

# THE MINERAL INDUSTRY OF

# ALGERIA

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Hydrocarbons remained by far the leading mineral sector, providing \$12.6 billion<sup>1</sup> in export earnings in 1996. The nation also sustained a modest production of metals and industrial minerals. Local parastatal mining companies and agencies were amalgamated into the Office de Recherche Géologique et Minière (ORGM) with the objective of centralizing the promotion of international investment in the Algerian mineral industry. Working with local and international companies, ORGM is responsible for information distribution relating to the mining sector, as well as for the publication of geological maps and the evaluation and development of deposits. ORGM has identified several exploitable mineral deposits; their location is, however, in remote areas devoid of any infrastructure.

The Government continued to focus priorities on the following: expanding exploration activities, improving the recovery rate of oil and gas, augmenting hydrocarbon reserves, and increasing hydrocarbon production, transport, and export capacities. The Government offered foreign companies minority equity interest in producing fields, an area from which they had been excluded. A production-sharing agreement with Atlantic Richfield Co. of the United States (ARCO) is Algeria's first association with a foreign partner in exploiting a producing field, the Rhourde El Baquel. ARCO is to receive as much as 49% of the field's output. The field's current production is 25,000 barrels per day (bbl/d). With ARCO's use of in-fill drilling and miscible gas injection technology, the field is expected to reach peak production of 125,000 bbl/d after the turn of the century.

The decree of April 6, 1996, covered the following stipulations relating to foreign company participation in the hydrocarbon industry. A foreign company is no longer required to form a commercial company subject to Algerian law with its head office in Algiers if it sets up a joint stock company with the Government's Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH). If a field has not yet been developed or is under development, then the foreign company is required to pay a bonus to access known reserves. If a foreign company finances a pipeline, then priority will be given to transporting hydrocarbons from the field operated by that company. The foreign partners of SONATRACH have the right to use the proceeds of gas exports covered by joint marketing agreements with SONATRACH.

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<sup>1</sup>Where necessary, values have been converted from Algerian dinars (AD) to U.S. dollars at the rate of AD58.04=US\$1.00 in 1996.

The foreign partners are not required to return their share of proceeds from these sales to Algeria.

Crude oil production was 812,000 bbl/d compared with 767,000 bbl/d in 1995. Lease condensates were produced at an average of 430,000 bbl/d compared with 390,000 bbl/d in 1995. The production of natural gas plant liquids averaged 145,000 bbl/d in both years (Energy Information Administration, 1997). A variety of nonfuel minerals were produced in minor amounts; but only iron ore, mercury, and phosphate rock were produced in significant amounts. (See table 1.) The entire output of iron ore was consumed by the domestic iron and steel industry. Phosphate rock and mercury was produced entirely for export. Although the Algerian production of mercury has fluctuated widely with the price of this commodity in the world market, the 1995 production was reduced because of technical difficulties.

Natural gas and liquid fuels accounted for about 98% of Algeria's export earnings. The increase in export volumes and oil prices contributed to increased earnings in 1996. Hydrocarbon exports were valued at \$12.6 billion compared with \$9.6 billion in 1995 (Arab Petroleum Research Center, 1997, p. 18). Other exports were, by order of value, metals and metal products, phosphates, and iron ore. In 1995, exports of helium and nitrogen began with Europe as the principal market for helium and north African countries as the principal markets for liquid and gaseous nitrogen; both types of nitrogen were also marketed domestically (Arab Petroleum Research Center, 1997, p. 45).

In 1996, nearly 275 million barrels (Mbbbl) of Algerian crude oil and refined products was exported to Western Europe and 95 Mbbbl, to the United States. Exports of natural gas totaled nearly 40.8 billion cubic meters in 1996 compared with 37.7 billion cubic meters in 1995. Natural gas exports via pipeline totaled 21.22 billion cubic meters exceeding liquefied natural gas (LNG) exports, which totaled 19.55 billion cubic meters. Italy continued to be the principal market for Algerian natural gas, importing 18.9 billion cubic meters, followed by France at nearly 7.6 billion cubic meters; Spain, 4.8 billion cubic meters; Belgium, nearly 4 billion cubic meters; Turkey, 2.2 billion cubic meters and Slovenia, Tunisia, and the United States, 1 billion cubic meters or less each. Algeria's share of the European gas market ranks third behind the Netherlands with 26% and Russia with 36% (Arab Petroleum Research Center, 1997, p. 45).

Studies conducted by Entreprise d'Exploitation des Mines d'Or (ENOR) show gold deposits at a grade of as much as 25.1 grams per ton. ENOR is looking for international expertise and capital to develop prospects in five geological provinces in the Hogar region. The nation's political climate was the major

cause of the decision of Anglo American Corp., JCI Ltd., and Gencor Ltd.—all of South Africa—to abandon interest in the pursuit of Algeria's gold potential.

The bulk of Algeria's iron ore output was extracted from the mine at Ouenza. Mining operations were spread over 17 square kilometers, with the main seam 2 kilometers (km) long and 500 meters wide. Iron ore also was mined at Bou Khadra and shipped with Ouenza ore by rail to the El Hadjar processing plant, near Bejaia, a distance of 170 km. Both mines were operated by Entreprise Nationale de Fer et de Phosphates.

Helium is produced at the Helios Co.'s Bethious plant, near Arzew. SONATRACH owns a 51% equity in the company, and Air Products & Chemicals, Inc., of the United States and L'Air Liquide of France share the remaining equity. The plant's capacity is 16 million cubic meters per year of liquid helium, accounting for 20% of world output and 33,000 metric tons per year of liquid and gaseous nitrogen (Arab Petroleum Research Center, 1997, p.55).

Anadarko Petroleum Corp. of the United States (Anadarko) discovered oil and gas at its HBNS 3 delineation well at the Hassi Berkine South Fields. The oil is of 42° API gravity. Partners in the concession are Lasmo of the United Kingdom and Maersk Oil & Gas of Denmark.

Gross production of natural gas was 143 billion cubic meters, about 50% of which was reinjected to maintain petroleum-reservoir pressure. The combined total production of LNG at the three liquefaction plants at Arzew and the one at Skikda was about 85,000 cubic meters per day of LNG (Secretariate of the Organization of Petroleum Exporting Countries, 1996).

Most of Algeria's crude oil production was derived from the Hassi Messaoud-Haoud el Hamra Fields in the Sahara; the Zarzaitine-Edjeleh Field near Ohanet; and the In Amenas Field, near the Libyan border. In the near future, increased output will be largely derived from additional production from the Rhourde el-Baguel Field as a result of ARCO's efforts and the development of the Hassi Berkine and the Berkine East Fields by Anadarko. The Hassi Berkine North-1 well flowed at 15,000 bbl/d of 41° API crude oil. Other field activities include a new discovery announced by Agip in April 1996 in block 403. Petro-Canada announced that the Tamadanet Field came on stream in mid-1996 at 12,500 bbl/d. Cepsa of Spain brought the Rhourde El Khrouf Field into production at about 20,000 bbl/d of 51° API crude oil and condensate at the close of 1996 (Arab Petroleum Research Center, 1997, p. 33-37).

Petroleum-refining capacity has been stabilized since the early 1980's when the 325,000-bbl/d-capacity Skikda refinery and the 6,500-bbl/d-capacity In Amenas refinery came on-stream, elevating national refining capacity to 474,500 bbl/d.

Hydrocarbon reserves in January 1997 were 5.1 trillion cubic meters of natural gas. Unassociated natural gas accounted for 85% of these reserves. Recoverable petroleum reserves were 9.98 billion barrels. Iron ore reserves were 35 million metric tons (Mt) averaging 53% iron; an estimated additional resource of 970 Mt grading 53% iron was, however, identified at the undeveloped Gara Djebilit deposit.

Algeria's railroad system, which totaled 4,060 km of track, and its road network, which covered more than 90,000 km, were

in the northern section of the country and supported long-established mining and other export-oriented industries. The existing infrastructure was too distant to lend support to the development of commercial mineral deposits reported in the southern desert.

More than 11,400 km of pipeline served the hydrocarbon industries within Algeria. The center of the crude oil pipeline network was Hassi Messaoud, in the southeast, from which three crude pipelines ran north to Skikda, Bejaia, and Arzew. The center for the natural gas pipeline network was Hassi R'Mel, with pipelines connecting to liquefaction facilities at Arzew and Skikda. Hassi R'Mel was also the source for natural gas exports to southern Europe by means of the 4-billion-cubic-meter-capacity Trans-Mediterranean pipeline and the 8-billion-cubic-meter-capacity Maghreb-Europe pipeline. The Transmed natural gas export pipeline extended for 2,340 km from Algeria northeastward through Tunisia and under the Mediterranean Sea to Sicily and the Italian mainland. Natural gas was exported to Slovenia by means of a 35-km spur line near the Italian end of the Trans-Mediterranean pipeline. The 1,845-km Maghreb-Europe pipeline was under construction traversing Algeria northwestward through Morocco and the Straits of Gibraltar to Seville, Spain. The pipeline was inaugurated in November 1996 at an initial capacity of 8 billion cubic meters per year. The second phase of the Maghreb-Europe pipeline construction will include extensions to Portugal, France, and Germany. Additional compressor stations could bring the pipeline capacity to 18 billion cubic meters per year, if commercial outlets warrant it.

Algeria used seven marine terminals for the export of hydrocarbons, including La Skhirra, in Tunisia. The largest terminal was Arzew-Bethioua, which accommodated 40% of all hydrocarbon exports. Port capacity at Skikda was limited to 90,000-cubic meter LNG carriers. Efforts were underway to augment facilities to permit the accommodation of 125,000-cubic meter LNG carriers.

Stimulating foreign investment interest in Algeria's aging energy industries was vital to the economy because the nation did not have enough cash or access to sufficient credit to sustain economic activity. In pursuing this course of action, the Algerian Government has not only encouraged exploration agreements, but has offered a portion of production rights in existing oil fields and gas fields to private companies with capital and enhanced recovery capabilities. This action represented the most significant change in oil policy since nationalization in 1971. ARCO, Agip, Anadarko, British Petroleum, Cepsa, Petro-Canada, Repsol, and Total SA were among those under contract with SONATRACH. Without foreign capital to refurbish the hydrocarbon extraction and processing facilities, as well as the supporting transport infrastructure, Algeria may be unable to satisfy demand within a few years. The World Bank extended a \$150-million economic rehabilitation support loan. Specific reform requirements of the World Bank include the following: preparing legislation for privatization, selling public enterprises, and restructuring major public enterprises such as the steel and fertilizer industries.

In the hydrocarbon sector, financing difficulties have delayed some oil and gas projects. SONATRACH is pursuing a policy of simultaneous upstream capacity expansion in oil, natural gas, and gas liquids production.

With an accumulated external debt of \$33.5 billion, any decline in oil prices has serious implications for the Government's domestic finances. Since 1994, the recovery of global oil prices has, however, brought improved export earnings and, consequently, an improved environment for international debt rescheduling. The spot price for Algeria's Saharan Blend crude oil was 22% higher, at an average of \$21.27 per barrel, compared with an average of \$17.42 per barrel in 1995.

In future years, recoverable reserves should increase as a result of new discoveries, improved data on existing fields, and the installation of enhanced recovery systems. Seven promising hydrocarbon discoveries were reported in 1996. Although the delineation and appraisal work was not fully completed, preliminary data indicate that most of the discoveries should, in all probability, be pronounced commercial.

### References Cited

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- Secretariat of the Organization of Petroleum Exporting Countries, 1996, Annual statistical bulletin: Vienna, Organization of Petroleum Exporting Countries, p. 16.

### Major Sources of Information

Office de Recherche Géologique et Minière (ORGM)

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TABLE 1  
ALGERIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1992	1993	1994	1995	1996 e/
<b>METALS</b>					
Cadmium, refined e/	75	75	75	75	75
Iron and steel:					
Iron ore, gross weight thousand tons	2,523	2,311	2,047	2,200	2,245 3/
Metal:					
Pig iron do.	930	925	919	940	800
Steel, crude do.	842	865	808	827	620 3/
Lead:					
Concentrate, Pb content	920	1,538	1,100 r/	1,383	1,016 3/
Metal, refined	4,500	6,000	8,000	8,000	8,000
Mercury kilograms	476,000	459,100	414,000	292,000	367,800 3/
Silver e/ do.	1,900	2,200	3,000	3,000	3,000
Zinc:					
Concentrate, Zn content	7,500	6,800	5,700 r/	7,174	5,912 3/
Metal, smelter output	31,500	33,400	30,000	30,000	25,000
<b>INDUSTRIAL MINERALS</b>					
Barite: Crude	51,159	47,232	20,584	29,838	31,348 3/
Cement: Hydraulic	6,400	6,400	6,060	6,200	6,500
Clays:					
Bentonite	31,019	20,833	20,215	17,088	17,200
Fuller's earth	3,656	3,229	4,550	4,500	4,500
Kaolin	20,844	12,586	16,984	24,068	25,000
Diatomite	2,671	3,471	2,800 r/	3,700	3,700
Feldspar	4,700	6,500	6,900	7,000	7,000
Gypsum 4/ thousand tons	355	225	225	250	250
Helium, liquid million cubic meters	--	--	--	10	15
Lime, hydraulic e/	62,000	62,000	62,000	62,000	62,000
Nitrogen, N content of ammonia	438,000	380,000	380,000	400,000	425,000
Phosphate rock:					
Gross weight thousand tons	1,136	718	730	1,596	1,051 3/
P2O5 content do.	389	245	251	500	320
Salt: Brine and sea salt	180,000	179,000	178,000	178,000	178,000
Sodium compounds, caustic soda e/	700	700	700	700	700
Strontium minerals, celestite, gross weight e/	5,400	5,400	5,400	5,400	5,400
Sulfur, elemental e/	20,000	20,000	20,000	20,000	23,000
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Gas, natural:					
Gross million cubic meters	128,000	133,700	131,100	114,779 r/	143,100 3/
Dry 5/ do.	53,200	53,900	51,100	58,100	62,300 3/
Natural gas plant liquids thousand 42-gallon barrels	52,855	52,925	51,500	53,000	53,000
Petroleum:					
Crude including condensate do.	443,110	424,130	430,700	436,905	453,300 3/
Refinery products:					
Liquefied petroleum gas do.	10,000	9,000	9,500	10,000 r/	10,000
Gasoline do.	19,272	20,988	18,900 e/	21,900 r/	21,900
Naphtha e/ do.	30,000	30,000	31,000	31,000	31,000
Kerosene do.	3,869	3,723	8,540 r/	8,030 r/	8,100
Distillate fuel oil do.	57,378	54,530	49,800 r/	51,976 r/	52,000
Lubricants do.	825	800	825 e/	850 r/	850
Residual fuel oil do.	37,630	37,700	37,400 e/	36,646 r/	36,800
Other e/ do.	2,900	2,700	3,000 r/	3,500	3,500
Total do.	161,874	159,441	158,965 r/	163,902 r/	164,150

e/ Estimated. r/ Revised.

1/ Table includes data available through July 1, 1997.

2/ In addition to the commodities listed, secondary aluminum, secondary lead, and secondary copper may be produced in small quantities, and crude materials are produced for local consumption. Output is not reported, and available information is inadequate to make estimates of production levels.

3/ Reported figure.

4/ Includes about 50,000 tons of plaster each year.

5/ Excludes gas used in reinjection, flaring, venting, transmission losses, and natural gas liquids extraction.