THE MINERAL INDUSTRIES OF

JORDAN, LEBANON, AND SYRIA

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JORDAN

In recent years, Jordan has been a major producer and exporter of potash and phosphate. It has also produced such industrial minerals as feldspar, gypsum, kaolin, lime, and salt and such building materials as cement, dimension stone, limestone, and marble. Natural gas and petroleum products have been produced for domestic consumption. Deposits of copper, gold, iron, and titanium also occur in Jordan.

In 1999, Jordan's gross domestic product (GDP) amounted to about $16 billion at purchasing power parity, and per capita income at purchasing power parity was $3,500 in 1999 (U.S. Central Intelligence Agency, 2000a). In the same year, the output of the mining and quarrying sector amounted to 3.1% of GDP; construction, 4.6%; and electricity and water, 2.6% (Jordan Central Bank, May 2001, Sectoral relative importance of gross domestic product at 1994 prices, accessed June 28, 2001, at URL http://www.cbj.gov.jo/docs/bulletin/36.xls).

In 2000, total exports were valued at $1.5 billion. Exports of potash amounted to $195 million; phosphate rock, $128.2 million; phosphoric acid, $104 million; fertilizers, $84.4 million; cement, $23.1 million; building stone, $5.1 million; and sulfuric acid, $2.9 million[1] (Jordan Central Bank, May 2001, External sector—Domestic exports by commodity, accessed June 28, 2001, at URL http://www.cbj.gov.jo/docs/bulletin/36.xls). Jordan's exports of phosphate rock rose to nearly 6 million metric tons (Mt) in 1998 from 3.9 Mt in 1998. The country's exports of potash fell to 1.7 Mt in 1999 from 1.8 Mt in 1995. Jordanian salt exports grew to 144,749 metric tons (t) in 1998 from 1,475 t in 1995 (British Geological Survey, p. 209, 218, 232). Cement exports amounted to about 800,000 t in 1999 (International Cement Review, 2001a). Other exports included alumina hydrate, kaolin, and sulfur as well as secondary scrap of aluminum, copper, lead, steel, tin, and zinc.

In 2000, total imports were valued at $4.5 billion. Imports of crude petroleum amounted to $526.9 million; refined petroleum products, $144.4 million; iron and steel products, $138.5 million; crude minerals and crude fertilizers, $36.5 million; and ammonia, $24.3 million (Jordan Central Bank, March 2001, External sector—Imports by commodity, accessed April 30, 2001, at URL http://www.cbj.gov.jo/docs/bulletin/37.xls). Other imports included alumina, aluminum and aluminum alloys, feldspar, fluorspar, gold, gypsum, industrial diamond, kaolin, lead, silver, sulfur, talc, titanium oxides, and zinc.

Commodity Review

Metals

Magnesium.—An estimated 23,000 Mt of magnesium chloride is dissolved in the waters of the Dead Sea (Jordan Natural Resources Authority, 1989, p. 104). Arab Potash Company (APC) was exploring the possibility of using carnallite or brines from the Dead Sea to produce magnesium metal (Arab Potash Company, 2000).

APC was engaged in a feasibility study for a magnesium chloride flakes plant with a capacity of 100,000 to 300,000 t/yr. The plant's product would be used mainly for deicing, dust control, and other industrial applications (Al Ali, 2000).

Jordan Magnesia Company (a subsdiary of APC that was established in 1997) was building a plant to produce magnesia; magnesium will be extracted from the Dead Sea's plentiful resources of magnesium chloride. The plant will produce about 50,000 metric tons per year (t/yr) of refractory-grade magnesia and 10,000 t/yr of other grades of magnesia for chemical, environmental, fertilizer, and plastic applications. The fused magnesia will have a grade of at least 97.5% MgO. Production was expected to start in mid-2001 (Jordan Magnesia Co., 2000, Profile, accessed April 27, 2001, at URL http://www.jormag.com/profile.htm).

Manganese.—Several deposits of manganese ore occur in the Feinan area (Wadi Dana, Khirbet en Nahas, Salawan, Wadi Mahjoub, and Wadi Dabba'a). Only Wadi Dana has been studied in detail; this deposit has estimated resources of 1.5 Mt of ore at a grade of 38% manganese and 1.5% copper. A rough estimate of the possible resources in the Feinan area was about 5 Mt of ore at a grade of 35% to 45% manganese and 1.0% to 1.5% copper (Abu-Ajamieh, 1989, p. 101).

Industrial Minerals

Bromine.—An estimated 975 Mt of magnesium bromide is dissolved in the waters of the Dead Sea (Jordan Natural Resources Authority, 1989, p. 104). Jordan Bromine Co. Ltd. (a joint venture of APC, Jordan Dead Seas Industry Co. Ltd., and the U.S.-based Albemarle Holding Co. Ltd.) was building a plant to produce bromine and bromine compounds and was expected to start production by 2004. The plant will have a production capacity of 50,000 t/yr of elemental bromine, 49,000 t/yr of caustic potash, 35,000 t/yr of tetrabromobisphenot, 30,000 t/yr of calcium bromide, and 30,000 t/yr of chlorine (Arab Potash Company, 2000, JODICO, accessed April 25, 2001, at URL http://www.arabpotash.com/arabpotash/jodico.html).

Feldspar.—Extensive resources of feldspar are found at Wadi Hawd Es Sufun, Jebel Aboul Ghoufran, and Wadi Mahlaba. Research conducted by the Jordan Natural Resources Authority has revealed that the process of separating feldspar to its main components and reducing the iron content would not be cost effective. In 2000, feldspar was consumed without

[1]Where necessary, values have been converted from Jordanian dinar (JOD) to U.S. dollars at the rate of JOD0.714=US$1.00.

beneficiation except grinding by the Jordanian ceramic industry (Al Ali, 2000).

Gypsum.—Jordan has several deposits of gypsum that were being commercially exploited. Reserves were estimated to be 10 Mt at Wadi Zarqa, 8 Mt in the area between Wadi Mujib and Tafila, and 3 Mt at Azraq; reserves in the Lisan area have not been determined. The Wadi Zarqa gypsum is low grade but suitable for use in cement manufacturing. The deposits in southern Jordan were higher grade and were used at the cement factory at Al-Rashadiya and by many local miners to produce a variety of products, such as plaster and gypsum board (Al Ali, 2000).

Kaolin.—Most of Jordan's kaolin occurs in the southeastern part of the country. Reserves were estimated to be 9.7 billion metric tons (Gt) at Al-Mudawwara, 400 Mt at Batn-El Ghoul, 20 Mt total at Fujij and Rashadiya, and 5 Mt at Ghor Kabid and Mahis. The reserves at Al-Hiswa have not been determined (Jordan Natural Resources Authority, 2000, Nonmetallic minerals—Clay, accessed April 25, 2001, at URL http://www.nra.gov.jo/side.htm). At Al-Mudawwara and Batn El-Ghoul, the average Al_2O_3 content of the kaolin ranges between 14% and 25%, and the average Fe_2O_3 content ranges between 6% and 9%. Kaolin was produced by the Public Mining Company for use in the local ceramics industry (Al Ali, 2000).

Limestone.—Notable deposits of limestone occur at several locations. Reserves were estimated to be 50 Mt in the area between Qatrana and Siwaqa and 10 Mt at El Lubban. Resources at El-Hallabat, which is 60 kilometers (km) northeast of Amman, and Al Fuheis, which is near a major cement plant, have not been determined. Jordan's limestone was used in aggregates, building stone, floor tiles, powder in fertilizer and pharmaceuticals, and raw material for white cement (Al Ali, 2000). Jordan Magnesia's plant will also require about 165,000 t/yr of limestone as raw material. The limestone will be mined from Qatrana starting in 2001 (Jordan Magnesia Company, 2000, Raw materials, accessed April 27, 2001, at URL http://www.jormag.com/raw.htm).

Phosphate.—Jordan has substantial reserves of phosphate rock, which were exploited by the Jordan Phosphate Mines Company (JPMC) at four mines. The Shidiya Mine has proven reserves of 1.2 Gt and possible reserves of 4.0 to 5.0 Gt; al-Hasa and al-Abiad Mines, 200 to 300 Mt of proven reserves; and the Ruseifa Mine, 70 Mt. Production at the Shidiya Mine was running at 3.3 million metric tons per year (Mt/yr) in 1999; JPMC planned to boost the output to 7.5 Mt/yr by 2001 and to 10 Mt/yr by 2003. About 85% of phosphate rock production was exported, and the rest was used in the domestic manufacture of fertilizers (Arab Petroleum Research Center, 2000a).

In 1998, APC and Kemira Agro OY formed a joint venture to produce 150,000 t/yr of potassium nitrate fertilizer and 75,000 t/yr of dicalcium phosphate animal feed supplement. These products will be marketed worldwide and were expected to generate $60 million per year. Production was expected to start in 2002. This plant will absorb most of the increase in APC's potash capacity (Industrial Minerals, 2000).

Potash.—The Dead Sea has enormous resources of potassium; an estimated 7.3 Gt of potassium, which includes 2.1 Gt of potassium chloride is dissolved in its waters (Abu-Ajamieh, 1989, p. 61). Potassium from the Dead Sea was used as raw material for Jordan's potash plants. The APC was one of the world's largest producers of fertilizer-grade potassium chloride with a capacity of 2.0 Mt/yr. The company planned to increase capacity to 2.4 Mt/yr of potash by the year 2006. The capacity of the plants and the solar evaporation ponds expansion will be increased (Industrial Minerals, 2000). APC sold its products in 30 countries, mainly to markets in India, China, and Indonesia; these countries were expected to account for more than 60% of APC's exports (Al Ali, 2000).

Salt.—Jordan's resources of salt are located in the Azraq depression, the Dead Sea, and below El Lisan peninsula in the Dead Sea. An estimated 12.7 Gt of salt is dissolved in the Dead Sea's waters (Jordan Natural Resources Authority, 1989, p. 132, 134). The salt deposit in the Azraq depression was exploited by Al Azraq, and the Dead Sea salt was exploited by the Jordan Safi Salt Company (JOSSCO) (36% owned by APC).

JOSSCO's plant, which started production in 1996, had a capacity of 1.2 Mt/yr of industrial salt and 32,000 t/yr of table salt (Al Ali, 2000). The local market absorbed only 11% of JOSSCO's production; in 1999, the company exported more than 350,000 t of industrial salt to 12 markets. Saudi Arabia and Iraq accounted for 16% and 14%, respectively, of JOSSCO's industrial salt exports. In 1999, the Qatari Salt Processing and Production Company purchased 40% of JOSSCO and signed a 5-year contract to purchase 250,000 t/yr of Jordanian salt. The 5-year purchase contract took effect in the last quarter of 2000 (Jordan Times, February 3, 2000, Bid by Qatari investors could shake up salt company, accessed April 25, 2001, at URL http://www.jordanembassyus.org/020320000009.htm).

Silica.—Jordan has substantial reserves of silica sand. The sands at the Ras En Naqab averaged 99.31% SiO_2 and 0.03% Fe_2O_3, while the Qa'a Disi deposit averaged 98.2% SiO_2 and 0.028% Fe_2O_3, and the Wadi Es Sik deposit averaged 98.23% SiO_2 and 0.035% Fe_2O_3. After refining, the Ras En Naqab, the Qa'a Disi, and the Wadi Es Siq sands averaged 99.72% SiO_2, 99.34% SiO_2, and 99.21% SiO_2, respectively. The International Silica Industries Company was established as a public shareholding company to target a market that employs silica sand as a raw material (Al Ali, 2000).

Jordan's principal deposits of tripoli, which is a fine grained crystalline silica commonly used as an abrasive, occur in the Karak District. Reserves were estimated to be 13 Mt at El-Adnanieh and 6.2 Mt at El-Shahabiyeh. Other deposits occur at Ainun, Wadi Falqa, and Wadi Rakin (Jordan Natural Resources Authority, 2000, Nonmetallic minerals—Tripoli, accessed April 25, 2001, at URL http://www.nra.gov.jo/nonmetalic/tripoli.htm). Very limited amounts of this material is being used locally by small companies (Al Ali, 2000).

Other.—Other industrial minerals found in Jordan include apatite, barite, bentonite, clay, and sulfur. The only significant

apatite deposit is located near Suweileh. Deposits of barite occur at Aqaba, Beit Sahur, Gharandal, Wadi el Mingar, and Zakimat el Hasa. Bentonite was found in the northern Wadi Sirhan Depression; resources were believed to be 17 Mt. Deposits of clay were found at Mahis, which had estimated resources of 1.9 Mt, and at Ghor Kabid, which had estimated resources of 520,000 t. The sulfur content of Jordan's oil shale ranges from 4% to 5%; estimated total sulfur resources are about 600 Mt (Jordan Natural Resources Authority, 1989, p. 101-102, 106, 139). Building materials found in substantial quantities in Jordan include dimension stone, marble (green, brown with greenish tint, brown, violet, and black), raw materials for brick (found at Mahis), and sand and gravel.

Mineral Fuels

Natural Gas.—Jordan has 6.8 billion cubic meters of natural gas reserves and has developed a single gasfield at Risha in the eastern desert near Iraq. The annual output of around 310 million cubic meters from the Risha field was used to fuel a nearby powerplant, which generated about 12% of Jordan's electricity. Exploration for further reserves of natural gas has not yet been successful; gas production was not expected to increase substantially in the near future (U.S. Energy Information Administration, June 2000, Jordan—Natural gas, accessed April 25, 2001, at URL http://www.eia.doe.gov/emeu/cabs/jordan.html).

Petroleum.—Small reserves of crude oil are found at the Azraq and the Hamza fields. Jordan has one oil refinery at Zarqa with a capacity of 100,000 barrels per day (bbl/d); an expansion of the capacity to 150,000 bbl/d was to be completed by 2003. In 1998, Iraq and Jordan agreed to build a pipeline for the transport of Iraqi oil to the Zarqa refinery. The project was postponed in June 1999 pending an improvement in Jordan's economic situation (Arab Petroleum Research Center, 2000a).

Jordan's oil shale resources were estimated to be about 34 billion barrels (Gbbl). Wadi Maghar accounted for 14 Gbbl; Attarat Um Ghudran, 8.1 Gbbl; El-Thamed, 7.43 Gbbl; Juref-Ed-Darawish, 3.3 Gbbl; El-Lajjun, 821 million barrels (Mbbl); and Sultani, 482 Mbbl (J.R. Dyni, Chairman, Oil Shale Committee, American Association of Petroleum Geologists, February 27, 2000, Oil shale, accessed May 11, 2001, at URL http://www.emdaapg.org/Oil%20Shale.htm). In 1999, the Canadian company Suncor Energy Inc. expressed an interest in exploiting Jordan's shale oil. If Suncor proceeds with the project, then it would plan to produce 17,000 bbl/d within 3 years, 67,000 bbl/d after 5 years, and 210,000 bbl/d after 8 years (Arab Petroleum Research Center, 2000a).

Infrastructure

Jordan produced 7,200 gigawatthours (GWh) of electricity in 2000 (Jordan Central Bank, March 2001, Production, prices, and companies, quantities produced by major industries, CBJ Monthly Statistical Bulletin, accessed April 30, 2001, at URL http://www.cbj.gov.jo/docs/bulletin/ 37.xls). In 1998, fossil fuels accounted for 99.51% of the electricity generated, and hydroelectric power accounted for the remaining 0.49% (U.S. Central Intelligence Agency, 2000a). Installed generating capacity was 1.4 gigawatts (GW) in 2000; an estimated 500 megawatts (MW) was to be installed by 2006. Expansions of capacity include a new 300- to 450-MW plant at al-Samra, and a new 30-MW solar plant at Wadi Rum and doubling the capacity of the 260-MW Aqaba plant (Arab Petroleum Research Center, 2000a). Jordan's known exploitable potential hydroelectric energy was 87 MW (World Resources Institute and others, 1996, p. 288). The most promising sources of geothermal energy are at Zara and Zerqa Ma'in (Jordan Natural Resources Authority, 1989, p. 72).

Jordan's transportation network comprised about 8,000 km of highways and 677 km of railroads. There was 209 km of crude oil pipelines. Aqaba, which is located in the southwestern corner of the country, is Jordan's only port.

Outlook

The outlook for Jordan's phosphate, potash, and salt industries depends heavily upon world market conditions for these commodities. The cement, dimension stone, gypsum, limestone, marble, and natural gas industries are more dependent upon the strength of the Jordanian economy.

LEBANON

The Lebanese minerals industry continued its historically small contribution to the country's economy. In recent years, Lebanon has been known to produce cement, gypsum, lime, salt, and steel for domestic consumption. In 1999, Lebanon's GDP amounted to about $16.2 billion at purchasing power parity, which was an increase of about 1% compared with that of 1998. Per capita income at purchasing power parity was $4,500 in 1999. The output of the industrial sector accounted for about 27% of the GDP (U.S. Central Intelligence Agency, 2000b).

In 1998, total imports were valued at $7.4 billion, the bulk of which were refined petroleum products and ferrous scrap for the Lebanese steel industry (Michalski, 2001). Other mineral imports included phosphate rock and sulfur. Lebanese imports of phosphate rock were 377,221 t in 1999; this was an increase of 4.5% from 1995. Lebanon imported 101,244 t of sulfur in 1999; the country's sulfur imports have more than tripled from their level of 31,700 t in 1995 (British Geological Survey, 2001, p. 210, 255).

Lebanon, which was a net exporter of cement, produced about 3.2 Mt of cement and consumed 2.7 Mt in 2000. Exports of cement rose to 500,000 t in 2000 from 350,000 t in 1999; some cement was exported to Syria. The country's cement factories were owned by Societe des Ciments Libanais, which had a capacity of 2.2 Mt/yr; Cimenterie Nationale, 1.6 Mt/yr; and Ciment de Sibline, 1.2 Mt/yr (International Cement Review, 2001b).

Modest deposits of asphalt, coal, iron ore, lignite, phosphates, and salt occur in Lebanon. All of these resources have been exploited for internal consumption. The country also has several quarries for building stone, limestone, and sand suitable for use in construction (Worldinformation.com, 2000, Lebanon—Country profile, accessed April 24, 2001, at URL http://www.worldinformation.com/World/Asia/Lebanon/profile.asp?country=961).

Because Lebanon has no known gas or petroleum reserves, it relies on imports for its energy requirements. In 1999, Lebanon's imports of refined petroleum products amounted to nearly 5 Mt. The Zahrani and the Tripoli refineries were shut down in 1989 and 1992, respectively. The Government drew up plans to convert power stations from fuel oil to natural gas for cost and environmental reasons. Electricite du Liban (EdL) estimated that switching to natural gas could save $100 million per year. In June 1999, Lebanon and Syria signed an agreement in principle to build a pipeline to supply Lebanon with Syrian natural gas (Arab Petroleum Research Center, 2000b).

Lebanon produced 8,700 GWh of electricity in 1999. Fossil fuels accounted for 90.78% of the electricity generated, and hydroelectric power accounted for the remaining 9.22%. EdL imported 500 MW of electricity from Syria in 1999. In January 2000, Lebanon and Syria renewed their agreement to supply Lebanon with Syrian electricity another 2 years. Lebanon's installed generating capacity was more than 2.0 GW at the beginning of 2000, although effective operating capacity was estimated to be no more than 1.2 GW (Arab Petroleum Research Center, 2000b). Lebanon's known exploitable potential hydroelectric energy is 1.0 GW (World Resources Institute and others, 1996, p. 289).

EdL estimated that installed capacity will have to be expanded to as much as 2.1 GW in 2005 and 2.6 GW in 2010 to meet the growing demand for electricity. Owing to the decommissioning of the 331-MW Jieh and the 65-MW Al Haricha plants by 2006, the installation of 750 MW of new capacity will be necessary. EdL did not have the estimated $1 billion needed to build the new powerplants and to upgrade the transmission and distribution network. In 1999, the Lebanese government decided to privatize the power industry (Arab Petroleum Research Center, 2000b).

Lebanon's transportation network comprised about 7,300 km of roads, of which 6,200 km was paved. Railroad track totaled 399 km, most of which were damaged during the civil war. The country had 72 km of crude oil pipelines, but none was operational. Ports and harbors were Antilyas, Batroun, Beirut, Chekka, El Mina, Ez Zahrani, Jbail, Jounie, Naqoura, Sidon, Tripoli, and Tyre (U.S. Central Intelligence Agency, 2000b).

The success of the Lebanese minerals industry depends upon the long-term restoration of peace and stability to the country. The International Cement Review (2001b) predicted that the production and consumption of cement in Lebanon would decline modestly in 2001.

SYRIA

The Middle Eastern nation of Syria was a producer of dimension stone, fertilizers, gravel, industrial minerals, natural gas, oil, sand, and semimanufactured goods. Industrial minerals produced in recent years have included gypsum, phosphate rock, salt, and sulfur. Semimanufactured goods included cement and crude steel.

Syria's 1999 GDP at purchasing power parity was estimated to be $42.2 billion. Per capita GDP at purchasing power parity was $2,500 (U.S. Central Intelligence Agency, 2000c). Following 2 years of recession caused by low oil prices and a severe drought, Syria's economy resumed growth in 2000, and inflation remained subdued. For 2000, Syria's real GDP grew by 1.5%. Oil, which is critical to Syria's economy, accounted for 55% to 60% of Syria's total export earnings and more than one-third of its GDP (U.S. Energy Information Administration, February 2001, Syria—Recent developments, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

Commodity Review

Industrial Minerals

Cement.—Seven state-owned but independently operated companies within The General Organization for Cement and Building Materials produced cement. In 2000, Syria produced about 4.8 Mt of cement (table 1) and consumed 5.0 Mt. The production and consumption of cement increased from 1999. Imports were 200,000 t in 1999 and 2000; Syria imported some cement from Lebanon (International Cement Review, 2001c). In September, Saudi Cement Company was given permission to build a $537 million 3-Mt/yr cement plant in Syria (Building Bulletin, 2000). In December, Iran Industries Construction Company announced its intention to build a $196 million cement plant in Syria (Iran Daily, 2000a).

Fertilizer.—Syria has considerable deposits of phosphate rock; known phosphate rock reserves are 1.7 Gt. The majority of Syria's phosphate rock reserves are located 170 km northeast of Damuscus. In 2000, Syria was the world's third largest exporter of phosphate rock after Morocco and Jordan; most phosphate rock was exported to Asia, Europe, and North America, and the remainder was used for domestic fertilizer production (Arabia Online Ltd., January 18, 2001, Syria phosphate reserves up to 1.7 bln tonnes, accessed April 24, 2001, at URL http://www.arabia.com/Business/article/english/0,1690,37839,00.html).

Syria's abundant phosphate reserves and rising natural gas production have led to plans for expanding fertilizer production capacity. In 2000, Syria had two nitrogenous fertilizer plants and one phosphate-based unit at Homs. Domestic demand for phosphate fertilizers was more than 400,000 t/yr, but phosphate fertilizer plant production was only 250,000 t/yr. A 500,000-t/yr triple superphosphate plant was being constructed near Palmyra by Bechtel Corp. and Makad International. This plant would obtain phosphates from the Khunaifis Mines. For nitrogenous fertilizers, Syria also planned to build a plant with a production capacity of 365,000 t/yr of ammonia and 639,000 t/yr of urea. This plant would use gas from the Omar field (Arab Petroleum Research Center, 2000c, p. 443).

Sulfur.—Syria produced sulfur as a byproduct of oil refining. The General Establishment for Chemical Industries operated a 150-metric-ton-per-day-capacity sulfur plant in Homs (British Sulphur Publishing, 1999, p. 32).

Mineral Fuels

Natural Gas.—Syria's proven natural gas reserves were estimated at 241 billion cubic meters. Most of these reserves were owned by the Syrian Petroleum Company (SPC), which was a state-owned company. The Palmyra area contained 102 billion cubic meters; the al-Furat fields, 45 billion cubic meters;

Suwaidiyah, 34 billion cubic meters; Jibsah, 23 billion cubic meters; Deir ez-Zour, 20 billion cubic meters; and at al-Hol, al-Ghona, and Marqada, the remainder. About half of Syria's gas is nonassociated. In June 1999, SPC reportedly discovered a new gasfield called North al-Faydh (U.S. Energy Information Administration, February 2001, Syria—Natural gas, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

In 1999, Syria produced about 6.2 billion cubic meters of natural gas, which was an approximately fivefold increase compared with that of the past decade (Arab Petroleum Research Center, 2000c, p. 437). Syria planned to increase production further (possibly doubling by 2005) as part of a strategy to substitute natural gas for oil in power generation.

The Syrian natural gas industry has been facing logistical challenges. Gas reserves are located mainly in northeastern Syria, but population and end users are centered in the western and southern parts of the country. SPC has invited foreign energy companies to submit proposals on gas development projects in the Palmyra region, which is in central Syria (U.S. Energy Information Administration, February 2001, Syria—Natural gas, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html). At the end of 1999, Al-Sokhnah and the Najib fields were developed in the Palmyra region; each has a production capacity of 1.5 million cubic neters per day. Al-Abbas, Al-Rasem, Al- Sharif, the Kom Abu Arabat, the Rasif, and the Zamlakh fields were estimated to have a total production potential of 5.65 million cubic meters per day and were expected to come on-stream in 2002 (Arab Petroleum Research Center, 2000c, p. 437).

Other sources of new natural gas production will come from the Dez Gas project. In November 1998, SPC awarded a contract worth $430 million to TotalFinaElf SA and Conoco Inc. for the recovery of associated gas from the Deir ez-Zor oilfields. A new gas-processing plant with a capacity of 5 Mm^3/d and associated gas gathering and transmission facilities was scheduled for completion in September 2001. In 2000, gas-processing plants included Omar with a capacity of 2.4 billion cubic meters per year; Palmyra, 2.2 billion cubic meters per year; Jbeisseh, 1.06 billion cubic meters per year; and Suwaidiyah, 240 million cubic meters per year (Arab Petroleum Research Center, 2000c, p. 438).

Petroleum.—Official and independent sources have estimated Syria's oil reserves to be 2.5 Gbbl. Suwaidiyah was the largest oilfield; its reserves were originally more than 1 Gbbl. Omar has recoverable reserves of 200 Mbbl, and Al-Thayyem has reserves of 180 Mbbl (Arab Petroleum Research Center, 2000c, p. 431).

The SPC operated fields of heavy crude oil in northeastern Syria. The company's largest fields were Jibsah, which also produces natural gas; Karatchok; and Suwadiyah. TotalFinaElf and Royal Dutch/Shell Group bid on a service contract to enhance oil recovery and to increase production at Karatchok to 150,000 bbl/d. Smaller fields included Alian, Gbebeh, Rumailan, and Tishreen. SPC's oilfields produced 140,000 bbl/d in 1999 (Arab Petroleum Research Center, 2000c, p. 432).

SPC also owned 50% of Syria's largest oil producer Al-Furat Petroleum Company (AFPC). Other partners in AFPC were Germany's Deminex GmbH (18.75%), Pecten Syria Petroleum (15.625%), and Royal Dutch/Shell (15.625%). AFPC's fields are located in northeastern Syria and produced light crude oil (U.S. Energy Information Administration, February 2001, Syria—Oil, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

In 1999, AFPC produced 330,000 bbl/d of oil, which was about 61% of Syria's total crude petroleum production. The company's main oilfields were al-Thayyem (60,000 bbl/d), Al-Izba (55,000 bbl/d), Omar/Omar North (45,000 bbl/d), Maleh/Azraq (35,000 bbl/d), Sijan (35,000 bbl/d), Jarnof/Saban (30,000 bbl/d), Al-Ward (25,000 bbl/d), and Tanak (18,000 bbl/d). Other AFPC oilfields included Abu Hardan, Jazieh, Shdeha, and Tayani. In May 1999, the company awarded a contract to Engineering for the Petroleum and Process Industries to increase the capacity of its crude-oil-gathering centers (Arab Petroleum Research Center, 2000c, p. 431, 432, 434).

In May 2000, Canada's Tanganyika Oil Company Ltd., which was an affiliate of Sweden's Lundin Oil AB, signed an agreement to develop the Oude oil block in northeastern Syria. The deal marked the first time that foreign investment had been sought for a field operated by SPC. This opened up the possibility of future deals; for example, the Suwaidiyah field for which Conoco, TotalFinaElf, and Shell have bid (U.S. Energy Information Administration, February 2001, Syria—Oil, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

The Deir ez-Zor Petroleum Company operated the Attala North, the Jafra, and the Qahar oilfields, which produced 60,000 bbl/d in 1999. The Al-Khabur Petroleum Company (a joint venture between SPC (50%) and a consortium composed of Clyde Petroleum Exploration Ltd., Petronas Carigali Sdn Bhd, Premier Pict Petroleum Ltd., and Seafield Resources plc.) operated the Kishma oilfield, which produced 12,000 bbl/d (Arab Petroleum Research Center, 2000c, p. 434).

Syria's two refineries, which were located at Banias and Homs, had production capacities of 135,000 bbl/d and 107,140 bbl/d, respectively. Syria was planning to construct a third refinery with a capacity of 60,000 bbl/d (possibly increasing to 120,000 bbl/d) at Deir ez-Zor to supply products to the eastern part of the country. Additionally, Syria planned to upgrade its two existing refineries, both of which were in urgent need of overhauling, to replace output of fuel oil with light products (U.S. Energy Information Administration, February 2001, Syria—Oil, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

In November, Syria and Iraq reopened the Kirkuk-Banias pipeline. The Iran Daily (2000b) reported initial deliveries of Iraqi crude oil through the pipeline at around 150,000 bbl/d. The oil, most likely Basra Light, could be used in Syrian domestic refineries, thus freeing up more Syrian crude oil for export to world markets to generate additional export revenues.

Infrastructure

Syria's hydroelectric powerplants had total designed capacity of about 900 MW, but effective operating capacity was about 200 MW owing to technical problems and low water levels in Lake Assad (Arab Petroleum Research Center, 2000c, p. 440). Syria's known exploitable potential hydroelectric energy was 4.5 GW (World Resources Institute and others, 1996, p. 289).

As of 1999, total installed Syrian electric generating capacity was 4.5 GW. With Syrian electricity demand growing at about the same pace as the economy, adding new capacity will be an important national priority. Since 1993, existing power stations have undergone maintenance, and four generating plants have been built. Mitsubishi Heavy Industries Ltd. completed the 600-MW Al-Zara plant near Hama in November 2000. Also planned were the 300-MW Zeizoun plant and the 630-MW Tishreen hydro station. Overall, Syria planned to add 3.0 GW of capacity between 2004 and 2010 (U.S. Energy Information Administration, February 2001, Syria—Electric power, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

As part of its strategy to save oil for export to earn hard currency, Syria planned to build several natural gas combined-cycle powerplants and to convert the country's largest oil-fired powerplants to natural gas. The Banias and the Mahrada plants have been converted from fuel oil to natural gas in recent years; gas for these two plants has been coming from the Palmyra fields. Syria also planned to increase gas usage at the dual-fuel (fuel oil or natural gas) Tishreen powerplant; gas for Tishreen will be supplied by the Omar treatment plant.

Syria was also pursuing nuclear power as an alternative to oil-fired plants. On May 19, 1999, Syria signed an agreement with Russia on cooperation in nuclear power; this included the construction of two nuclear reactors in Syria. In 1998, the two countries had agreed on a timetable for a 25-MW light-water nuclear powerplant in Syria with the participation of Russia's Atomstroyeksport and Nikiet (U.S. Energy Information Administration, February 2001, Syria—Electric power, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

In 1999, Jordan and Syria signed a formal agreement to connect their power grids. In the same year, Syria and Iran signed an agreement on electric power cooperation. Syria's power distribution system suffered from transmission losses as high as 25% of total generated capacity owing to poor-quality wires and outdated transformer stations. In December 2000, the European Investment Bank agreed to lend Syria $69 million for the expansion and upgrading of the country's power transmission network. The project, which was scheduled for completion by 2005, will also be funded by Arab Gulf states and the Syrian Government (U.S. Energy Information Administration, February 2001, Syria—Electric power, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

Outlook

The International Cement Review (2001c, p. 282) predicted that the production and consumption of cement in Syria would increase modestly in 2001. The increased demand for construction materials may also lead to greater production of gravel, gypsum, marble, and sand.

Syria's oil industry was expected to face many challenges in the coming years. Oil production continues to decline owing to technological problems and depletion of reserves. Since peaking in 1996, Syria's oil output has fallen steadily as older fields, especially the Jebisseh field, have reached maturity (table 1). During the next several years, analysts expect production to continue to decline, net oil exports to decline, and consumption to rise. If future oil and gas exploration and production efforts are successful, then the problem of resource depletion may be significantly alleviated (U.S. Energy Information Administration, February 2001, Syria—Oil, accessed May 3, 2001, at URL http://www.eia.doe.gov/emeu/cabs/syria.html).

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TABLE 1
JORDAN, LEBANON, AND SYRIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Country and commodity		1996	1997	1998	1999 e/	2000 e/
JORDAN						
Cement, hydraulic	thousand tons	3,512 r/	3,251 r/	2,650 r/	2,687 r/ 3/	2,640 3/
Clay:						
Common clay		NA	843,986	590,897	450,178 3/	199,468 3/
Kaolin		47,500	57,255	78,000	34,040 r/ 3/	36,795 3/
Zeolite tuff		NA	NA	NA	13,086 3/	9,797 3/
Feldspar		2,500 e/	--	4,008	1,000 r/ 3/	11,112 3/
Gypsum		190,000	193,527	175,807	244,920 r/ 3/	157,868 3/
Kaolin		47,500	57,255	78,000	34,040 r/ 3/	36,795 3/
Lime		7,275	4,263	4,064	4,120 r/	4,050
Natural gas, gross	million cubic meters	200 e/	291	264	282 r/ 3/	287 3/
Petroleum:						
Crude	42-gallon barrels	16,000 e/	14,680	12,400	-- 4/	--
Refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	1,500 e/	1,542	1,660	1,505 r/ 3/	1,684 3/
Gasoline	do.	4,500 e/	4,469	5,429	4,685 r/ 3/	4,957 3/
Jet fuel	do.	300 e/	253	245	1,722 r/ 3/	1,950 3/
Kerosene	do.	1,500 e/	1,507	1,517	1,382 r/ 3/	1,991 3/
Distillate fuel oil	do.	6,500 e/	6,920	6,882	8,222 r/ 3/	10,001 3/
Residual fuel oil	do.	7,000 e/	7,326	7,105	-- r/ 3/	-- 3/
Other	do.	1,000 e/	866	783	830 r/ 3/	688 3/
Total	do.	22,300 e/	22,883	23,621 r/	18,346 r/	21,271
Phosphate:						
Mine output:						
Gross weight	thousand tons	5,355	5,896	5,925 r/	6,014 3/	5,458 3/
P_2O_5 content	do.	1,765	1,946 r/	1,955 r/	1,924 r/ 3/	1,746 3/
Phosphatic fertilizers		639,800	576,142	579,835	613,821 r/ 3/	409,149 3/
Phosphoric acid		NA	37,761	68,345	372,169 r/ 3/	178,701 3/
Potash:						
Crude salts	thousand tons	1,765	1,416 r/	1,527 r/	1,800	1,936 3/
K_2O equivalent	do.	1,080	850 r/	916 r/	1,080 r/	1160 3/
Salt		50,000 r/	157,830 r/	263,314 r/	279,135 r/ 3/	311,189 3/
Sand, silica	cubic meters	NA	NA	NA	52,224 3/	47,218 3/
Steel, crude e/		30,000	-- r/ 3/	-- r/ 3/	--	--
Stone:						
Dimension, worked	thousand meters	6,000 e/	6,308	6,205	6,303 r/ 3/	3,508 3/
Gravel and crushed rock e/	thousand cubic meters	NA	NA	NA	12,180 3/	10,381 3/
Limestone	do.	8,000 e/	12,388	8,031	8,000	8,000
Marble	cubic meters	100,000 e/	57,550 r/	134,670 r/	10,250 r/ 3/	21,575 3/
LEBANON e/						
Cement, hydraulic	thousand tons	3,500	2,703 3/	3,310 r/ 3/	3,200 r/ 3/	3,200
Gypsum		1,980 r/	1,530 r/	1,870 r/	1,810 r/	1,810
Iron and steel, metal, semimanufactures		80,000	80,000	80,000	80,000	80,000
Lime		14,800 r/	11,400 r/	14,000 r/	13,500 r/	13,500
Salt		3,500	3,500	3,500	3,500	3,500
SYRIA						
Cement, hydraulic	thousand tons	4,500 e/	4,840 r/	4,607 r/	4,781 r/ 3/	4,830
Gas, natural:						
Gross e/	million cubic meters	5,500	6,400	8,000	9,000	9,000
Dry	do.	2,900 r/	4,560	5,900 r/	6,200 3/	6,200
Gypsum e/		338,000 r/	364,000 r/	346,000 r/	359,000 r/	363,000
Iron and steel, steel, crude e/		70,000	70,000	70,000	70,000	70,000
Natural gas liquids	thousand 42-gallon barrels	2,928 r/	3,650 r/	2,928 r/	2,928 r/	3,000
Nitrogen:						
N content of ammonia		80,400	83,700	129,200	111,800 3/	91,100 3/
N content of urea		46,000	54,400	79,600 r/	73,400 3/	56,600 3/
Petroleum:						
Crude		220,500	204,800	202,000	196,000	194,000
Refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	2,122	2,170	2,215	2,200	2,200
Gasoline	do.	11,406	11,400	11,785	11,700	11,700
Naphtha	do.	1,685	1,700	1,710	1,700	1,700
Jet fuel	do.	1,728	1,725	2,029	2,000	2,000

See footnotes at end of table.

TABLE 1--Continued
JORDAN, LEBANON, AND SYRIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Country and commodity		1996	1997	1998	1999 e/	2000 e/
SYRIA--Continued						
Petroleum--Continued:						
Refinery products--Continued:						
Kerosene	thousand 42-gallon barrels	1,491	1,500	1,546	1,500	1,500
Distillate fuel oil	do.	30,078	30,600	30,772	30,600	30,700
Residual fuel oil	do.	35,038	35,000	34,978	34,800	34,900
Asphalt	do.	1,916	1,900	1,900	1,900	1,900
Other	do.	1,900	1,900	2,000	2,000	2,000
Total	do.	87,364	87,895	88,935 r/	88,400 r/ 3/	88,600 3/
Phosphate rock:						
Gross weight	thousand tons	2,189	2,392	2,496	2,084 r/ 3/	2,166 3/
P_2O_5 content	do.	670	730	765 r/	635	658
Salt		72,000	119,000 r/	163,452	150,000 3/	150,000
Stone, sand and gravel: e/						
Stone, dimension, marble	thousand cubic meters	1,156 3/	1,150	1,200	1,200	1,200
Sand and gravel	thousand tons	4,200	4,200	4,200	4,000	4,000
Sulfur, byproduct of petroleum and natural gas		30,000 r/	30,000 r/	30,000 r/	30,000 r/	30,000

e/ Estimated. r/ Revised. NA Not available. -- Zero.
1/ Table includes data available through May 4, 2001.
2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.
3/ Reported figure.
4/ Crude oil production from the Hamza field ceased.