THE MINERAL INDUSTRY OF

BOLIVIA

By Pablo Velasco

According to the National Statistical Institute of Bolivia, the gross domestic product grew by 4.1% to about $7.8 billion[1] in 1997, higher than the 3.9% growth registered in 1996.

Bolivia's foreign debt decreased by $145 million, to $4.1 billion from $4.37 billion on December 31, 1996. Export revenues increased by about 7.7%, to about $1.27 billion, owing to increases in the mineral exports of crude oil, natural gas, gold, silver, tin, and zinc. These revenues, including crude oil and natural gas, represented about 54% of Bolivia's total export earnings. The 1997 inflation rate was 6.7%, well below the 7.5% target of the International Monetary Fund (IMF) program. Mining's contribution to Bolivian exports trade was more significant. In the past 6 years, metallic minerals have provided up to 51.3% of the value of Bolivia's exports ($1.07 billion in 1997), and hydrocarbons, up to 17.1%. Gold, silver, tin, and zinc outputs are currently the mineral base sustaining Bolivia's mineral industry.

Government Policies and Programs

Bolivia enacted new minerals legislation in 1997. Under the Bolivian Constitution of 1952, however, all mineral substances are the property of the State. Mining concessions confer a right other than ownership. Exploration also requires the granting of a concession x and are subject to the
payment of $1 per hectare for the firs 5 years and increase will increase to $2 per hectare after 5 years. Bolivian and foreign citizens may hold exploration and mining concessions. Mining concessions are, therefore, owned and administered by the Servicio Nacional de Geología y Minería, (SERGEOMIN—formerly Servicio Geológico de Bolivia). There are export credit support agreements with the Multilateral Investment Guarantee Agency and the Overseas Private Investment Corporation, in addition to some individual European countries. The new minerals legislation and regime described don't draw distinctions between locally and internationally funded companies. Since 1991, Corporación Minera de Bolivia's (COMIBOL) concessions were subject to the same terms as those for by private companies. Through this mechanism, the company will transfer operational control to the private sector via leases, joint ventures, and services and operational contracts. Under the law, joint-venture contracts do not establish a corporate entity; in other words, the individual parties continue to manage themselves. Most mining concessions are freely transferable, and concessions may be leased. The cancellation of a concession occurs only if the relevant payment is not made on time. A company may freely export its products. Profits and dividends reinvested into the industry are exempted from all taxation. The mineral sector is liable to direct taxation through a corporate income tax and a complementary mining tax. The industry is also subject to indirect taxation such as value added tax, transaction tax, specific consumption tax, and import duties. Income tax is payable at 25% of net income. Net losses may be carried forward and deducted from future income for the purpose of tax calculations. Certain deductions apply to the calculation of total taxable income. Depreciation, bad loans, directors' compensation, travel, transport and personnel expenses, and contributions are deductible, as are employee bonuses and benefits. Depreciation is generally accounted for by the straight-line method, but accelerated schedules may also be used for tax purposes if approved by the authorities.

On April 30, 1996, the new Hydrocarbons law No. 1689 was enacted. Under the Constitution, all hydrocarbon deposits, in whatever condition or form they are found, fall within the direct, inalienable, and imprescriptible domain of the Government. No concession or contract can confer ownership of the hydrocarbon deposits. The right to explore and exploit the hydrocarbon fields and market the products thereof is exercised by the Government through Yacimientos Petroliferos Fiscales Bolivianos (YPFB). This Government-owned company will necessarily execute joint-risk contracts of limited duration with individual or legal entities, whether Bolivian or foreign nationals, for the exploration, exploitation, and marketing of hydrocarbons, pursuant to the provisions of this law. The transportation of hydrocarbons and the distribution of natural gas through networks will be the object of administrative concessions in favor of individual or legal entity whether Bolivian or foreign investors, granted by the Superintendency of Hydrocarbons of the Sectorial Regulation System .

The refining and industrialization of hydrocarbons will be carried out subject to the provisions of article 44 of this law. Foreigners will be unable to acquire or possess real property under any title within 50 kilometers of the national borders, except in the case of national necessity declared by express law. YPFB, representing the Government, can subscribe joint-risk contracts with individual or foreign legal entities, public or private, for exploration, exploitation, and marketing of hydrocarbons in said exclusion zone, maintaining, in every case, ownership title of the property that is built in that excluded zone for petroleum industry purposes and shall exercise possession of the same even through third parties. The Government and YPFB shall not assume any financing obligation or third-party responsibility with respect to the joint-risk contract subject to this law.

The petroleum activities, which are the object of this law, will be executed buy using modern techniques and procedures in the exploitation of the fields, under the supervision of YPFB, to establish production levels in accordance with efficient and rational recovery practices for hydrocarbon reserves, and the conservation of reservoirs, and it is prohibited to burn or vent gas without the prior express approval of the National Secretariat of Energy and the

[1]Where necessary, values have been converted from bolivianos ($b) to U.S. dollars at the rate of$b 5.37 US$1.00.

supervision and control of its compliance by YPFB. Imports, exports, and domestic marketing of hydrocarbons and their derived products may be freely carried out, subject to the dispositions of this law.

The dispositions of Article 171 of the Political Constitution of the State and the law of the Environment and its regulations will apply to the hydrocarbons sector.

After 20 years of negotiations, natural gas produced in Bolivia is scheduled to arrive in São Paulo, Brazil, on December 15, 1998, via the new Bolivia-Brazil pipeline. The agreement behind the project allows for the initial delivery of 8 million cubic meters per day (Mm^3/d); this volume is expected to grow to 30 Mm^3/d within 8 years. The natural gas will travel through a 32-inch pipeline that telescopes down to 16-inch as it nears São Paulo, the fastest growing industrial city in South America.

When Amoco Corp. capitalized Chaco—about half of YPFB's oil and gas exploration unit— in December 1996, the U.S. company pledged to invest $307 million in the company over the next 8 years. Chaco has announced that investment will total more than $700 million over the same 8 year period to meet Brazil's growing energy demands.

Other capitalized companies have also recently reported higher-than-required investments in Bolivia; Andina (owned by YPF-Argentina, the other capitalized subset of YPFB's former oil and gas exploration unit) has increased its investment plan from $265 million during the past 6 years to $730 million; Transredes (the Enron/Shell partnership that owns YPFB's former gas transportation network) has raised its planned investment from $263 million to $450 million (U.S. Embassy, La Paz, Bolivia, 1998, p. 1-2). Capitalization of YPFB brought the total amount of investment pledged through the capitalization process to almost $1.7 billion. The other companies were Empresa Nacional de Telecomunicaciones, Lloyd Aéreo Boliviano, Empresa Nacional de Electricidad, and Empresa Nacional de Ferrocarriles. Only Empresa Metalúrgica de Vinto (formerly Empresa Nacional de Fundiciones), which processes tin and antimony, remained to be capitalized. Vinto's value was estimated at $50 million.

Environmental Issues

New environmental regulations became effective at the beginning of 1996. Included in the legislation are requirements for environmental impact studies to be submitted for all new mining and industrial projects and for all existing projects to conform to environmental quality control systems within the next 5 years. Any operation failing to comply with these regulations faces closure, although the legislation does not address the widespread problems associated with 500 years of historical mining in the region and the pollution caused by artisanal miners. Environmental standards are monitored nationally by the Ministry of Sustainable Development and by its Departmental Secretary of Sustainable Development and Environment at the regional or departmental levels. All projects require an environmental licence, which can be obtained by a certificate of dispensation, a declaration of environmental impact, or the approval of an environmental manifesto. The license will expire after a fixed period of time or may be revoked if its conditions are violated. (Mining Journal, 1998).

Production

In spite of lower mineral prices in the market, Bolivia's mining industry output increased in volume and value in 1997 owing to the $562 million investment in the private mining sector during the past 12 years. In 1997 the mining investment was about $59 million short of the planned $155 million. As a result of this program, a large portion of this money was used in the exploration of new mineral deposits. Traditional exports of metallic minerals increased by more than 7% to $482.5 million. Production of metallic and nonmetallic minerals increased substantially in 1997 compared with that of 1996. (*See table 1.)* The medium mining sector (the privately owned commercial mines) continued to be the dominant producer and was responsible for about 57% of the value of mine production in 1996, followed by the small mining sector with 37%. In 1997, zinc production was the largest money earner, followed by gold, tin, and silver for the country's mining industry. The value of production of minerals by COMIBOL, declined by 12.9% in 1997 compared with that of 1996.

Crude oil and natural gas produced by YPFB and its contractors represented about 68% and 32% of the total production, respectively. Natural gas output increased by 4.8% in 1997 compared with 5,281 million cubic meters (Mm^3) in 1996.

Mining companies, large and small, were involved in an increasing level of exploration activity; some promising projects were underway in 1997. Exploration was taking place in each of the four principal regions of the country— Altiplano, Brazilian Shield, Cordillera, and the Northeast. The most promising prospects are the gold properties of Cashi Laguna, Don Mario, and Escala, each with a good possibility of becoming an open-pit mine. Corporacion Minera del Sur S.A's. (COMSUR) El Puquio Norte project also has considerable potential.

Bolivia's gold reserves, estimated to be between 373 and 404 metric tons (t), are the main reason for the presence of 38 major mining firms in Bolivia. According to Mintec S.A. officials, the key to this increase in investments can be summed up by opportunity, stability, guaranteed monetary exchange, and competitive tax legislation. Renison Goldfields' exploration official for Latin America indicated that besides the political stability, his company decided to come to Bolivia for the favorable geology and the lack of much previous exploration in the country. Other large mining Companies such as Barrick Gold, Rio Tinto Zinc, Battle Mountain Gold, Billiton, and BHP Minerals, share the same motivations; the mining community expects that the policy set by the Government will continue.

Trade

Bolivia currently exports natural gas to Argentina and has major plans to export gas to Brazil, Chile, and Paraguay in the near future. Nonfuel minerals and hydrocarbons (oil and gas) continued to be Bolivia's leading exports; in combination, they contributed more than 50% of Government revenues. Compared with those of 1996, exports of nonfuel minerals in 1997 increased by about 7% in value, to $482.5 million, amounting to 39.5% of total exports. Zinc became the most valuable export commodity, producing an income of about $200 million, an increase of 32% compared with that of

1996, followed by gold with $110 million a decrease of 7.6% compared to the previous year and tin, which decreased by 1.2% to about $81 million. Exports of metallic tin by Vinto increased in volume to 12,423 (t) and increased in value by 0.2%, to $70.1 million from $69.9 million in 1996.

In 1997, Bolivia continued to be a modest source of minerals to the United States. Bolivian mineral exports to the United States decreased by 13.5% in 1997, to about $69.1 million.

On December 17, Bolivia and the four MERCOSUR countries (Argentina, Brazil, Paraguay and Uruguay) signed the final version of the Free Trade Agreement in Brazil. The Agreement includes a list of 7,000 products that will reach a zero tariff rate, during a period of 18 years. Approximately 30% of the products will become tariff free when the accord goes into effect on March 1, 1997. The vast majority of the products will be tariff-free within 10 years. The Government of Bolivia views the agreement as an opportunity to increase exports and to integrate with its Southern Cone neighbors, although Bolivia will remain an Andean Pact member and not a formal MERCOSUR member, (U.S. Embassy, La Paz, Bolivia, 1997. p. 3).

Structure of the Mineral Industry

The Vice Ministry of Mining and Metallurgy, a branch of the Ministry of Economic Development, is legally responsible for formulating mining policy and orienting the promotion of the sector's development. It also provides investors with the necessary information regarding the rights and guarantees of mining concession holders, current tax and mining laws, and mining environmental regulations. It controls and participates in the mineral industry through SERGEOMIN, the Instituto de Investigaciones Minero-Metalúrgicas de Oruro, and the Sistema Nacional de Información Minera. The Servicio Nacional de Catastro Minero and COMIBOL are autonomous entities.

In accordance with the provisions established in Supreme Decree 23230-A of July 30, 1992, the Government of Bolivia, for the purpose of promoting private investment in the mining sector, sought to transfer to private sector initiative interests in several mining, metallurgical, and infra- structural assets held by COMIBOL, including joint ventures, leases, and optional arrangements. According to COMIBOL's officials, the plan to transform COMIBOL was just beginning to be implemented. The first step of the plan was administrative; the second, the closing of unprofitable mines that generate losses; and the third, the transference of mineral deposits to the private sector by means of an international and very transparent bidding process. In 1996, the company managed a shared-risk agreement with COMSUR, as small as 13 other contracts, all in the exploration phase. Moreover, COMIBOL was in the last stage of transferring four productive mines that were still under state company's administration to private hands. Two of these mines were the Huanuni (tin) and the Colquiri (tin and zinc). Both were part of the Vinto capitalization package. The company that wins the bidding process will enter into a shared-risk agreement with COMIBOL to administer both deposits. Once this is done, the remaining Caracoles mine and another small mine, as well as the Río Yura electric powerplant, which supplies power to the southern part of the country, will be offered internationally for bids. The mines where production has been halted were The San Vicente (silver and zinc) and the San José (gold, silver and lead) and the Mutún (iron ore) deposit (near the border with Brazil). The industrial portion of the capitalization package was made up of the Karachipampa lead-silver smelter plant and La Palca tin volatilization plant, in addition to the Río Yura powerplant (Minas Hoy, 1997).

The activities of COMIBOL will be reduced to a purely administrative role following the transfer of operating control over its properties to the private sector. Only three of COMIBOL's existing mines remained in operation in 1997:—Caracoles tin mine, Colquiri tin- zinc mine and Huanuni tin mine.

The private mining sector, comprising medium-and small-scale mining entities and cooperatives, maintained its position as the leading producer of antimony, gold, lead, tin, tungsten, and zinc in the country. In 1997, the private Medium-Size Miners Association was composed of 14 affiliated mining companies, which were: ARISUR; Avicaya Ltda; BAREMSA; Barrosquira Ltda; Empresa Minera Bernal; Cia. Minera La Barca S.A.; Cia. Minera Salinas S.A. (COMISAL); Cia. Minera del Sur (COMSUR); Cía. Minera Concepción ; Empresa Minera Unificada S.A. (EMUSA); Inti Raymi S.A.; Cía. Minera La Rosa; Cía. Minera La Solución; and Cia.Minera Yamin Ltda.

The Small-Size Miners Association, grouped under the Cámara Nacional de Minería, included 600 small mines operating in the country. Mining cooperatives were organized under the Federación Nacional de Cooperativas Mineras and included most of the gold mining cooperatives of Gonzata, Guanay, Mapirí, and Tipuani. According to the National Institute of Cooperatives, there were more than 320 mining cooperatives in the country, grouped under the Federación Regional de Cooperativas, of which about 40% were mining gold in 1997, mainly in the Tipuani area in the Province of Larecaja, La Paz Department.

Commodity Review

Metals

Antimony.—Bolivia's antimony output decreased by 7.5% in 1997 compared with that of 1996, amounting to about 6,000 t for a total value of $10.7 million. Its production was entirely in the hands of the private sector. Approximately 63.4% was produced by the medium-sized group of mines, and 36.6%, by the small-sized group and cooperatives. EMUSA with its Caracota, Chilcobija, and Espiritu Santo mines remained by far the largest Bolivian antimony producers in the country, followed by COMISAL, and is also involved in exploration with Orvana Minerals of Vancouver, Canada, on the Pederson project. In addition to its Pederson Project, Orvana Minerals holds several other properties. The most significant of these is Don Mario in the southeast (see section on gold).

During 1997, the Vinto tin and antimony smelter processed 4,136 t of antimony in concentrates received from Laurel Industries to produce about 3,788 t of antimony trioxide. Bolivia exported 15% of its production as antimony concentrate, 82.6% as antimony trioxide, and 2% as antimony alloy.

Gold.—Official gold production in Bolivia increased by 5.2% from that of 1996, amounting to 13.3 tons for a total value of $141 million, 85% less than that of 1996. The success of the Kori Kollo gold and silver mine operated by Empresa Minera Inti Raymi S.A., and in which Battle Mountain Gold Mining Co. holds an 88% interest, in the Altiplano north of Oruro, continued to be Bolivia's

most productive operation, although falling grades, a drop in mill recovery, and a higher stripping ratio adversely affected production. This mine, however has stimulated much of the recent foreign interest in the Bolivian mining sector. In 1997, the Kori Kollo Mine set another production record with an output of 10.2 t of gold and 28.7 t of silver.

Orvana Minerals Corporation of Canada has decided to retain a 100% interest in the Don Mario gold-copper project in eastern Bolivia, with the intention of advancing the property to the development stage. Once a positive bankable study is in hand, the company will be able to complete negotiations with commercial lenders for project financing of as much as $40 million, which would be sufficient to fund development of a higher-grade zone at Don Mario. If all goes as planned, then commercial production could be achieved within the next 24 to 30 months, at a rate averaging more than 3,215 kilograms per year (100,000 ounces per year) of gold by, using conventional mining and metallurgical methods. Previous studies by Billiton and Pincock Allen & Holt (modified by subsequent drilling and in-house evaluation) show that the project could produce gold at a cash cost of $3.11 to $3.73 per gram ($100 to $120 per ounce), based on minable reserves of 1.5 million metric tons (Mt) grading 13 grams per ton (g/t) of gold. (Northern Miner, 1998).

Orvana Minerals and EMUSA formed a joint venture to explore the disseminated gold prospect of San Bernardino in Challapata (Pederson project) in the Altiplano. The Pederson project is 360 kilometers (km) south of La Paz, close to the town of Challapata in the Department of Oruro. It is the former San Bernardino antimony mine where a gold vein was discovered. To date, 206 holes have been drilled with reverse circulation for a total of 16,800 meters (m) plus a further 10 diamond drilling holes totaling 1,700 m which covers an area of 47 square kilometers (only the nucleus of the Achachucani Mountain). The results obtained were fairly positive, identifying a potential on the order of 52 Mt of ore containing an average grade of 1.4 g/t of gold, totaling 72,800 kilograms (2.3 million ounces) of gold as measured and inferred geologic resources. Vista Gold Corp., formed from the amalgamation of Granges Inc. and Da Capo Resources Ltd. of Canada, plans to carry out exploration and development drilling programs on 10 of its properties during the next 6 months. These programs, including development drilling at the Amayapampa, the Capa Circa, and the Guariche properties, are budgeted to cost a total of $3 million. It is anticipated that significant additions to Vista's gold reserves and resources will result from these aggressive programs by mid-1997. A 9,000-m development drilling program using three drills has been underway since 1996 on the Amayapampa property. Development drilling will begin on the Capa Circa property in early 1997. These programs are expected to increase proven and probable gold reserves at both properties and to form the basis for a feasibility study due in April 1997. Vista Gold Corp., 1996, Vista plans aggressive exploration programs: Vista Gold Corp. news release, November 7, 1996.(Accessed September 17, 1997, on the World Wide Web at UR. http://www.vista gold.com/news/nov 7-96. html).

The richest and most productive alluvial gold deposits in Bolivia are located on the Challana, the Kaka, the Mapirí, and the Tipuani River valleys where Golden Eagle International, Inc., holds mining rights to concessions in the Cangalli gold deposit, all in the northern area of the Department of La Paz. The second most important alluvial mining is in the Araras area, in the northeastern part of the country on the border with Brazil, where gold has been recovered from the Madera and the Madre de Dios Rivers.

Lead, Silver, and Zinc.—Production of lead ore and concentrates and metallic lead, including alloys, increased by 12.5% and decreased by 24.5%, respectively, from the already depressed level of 1996. Output of metallic silver was maintained at about the same level as that of 1996, which was 70,102 kg. The medium-sized mining sector was the dominant lead and zinc producer, with 79.5% of total lead and 62% of total zinc. In this sector, the major producers of lead, silver, and zinc was COMSUR. In 1997, Apex Silver Mines Ltd. of Canada reported expenses of about $9.8 million for exploration with the completion of the first-phase feasibility study on the San Cristóbal project in southern Bolivia, $9.6 million had been spent in 1996. After establishing proven and probable reserves at the San Cristóbal project on August 31, 1997, the company began capitalizing exploration and development costs related to the project. Apex has discovered one of the world's largest silver deposits at its San Cristóbal project in the Potosí Department of southern Bolivia. Exploration efforts at San Cristóbal already have delineated substantial proven and probable reserves of silver (219 million ounces), zinc (1.8 Mt) and lead (0.6 Mt). When fully operational, San Cristóbal will average 43 metric tons per year (t/yr) of silver, as well as 132,700 t/yr of zinc. This would effectively double Bolivia's production of these metals and, on the basis figures, would account for 50% of the country's mining related exports and 20% of the total exports. In its search for bulk mining opportunities, Apex Silver has entered into several joint ventures with COMIBOL. This has led to the discovery of Cobrizos, a copper-silver property only 12 km to the north of San Cristóbal. (Silver Mines Ltd. reports yearend results).CNN Canada NewsWire April 1, 1998.

Lead and zinc exports decreased by 5.3% and increased by 32%, respectively, of the total nonfuel mineral exports value.

Tin.—Tin production decreased by about 12.9%, to 12,898 t from 14,802 t in 1996. Tin output decreased in value 2% of the country's total 1997 mineral-export value. The largest production increase in the private sector was by the small-sized mines and cooperatives. For the 11th consecutive year, they replaced COMIBOL as the leading tin producer, with an output of about 71% of Bolivia's tin production in 1997. The COMIBOL Mines produced about 25% of the country's total tin mining output.

COMIBOL signed 13 new joint-venture exploration contracts with local and foreign mining companies to explore its own mines and ore bodies in Northern and Southern Lipez in Potosí Department. COMIBOL's Huanuni Mine continued to be the largest tin mine in the country since its reopening in September 1988. The Vinto tin smelter, formerly operated by Empresa Nacional de Fundiciones, produced 16,853 t of metallic tin. Of this, under a toll contract, Vinto smelted 3,788 t of tin concentrate. Vinto's exports increased to 12,424 t of metallic tin (99.95% average tin content). About 70% of Bolivia's metallic tin exports went to the United States, and the rest, to three Latin American countries (Colombia, Mexico, Perú) and Spain.

Tungsten.—Bolivia's production of tungsten concentrate, heavily dependent on international prices, decreased by about 12%, to 647 t from 733 t in 1996. Production came from the small miners and cooperatives that have small deposits with high ore grades and low

labor costs.

Industrial Minerals

Cement.—According to the evaluation made by Sociedad Boliviana de Cementos S.A. (SOBOCE), the only private cement company in Bolivia, total cement production during 1997 was 1.03 Mt, an increase of 10.8% compared with that of 1996; the evaluation was made, however, without considering production data from the small cement factory EMISA. Cement was produced by four plants in different regions of the country having a total production capacity of about 1.4 million metric tons per year. Sociedad Boliviana de Cementos S.A. (SOBOCE). located in Viacha, Deparment of La Paz, has two plants, the Viacha and the Warnes. The former was in the process of expanding clinker production to 300,000 t/yr. In January 1997, SOBOCE acquired, in public bidding, the state cement factory Cemento el Puente, S.A., in the Tarija Department; capacity was 60,000 t/yr of clinker and 57,000 t/yr of cement. Conpañía Boliviana de Cementos S.A., located in Irpa Irpa, Department of Cochabamba, has a production capacity of 300,000 t/yr and is a mixed-capital company (50% private and 50% state owned).

Mineral Fuels

The two upstream units for exploration and production and one transport division belonging to YPFB were sold as separate entities to three international bidders from a group of six contenders. The winners were a consortium of three Argentine companies led by Yacimientos Petrolíferos Fiscales S.A. (YPF S.A.), the United States oil firm AMOCO Petroleum, and a U.S. gas specialist, the Enron Corporation, in joint venture with Britain's Shell International. The Argentine consortium comprising YPF S.A., Pérez Companc, and Plus Petrol bought their 50% interest in the upstream unit Empresa Petrolera Andina for US$264.8 million, beating rival bidders AMOCO Petroleum, which presented a bid for the US$242.4 million. AMOCO was not left out, however, winning the bid for the second upstream unit Empresa Petrolera Chaco S.A. for US$306.7 million, ahead of Repsol Exploration, who bid US$280.1 million for the unit. Finally, YPFB's transport unit went to Enron and Shell Overseas Holdings, in a partnership bid totaling US$263.5 million, well ahead of rivals Nova Gas, who bid US$213.1 million, and the Williams International Pipeline Company, who bid US$200 million. The US$835 million received for YPFB on December 5, 1996, was the highest amount offered for any of the five Bolivian state-owned companies capitalized to date. This capitalization program has now raised an unprecedented US$1.66 billion in foreign investment.

The World Bank approved financing for the construction of the 3,150-km Bolivian-Brazil gas pipeline, one of Latin America's biggest infrastructure projects. The cost of the project is estimated at about $2 billion, besides the World Bank, bankers included the Inter-American Development Bank, the Export-Import Bank of Japan, and European Investment Bank, which was making its first investment in Brazil. The pipeline runs from Santa Cruz, Bolivia, across the Brazilian border at Puerto Suarez-Corumbá to the southern Brazilian cities of São Paulo, Curitiba, and Porto Alegre. Ultimate capacity expected is 31.1 Mm^3/d, beginning with about half the volume. Cumulative distribution of 198.2 billion cubic meter (7 trillion cubic feet) of gas will be delivered to Brazil over 20 years (Bolivia only has 127.4 billion cubic meter) (4.5 trillion cubic feet of proved reserves.) The first gas is expected to be reach to customers in São Paulo by December 1998. Construction of the pipeline began this year financed by shareholder funds. The primary venture partners are Petrobrás (51%); BTB British Gas, Tenneco, and Australia BHP (25%); Enron, Royal Dutch Shell, and YPFB (20%) and other Brazilian companies (4%). Bolivia expects to receive approximately $320 million per year for gas exports beginning in 1999 (Financial Times, 1997).

In 1997, YPFB produced about 29,267 barrels per day of crude oil. Although increases were seen in YPFB's new oilfields of Los Cusis, Patujusal, Carrasco, Montecristo, Monteagudo, and Camiri, La Víbora field continues as YPFB's largest liquid producer.

The contractors' crude oil production continued to rise and was 54.0% higher than in 1996 owing the increased output of Maxus Bolivia Inc.'s Energy Corp. of the United States. The Surubi Oilfield, operated by Maxus, started production in August 1992 and has already doubled its total output to 2.3 million barrels (Mbbl) (up 136%). Production of natural gas increased about 4.8%, to 5,535 Mm^3, compared with that of 1996. The Víbora Gasfield continued as the largest natural gas producer, and the Carrasco Gasfield was the second largest natural gas producer; production from the new fields of Patujusal and Los Cusis increased as well. Surubi Gasfield and Pluspetrol S.A.'s Toro gasfield increased also. Of the total natural gas produced in Bolivia, 38.4% was exported to Argentina; 16.5% was consumed domestically; 28.6% was reinjected into the gasfields; 9.9% was vented, flared, or lost; 3.9% was consumed as fuel by YPFB; and the remaining 2.7% was converted into liquefied petroleum gas. Currently, Bolivia exports natural gas to Argentina and has major plans to export gas to Brazil, Chile, and Paraguay in the near future. Bolivia's pipeline plans included a link to Southern Brazil, northern Chile and, Paraguay. The pipeline to Chile has been delayed since January 1995 because of cross active geologic faults. The pipeline is eventually expected to handle as much as 20 Mm^3/d of natural gas.

In September 1995, Bolivia and Paraguay signed an agreement for Bolivia to supply natural gas to Paraguay through a new pipeline. The Paraguay-Bolivia pipeline would run from Vuelta Grande Gasfield in Santa Cruz, Bolivia, to Asunción, Paraguay. The Trans Chaco pipeline is 800 km long and could transport up to 1.4 Mm^3/d after 5 years from its initial level of 566,000 (m^3/d.) This initial delivery was at a cost of $1.20 per million British thermal units.

Infrastructure

The transportation network of Bolivia was composed of a total of 42,815 km of highways. The Pan-American Highway linking Argentina and Peru crossed the country from south to northwest. The 3,684-km, Government-owned railroad system was controlled by Empresa Nacional de Ferrocarriles; it was capitalized to the Chilean firm Cruz Bianca in 1996. Bolivia's 10,000 km of commercially navigable waterways connected the eastern region of the country with the Amazon basin. As a landlocked country, Bolivia had no ocean ports, but had access to international markets through ports in Arica and Antofagasta Provinces Chile, and Peru via Matarani Port.

As of June 1997, YPFB has been nearly capitalized. About 13.5 Mbbl of crude oil and condensates, 5.6 Mbbl of refined oil products, and 1,251 Mm^3 of natural gas were transported between major distribution centers in Bolivia through 5,980 km of pipelines owned

and operated by YPFB. All the pipelines were reversible, with the exception of an export pipeline to Arica. The generation, transmission, and distribution of electrical power in Bolivia was carried out by state and private companies. The Government sold its electric company to three United States firms. Bolivia had an installed electrical generating capacity of 787 megawatts (MW), of which 308 MW, or about 55%, was generated by hydroelectric plants; the remainder was generated by thermoelectric plants, operated by Empresa Nacional de Electricidad, that had an installed generating capacity of 496.5 MW, or 62% of Bolivia's total.

Outlook

The Bolivian economy will continue to rely heavily on the hydrocarbon sector. Taxes and royalties to be paid on internal sales of finished petroleum products will remain essential revenues for the national treasury. Natural gas exports to neighboring countries will be a significant component of Bolivia's foreign exchange earnings. The Bolivia-Brazil gas pipeline project is expected to become a major driving force for the Bolivian economy, in addition to transporting natural gas to the largest South American market, Brazil. At the same time, the project will help attract private investments for the hydrocarbon sector as the volumes of natural gas to be provided to Brazil will activate exploration and production activities. Once the pipeline is operating, the value of these exports will range from $125 million for the first year to $500 million per year, after 5 years of operation. If thermoelectric powerplants are included and the pipeline system is expanded, then exports can be doubled. Other benefits for Bolivia included (1) attraction of private investment needed for natural gas exploration and development, (2) infrastructure development along the pipeline (compression facilities, liquids extraction plants), (3) creation of new employment opportunities, (4) economic integration with Brazil, (5) expansion of the internal natural-gas-gathering transportation system, (6) production and exports of liquids byproducts, (7) improved access of natural gas to Southern Cone markets, and (8) incentive for other private companies to construct more gas pipelines and to invest in gas-transportation activities (Viceministerio do Energia y Hidrocarburos, March 20,1998, Bolivia-Brazil pipeline, accessed July 29, 1998, at URL http://www.energiagov.bo/ingles/GAsDuct.html).

Future resource development is likely to focus on continued expansion of the hydrocarbon sector, as well as the development of Bolivia's gold industry, the iron ore-steel prospects at the Mutún deposit near the Brazilian border, the development of the lithium and potassium projects from the Uyuni salt flats, the expansion of sulfur production, and the extraction of gold from deposits at Tipuani and Cangalli in La Paz, Don Mario gold/copper deposit in eastern Bolivia, and the San Cristobal silver-zinc-lead deposit in southern Bolivia.

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Major Sources of Information

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Major Publications

Ministerio de Desarrollo Economico
Viceministerio de Minería y Metalúrgia
Boletín Estadístico 1997
Publicación Oficial No. 182
La Paz-Bolivia
Asociación Nacional de Mineros Medianos
Memoria e Informe Anual—1997
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Major Sources of Information—1997

TABLE 1
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1993	1994	1995	1996	1997 p/
METALS 3/						
Antimony:						
Mine output, Sb content		5,556	7,050	6,426	6,488 r/	5,999
Metal including Sb content of trioxide		4,470	5,880	4,840	4,909	4,136
Arsenic, mine output, arsenic trioxide, arsenic sulfide		663	341	362	255	282
Bismuth:						
Mine output, Bi content	kilograms	--	--	121	348	684
Metal, smelter	do.	7	36	19	28	55
Cadmium, mine output, Cd content 4/		4	--	--	--	--
Copper, mine output, Cu content		94	79	127	92	182
Gold, mine output, Au content 5/	kilograms	10,400	12,838	14,405	12,634	13,292
Iron ore: 6/						
Gross weight e/		51,000	2,600	--	--	--
Fe content		32,100	1,650	--	--	--
Lead :						
Mine output, Pb content		21,220	19,679	20,387	16,538	18,608
Metal, smelter		537	597	195	102	77
Silver, mine output, Ag content 7/	kilograms	332,768	352,083	425,053	384,384	387,200
Tantalum, tantalite	do.	3,535	1,820	565	--	--
Tin:						
Mine output, Sn content		18,600	16,169	14,419	14,802	12,898
Metal, smelter		14,500	15,300	17,709	16,733	16,853
Alloys		94	100 e/	248	226	123
Tungsten, mine output, W content		287	462	655	582	513
Zin, mine output, Zn content		122,638	100,742	146,131	145,092	154,491
INDUSTRIAL MINERALS						
Barite		--	3,310	10,845	4,745	4,402
Bentonite		368	364	252	69	--
Calcite e/		37	100	20	20	--
Cement, hydraulic		653,800	767,953	891,776	934,303	1,034,800
Gemstone, amethyst:						
Polished	kilograms	15	33	47 e/	36	18
Rough	do.	248	220	310	238	122
Gypsum, crude		4,000	532	1,800	192	20
Marble		37	318	170	242	274
Onyx	kilograms	133	56	250	--	--
Pumice e/		80	50	--	--	--
Quartz	kilograms	816	400	--	--	39
Salt		200 e/	200 e/	4,924	273	869
Slate (pizarra)		163	268	280	393	458
Sulfur, native		1,050	252	--	--	--
Ulexite		11,990	10,433	6,891	9,231 r/	12,469
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	5,590 r/	5,921 r/	5,349 r/	5,281 r/	5,535
Marketed	do.	3,070 r/	3,121 r/	3,361 r/	3,259 r/	3,203
Natural gas liquids:						
Natural gasoline	thousand 42-gallon barrels	772	788	902	900 e/	920 e/
Other (consumption)	do.	1,809	1,939	2,447	2,450	2,600 e/

See footnotes at end of table.

TABLE 1--Continued
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1993	1994	1995	1996	1997 p/
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Crude including condensate	thousand 42-gallon barrels	8,117 r/	8,249 r/	10,220 r/	10,682 r/	11,000 e/
Refinery products:	do.					
Liquefied petroleum gas	do.	579 r/	2,523 r/	1,650 r/	500 e/	500 e/
Gasoline	do.	4,076 r/	4,163 r/	3,097 r/	3,450 e/	3,450 e/
Jet fuel	do.	741 r/	750 r/	760 r/	825 e/	825 e/
Kerosene	do.	231 r/	276 r/	301 r/	225 e/	225 e/
Distillate fuel oil	do.	2,636 r/	2,883 r/	2,693 r/	2,690 e/	2,690 e/
Lubricants	do.	29 r/	30 r/	34 r/	60 e/	60 e/
Residual fuel oil	do.	52 r/	302 r/	295 r/	400 e/	400 e/
Unspecified e/	do.	216 r/	228 r/	3,445 r/	2,250 e/	2,250 e/
Refinery fuel and losses	do.	453 r/	2,906 r/	1,995 r/	100 e/	100 e/
Total	do.	8,560 r/	11,155 r/	12,215 r/	10,500 e/	10,500 e/

e/ Estimated. p/ Preliminary. r/ Revised.

1/ Table includes data available through July 1998.

2/ In addition to the commodities listed, a variety of industrial minerals (clays, crushed and broken stone, dimension stone, and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.

3/ Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-size mines.

4/ Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)

5/ Includes production of metallic gold.

6/ Data represent exports and are regarded as being equal to production.

7/ Includes production of metallic silver.

TABLE 2
BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Antimony		Empresa Minera Unificada S.A. (EMUSA) (private 100%)	Caracota, Chilcobija, and Espíritu Santo Mines, Potosí Department	2.5
Do.		Cía. Minera Salinas S.A. (COMISAL) (private, 100%)	Potosí Department	0.8
Do.		Empresa Minera Hermanos Bernal S.A. (private 100%)	Putuma Mine, Potosí Department	0.4
Antimony trioxide		Empresa Minera Hermanos Bernal S.A (private 100%)	Palala smelter, Tupiza, Potosí Department	0.3
Cement		Sociedad Boliviana de Cemento S.A. (private, 100%)	Viacha, (La Paz); Sucre; and Tarija plants	650
Do.		Cía. Boliviana de Cementos S.A.M. (50% Government, 50% private)	Irpa Irpa, Cochabamba Department	300
Gas	million cubic meters	Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) (Government, 100%) 1/	Río Grande, Vuelta Grande, and Sirari Gasfields, Santa Cruz Department	2,472
Do.	do.	do.	San Roque, Vibora, and Yapacani Gasfields, Southern District	683
Do.	do.	do.	Cascabel, Naranjillos, Carrasco, Camiri, Monteagudo, Santa Cruz Gasfield Central, and Southern Districts	441
Do.	do.	Occidental Boliviana Inc., Tesoro Bolivia Petroleum Co. (U.S.) and Empresa Naviera	El Porvernir, La Vertiente, Gasfields, Santa Cruz Department	66,100
Gold	kilograms	Cooperatives. (private, 100%)	Tipuani, Guanay, Mapiri, Huayta, Kaka and Teoponte Rivers, La Paz Department	3.1
Do.	do.	Empresa Inti-Raymi S.A. (private, 100%) (Battle Mountain Gold Mining Co., 85%; EMUSA, 15%)	Gold leaching, open pit operation at La Joya, near Oruro, Oruro Department	10.2
Lead		Cía. Minera del Sur S.A. (COMSUR), Cía. Minera Arisur S.A., Cía. Minera La Solución S.A. (private, 100%)	Asientos, lead-silver-zinc mine at Mizque, Cochabamba Department	15.0
Do.		Empresa Metalúrgica de Karachipampa; Subsidiary of Corporación Minera de Bolivia (COMIBOL).	Karachipampa, Lead/silver smelter at Potosí Department.	24
Petroleum	thousand 42-gallon barrels	Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) (Government, 100%) 1/	La Peña, Vuelta Grande, Rio Grande, San Roque, and Vibora Oilfields Santa Cruz Department	5,500
Do.	do.	Occidental Boliviana Inc. and Tesoro Bolivia Petroleum Co., both U.S. companies, and other contractors (private, 100%)	Porvenir, La Vertiente, Bermejo, Caigua, and Colpa Oilfields	1,200
Silver	kilograms	Cía. Minera del Sur., S.A. (COMSUR) (private, 100%) (RTZ of the United Kingdom, shareholders)	Martha, Huari, Porco, and Milluni Mines La Paz Department	116.4
Do.	do.	Empresa Inti-Raymi S.A., Battle Mountain Gold Co., 85% EMUSA, 15%	La Joya, near Oruro, Oruro Department	28.7
		Cía. Minera Arisúr S.A.	Silver, lead and zinc mines in Potosí Department	13.9
Tin		COMIBOL: Cía. Minera de Oruro, Cía Minera Quechisla, Cía Minera de Potosí, and Cía Minera La Paz (Government, 100%)	Huanuni, Colquiri, Caracoles, Viloco, and Chorolque Mines, at Oruro, Potosi, and La Paz Departments	3.9
Do.		Barrosquira Ltda., Avicaya Ltda.,and COMSUR S.A. (private, 100%)	Martha, Cerro Grande, Milluni, and Berenguela tin mines	0.5
Do.		Small miners and cooperatives (private, 100%)	Catavi-Siglo XX, Caracoles, Bolivar Viloco, Colquiri, and Colquechaca Mines	10.3
Tin, refined		Empresa Metalúrgica de Vinto (COMIBOL's subsidiary) (Government, 100%)	Vinto, Oruro Department	16.7
Do.		Fundestaño de Oruro S.A. (private, 100%)	City of Oruro, Oruro Department	0.1
Do.		Cía. Metalúrgica Industríal y Comercíal Hormet S.A. (private, 100%).	City of La Paz, La Paz Department	4.7
Zinc		COMIBOL, Cía. Minera de Oruro, Cía. Minera Quechisla, Cía. Minera de Potosí (Government, 100%)	Santa Fe, Colquiri, San Vicente, Tatasi, Animas-Inocente and Unificada Mines at Oruro, Potosí, and La Paz Departments	7.3
Do.		COMSUR, S.A., Arisúr, S.A. and La Solución S.A. (private, 100%).	Porco, Asientos, Maragua, Huari-Huari Monserrate,and Monte Blanco Mines at Cochabamba, Oruro, and Potosí Departments	97

1/ At yearend 1996, 50% of Y.P.F,B. was sold to the private sector. The new company structure was to become effective in March 1997.

TABLE 3
BOLIVIA: RESERVES OF MAJOR MINERAL COMMODITIES IN 1997

(Metric tons unless otherwise specified)

Commodity		Reserves
Antimony, metal content		350,000
Gold, metal content	kilograms	390,000
Lead, metal content		26,000
Lithium carbonate	thousand metric tons	5,500
Natural gas	trillion cubic meters	6.6
Petroleum	million 42-gallon barrels	140
Silver, metal content	thousand metric tons	29,970
Tin, metal content		448,000
Tungsten, metal content		53,000
Zinc, metal content		935,000
Iron, metal content	thousand metric tons	143,190

Source: Corporación Minera de Bolivia