THE MINERAL INDUSTRY OF

FRANCE

By Harold R. Newman [1]

France is one of the major European mineral producers. The traditional mineral industries in France have been in a state of transition during the past several years. Changing economic conditions, such as rising energy costs, increasing supplies of raw materials from other countries, lower prices owing to increased competition, and depletion of reserves, have necessitated the rationalization of many traditionally strong mineral industries, such as bauxite, coal, iron ore, and steel.

Industries have had to adjust to a change in the state's economic policies. In the past, the heavy involvement of the state, both economically and politically, was one of the main elements of French mineral policy. Reduction of Government subsidies supporting uneconomic mineral operations and the depletion of mineral reserves have had a significant impact on a number of extractive operations in the French mineral industry.

The French economy has performed well relative to its European neighbors, with economic growth reaching 2.5% in 1994. One bright spot was the rate of inflation, about 2.2% at midyear. This was one of the lowest rates in the European Union (EU). The country does face a serious problem with unemployment, which was estimated to have been about 12.5% of the work force at yearend.

Government Policies and Programs

The French Government was continuing to reduce the budget deficit with policies that were not only affecting the mineral industry, but other industries as well. At the same time, other economic policies were driven by the desire to reduce unemployment and improve French competitiveness, particularly in the European internal market. Efforts have been made to promote the private sector and to reduce the dependence of state-owned companies on subsidies, although significant industrial capacity remains in the public domain.

In 1994, the privatization policy of limiting foreign investment to 20% in privatized companies was lifted. One condition, the "golden share" concept, remained. Any such share taken by the Government would have an unlimited lifespan and would allow it to reject hostile takeover bids.

Bureau de Recherches Géologiques et Minières's (BRGM) French and international mining interests were merged with a private mining group, Normandy Poseidon of Australia, to create an international group consisting of two companies. The first, La Source Compagnie Minière, received all of BRGM's mining assets, except for gold assets in France and abroad, nickel assets in New Caledonia, and manganese assets in Gabon. The second, Compagnie Internationale Or S.A., received all of BRGM's gold assets. After the various operations change assets, BRGM will become a 9% shareholder in Normandy Poseidon.

In an effort to encourage exploration within the country, the mining code was modified in July 1994 by a law that established clearer, expedited rules to allocate surveying and mining licenses.

Environmental Issues

The main aims of the National Environmental Plan of 1990 were to cut air pollution by 20% to 30%, to increase the share of treated household waste by 60% as compared with the current 40%, and to improve waste recycling. The special depreciation allowance of 50% during the first year for environmental investment was extended to air and water pollution control equipment. Also, a law was proposed to introduce a tax on the dumping of solid waste as well as a prohibition on the dumping of untreated waste.

Production

Mineral and metal industries generally maintained their production and other activities at about the same or decreased rate of the previous year. Gold production increased owing to the reopening of the Salsigne Mine. Lead, silver, and zinc production were about the same level. Several industries, such as bauxite, coal, iron ore, and uranium, have steadily undergone changes during the past few years. Bauxite is no longer mined in France.

The coal and iron ore industries were affected by cheaper foreign sources and the depletion of domestic resources. Coal mining is directed by Charbonnages de France (CdF), a state-owned company. As a result of the high cost of underground production in comparison with cheaper imported coal, CdF was maintaining its policy of investing in high-productivity mines and closing uneconomic operations.

The uranium industry reduced its operations by closing a number of mines and processing plants owing to low market prices and depletion of certain deposits. Another factor in the drop of uranium demand was the reduced cost for petroleum

and the increased accessibility of natural gas from the North Sea and the former Soviet Union (FSU). Lower petroleum prices meant that fewer new nuclear plants were considered for construction, some older plants were being closed, and the export market decreased. (*See table 1.*)

Trade

The Government maintained efforts to refocus the country's trading patterns toward the Organization for Economic Cooperation and Development (OECD) countries. Strong commercial relations continued between France and the United States, while Germany remained France's largest export trading partner. Table 2 shows the relationship of selected classes of mineral commodities on France's balance of payments position in relation to the EU and the world. (*See table 2.*)

Structure of the Mineral Industry

Government and private companies produced minerals and mineral products, conducted research, and explored domestically and internationally for new resources. Since 1981, when some of the major companies were nationalized, the Government has restructured some of these industries, notably steel and coal. Adjustments to the single European market resulted in numerous mergers, closures of operations, and co-operative ventures as companies sought ways to obtain competitive advantages. Some industries that have benefited greatly from Government assistance in the past were affected by a Government policy aimed at reducing assistance for nonprofitable operations. Others were expanding as Government programs resulted in exploitable opportunities, such as the availability of abundant and inexpensive electrical power.

The Government held significant financial interests in most of the mining, metallurgical, and energy companies in France. These included Société Nationale Elf Aquitaine (SNEA); Usinor-Sacilor S.A.; Imetal S.A.; Péchiney; CdF; Compagnie Générale des Matières Nucleaires (Cogema); Gaz de France (GdF), and Rhône-Poulenc S.A., as well as BRGM and its subsidiary, Compagnie Française des Mines S.A. (CFM). (*See table 3.*)

The Government was proceeding with a privatization program involving 21 large state-controlled companies. Included among these were SNEA, which was privatized in February 1994, Rhône-Poulenc, and Usinor-Sacilor. The selloff was to begin on a company-by-company basis, with the Government hoping to raise about $7.25 billion[2] the first year.

Commodity Review

Metals

Alumina and Bauxite.—French bauxite production had ceased altogether by the end of 1993. The closures of alumina refineries followed the pattern of the bauxite operations. The Gardenne plant, which was opened by Charles Bayer in 1893, remained the only operating alumina refinery in France. Bauxite feedstock was purchased on the open market, as well as from Aluminium Péchiney's Les Baux operations.

Aluminum.—At a reported average cost of $1.27 per kilogram (kg), France was considered the lowest-cost aluminum-producing country in Europe. The main reasons were lower energy costs and advanced technology.

The Government was proceeding with privatization plans for Péchiney, albeit slowly. The reported reason was that the holding company could not be ceded to private shareholders until it was broken down into smaller entities.

Péchiney was continuing with plans to build specialized foundries for aluminum beverage can recycling. One went on-stream at Nogueres at the site of a previous primary aluminum smelter. The foundry has a reported capacity to process 30,000 metric tons per year (mt/a) of used beverage cans. Cost of the project was estimated to be $710,000.

Antimony.—The Gagneraud Mine at Brouzils, Vendee, which started development and limited production in 1991, was continuing with a testing program to determine whether to go into full production of 200 metric tons (mt) per month of contained antimony, according to BRGM, owner of the project. The ore, grading about 7% antimony, was thought to be comparable in quality with Bolivian ore. Most of the production was expected to be shipped to Compagnie Lucette, a BRGM subsidiary that produces antimony trioxide.

Other domestic sources of the metal were from Métaleurope's refining of lead-zinc at Noyelles-Godault and the Société Industrielle et Chimique de l'Aisne at Chauny. France was importing most of its 4,500 mt/a of antimony metal requirements from Bolivia and China.

Ferroalloys.—Société Européen d'Alliages pour la Siderurgie's (SEAS) new 110,000 mt/a high-carbon ferromanganese and silicomanganese plant was in operation. The plant, on a 23-hectare (ha) site in Dunkerque, was employing modern submerged-arc-furnace technology and utilizing relatively low-cost power from the nearby Graveslines nuclear power station. Most of the smelter's output was expected to be used internally in Usinor's steelmaking operations.

Société du Ferromanganèse de Paris-Outreau (SFPO) and Samancor S.A. of South Africa entered into an agreement to produce ferromanganese. Samancor will supply between 80,000 and 100,000 mt/a of high-grade ore to SFPO from which SFPO will produce 40,000 to 80,000 mt/a of medium-carbon ferromanganese. SFPO was expected to use the existing blast furnaces at its facility in Boulogne to convert the ore.

Gold.—Gold mining in France was mostly concentrated in Société des Mines du Bourneix's operations in the Saint-Yrieix la Perche District south of Limoges. Gold mineralization at Bourneix's mines was associated with galena, arsenopyrite, and pyrite within broad quartzitic lenses covering an area 15 to 20 kilometers (km) in length. Of the operating mines, the underground operations at Bourneix and Laurieras produced the greatest tonnages of gold ore and the highest gold content.

Three smaller surface mines, Les Renartieres, Cros-Gallet Sud, and Les Fouilloux, truck their ores to the Bourneix concentrator for processing. The original 60,000-mt/a concentrator batch processes the ores depending on the source and gold content of the ore.

Bourneix completed construction of a 35-mt-per-hour concentrator that was expected to raise the annual contained gold output to 1,600 kg. There were plans, pending environmental approval, for leaching and smelter facilities.

It was announced that Mines et Cyanurations de Salsigne (MCS), a joint venture between Peter Hambro PLC of the United Kingdom and Ranger Exploration and Eltin PLC of Australia, had started production. The Salsigne Mine, which has open pit and underground operations, was formerly owned by Société des Mines et Produits Chimiques de Salsigne (MPCS). The mine closed after MPCS went bankrupt. MCS took over the mining and processing operations and initiated a $17 million capital investment program. This involved a new 500,000-mt/a processing plant and the extension of the underground workings.

Iron Ore.—The famous iron ore basin of northern France stretches from Lorraine, France, northward into Belgium. However, for many years, the high phosphorus and relatively low iron content of the ore limited its desirability. The iron content of the ore varies from 30% to 32%. Consequently, production in Lorraine has been declining for several years. Iron ore production has decreased more than 50% in the past 10 years.

Lormines S.A. continued with its planned reorganization, and production was about 5 million metric tons (Mmt) for 1994 from the company's four open pit mines. Production from the other two French iron ore-producing basins, Normandy and Anjou, were following a similar trend of dropping to small fractions of previous production levels.

Iron and Steel.—As a result of a consolidation of the French steel industry and of purchases of additional production facilities outside of France, Usinor-Sacilor S.A., the state steel group, ranked 2nd in world steel production behind Nippon Steel of Japan. The Government has listed Usinor-Sacilor, along with Péchiney, Rhône-Poulenc S.A., and others, as companies to be privatized. This was not expected to take place before 1996 and would depend on market conditions.

The European Commission approved the joint reorganization of the production and sales of long steel products by Arbed S.A. of Luxembourg and Usinor-Sacilor. Under the arrangement, each of the companies would withdraw from certain steel product sectors, allowing the other to be the sole supplier for the two groups. Under the agreement, Arbed would end the production and sales of rails and wire rod and Usinor-Sacilor would end the production and marketing of sheet piling and girders.

Also, the Commission gave its approval for Sollac, a subsidiary of Usinor-Sacilor, to take a 30%-stake in Barcelonesa de Metales S.A. of Spain. The Commission ruled that the acquisition did not violate antitrust laws, even though Usinor-Sacilor is a principal supplier to the Bamesa Group, of which Barcelonesa is a member. The reason given was that competition in the Spanish and Portuguese market would be maintained by other distributors and low market entry barriers.

Compagnie Française des Ferrailles (CFF), the largest independent scrap metal processor in Europe, was maintaining its investments in shredders and joint ventures. CFF has investments in 22 shredder operations, including 1 each in Spain and Belgium and 2 in the United States. Construction of four new sites was proceeding; three are in France and one is in Spain. CFF supplied about 4 million metric tons per year (Mmt/a) of ferrous scrap, which was about 40% of the total French market.

Lithium.—The use of lithium in alloying with aluminum has been undergoing extensive research in the aerospace and automobile industries. In France, the granites of Beauvoir contain high concentrates of barium, lithium, niobium, tantalum, and tin. Owing to the low grades of lithium in ores and the physical problems of separating the metal from the silica minerals, lithium metal recovery has been difficult. Also, a concentration of approximately 7 kg of lithium oxide (LiO_2) per ton of rock makes economic exploitation of the deposit difficult. The ores exploited are processed at the Pombliere Saint Marcel refinery facility operated by Métaux Spéciaux, which produces lithium and other chemical compounds.

Polymetallics.—BRGM was proceeding with exploration and development of the Chessy polymetallic deposit. Poseidon Gold, a subsidiary of Normandy Poseidon of Australia, took over Aztec Mining Ltd's 24% interest in the project.

According to BRGM, exploration drilling has defined estimated geological reserves of 5.4 Mmt of ore with minable reserves estimated to be 4.1 Mmt of ore having average grades of 2.5% copper, 7.8% zinc and 21% barite. The company expected to produce about 30,000 mt/a of 28% to 30% metal content copper concentrate, 40,000 mt/a of 55% to 60% metal content zinc concentrate with a byproduct production of 100,000 mt/a of 52% sulfur content pyrite, and 60,000 mt/a of chemical-grade barite.

Permits to allow construction of the plant and underground mine work to commence were obtained. BRGM stated that a production rate of 300,000 mt/a was planned. Production

was scheduled to begin in early 1995 with an estimated mine life of 14 years.

Métaleurop S.A. operated two lead-zinc mines, one at Les Malines and the other at Noailhac-Saint Salvy. The company increased production at Les Malines to offset the lower metal content of the ore and increased efficiency to reduce operating expenses. At the Saint Salvy Mine, Métaleurop, in collaboration with BRGM, was continuing exploration of the western extension of the main vein of the Saint Salvy deposit.

Uranium.—Cogema, the state-owned uranium mining company, was the major producer of uranium in France. In recent years, the pace of exploration has decreased and projected future ore requirements have leveled off. In fact, most projects worldwide have been halted or canceled.

Division Minière Vendee (DMV), a division of Cogema based in the Loire-Atlantique region of western France, operated four mines and a 450,000-mt/a processing plant, which produced about 650 mt/a metal content of uranium. Two of the mines, Ecarpiere and Piriac, were closed in mid-1990, with the remaining two mines, Le Chardon and La Commanderie, shut down in 1993. The processing plant at Ecarpiere also was expected to be shut down. Cogema cited the low grade of ore mined by DMV as the reason for the closure of the division.

Cogema has two other mining divisions in France, La Crouzille, near Limoges, and Hérault, in southwest France, that were continuing operations. Cogema stated that La Crouzille was scheduled to be closed in 1996.

France has 56 nuclear reactors producing 55,778 megawatts (MW) of electricity. Six more reactors were under construction and, when completed, would furnish an additional 8,305 MW of electricity. Nuclear power reactors provided almost 75% of electricity generated in France. About 12% of production was exported to neighboring countries. Electricité de France (EdF) signed agreements with agencies of the FSU for cooperation in various nuclear fields. Areas of possible cooperation were operational safety; accident recovery; design, construction and decommissioning of nuclear facilities; and enrichment of reprocessed uranium.

Zinc.—Two companies operated primary zinc plants in France. The company, Société des Mines et Fonderies de Zinc de la Vieille Montagne (VM), of Belgium, operated a zinc refinery at Auby-les-Douai with an annual capacity of 210,000 mt/a of zinc. This electrolytic plant is the newest and most modern in Europe and was built at a cost of $70 million in 1987. The other company, Métaleurop S.A., operated a 110,000-mt/a primary smelter and a 15,000-mt/a secondary smelter at Noyelles-Godualt.

Industrial Minerals

Andalusite.—Denain-Anzin Minéraux Refractaire Ceramique (DAMREC), a subsidiary of the Imetal Group, was the only producer of andalusite in Europe. DAMREC's mining operation is at Glomel, Brittany, and produces about 75,000-mt/a. This placed France second only to South Africa in world output of andalusite. The company produced three grades of andalusite that were distinguished by different alumina and iron oxide contents. These products were sold to the refractory and ceramic industries.

Barite.—The primary barite area in France is at Chaillac in central France, near Limoges. Barytine de Chaillac, a subsidiary of Solvay Barium Strontium GmbH of Germany, is the major producer with an open pit mine and plant at Chaillac. Barytine produces about 90,000-mt/a of flotation-grade barite averaging 98% barium sulfate, suitable for chemicals production. Most of the output is exported to Solvay for further processing.

Byproduct barite is produced by Société Industrielle du Centre from its underground fluorspar mining operations at Chaillac. The company produces about 3,000-mt/a, mainly for the domestic market.

Calcium Carbonate.—Blancs Mineraux de Paris's (BMP) calcium carbonate plant at Saint-Croix-de-Mareui became fully operational in 1992 and has since operated continuously. The plant, which cost about $8 million, has a production capacity of 70,000 mt/a of calcium carbonate slurry consisting of wet-processed ultrafine ground calcium carbonate for the paper industry.

Pfizer Inc. of the United States announced it would construct the company's first European precipitated calcium carbonate (PCC) plant at Saillat-sur-Vienne. The plant will be built at French paper manufacturer Aussedat Rey's paper mill. The PCC slurry would be piped directly to the paper mill. PCC imparts high brightness and high opacity to paper. Conversion from the acid process of papermaking to the alkaline process has increased the use of both PCC and natural calcium carbonate in carbonate filters. This has reduced kaolin's market share of the paper market.

Cement.—Lafarge Coppee S.A. and Société Des Ciments Français were the two largest cement producers in France. During the past several years, these two companies have been acquiring a number of companies within France as well as internationally. Each company has gained control of approximately one-third of the domestic market, leaving fewer than eight other companies holding the remaining one-third.

Feldspar.—French feldspar production was by five companies. Ets. Baux, at Saint Paul de Fenouillet, operated three open pit mines and a plant with a production capacity of 180,000 mt/a. Most of the material produced was sold to the glass industry with the remainder going to the ceramics industry.

Other producers were Société des Feldspaths du Midi and Société des Feldspaths du Morvan. They produced feldspar

for the ceramics industry and have annual capacities of 80,000 mt/a and 50,000 mt/a, respectively.

Société d'Exploitation de Sables et Mineraux S.A. (Samin) has an open pit mine at Roche en Regnier with a production capacity of 70,000 mt/a. Samin produced phonolite, which is a fine-grained equivalent of nepheline syenite. This can be substituted for feldspar in most glassmaking and ceramic applications.

Fluorspar.—Société Générale de Recherches et d'Exploitations Minieres (Sogerem), a Pechiney subsidiary, controlled more than 60% of fluorspar production. The fluorspar vein deposits are found in Hercynian massifs, Massif Central, the Vosges, the axial zone of the Pyrénées, and the outer Alps.

Sogerem's mining operations supply Comifluor S.A., another Pechiney subsidiary, which operates a plant at Bastîde-a-Olette. This plant produces acid-grade fluorspar, 97% calcium fluoride (CaF_2), and electrical-grade fluorspar. Total production of both grades is approximately 45,000 mt/a. The Escardo Mine, owned by Denain-Anzin Minéraux, also ships approximately 90,000 mt/a from its surface operation to the Olette plant.

The other main producer is Société Industrielle du Centre's Rossignol Mine in Chaillac. The mining operation extracts ore from a 1,000-meter(m)-long vein. The facility reportedly has the capacity to process 50,000 mt/a of crude ore to produce both metallurgical-grade and acid-grade feldspar.

Gypsum.—France was one of Europe's largest producers of gypsum. Two-thirds of the production was from the Paris Basin. Four companies produce approximately 95% of the output. In recent years, France has reported increased sales of gypsum products to other European countries. S.A. de Materiel de Construction, the largest company, accounts for almost one-half of the total gypsum produced. The largest operation was the 1.3-Mmt/a underground mine at Taverny.

Kaolin.—Kaolin deposits derived from the granite massifs in Brittany are the most actively mined in France. The largest mine, operated by Société Kaoliniere Armoricaine, was at Quessoy. The mine has a capacity of 120,000 mt/a. Another deposit in the northern area of Brittany is Plemet. In the southern part of the peninsula, at Ploemeur, are two operations, Société des Kaolin d'Arvor and Société Kaolins de Morbihan. Reportedly, these operations each have a capacity to produce 75,000 mt/a. Société des Kaolins du Finistère's 30,000 mt/a operation, at Berrien, was bought by Kaolins de Moribihan. The kaolin was used mostly in the paper and ceramics industries. Ball and refractory clays are mined in the Charante Basin to the southwest, producing more than 1 Mmt/a.

Mica.—The country's three largest producers of mica have operations in Brittany. The mica produced was a byproduct of kaolin operations. The largest producer, Micarec SA, partially owned by Kaolins de Morbihan, operated the kaolin deposit at Ploemuer, as does Kaolins d'Arvor SA, the second largest producer. Kaolins du Finistère uses flotation at its Berrien deposit to process the byproduct mica.

Potash.—Mines de Potasse d'Alsace S.A.(MDPA) was the principal producer of potash with two mines, Marie-Louise and Amélie, located near Mulhouse, Alsace. MDPA is the world's 5th-largest supplier of potash salts. The main products are about 10 Mmt/a of 15.52% potash ore, which is concentrated to 62% potassium oxide material, bromine and other industrial products, and rock salt for snow clearing. About 90% of the potash production is used by agriculture for fertilizer and 10% is purified and treated for use in other industries.

The Alsace deposits in the Upper Rhine Valley are in the Mulhouse area where a graben of Late Eocene geologic age was filled with two influxes of seawater. The latter surge of seawater in Early Oligocene time resulted in the deposition of two potash-rich beds. The strata were subsequently folded in Pliocene time into three different basins, the Wittelsheim and Munchausen in France and the Buggingen in Germany.

Based on estimated reserves, the French deposit will last into the next century. However, future development will be constrained to the east, west, and south by the boundaries of the tilted potash beds and to the north by the depth of the deposit.

Rare Earths.—Rhône-Poulenc S.A. is one of the world's leading processors of rare earths. In recent years, there has been growth in the rare-earth market for yttrium, neodymium, samarium, and cerium. This growth is due to developments and applications in permanent magnets, electronics, and superconductivity products.

Salt.—France is a significant European producer of salt. The country produces rock, solar, and vacuum salt as well as brine. Mining of rock salt is from two areas, Varangeville and Nancy, in northeastern France. One company, Cie Industrielle et Minière, operates an 850,000-mt/a facility at Nancy and a 500,000-mt/a facility at Hautrives. Rock salt's share of crystallized salt production is about 7%.

Solar salt production is concentrated along the Mediterranean coast and on the Island of Corsica. This production accounts for 59% of the 4.7-Mmt/a crystallized salt capacity.

Vacuum salt is produced at seven locations, representing a capacity of 1.45 Mmt/a. This method of production accounts for the remaining crystallized salt capacity. The largest operation is the 600,000-mt/a facility operated by Cie. des Salins du Midi et des Salins de l'Est (CSMSE) at Varangeville in northeastern France.

Talc.—Talc de Luzenac S.A. not only is significant to the domestic market, but also is Europe's largest corporate talc producer. The company has acquired several talc mining

interests worldwide. Borax Français S.A., a subsidiary of RTZ Corp., subsequently purchased 92% of Talc de Luzenac S.A. As a result, RTZ Corp. became one of the major talc producers in the world.

Talc de Luzenac's open pit mine near Aix-les-Themes, where the company has been mining since 1905, was the largest operation. Production was about 300,000 mt/a of ore, from which more than 40 different grades of talc are derived. In terms of estimated reserves, the deposit, considered one of the largest in the world, could possibly support the current output for another 100 years.

Mineral Fuels

Coal.—All underground coal mines were closed in the Midi-Pyrénées region in southern France and in the Nord Pas-de-Calais basin. In the northeast producing regions, Charbonnages de France (CdF) was proceeding with further rationalizations, resulting in reduced production. CdF was planning to stabilize production at 9 to 10 Mmt/a of coal and 2 to 2.5 Mmt/a of lignite. Also, CdF envisioned the final stoppage of coal mining in France by 2005.

CdF and Electricité de France (EdF) were continuing with plans to add a number of coal-fired generating plants to the electrical utility grid, composed mostly of nuclear plants. The objective was to develop a large, pollution-free, coal-fired electric generating plant utilizing technology present in smaller plants. Initially, a 250 MW plant was planned, which could be upscaled to 600 MW in the future.

Petroleum and Natural Gas.—Elf Aquitaine was continuing negotiations with various republics of the FSU to begin a 5-year petroleum exploration program starting in the early 1990's. The company would explore 6,400 ha of territory in western Kazakhstan and in Russia. Also, Elf stated it was planning to eventually develop refinery distribution and petrochemical operations.

In 1994, onshore petroleum production was mainly from the Paris Basin, which produced an estimated 11.7 million barrels (Mbbl), and the Aquitaine Basin, which produced an estimated 8 Mbbl. Esso S.A. was the main producer with 52% of the output. Because production has started to decline in these areas, the Government was planning to initiate a program to encourage exploration for new deposits in other areas thought to have good potential. The Jura Basin was one area under consideration.

Five companies were operating refineries in France: SNEA, Total, Royal Dutch/Shell Group, British Petroleum Co. PLC, and Mobil Corp. The structure of the industry is geared to gasoline production. Refining is mainly focused on high-octane unleaded gasoline used by a majority of the vehicles in France without needing engine modifications.

No refining units are capable of processing heavy fuels, nor are there available hydrocracked feedstocks for the production of gas oil, thus leaving the process stream short on middle distillates and naphtha. France is a net importer of petroleum products.

Infrastructure

France has a very modern and well-developed infrastructure. The French National Railways (SNCF) operates 34,568 kilometers (km) of 1.435-m standard gauge, of which 11,674 km was electrified. The system incorporates the use of high-speed trains on selected tracks. Similarly, its highways are extensive and modern to transport goods and services. The inland waterways are increasingly used to transport more goods; however, they always have been significant avenues of commerce, with 6,969 km of the 14,932-km-long waterways heavily used. The major seaports are Bordeaux, Boulogne, Brest, Cherbourg, Dunkerque, Fos-Sur-Mer, Le Havre, Marseille, Nantes, Rouen, Sete, and Toulon.

One of the most significant infrastructure developments in recent times has been the Channel Tunnel Project. The tunnel, constructed underneath the English Channel, connects Coquelles, near Calais, France, and Folkestone, England. Transportation, not only in France but also in the whole of Europe, was expected to change significantly with the completion and full operation of the Channel Tunnel in 1995. From these terminals, people drive their vehicles onto trains transporting them 49 km to the other side in about one-half hour. The Channel Tunnel connecting the two countries was expected to be a vital infrastructure component as the EU becomes a single marketplace of more than 320 million people.

Outlook

One of the world's most developed economies, France was an advocate for the EU and the European single-market concept. The country has had to make considerable changes in the structure of its industries, particularly those controlled by the state. Several state-owned companies have taken the initiative to become leaders in their respective industries. Others have been forced to make additional adjustments under rationalization schemes proposed by the EU or French Government. The depletion of natural resources and/or the cessation of subsidies for uneconomic operations will have impacts on local communities and their economies. France will have the advantage of plentiful electrical power to attract industrial facilities requiring a good work force and access to significant markets in Europe.

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[1]Text prepared May 1995

[2]Where necessary, values have been converted from French francs (f) to U.S. dollars ($) at the rate of Ff5.35=US$1.00, the average rate in 1994.

Major Sources of Information

Ministere de la Recherche et de l'Industrie (Ministry of Research and Industry)
68 rue de Bellechasse
75353 Paris, cedex 07
France

Bureau de Recherches Géologique et Miniéres (Bureau of Geological and Mining Research)
Avenue de Concyr - BP 6009
45060 Orleans, cedex 2
France

Observatoire des Matieres Premieres
120 rue du Cherche-Midi
75006 Paris
France

Major Publications

Annales des Mines.
Annuaire de Statistique Industrielle.
Annual Reports: BRGM, CdF, Imetal, Entreprise Minnnière et Chimique, Péchiney, SNEA, Total, and Usinor Sacilor.
Chronique de la Recherche Miniere.
L'écho des Mines.
Matières Premières Minérales.
Minéraux Industriels et Méaux non Ferreux

TABLE 1
FRANCE: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1990	1991	1992	1993	1994 e/
METALS						
Aluminum:						
Bauxite, gross weight	thousand tons	490	183	104	--	--
Alumina:						
Crude	do.	606	538	508	476	450
Calcined	do.	467	414	391	367	438
Metal:						
Primary	do.	325	286	418	426	410
Secondary	do.	208	217	227	196	200
Antimony metal, including regulus		6,520	760	1,425	848	750
Arsenic, white e/		6,480	2309	2,000	3,000	3,000
Bismuth metal		70	50	--	--	--
Cadmium metal		187	271	252	137	140
Cobalt metal:						
Powder		175	175	226	222	200
Chloride		150	123	150	150	150
Copper:						
Mine output, Cu content		300	300	149	72	--
Metal:						
Blister, secondary e/		6,600	5,800	6,100	5,900	5,880
Refined:						
Primary		18,034	19,600	27,700	21,100 r/	20,200
Secondary e/		26,000	30,000	29,000	23,300 r/	21,500
Total		44,000	49,600	56,700	44,400 r/	41,700
Gold, mine output, Au content	kilograms	5,426	4,612	3,060	2,155	3,800
Iron and steel:						
Iron ore and concentrates:						
Gross weight	thousand tons	8,729	7,472	5,707	3,518	3,550
Fe content	do.	2,793	2,316	1,697	1,055 r/	1,065
Metal:						
Pig iron	do.	14,415	13,646	13,051	12,679 r/	13,293
Ferroalloys:						
Blast furnace:						
Spiegeleisen and ferromanganese	do.	315	290	280	250	300
Electric furnace:						
Ferrochrome	do.	25	23	7	--	--
Ferromanganese	do.	36	30	60	57	60
Ferrosilicon	do.	117	106	98	39	40
Silicon metal	do.	64	64	66	59	60
Other e/	do.	23	43	32	29	30
Total /e		589	586	563	434	390
Steel ingots and castings	do.	19,015	18,434	17,961	17,179	18,028
Semimanufactures	do.	16,774	16,678	16,172	14,750	15,000
Lead:						
Mine output, Pb content		1,187	1,725	--	--	--
Smelter:						
Primary		136,800	140,000	130,000	112,281	115,000
Secondary e/		20,000	30,000	25,000	25,000	25,000
Total e/		156,800	170,000	155,000	137,281	14,000
Lead:						
Refined:						
Primary: Soft lead		162,260	154,500	160,500	112,300	165,137
Secondary:						
Softlead		47,612	57,500	49,400	67,800	55,587
Pb content of antimonial lead		60,598	71,500	74,160	78,600	45,480
Total		270,470	283,500	284,060	258,700	266,204
Magnesium metal, including secondary		14,000	14,000	13,700	10,982	8,800
Nickel metal		8,540	7,400	6,800	10,375 r/	10,041
Silver: e/						
Mine output, Ag content:						
Lead and zinc concentrates	kilograms	20,500	23,600	13,300	10,000	6,000
Mixed copper, gold, silver concentrates	do.	5,000	5,000	3,000	1,600	1,500
Total	do.	25,500	28,600	26,300	11,600	7,500
Metal, Ag content of final smelter products e/	do.	22,200	20,000	14,100	14,000	14,000

See footnotes at end of table.

TABLE 1--Continued
FRANCE: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1990	1991	1992	1993	1994 e/
METALS--Continued						
Tin, secondary:						
Smelter output of solder and other alloys e/		2,560	2,400	2,000	3,439	35,000
Uranium:						
Mine output, U content		2,816	2,486	2,119	1,774	1,800
Chemical concentrate, U3O8 equivalent		2,820	2,300	2,080	1,539	1,600
Zinc:						
Mine output, Zn content		23,851	27,109	16,539	13,834	1,000
Metal including secondary:						
Slab		263,136	299,600	318700	309,800	310,000
Dust e/		8,600	9,000	8,000	9,000	8,000
INDUSTRIAL MINERALS						
Barite		92,500	90,000	96,200	67,200	70,000
Bromine, elemental e/		3,100	3,000	3,200	2,290	2,500
Cement, hydraulic	thousand tons	26,388	26,507	21,165	19,320	20,200
Clays:						
Bentonite e/ 4/		10,000	10,000	6,000	6,000	7,000
Kaolin and kaolinitic clay (marketable)	thousand tons	367	344	334	295	300
Refractory clay, unspecified	do.	16	15	8	7	8
Diamonds: Synthetic, industrial e/	thousand carats	5,000	4,000	3,500	3,500	3,500
Diatomite e/	thousand tons	250	250	85	85	90
Feldspar, crude e/	do.	420	400	282	274	300
Fluorspar:						
Crude	do.	515	400	296	185	200
Marketable:						
Acid and ceramic-grade	do.	145	146	118	96	105
Metallurgical-grade	do.	113	50	15	20	26
Total	do.	258	196	133	116	131
Gypsum and anhydrite, crude	do.	5,796	5,600	5,160	5,000	5,000
Kyanite, andalusite, related materials e/	do.	50	50	50	50	50
Lime: Quicklime, hydrated lime, dead-burned dolomite e/	do.	3,000	3,000	3,000	3,000	2,500
Mica e/		7,000	6,000	12,000	8,000	8,000
Nitrogen: N content of ammonia	thousand tons	1,586	1,604	1,848	1,871	1,800
Pigments, mineral, natural: Iron oxide e/		15,000	14,000	12,000	1,000	1,000
Phosphates: Thomas slag	thousand tons	488	538	356	300	300
Potash:						
Gross weight (run-of-mine)	do.	9,468	9,500	8,570	8200	8,000
K2O equivalent (run-of-mine) e/	do.	1,400	1,400	1,400	1100	1,000
K2O equivalent (marketable	do.	1,292	1,129	1,141	890	870
Pozzolan and lapilli e/	do.	336	400	404	526	500
Salt:						
Rock salt e/	do.	790	800	103	116	100
Brine salt (refined)	do.	1,155	1,000	1,651	1,310	1,400
Marine salt	do.	1,298	1,200	1,156	1,200	1,200
Salt in solution	do.	3,362	3,500	3,206	4,355	4,200
Total e/	do.	6,605	6,500	6,116	6,981	6,900
Sodium compounds: e/						
Soda ash	do.	1,180	1,140	1,100	1,222	1,200
Sodium sulfate	do.	120	93	77	62	65
Stone, sand and gravel:						
Limestone, agricultural and industrial e/	do.	7,000	6,000	6,000	6,000	6,000
Slate, roof e/	do.	40	50	45	26	30
Sand and gravel: e/						
Industrial sands, total	do.	3,500	3,500	6,300	5,400	6,000
Other sand, gravel and aggregates	do.	308,500 r/	319,240 r/	362,600 r/	333,200 r/	353,600
Sulfur, byproduct:						
Of natural gas	do.	666	794	770	829	700 r/
Of petroleum	do.	233	225	230	278	250
Of unspecified sources e/	do.	150	180	150	150	150
Total e/	do.	1,049	1,199	1,150	1,257	1,100 r/
Talc:						
Crude		328,100	310,000	320,000	282,000	275,000
Powder e/		287,000	280,000	260,000	200,000	200,000

See footnotes at end of table.

TABLE 1--Continued
FRANCE: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1990	1991	1992	1993	1994 e/
MINERAL FUELS AND RELATED MATERIALS						
Asphaltic material e/		44,500	45,000	39,400	52,700	50,000
Carbon black e/		252,000	250,000	200,000	204,900	200,000
Coal, including briquets:						
Anthracite and bituminous	thousand tons	10,488	10,128	9,478	8,676	7,458
Lignite	do.	2,256	1,963	1,578	1,670	1,600
Total	do.	12,744	12,091	11,056	10,346	9,058
Briquets e/	do.	540	500	500	500	500
Coke, metallurgical	do.	5,208	5,315	5,362	4,752	4,800
Gas, natural:						
Gross	million cubic meters	4,334	4,097	3,300	3,300	3,400
Marketed	do.	3,031	2,845	2,280	2,520	2,500
Petroleum:						
Crude	thousand 42-gallon barrels	22,036	21,240	21,913	20,039	20,404
Refinery products:						
Liquefied petroleum gas	do.	32,492	30,000	29,348 r/	31,262 r/	28,861
Gasoline, all kinds	do.	140,820	145,000	150,416 r/	149,438 r/	146,947
Jet fuel e/	do.	39,976	40,000	41,340 r/	43,672 r/	46,965 r/
Kerosene	do.	462	500	500	500	500
Distillate fuel oil	do.	210,372	210,000	200,000	200,000	200,000
Heavy fuel oil	do.	76,510	75,000	76,000	76,000	79,322 r/
Other products	do.	42,000	40,000	40,000	40,000	40,000
Refinery fuel and losses	do.	20,286	20,000	20,000	20,000	20,000
Total e/	do.	562,918	560,500	557,604 r/	560,872 r/	562,595 r/

e/ Estimate. r/ Revised

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Table includes data available through Jan. 1995

3/ In addition to the commodities listed, France also produces germanium from domestic ores and has been described as the world's leading producer of this commodity in French sources. Output was reported as being all from the Saint-Salvy Mine. Unfortunately, actual output is not regularly reported, and the ore from this mine is not sufficiently uniform in grade to permit estimates of output based on reported concentrate production. In addition France produces large quanties of stone, but statistics on output are not available.

TABLE 2
FRANCE: 1993 BALANCE OF PAYMENTS, SELECTED MINERAL COMMODITIES 1/

(Thousand dollars)

Mineral commodity	Exports to EU	Imports from EU	Net gain or (loss)	Exports to the world	Imports from the world	Net gain or (loss)
Crude industrial minerals:						
Feldspar	5,309	1,003	4,306	6,098	5,422	676
Magnesite	157	169	(12)	175	461	(286)
Slate	3,674	4,128	(454)	3,994	4,211	(217)
Other	406,498	354,019	52,479	554,730	630,841	(76,111)
Total	415,638	359,319	56,319	564,997	640,935	(75,938)
Metalliferous ores:						
Copper	221	794	(573)	525	860	(335)
Lead	14	1,457	(1,443)	16	23,976	(23,960)
Tin	45	78	(33)	45	78	(33)
Zinc	3,861	25,212	(21,351)	3,883	124,163	(120,280)
Other (including waste and scrap)	876,650	380,875	495,775	1,011,548	1,172,294	(160,746)
Total	880,791	408,416	472,375	1,016,017	1,321,371	(305,534)
Nonmetallic mineral manufactures	223,146	463,205	(240,059)	579,788	860,503	(280,715)
Metals:						
Iron and steel	4,739,405	4,667,317	72,088	7,641,104	5,511,649	2,129,455
Mercury	71	510	(439)	139	581	(442)
Other nonferrous metals	2,452,838	2,263,789	189,049	3,331,928	4,092,780	(760,852)
Total	7,192,314	6,931,616	260,698	10,973,171	9,605,010	1,368,161
Mineral fuels	3,571,250	4,801,745	(1,230,495)	5,826,961	18,682,131	(12,855,170)

1/ Table prepared by Harold Willis, Section of International Data.

TABLE 3
FRANCE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of facilities	Annual capacity
Alumina		Aluminium Péchiney (Government)	Plant at Gardanne, Bouches-du-Rhone Province	700
Aluminum		do.	Aluminum smelters at:	
Do.		do.	Saint-Jean-de-Maurienne, Savoie Province	120
Do.		do.	Noguères, Pyrénées, Atlantiques Province	115
Do.		do.	Lannemezan, Hautes-Pyrénées Province	63
Do.		do.	Auzat, Arièege Province	44
Antimony, metal		Société Nouvelle des Mines de la Lucette	Plant at Le Genest, Mayeene Province	10
Barite		Barytine de Chaillac	Mine and plant at Chaillac, Indre Province	150
Do.		Société Industrielle du Centre	Mine at Rossigno, Indre Province	100
Bauxite		Aluminium Péchiney (Government)	Mines in Var Province	900
Do.		Société Anonyme des Bauxites et	do.	400
Do.		Alumines de Province (S.A.B.A .P.)	do.	
Cadmium	tons	Compagnie Royal Asturienne des Mines	Plant at D'Auby-les-Douai, Nord Province	300
Cement		Eight companies, of which the largest are:	80 plants, including--	23,233
Do.		Cement La Farge France	15 plants;	7,815
			Largest at St. Pierre-la-Cour	(1,160)
Do.		Société des Ciments Français	13 plants;	6,190
			Largest at Gargenville	(1,100)
Coal		Charbonnages de France (CDF) including:		13,000
Do.		Bassin de Paris	Mines and washeries in middle France	(2,500)
Do.		Bassin de Nord-Pas-de-Calais	Mines and washeries in northern France	(1,000)
Do.		Bassin de Lorraine	Mines and washeries in eastern France	(9,500)
Cobalt, metal	tons	Société Métallurgique Le Nickel (SLN)	Plant at Sandouville, near Le Havre	600
Copper, metal		Compagnie General d'Electrolyse du Palais	Electrolytic plant at Palais-sur-Vienne	45
Do.		Société Française d' Affinage du Cuivre.	Smelter at Poissy	11
Do.		Affinerie Sud-Ouest	Refinery at Toulouse	2
Feldspar		Denain-Anzin Minéraux S.A.	Mine and plant at St. Chély d' Apcher	55
Ferroalloys		Société du Ferromanganese de Paris, Outreau	Plant at Boulogne-sur-Mer	420
Do.		Péchiney Electrométallurgie (Government)	Plants at Bellegarde	387
Do.		Chromeurope S.A.	Plant at Dunkerque	25
Fluorspar		Société d'Enterprises, Carrières et Mines de l'Esterel	Forsante Mine, at Adrets d'Esterel, Var Province	150
Do.		Denain-Anzin Minéraux	Mine and plant at Escaro, Pyrénées	120
Do.		Société Générale de Recherches et d'Exploitation Minière	Mine at Montroc, Tarn Province	100
Gold	kilograms	Société des Mines du Bourneix (Government)	Mines in the Saint Yrieix la Perche District, Limoges	5,000
Do.	do.	Mines d'Or de Salsigne	Mines near Carcassonne	3,000
Iron and Steel:				
Iron ore		Lormines S.A. (Government)	Mines in Bassin de Lorraine, eastern France	8,000
Steel		Usinor-Sacilor (Government)	Dunkerque	7,500
Do.		do.	Fos-sur-Mer	4,200
Do.		do.	Seramange	3,000
Do.		Sollac, Unimetal (Usinor-Sacillor, 100%)	Gadrange, Neuves Maisons, Thonville, Trith-St-Leper	8,400
Lead, metal		Société Miniere et Metallurgique de Penarroya S.A.	Imperial smelter, Noyelles Godault	150
Magnesium, metal		Société Française d'Electro-Metallurgique, (Péchiney)	Plant at Marignac, Haute Garonne	14
Natural gas	million cubic meters	Société Nationale Elf Aquaitane (SNEA)	Gasfield and plant at Lacq	20,000
Nickel, metal		Société Métallurgia le Nickel (SLN)	Plant at Sandouville	16
Petroleum:				
Crude	barrels per day	Société National Elf Aquaitane (SNEA)	Paris Basin oilfields	1,000
Refined	do.	Compagnie Française de Raffinage (Total)	Refineries at Gonfreville and La Mede	446,000
		Shell-Française	Refinery at Petite Couron	285,000
Do.			Refinery at Berre	270,000
Do.		Elf-France	Refinery at Feyzin	120,000
Do.			Refinery at Donges	200,000
Do.			Refinery at Gr andpuits	96,000
Do.		Société Française British Petroleum (S.F.B.P.)	Refineries at Lavera	175,000
Do.		Esso S.A.	Refineries at Fos-sur-Mer	237,000
Do.		Mobil Oil Française	Refineries at Gravenchon	62,000
Do.		Cie. Rhenane de Raffinage (CRR)	Refinery at Reichstett	80,000
Potash, K2O		Mines de Potasse d' Alsace S.A. (M.D.P.A.)	Mines at Amélie, Marie-Louise, and Theodore, in Alsace	1,750
Salt, rock		Compagnie des Salins du Midi et des Salines de l'Est	Varangeville Mine at Saint-Nicolas-de-Port	9,000
Sulfur		Société Nationale Elf Aquaitane (SNEA)	Byproduct from natural gas desulfurization, Lacq plant	3,000
Talc		Talcs de Luzenac S.A. (RTZ Corp. 100%)	Trumons Mine near Ariège, Pyrenees	350,000
Uranium, U3O8	tons	Compagnie Général des Matèrials Nucleaires (Government)	Mines at Limousin, Vendee, and Hérault	1,800
Zinc, metal		Compagnie Royal Asturienne des Mines	Electrolytic plant, Auby-les-Douai	115
Do.		Société des Mines et Fonderies de Zinc de la Montagne	Electrolytic plant at Viviez	110