Co.	Plant at Turaif, Northern Border Province	1,750
Do.		Arabian Cement Co. Ltd.	Plant at Rabigh, Mecca Province	4,800
Do.		Eastern Province Cement Co.	Plant at Al Khursaniyah, Eastern Province	3,400
Do.		Najran Cement Co.	Plant at Aakfa, Najran Province	3,000
Do.		Northern Region Cement Co.	Plant at Turaif, Northern Border Province	1,700
Do.		Qassim Cement Co.	Plant at Jal al Watah, Buraydah, Qassim Province	4,000
Do.		Riyadh Cement Co.	Plant 30 kilometers southwest of Riyadh, Riyadh Province	3,800
Do.		Saudi Cement Co.	Plant at Al Hofuf, 120 kilometers southwest of Dammam, Eastern Province	8,600
Do.		Southern Province Cement Co. (Government, 52%)	Plant at Suq Al Ahad, Jazan, Jazan Province	7,500
Do.		do.	Plant at Bishah, southeast Jiddah	2,000
Do.		do.	Plant at Tihama, Mecca Province	1,800
Do.		Tabuk Cement Co.	Plant at Tabuk, Tabuk Province	1,300
Do.		Yamama Cement Co. Ltd.	Plant at Riyadh, Riyadh Province	6,300
Do.		Yanbu Cement Co.	Plant at Yanbu, Al Madinah Province	6,400
White		Al-Gharbiah Cement Factory	Plant at Jeddah	250
Do.		Saudi White Cement Co.	Plant 30 kilometers southwest of Riyadh, Riyadh Province	200
Clay, kaolin		Ma'aden Industrial Minerals Co. (IMC) [Saudi Arabian Mining Co. (Ma'aden)]	Mine at Ranyah in Mecca Province	120
Copper in concentrate	metric tons	Ma'aden Barrick Copper Co. (MBCC) [Barrick Gold Corp., 50%, and Saudi Arabia Mining Co. (Ma'aden), 50%]	Jabal Sayid Mine, Al Madinah Province	165,000
Do.	do.	Al Masane Al Kobra Mining Co. (AMAK) (local investors, 50%; Trecora Resources, 35%; Arab Mining Co., 15%)	Al Masane Mine, Najran Province	50,000
Dolomite		Saudi Lime Industries Co.	Mine at Riyadh Province	NA
Do.		Saudi Dolomite Co. Ltd.	Plant at Al Khobar, Eastern Province	NA

See footnotes at end of table.

TABLE 2—Continued
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2016

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Feldspar		United Mining Investment Co.	Mine at Rabigh, Mecca Province	30
Do.		Al Rashed Cement	Plant at Khobar, Eastern Province	NA
Gold	kilograms	Ma'aden Gold and Base Metals Co. (MGBMC) [Saudi Arabian Mining Co. (Ma'aden)]	Al Amar Mine, Ar Riyadh Province; Ad Duwayhi Mine, Mecca Province; Al-Hajar Mine, Asir Province; As Suq Mine, Mecca Province; Al Bulghah Mine, Al Madinah Province; Mahd Adh-Dahab Mine, Al Madinah Province; Sukhaybarat Mine, Al Madinah Province	8,000
Granite		Red Sea Mining Co. Ltd.	Eleven quarries in Najran Province; Ranyah, Mecca Province	18
Do.		Tanhat Mining Co. Ltd.	Ten quarries in Najran Province; Ranyah, Mecca Province; Rowaidah, Jamur and Samakh, Khamis Mushait, Asir Province	48
Gypsum		National Gypsum Co.	Plants at Damman, Jeddah, Riyadh, Yanbu,	960
Do.		Al-Zahid Industrial and Mining Group	Taymah, Tabouk Province	NA
Do.		Mada Gypsum Co. (Al Rajhi Holding, 100%)	Yanbu Industrial City	400
Do.		Global Gypsum Co. Ltd.	do.	300
Iron and steel:				
Direct-reduced iron		Saudi Iron and Steel Co. (Hadeed) [Saudi Basic Industries Corp. (SABIC), 100%]	Plants A, B, C, D, and E, Jubail, Eastern Province	5,500
Do.		Direct Reduction Iron Co. Ltd. (Al-Ittefaq Group, 100%)	Plants I and II, Dammam, Eastern Province	1,300
Steel, raw		National Steel Co. Ltd. (Al-Ittefaq Group , 100%)	Plant at Dammam, Eastern Province	1,300
Do.		Saudi Iron and Steel Co. (Hadeed) [Saudi Basic Industries Corp. (SABIC), 100%]	Plant at Jubail Industrial City, Eastern Province	5,500
Lime:				
Hydrated		Astra Mining (Astra Industrial Group, 60%, and Tharawat Holding, 40%)	Plant at Al Kharj Industrial City	66
Do.		Saudi Lime Industries Co.	Plant at Riyadh, Riyadh Province	100
Quick lime		Astra Mining (Astra Industrial Group, 60%, and Tharawat Holding, 40%)	Plant Al Kharj Industrial City, Riyadh Province	99
Do.		Saudi Lime Industries Co.	Plant at Riyadh, Riyadh Province	400
Magnesium:				
Magnesite ore		Ma'aden Industrial Minerals Co. (IMC) [Saudi Arabian Mining Co. (Ma'aden)]	Mine at Al Ghazalah, Al Madinah Province	79
Magnesia, caustic calcined		do.	Processing plant at Al Madina Al Munawwara Industrial City, Al Madinah Province	39
Natural gas, gross	million cubic meters	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Gawar field	75,000
Do.	do.	do.	The Arabiyah and Hasbah offshore gasfields	25,850
Do.	do.	do.	Karan field	5,000
Do.	do.	do.	Safaniya field	10,000
Do.	do.	do.	Zuluf field	10,000
Do.	do.	do.	Wasit gas-processing plant, Jubail Industrial City, Eastern Province	27,800

See footnotes at end of table.

TABLE 2—Continued
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2016

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nitrogen:				
Ammonia		Ma'aden Phosphate Co. (MPC) [Saudi Arabian Mining Co. (Ma'aden)]	Plant at Ras Al Khair, Jubail Industrial City, Eastern Province	3,000
Do.		Saudi Arabian Fertilizer Co. (Safco) [Saudi Basic Industries Corp. (SABIC), 42.99%]	Jubail Industrial City, Eastern Province	3,200
Urea		do.	do.	6,000
Petroleum:				
Crude	million 42-gallon barrels	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Ash Shargiyah, Najd region, and offshore; includes the Ghawar, Hawtah, Khurais, Safaniya, and Shaybah fields	4,500
Refined products	do.	Jeddah Oil Refinery Co. [Saudi Arabian Oil Co. (Saudi Aramco), 100%]	Refinery at Jeddah, Mecca Province	38
Do.	do.	Rabigh Refining & Petrochemical Co. (Petro Rabigh) [Saudi Arabian Oil Co. (Saudi Aramco), 37.5%; Sumitomo Chemical Co., 37.5%; private 25%]	Refinery at Rabigh, Mecca Province	140
Do.	do.	Riyadh Oil Refinery Co. [Saudi Arabian Oil Co. (Saudi Aramco), 100%]	Refinery at Riyadh, Riyadh Province	50
Do.	do.	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Refinery at Ras Tanura, Jubail Industrial City, Eastern Province	193
Do.	do.	do.	Refinery Yanbu, Al Madinah Province	82
Do.	do.	Saudi Aramco Mobil Refinery Co. Ltd. [Saudi Arabian Oil Co. (Saudi Aramco), 50%, and Mobil Yanbu Refining Co. Inc., 50%]	do.	140
Do.	do.	Saudi Aramco Shell Refining Co. [Saudi Arabian Oil Co., (Saudi Aramco), 50%, and Shell Saudi Arabia Refining Ltd., 50%]	Refinery at Jubail, Eastern Province	110
Do.	do.	Saudi Aramco Total Refining and Petrochemical Co. (SATORP) [Saudi Arabian Oil Co. (Saudi Aramco), 62.5%, and Total S.A., 37.5%]	Refinery at Jubail, Eastern Province	400
Do.	do.	Yanbu Aramco Sinopec Refining Co. Ltd. (YASREF) [Saudi Aramco, 62.5%, and China Petrochemical Corp. (SINOPEC), 37.5%]	Refinery at Yanbu, Al Madinah Province	400
Phosphate fertilizers		Ma'aden Phosphate Co. (MPC) [Saudi Arabian Mining Co. (Ma'aden), 70%, and Saudi Basic Industries Corp. (SABIC), 30%]	Plant at Ras Al Khair, Jubail Industrial City, Eastern Province	3,000
Phosphate rock		Ma'aden Phosphate Co. (MPC) [Saudi Arabian Mining Co. (Ma'aden), 70%, and Saudi Basic Industries Corp. (SABIC), 30%]	Al Jalamid Mine, Northern Border Province	6,000
Salt		Al-Zahid Industrial and Mining Group	Mines in Eastern Province	150
Silica sand		Adwan Chemical Industries Co. Ltd.	Eldarees Quarry, Ad Doghm, Riyadh Province	NA
Do.		Al Raddadi Group	Quarry at Taymah, Tabuk Province	1,000
Do.		Al-Zahid Industrial and Mining Group	do.	100
Do.		Gulf Sand (Al-Marbaie Group)	do.	NA
Sulfur		Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Refineries and gas processing plants at Jeddah, Rabigh, Mekkah Province; Jubail, Ras Tanura, Eastern Province	6,000
Sulfuric acid		Basic Chemicals National Co. (BCNC) (Basic Chemical Industries, 100%)	Yanbu Industrial City, Al Madinah Province	365
Do.		Ma'aden Phosphate Co. (MPC) [Saudi Arabian Mining Co. (Ma'aden), 70%, and Saudi Basic Industries Corp. (SABIC), 30%]	Plant at Ras Al Khair, Jubail Industrial City, Eastern Province	4,900

See footnotes at end of table.

TABLE 2—Continued
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2016

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Sulfuric acid—Continued	Ma'aden Wa'ad Al-Shamal Phosphate Co. (MWSPC), [Saudi Arabia Mining Co. (Ma'aden), 60%; Mosaic Co., 25%; Saudi Basic Industries Co. (SABIC), 15%]	Wa'ad Al Shamal, Turaif, Northern Border Province	5,500
Do.	Saudi Arabian Fertilizer Co. (Safco) (Saudi Basic Industries Corp. (SABIC), 42.99%)	Plant at Ras Al Khair, Jubail Industrial City, Eastern Province	130
Do.	National Company For Sulphur Products (NCSP)	Plant in Riyadh Province	170
Titanium dioxide	The National Titanium Dioxide Co. Ltd. (Cristal) [National Industrialization Co. (Tasnee), 79% and Gulf Investment Corp. (GIC), 20%, Al Shair Group, 1%]	Plant at Yanbu, Al Madinah Province	100
Zinc, Zn in concentrate	Ma'aden Gold and Base Metals Co. (MGBM) [Saudi Arabian Mining Co. (Ma'aden)]	Al Amar Mine, Ar Riyadh Province, and Mahd Adh-Dahab Mine, Al Madinah Province	40
Do.	Al Masane Al Kobra Mining Co. (AMAK) (local investors, 50%; Trecora Resources, 33.4%; Arab Mining Co., 16.6%)	Al Masane Mine, Najran Province	45

Do., do. Ditto. NA Not available.