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GEOGRAPHIC INTELLIGENCE REPORT

PETROLEUM IN LATIN AMERICA

CIA/RR-G-17
August 1957

CENTRAL INTELLIGENCE AGENCY

OFFICE OF RESEARCH AND REPORTS

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PETROLEUM IN LATIN AMERICA

Preface

Studies of the petroleum industry all too frequently are written solely for the petroleum specialist and, therefore, are heavily weighted with technical terminology and details that are of interest to oilmen only; or they present a superficial picture of a current situation and give little or no clarifying background data. This study is designed to fit somewhere between the two categories. It presents sufficient information, both current and basic, to aid the individual who requires an understanding of the petroleum industry in Latin America but has neither the technical training nor the time to wade through the voluminous specialized literature on the subject.

This report discusses the petroleum situation in each country and colony in Latin America where oil is being produced; where there is, or has been, an active exploration program; or where there are refineries. Thus, only the Guianas, El Salvador, and the smaller Caribbean islands are omitted. Topics considered for the major oil-producing countries include geographic setting, status and development, production, reserves, refineries, markets, and transportation. For the less important producing countries, only a summary of the overall petroleum situation is given.

Summary 1,p.144-145/

The amount of crude oil produced in Latin America has been increasing steadily for a number of years. In 1940, approximately 312 million bbls.* were produced; by 1950 the amount had more than doubled, reaching 716 million bbls.; and by 1956 production had passed the billion mark. In 1955 and 1956 the annual production in Latin America accounted for about 18 percent of the total world production. During these same years, the United States contributed 44 percent and the Middle East fields 21 percent.

The petroleum situation differs radically from one Latin American country to another. El Salvador, for example, has no oil production and apparently no oil potential; Venezuela, at the other extreme, is one of the world's greatest producers and has tremendous proved reserves. Between these two are shades of difference that defy generalization.

Venezuela -- second only to the United States among crude-oil producers -- in 1955 and 1956 produced about 75 percent as much crude as all the Middle East countries combined. For the last few years, about 90 percent of all Latin American oil came from Venezuela's 100 or more fields. The entire petroleum industry in Venezuela is booming: production is climbing steadily, new fields are being discovered, new concession areas have been granted, and refinery capacity is being expanded.

Mexico is the second most important oil-producing country in Latin America, but its annual production is only a fraction of the Venezuelan output. The petroleum industry in Mexico has been a government monopoly since the expropriation of private oil property in 1938. Development has been retarded by excessive demands by labor, lack of technical knowledge, shortage of capital, and other factors. Nevertheless, recent developments, including the discovery of new fields and a general expansion in refinery capacity, indicate an improved situation in the near future. Annual production is more than twice as great as in the years immediately preceding expropriation.

It has been the Colombians' hope that their country would, as far as oil is concerned, become a second Venezuela, but the hope has never materialized. Colombia produces only about 5 percent as

*As used in this study, "barrels" denotes U.S. barrels, 1 barrel equaling 42 U.S. gallons. The abbreviations "bbls." and "b/d" are used for "barrels" and "barrels per day," respectively.

much oil as does Venezuela, and proved reserves are only about 5 percent as great as those of Venezuela. Annual crude-oil output in Colombia has doubled, however, since the end of World War II, and Colombia ranks third among the Latin American oil-producing countries.

As in Mexico, the petroleum industry in Argentina is dominated by the government, and petroleum resources have not been fully developed. Production during the last few years has remained at an annual rate of about 30 million bbls., an amount far short of that necessary to meet the domestic demand.

The amount of oil produced in Trinidad has been increasing at the rate of about 5 percent a year since 1950, and in 1955 reached almost 25 million bbls. Some reports indicate, however, that the output will soon begin to decline unless the current exploration program is successful.

In Peru, a relatively stable output of petroleum is obtained from old, intensively developed fields. In addition, millions of acres -- including the comparatively inaccessible region east of the Andes -- are being explored. Currently, the major producing fields are in a small area along the Pacific coast.

Ecuadoran oilfields are concentrated on the Santa Elena Peninsula, along the Pacific coast. For a number of years these fields have produced crude oil, and recently the output has been increasing gradually, but the total production has never been great.

Petroleum production in Chile is a relatively recent activity and thus far has been undertaken on a small scale only. All production comes from Tierra del Fuego in the extreme southern part of the country. The Chilean petroleum industry has been practically a government monopoly, but legislation recently proposed will relax this monopoly and permit both domestic and foreign private interests to participate in the industry.

Crude oil has been produced in Bolivia for more than 25 years but in such small quantities that most of the petroleum consumed had to be imported, despite a limited domestic demand. In the last few years, however, the output has increased so substantially that the petroleum industry has become the one bright spot in an otherwise dismal economic scene. The oil industry has long been state owned, but in 1955 a new code was promulgated that welcomes private capital. This code is as favorable as any now in force in Latin America.

Brazil is believed to have vast petroleum resources, but the amount of oil actually produced is far less than is required to meet even domestic requirements. The reason for this situation

is simply that Brazil lacks the capital, technical knowledge, and incentive required to develop the petroleum resources but refuses to permit the full participation of foreign companies that could supply these needs.

An important oil discovery in Cuba in 1954, together with a new law designed to stimulate oil exploration, touched off the biggest oil boom in the island's history. Production has increased significantly, but as yet no new major fields have been brought into production. Currently, a tremendous exploration program is underway, in which at least 35 companies are participating.

Elsewhere in the Caribbean area -- in Jamaica, Haiti, the Dominican Republic, Puerto Rico, and the British island of Barbados -- exploration for oil is also being conducted, but as yet oil has not been produced on a commercial basis. Exploration is also being undertaken in all the Central American countries with the exception of El Salvador. Only in Costa Rica, however, has any oil been found, and additional test drillings must be completed before it will be possible to evaluate the discovery.

LATIN AMERICA
OILFIELDS AND REFINERIES

Oilfield • Refinery

0 500 1000 Miles

0 500 1000 Kilometers

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I. South America

A. Argentina

1. Geographic Setting of the Oilfields

Argentina is bounded along the full length of its western side by the Andes Mountains. To the east of these mountains are plateau and plains regions underlain by thick marine sediments that have been little affected by the intensive deformation characterizing the Andean mountain belt. These regions contain the present oilfields and offer the greatest possibilities for future oil discoveries. 2,sec 1,p.1/

The major Argentine oilfields are in 4 groups, 3 along the eastern foot of the Andes and 1 near the seaboard not far from the Andes. They include: (1) the Salta fields in the extreme north of the country, on or close to the Bolivian border; (2) the Mendoza fields in Mendoza province in west-central Argentina, only a few miles from the foot of the Andes; (3) the Neuquén fields in Neuquén province, also within sight of the Andes; and (4) the Comodoro Rivadavia fields near the Golfo (gulf) San Jorge in the far south. (See map 25947.)

The Salta fields are on rugged foothill ranges at the eastern base of the Andes. These ridges are precipitous, wooded, and sparsely populated; the lowlands to the east support scrub forest and are used for grazing and timber production. The Mendoza fields are in arid plains and badlands, about 750 miles south of the Salta area. Nearby is the irrigated horticultural area of Mendoza, which was served by railroad and airlines long before oil was discovered. The small Neuquén fields, located about 400 miles south of the Mendoza district, are in high, barren, sagebrush-covered plains, useful only for grazing. The Comodoro Rivadavia fields are in an area of barren, windswept badlands. Some industrial development has occurred in the area, and fair roads radiate to all parts of the interior. No important agricultural land use, aside from sheep grazing, has been or is ever likely to be developed. 3,p.126-127/

Petroleum deposits in Santa Cruz and Tierra del Fuego, at the southern end of the Continent, also have attracted considerable attention recently. Fragmentary repórts indicate that this cold, dry, desolate area contains important oilfields.

2. Status and Development

The petroleum industry in Argentina is dominated by the government organization Yacimientos Petrolíferos Fiscales (State Oil Fields), generally referred to as YPF. National reserve areas established in 1935 cover most of the nation and can be exploited only by YPF. As a

result, the private producers now operating in Argentina, limited to total holdings of about 385 square miles, are drilling in depleted oil reservoirs and are using all ingenuity to keep their fields producing. 2,sec 2,p.1/

In mid-1955, with then President Juan Perón in virtual agreement with the request of the Standard Oil Company of California for a concession, foreign capital appeared to have a foot in the Argentine door. By the end of September, however, the revolution that deposed Perón was in full swing -- and with Perón, out went the Standard Oil of California agreement and a similar arrangement pending with Standard Oil of New Jersey. Subsequent governments have completely disavowed the agreements and confirm the dominance of YPF in the management of the country's petroleum industry. 4/

As an alternative plan for bringing much-needed foreign money into the country, the government in 1956 sought to finance its own $250 million expansion program through long-term construction loans from foreign banks and equipment manufacturers. The aim of the program was to double production within 3 years. This plan was not intended to constitute entrance of private enterprise into petroleum exploitation; the government reiterated that development of Argentina's petroleum resources remains the exclusive province of YPF. 5/

To carry out the program, YPF was granted autonomous status and assigned the job of negotiating for both equipment and technical knowledge. Nonetheless, oil specialists are openly skeptical of the idea that the country can become sufficient in petroleum by 1959. 6,p.146/

Development of the petroleum industry in Argentina began in 1865, making it one of the oldest in Latin America. Production was insignificant, however, until the Comodoro Rivadavia field was accidentally discovered in 1907 by personnel of the government's Division of Mines while drilling for potable water for local sheepherders. Thereafter, crude production for the country as a whole increased steadily from year to year, except for a few years of slight decline after 1943.

The history of crude-oil output in Argentina indicates a trend to ever-increasing government ownership, with proportionate diminution of private ownership. In 1931, for example, 53 percent of total production was privately controlled; by 1938, positions were reversed and the government controlled 53 percent; 2,sec 2,p.1/ and by 1955 almost 84 percent was government controlled. 7,p.40/

In all four of Argentina's principal producing districts, YPF is a major producer, and in the Santa Cruz and the Tierra del Fuego fields it is the only producer. The Standard Oil of New Jersey subsidiary operates in the Neuquén and Salta districts; the Royal Dutch-Shell subsidiary, in the Comodoro Rivadavia district; Astra, in

Comodoro Rivadavia; and Río Atuel, in the province of Mendoza south of the major group of oilfields in that province. 2/

3. Production

In 1955, Argentina produced slightly more than 30 million bbls. of crude petroleum, or about 1/2 of 1 percent of the world total. This placed Argentina fourth among Latin American oil-producing countries -- following Venezuela, Mexico, and Colombia. 1,p.144/ On the basis of data for the first 9 months of 1956, it has been estimated that production for 1956 was slightly less than for the previous year, with a daily rate of about 83 thousand bbls. as opposed to the 1955 rate of 84 thousand bbls. 6,p.105;8,p.141/

The most important of Argentina's four major oil-producing districts is the Comodoro Rivadavia, which in 1955 produced about 18 million bbls. of crude oil, or about 60 percent of the nation's total. 1,p.229/ Many of the district's 16 fields have been producing for more than 30 years. In recent years the YPF has concentrated much of its effort in the Caleta Olivia field, about 60 miles south of the main Comodoro Rivadavia fields.

The area second in importance is the Mendoza district. In 1953 it had 5 producing fields, 9/ and in 1955 it accounted for about 20 percent of Argentina's crude production.

The Neuquén district had 8 producing fields in 1953. In 1955, the output of this district was about 16 percent of the total national production.

The fourth of the major producing areas is the Salta district. Despite the potentiality of the fields in this district, little has been done to develop them. In 1955, only about 2 percent of Argentina's crude oil came from this district. Large reserves are believed to have been proved in the northernmost fields of the district, the Campo Durán and Madrejones. 1,p.229/

The Santa Cruz and Tierra del Fuego districts contain small producing fields, but information on them is fragmentary. Development of the Santa Cruz area should be relatively easy and could be facilitated by constructing a 20-mile pipeline to the port of Río Gallegos. Development of the Tierra del Fuego district is also contingent upon construction of transportation facilities. In early 1957, a press report stated that a survey of the area had indicated good prospects for production of "large quantities" of petroleum and that YPF would soon accept bids for the drilling of 40 wells in the area. 10/

The following table indicates the relative importance of the four major producing districts in Argentina.

Crude Oil Production, 1955 1,p.229/

District	Daily (bbls.)	Annual
Comodoro Rivadavia	49,871	18,202,787
Mendoza	17,603	6,424,929
Neuquén	14,557	5,313,238
Salta	1,413	515,838
Totals:	83,444	30,456,792

In 1955, YPF fields produced about 26 million bbls. of crude oil, or, as previously stated, 84 percent of the nation's output. Virtually all remaining crude oil was produced by subsidiaries of 2 major international firms and by 2 small companies. The international firms are Royal Dutch-Shell (Diadema Argentina, S.A. de Petróleo) and Standard Oil of New Jersey (Esso Productora de Petróleo, S.A.); the small firms are the Astra Cia. Argentina de Petróleo and the Cia. Rio Atuel "El Sosneado." Astra is owned by Swiss interests, and Rio Atuel by Argentine.

4. Reserves

The estimate of proved reserves in Argentina has changed appreciably in the last 9 years. At the end of 1947, proved reserves were estimated at 253 million to 325 million bbls.; 2,sec 1,p.17/ in December 1956 the estimate was 400 million bbls., despite the withdrawal since 1947 of more than 225 million bbls. 6,p.105/ The geographical distribution of these reserves in 1952, the latest date for which such information is available, was as follows: Comodoro Rivadavia, 47 percent; Salta, 19; Neuquén, 14; Mendoza, 12; and Santa Cruz and Tierra del Fuego, 8. 2,sec 1,p.18/

Of nine areas termed "favorable," the Chaco basin in north-central Argentina is of paramount importance and could well develop into the most productive petroliferous area in the country. The Santa Cruz basin is also considered to have potential importance. The other areas, though of lesser importance, that are believed to contain significant quantities of petroleum are the San Jorge basin inland from the Comodoro Rivadavia district; the Neuquén embayment adjacent to the already-producing Neuquén fields; the Río Negro trough; the Mendoza basin near the producing Mendoza fields; the huge Paraná trough extending north from Mar del Plata, west to Córdoba, north to Corrientes on the north, and east to the Río Uruguay; the Paraná basin, most of which is in Brazil; and the Bahía Blanca basin.

The remainder of the country, including the Andes Mountains and much of northwestern and central Argentina, is considered "unfavorable" for the accumulation of petroleum. 2,sec 1,p.9-11 and fig.10/

5. Refineries

At the end of 1956, Argentina had in operation 17 refineries (including one asphalt plant), which had a crude capacity of almost 200,000 b/d. This amount represented about 8 percent of the total crude capacity (2,336,400 bbls.) for Latin America (including Mexico, Trinidad, and the Netherlands Antilles). 6,p.147/ Crude runs in 1956 were about 80 percent of capacity. 7,p.40/

Seven of the Argentine refineries are owned by YPF; their combined capacity is 137,600 b/d, or about 70 percent of the total Argentine capacity. The four refineries owned by Esso Refinadora de Petróleo, a subsidiary of Standard Oil of New Jersey, have a combined capacity of 32,300 b/d, or 16 percent of the country's total. The only major refinery not owned by either YPF or Esso is the 21,000-b/d plant owned by Diadema Argentina de Petróleo. 6,p.147/

In the following table, ownership, location, and capacity are given for both major and minor refineries.

Argentine Refineries 6,p.147/

Company	Location	Capacity (bbls./stream day) Crude distillation	Cracking a/
Cia. Condor	Avellaneda	900	...
Cia. La Isura, S.A.	Bahia Blanca	2,000	...
Diadema Argentina, S.A. de Petróleo (Shell)	Buenos Aires	21,000	9,000 TC
Esso Refinadora de Petróleo	Bahia Blanca	5,500	1,000 TC
	Campana	25,000	11,000 TC
	Dadín (Plaza Huincul)	500	...
	Manuel Elordi	1,300	...
Lottero y Papini	Avellaneda	1,500	...
Ramon Gorleri	Quilmes	1,500	...
Yacimientos Petrolíferos Fiscales	Avellaneda	6,000	2,500 TC
	La Plata	95,000 b/	18,400 FCC 7,000 TC

a. TC -- thermal cracking; FCC -- fluid catalytic cracking.
b. Additional 28,000-bbl. crude capacity planned for completion in 1960.

Yacimientos Petrolíferos Fiscales (Continued)	Lujan de Cuyo	11,300 c/	9,000 TC
	Plaza Huincul	1,300	...
	Comodoro Rivadavia	5,500	2,000 TC
	Salta	2,500	1,300 TC
	San Lorenzo	16,000	6,200 TC
Cia. General de Asfaltos	Buenos Aires	...	...
	Total:	195,900	66,400

c. Additional 12,500-bbl. crude capacity under construction, to be completed in 1958.

6. Markets and Transportation

Although Argentine governments have insisted that self-sufficiency in petroleum is a high-priority goal, the degree of accomplishment falls far short of the objective. Petroleum production has not expanded fast enough to meet the increased demand brought about by postwar industrialization and the rising standard of living. Between 1946 and 1952, for example, production increased at an average annual rate of only 3 percent, while internal consumption increased an average of 8 percent a year. Thus, the country has become more dependent upon imports, and the petroleum industry's foreign-exchange requirements have increased, rather than decreased. 2,sec 6,p.1-2/

In 1938, Argentina produced about 17 million bbls. of crude oil and imported less than 5 million barrels. By 1955, domestic production had almost doubled and amounted to about 30 million bbls. -- but imports had also increased to 30 million bbls. 1,p.145;11,p.3/ During the first 9 months of 1956, Venezuela was the source of more than half the imported crude oil. Kuwait supplied about one-third, and Peru, Ecuador, and Bolivia accounted for most of the remaining crude oil imported. 12,13,14/

Since World War II, Argentine refining capacity has expanded somewhat more rapidly than the rate of increase in domestic demand. Immediately after the war the output of domestic refineries accounted for only about 65 percent of the country's requirements, but by 1953 the proportion had increased to more than 80 percent, even though the growth in demand was considerable. 2,sec 6,p.6/

Despite the additional refining capacity, during the first half of 1956 Argentina imported about 14 million bbls. of refined products. As has been the case for a number of years, the Netherlands West Indies was the principal source, supplying about two-thirds of the imported products. Venezuela and the United States were the other major suppliers. In the first quarter of 1956, 111,000 bbls. of fuel oil were imported from the Soviet bloc. 12,13/

Argentina imported approximately 4.6 million bbls. of petroleum, principally refined products, from the USSR in 1955. This amount represented about 6 percent of total consumption in that year -- slightly more than in 1954, when the first Soviet Bloc petroleum was imported. In both years, Argentina ranked immediately after Finland and Sweden among Western recipients of Bloc petroleum. 15,16/

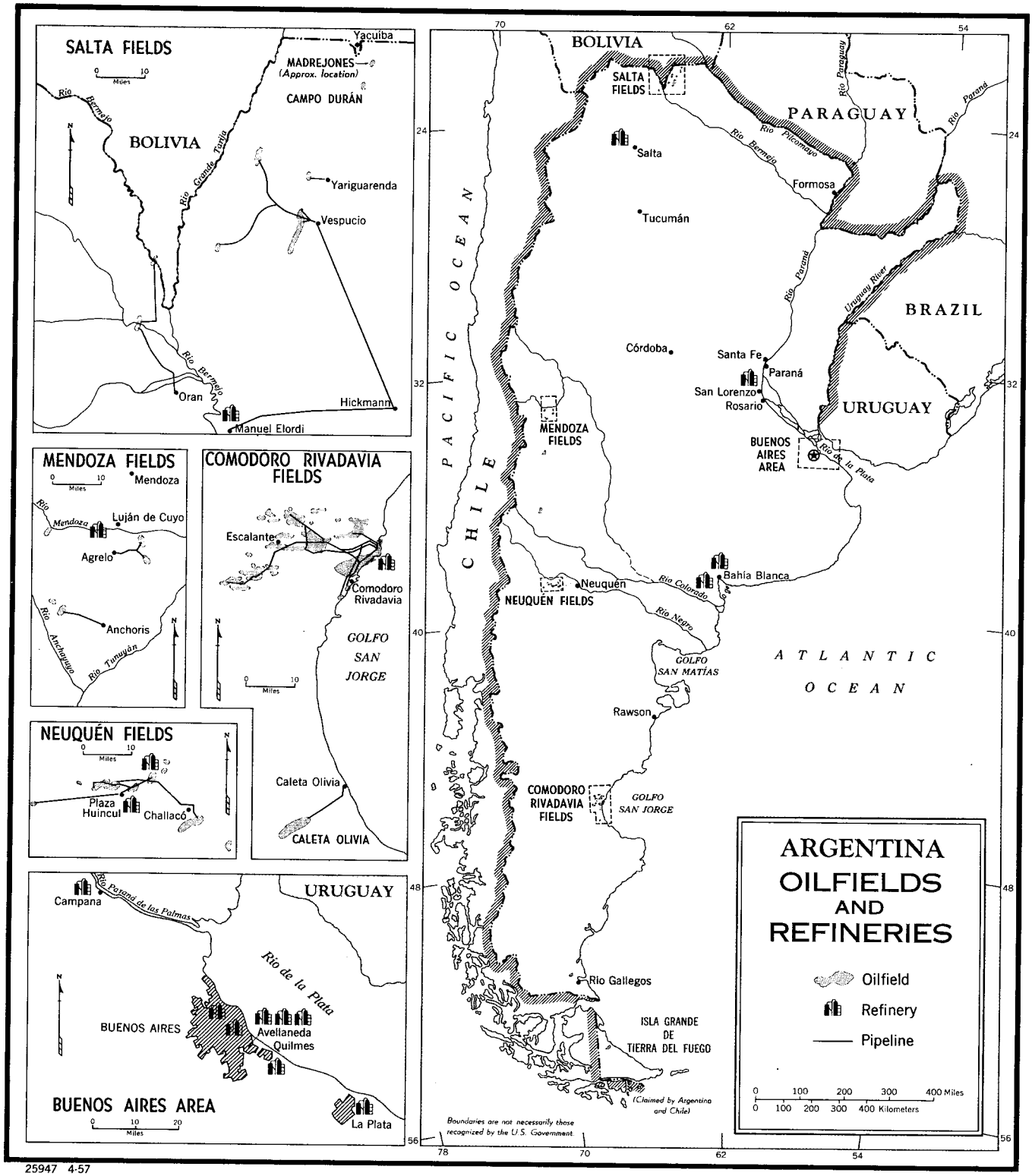
Argentina exports only minor quantities of petroleum. In the first half of 1956, the total petroleum exports reported consisted of 12,600 bbls. of aviation gas. This export was made by YPF to the Uruguay Government under a contract to supply 44,000 bbls. for use in military aircraft. No petroleum or petroleum products were exported in 1955. 13/

Geographical and climatic conditions constitute a major handicap in Argentina's efforts to become self-sufficient in petroleum. The oil deposits are located in remote areas of the country, far from centers of population, and must be developed under unfavorable climatic conditions. The producing districts of Comodoro Rivadavia, Neuquén, and Mendoza are located in dry wastelands. Investment in auxiliary facilities, such as housing, water systems, and roads, must accompany field development. On the other hand, consumption is concentrated in the heavily populated provinces; the province of Buenos Aires and the Federal District alone account for well over one-half the total petroleum consumption.

Transportation of domestic crude oil to refineries involves the use of pipelines, waterways, highways, and railroads. The petroleum pipelines are located principally in (1) the Comodoro Rivadavia district, from which the crude oil is transported to seaboard terminals, and (2) the Mendoza, Neuquén, and Salta districts, from which the crude is moved to nearby refineries or to loading points on the railroads. A pipeline also extends from the Agua Blanca field in Bolivia into the Argentine Salta district. Because the pipeline facilities are so limited, development of the producing districts that are located in the interior of the country has been retarded. To correct this situation, construction of additional pipelines has been given a high priority in the government's new petroleum-development plan. Work has already begun on an 800-mile crude pipeline from the Campo Durán field in the extreme north to the San Lorenzo refinery near Rosario. Plans also call for a 500-mile pipeline from the Mendoza fields, in the Andes foothills, to Buenos Aires. 1,p.224;17;18/

Tankers are used for coastal transportation of crude oil from the Comodoro Rivadavia district to the Buenos Aires consuming area, more than 1,000 miles to the northeast. Tankers also carry crude and fuel oil from Caribbean ports to Buenos Aires.

Railroads play an important part in the transportation of both crude petroleum and refined products. Movement of crude from the Salta, Mendoza, and Neuquén fields is at present by rail, but many of the wells have had to be shut back because of the poor condition of the railroad. Inadequacy of railroad facilities has also deterred importation of Bolivian crude oil. 18/



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B. Bolivia

The producing oilfields in Bolivia are located in the foothills of the Andes in the southeastern part of the country. (See map 25950.) The fields are on long narrow ranges, covered with dense but scrubby forest. The terrain is rough, making road building and other preparatory work both difficult and costly.

Crude oil has been produced on a commercial basis in Bolivia for more than 25 years, but for most of this time so little was produced that, despite limited domestic requirements, petroleum had to be imported. During the last few years, however, crude-oil production has increased so remarkably that the petroleum industry is the one bright spot in Bolivia's dismal economic picture. 19,p.8/ In 1954, crude-oil production was almost 3 times as great as in the previous year, and in 1955, the output had increased 60 percent over that of 1954. The 1955 total production was 2,692,000 bbls.; the daily average was more than 7,300 bbls. -- at least 2,700 barrels more than in the preceding year. The increase would have been even greater except that 21 wells capable of producing oil were shut in at the end of the year because of lack of an outlet for the crude. 1, p.145 and 229/ This upward trend continued into 1956, when the daily average was more than 9,500 bbls. 6,p.150/ As a result of the spiraling production, Bolivia has changed from an importer to a net exporter of petroleum and has been able to satisfy domestic demands with ease. 20/

The development of the Bolivian oil industry has been a state monopoly since the government founded its own petroleum agency, Yacimientos Petrolíferos Fiscales Bolivianos (YPFB), in 1936 and acquired the holdings of the Standard Oil Company of Bolivia. YPFB brought in a number of oil wells, constructed two refineries, and linked the fields and refineries by pipeline. Despite these activities, the refineries were idle more days than they operated, and production was only a fraction of the amount needed to supply the country's internal requirements. After the 1952 revolution, however, considerable progress was made in the petroleum industry; replacement parts were purchased, equipment was renovated, exploitation of the oilfields was intensified, and roads and storage plants were constructed. In addition, the government formulated a new policy and announced it would welcome foreign investment in oil leases on a royalty basis. 21/

The first foreign contract negotiated after the new policy went into effect was the Glenn McCarthy, Inc., of Bolivia, a subsidiary of the Texas firm, in 1953. The company received exclusive petroleum rights to an area of almost a million acres in southeastern Bolivia near the Argentine border. To date the results of this contract have been disappointing to both the company and the government. 6,p.151/ Both

oil and gas discoveries have been made on the acreage, but as of the end of 1955 only 5 wells had been drilled, 2 of which were abandoned because of technical difficulties. 19,p.3/ In December 1956 all wells were reported to be shut in. 6,p.151/

In 1955 the Bolivian Government proposed the annulment of a 1938 treaty with Brazil which called for joint development of a concession area near Santa Cruz. Neither government has appropriated sufficient funds to do any work on the concession other than to make a superficial geological survey. 22/ The Brazilian Government opposed annulment of the treaty, however, and as recently as November 1956 consultations between the two governments were being held to discuss the development of the concession area. 23/

The most far-reaching action in recent years affecting the Bolivian petroleum industry was the promulgation of a new petroleum code in October 1955 and the subsequent issuance of its regulations in January 1956. The code was formulated to provide incentive for foreign investment in the development of Bolivia's petroleum resources and, according to persons qualified to evaluate, it is as favorable as any code now in force in Latin America. Under the terms of the code, private oil firms are to be permitted to apply for concessions, first to explore and then to exploit petroleum lands as authorized by the Bolivian Government. The status of the Bolivian-Brazilian concession in the Santa Cruz area, the three producing YPFB fields, and the McCarthy concession was not changed by the code.

The first U.S. company to negotiate for concessions under the petroleum code was the Bolivian Gulf Oil Company, a subsidiary of the Gulf Oil Company. In addition, Bolivian Gulf entered into a contract with YPFB for exploration and development in the zone reserved to that agency. 19,p.1/ Shell Prospecting Company, Ltd., has applied for a large exploration concession, and late in 1956 the Richfield Oil Corporation was taking preliminary steps for filing a bid. 6,p.151/ Several other companies have sent representatives to Bolivia to study the country's petroleum potential. 1,p.230/

Data on Bolivia's producing oilfields, all of which are owned by YPFB, are given in the following table.

Bolivian Oilfields 6,p.150;24/

Name	Discovery year	Production (bbls.) 1955 total	1956 daily	Cumulative to mid-1956
Camiri	1927	2,504,963	8,108	9,497,125
Bermejo	1924	143,901	431	1,425,020
Sanandita	1926	43,901	101	2,012,020
Guairuy	1947	n.a. a/	532(est.)	534,342
Toro	1955	n.a.	350(est.)	187,200
	Totals:	2,692,765	9,522	13,651,207

a. Probably included in total for the nearby Camiri field.

Bolivia's proved reserves at the end of 1955 were estimated to total almost 80 million bbls. More than half of these reserves -- about 47 million bbls. -- were located at Camiri, the principal producing field in the country. Reserves at other oilfields were as follows: Bermejo, 15 million bbls.; Comatindi, a field in which Standard Oil of Bolivia many years ago drilled several wells but where YPFB has done no work, 10 million bbls.; Guairuy, near the Camiri field, 5 million bbls.; and Sanandita, 2 million bbls. 19,p.8/

Considerable time and effort has gone into exploratory work in Bolivia in recent years. In 1955 alone, YPFB had seven teams in the field. Geological work was performed over an area of 500,000 square kilometers, gravimetric work over 5,500 square kilometers, and seismological work over 600 square kilometers, all in southeastern Bolivia. 19,p.7/ YPFB has indicated it intends to conduct exploration in Caupolican province, northeast of Lake Titicaca, near the Peruvian border, in the near future. 25/

Bolivia has two major refineries, one at Sucre and the other at Cochabamba. A 6-inch pipeline connects the Camiri oilfields with Cochabamba, and a 4-inch branch supplies Sucre. In addition, there are two small local refineries in the oilfields, one at Camiri and the other at Sanandita. 26/ The YPFB plans to transfer a 2,000 b/d petroleum refining unit from Sucre to the city of Santa Cruz. This transfer is part of a plan to connect Santa Cruz by pipeline with the Camiri oilfield. Thus the refinery will be at the shipping point for petroleum-products exports to Brazil, and the long and costly truck haulage from the refinery at Cochabamba to Santa Cruz will be eliminated. 27/

The following table provides data on Bolivia's refineries, all owned by the YPFB.

Refineries 6,p.151/

Location	Crude capacity (bbls./stream day)
Cochabamba	5,850
Sucre	4,000
Camiri	1,450
Sanandita	410
Total:	11,710

As recently as 1952, petroleum imports were a major drain on Bolivia's meager foreign exchange. By the end of 1953, however, increased domestic production permitted the country to cease importing

gasoline and kerosene, and by 1954 Bolivia was self-sufficient in petroleum except for aviation gasoline and some lubricants. 28/ In 1955, the only petroleum imports were some 100,000 bbls. of aviation gasoline. 24/ Despite the expected increase in domestic consumption of all petroleum products, officials of YPFB believe the agency has sufficient production, refining, and distribution facilities to meet the higher demand. 19,p.5/

In 1954 Bolivia was faced, for the first time, with finding markets for surplus petroleum production. As a result, barter agreements providing for exports of oil and oil derivatives were signed that year with four of the neighboring countries. In 1955 Bolivia delivered crude petroleum and fuel oil to Argentina; gasoline to Chile; gasoline and kerosene to Brazil; and gasoline, kerosene, and diesel oil to Paraguay. 19,p.6/ The total value of these exports was about $3.5 million. A total of approximately 476 thousand bbls. of crude oil was exported in 1955, and about 143 thousand bbls. of refined products. 24/

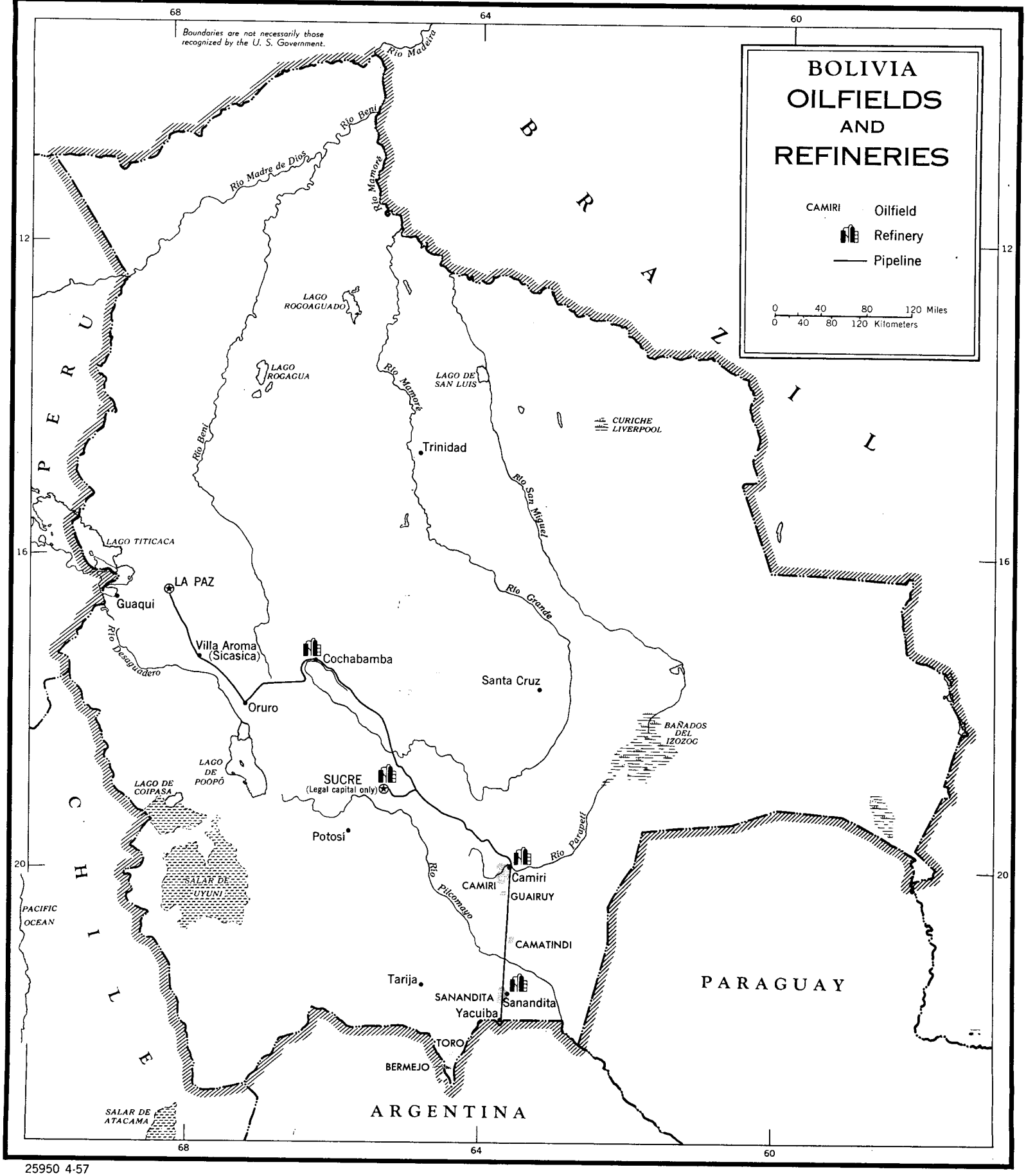
Gradually the Bolivian Government has been extending the network of pipelines servicing the country. The following pipelines are owned and operated by the YPFB: (1) a 6-inch line, 234 kilometers long, from the Camiri fields to the Cochabamba refinery; (2) a 4-inch branch line, 71 kilometers long, from a point on the Camiri-Cochabamba line to the Sucre refinery; (3) a 6-inch line, 285 kilometers long, from the Camiri fields to Yacuiba on the Argentine border (completed in 1955); and (4) a 6-inch line, 375 kilometers long, from the Cochabamba refinery to Oruro and La Paz (completed in March 1956). 19,p.4/

In mid-1956 arrangements were completed to acquire 300 kilometers of pipe to be used to connect the Camiri oilfields with the city of Santa Cruz. As previously mentioned, YPFB contemplates moving one of the Sucre refinery units to Santa Cruz, where the oil from the Camiri fields will be refined for domestic consumption and export to Brazil.

A proposed pipeline, for which a survey had already been completed, was to run from a point on the Cochabamba-Oruro-La Paz line called Sica Sica to Arica, Chile. The purpose of the line was to export crude petroleum to the Pacific seaboard. 19,p.4/ Complications arose, however, when the Chilean congress attempted to place certain limitations on the construction of a Bolivian pipeline across Chilean territory. The Bolivian Government therefore has been attempting to acquire an alternative outlet through the Peruvian port of Ilo. 29/ In December 1956, the Bolivian foreign minister made a formal proposal to the Peruvian Government for an agreement covering the construction of one or more pipelines across Peruvian territory to the Pacific seacoast. 30/ The Bolivians believe that

difficulties with Chile can be satisfactorily settled and that the proposed pipeline to Arica also will be constructed, thus giving Bolivia two outlets on the Pacific.

Also in December 1956 the foreign ministers of Bolivia and Paraguay signed an agreement stating the conditions for construction of pipelines to transport petroleum through Paraguayan territory. The pipelines will supply petroleum for Paraguayan domestic consumption and also for world markets. 31/



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C. Brazil

1. Geographic Setting of the Oilfields

All of Brazil's producing oilfields are located in the Recôncavo basin near the Atlantic seaboard in the state of Bahia, just north and northwest of the city of Salvador. (See map 25946.) Most of the oilfields in this semitropical area are on the low, rolling coastal plain. Some of the land is cleared, but most of it is covered with brush or scrub forest dense enough to require the use of bulldozers to build roads and to clear the location for wells. Crude petroleum, refined products, and oilfield supplies are transported via the nearby Baia (bay) de Todos os Santos.

In addition to the Recôncavo basin, at least 3 other large sedimentary basins measuring hundreds of thousands of square miles, as well as 5 or 6 smaller basins, have petroleum possibilities. The larger basins include the Amazon and Sub-Andean Troughs, which cover much of the Amazon basin and the eastern foothills of the Andes; the Maranhão basin in north-central Brazil; and the Paraná basin, encompassing most of southern Brazil. The smaller basins extend along the Atlantic coast from the vicinity of Fortaleza in northeastern Brazil southward as far as the Cabo de São Tomé, just north of Rio de Janeiro.

2. Status and Development

Brazil is believed to have tremendous petroleum resources, but the amount of oil that has actually been taken from the ground is minute when compared to either the potentialities of the country or its domestic needs. The cumulative production of crude petroleum up to the middle of 1956 was only 7.5 million bbls., which is not much more than the U.S. production for a single day in 1956. 6,p.105/ Brazilian production in 1956 was 11 thousand b/d against a demand of 165 thousand bbls. If the demand continues to increase at its present rate, it should reach 264 thousand b/d by 1958. 32/

Brazilian crude-oil production has been increasing in recent years, although it has not kept pace with the increasing demand. In 1940, only 2 thousand bbls. were produced; by 1950, production had spiraled to 339 thousand bbls.; and in 1955 it topped the 2 million mark. Despite this improvement, Brazil still ranks almost at the bottom of the list of Latin American oil-producing countries. 1,p.145/

Between 1920 and 1939 rather desultory prospecting for petroleum was conducted -- but unsuccessfully -- in various parts of Brazil by national and state agencies and by a few ill-equipped private operators financed by Brazilian capital. Finally in 1939 the first commercially productive well was discovered in the Recôncavo basin.

Private foreign capital has been excluded from petroleum exploration and development since 1937. From 1939 to 1953, the National Petroleum Council was in complete charge of the search for petroleum. With the help of foreign technicians the Council developed the Recôncavo fields and carried out limited exploration programs in other parts of Brazil.

Even though Brazil lacked sufficient capital and technical ability to develop her petroleum industry rapidly, the government in 1953 adopted a policy that has resulted in virtually a state monopoly of the Brazilian oil industry. Public opinion, inflamed by Communist and nationalist propaganda, greatly influenced the form of the legislation embodied in the Petrobras (Petróleo Brasileiro) Law, passed in 1953, which resulted in the nearly complete nationalization of the industry.

Under the provisions of the new law, a national petroleum company, Petrobras, was established and was given almost exclusive rights in all branches of the industry except marketing. The law authorizes the creation of government monopolies for all exploration, development, refining, and transportation of Brazilian oil under the administration of Petrobras. 33,sec 7,p.1-9/

Though Petrobras has recently made great progress in increasing the output of the only producing area, much of this increase was made possible by the completion of a pipeline gathering system, not as a result of the discovery of new fields. Local production still provides less than a tenth of consumption, and imports of crude oil and refined products in 1956 cost the equivalent of about $250 million, or well over 20 percent of the value of all Brazilian imports. 34/

The magnitude of the task of exploiting Brazil's petroleum resources is illustrated by the fact that the area to be explored -- with very limited capital resources -- is larger than the United States; the Brazilian state of Amazonas alone, the current focal point of exploration, is more than twice the size of Texas.

The logistics of the search for oil a thousand miles into the interior are formidable. The rain-forest area is accessible only by river. Exploration must be accelerated during the few months of the "dry" season, more accurately called the low-water season, which lasts from the end of July through September. Topographic maps are often inaccurate; in some cases rivers are located as much as 30 miles from their actual courses.

One of the few bright spots in the Brazilian petroleum picture is the fact that Petrobras apparently is gathering a corps of

technicians who have had sufficient experience to tackle the monumental task of pinpointing the nation's vast petroleum resources. The chief of Petrobras's exploration department has had many years of geological experience, much of it in South America. He was formerly the chief geologist for the Standard Oil Company of New Jersey, and he has accumulated a staff of geologists and geophysicists from many parts of the world. 32/

3. Production

Brazil began producing crude petroleum in 1939 after the discovery of the Lobato field in the Recôncavo basin. This basin has remained the sole producing area in Brazil despite the vast reserves believed to exist in other parts of the country. The Lobato field produced about 80 thousand bbls. of oil but is now abandoned. Subsequent exploratory drilling disclosed a number of other fields in the Recôncavo area, but only two -- Candeias, discovered in 1941, and Dom João, in 1947 -- have proved to be major producers.

The Candeias field has contributed about two-thirds of all the crude petroleum produced in Brazil; in 1956 it had a production rate of 3,000 b/d. The Dom João field has produced about one-fifth of Brazil's oil, and last year, with a daily production of 2,000 bbls., was second only to Candeias. It is expected that the Dom João field will contribute an increasing percentage of the country's production for at least the next few years, since it appears that the Candeias field may have reached its peak of production. 6,p.148-149/

Brazil's entire 1940 crude production, all from the Lobato field, amounted to only 2,089 bbls., or an average of 5.7 b/d. Although the Candeias, Dom João, and other fields were discovered within the next 7 years, total production for 1947 was less than 100,000 bbls. 33,sec 2,p.1/ Since 1947 the yearly production has shown a steady increase. In 1955 the production exceeded 2 million bbls. -- over 20 times as much as in 1947. Information is not yet available on the total 1956 production, but the daily rate has more than doubled, from 5.2 thousand bbls. in 1955 to 11 thousand in 1956. 1,p.145;8,p.141/

The following table gives pertinent information on each of the Brazilian oilfields.

Brazilian Oilfields, Mid-1956 6,p.148/

Name of field and discovery year	Proved acres	B/d production
Agua Grande		
Catu sand, 1953	50	Test only
"A" zone, 1950	200	n.a.

Name of field and discovery year	Proved acres	B/d production
Candeias, 1941	1,505	3,000
Dom João, 1947	4,893	2,000
Itaparica		
"A" zone, 1943	408	400
Sergi sand, 1942	235	n.a.
Lobato, 1939	22	Abandoned
Mata de São João		
Victoria sand, 1952	160	Shut in for lack of pipeline
"A" zone, 1951	40	n.a.
Sergi sand, 1953	160	n.a.
Nova Olinda, 1955	n.a.	Not on production
Paramirim V., 1950	60	60
Pomuca Central		
"A" zone, 1953	300	Shut in for lack of pipeline
Sergi sand, 1953	300	n.a.
Rio da Serra, 1950	200	Shut in for lack of pipeline
	Total:	5,460

4. Reserves

The estimates of proved reserves in Brazil have changed appreciably since 1947. In that year, estimates ranged from 3 million to 15 million bbls. At the end of 1956, Brazil's proved reserves had reached 40 million bbls. The improvement in the proved reserve position since 1947 is due primarily to the discovery of the Dom João field, which contains about two-thirds of the present reserves. Further substantial increases are probable, particularly if prospective areas outside the Recôncavo basin are found to be productive. 6,p.105;33,sec 1,p.2/

The producing fields in the Recôncavo basin have long been considered the only "proved" petroleum areas in Brazil. Oil was struck near Nova Olinda in the Amazon valley in March 1955, however, and this area can therefore also be considered "proved." Until

more test wells have been drilled and further exploration has been completed, it will be impossible to give a reliable estimate of the extent of the reserves in the area. In fact, it is not possible on the basis of data currently available to state unequivocably that petroleum in commercial quantities does exist, although there is no question that some petroleum is available. Nevertheless, Brazilians are optimistic about the prospects for this part of the Amazon valley. A responsible Brazilian official has stated that the discovery well at Nova Olinda, about 100 miles southeast of Manaus, has shown that "without doubt there are petroliferous accumulations in the Amazon basin and that this basin, by its extent and the thickness of sedimentation, can contain structures capable of accumulating sufficient oil to satisfy Brazilian home consumption for many years to come and may eventually provide an export surplus." 35/ The chief of the Petrobras exploration department has characterized the Nova Olinda strike as one of the biggest oil events in this hemisphere. 32/

To date, the production record of Nova Olinda would hardly justify such enthusiasm, except possibly from a long-range, speculative point of view. Initially the flow from the discovery well was 250 b/d, but later it dropped to 17 to 30 b/d. In July 1956 the well was reported to be entirely shut-in, 36/ and as of the end of 1956 there still had been no commercial production. More wells are now being drilled in the area. 34/

The Paraná basin, the Sergipe-Alagoâs basin, the Tucano basin, and the coastal basin between Baia de Todos os Santos and Ilhéus are classified as "favorable" petroleum prospecting areas. The Maranhão basin, the Amazon and Sub-Andean Troughs (excepting the proved area of Nova Olinda), the belt of coastal plain between Ilhéus and the Cabo de São Tomé, and the northeastern coastal basins are all classified as "possible" petroleum prospecting areas. 33,sec 1,p.13-14 and fig 14/ In 1956, exploration was undertaken in the Amazon and Sergipe-Alagoâs basins, the northeastern coastal basin of Rio Grande do Norte, the Maranhão basin, the Paraná basin, and new sections of the Recôncavo area.

5. Refineries

As recently as 1951, Brazil had only 4 small petroleum refineries with a combined capacity of 4,000 b/d. The yields from these facilities met only a fraction of the country's needs. Since the importation of refined products imposed a severe drain on Brazil's foreign exchange, there has been a strong trend toward the development of local refineries.

At present, the total refining capacity is about 111,000 b/d, or sufficient to meet about half the country's needs for refined

products. There are 8 refineries, 2 of which are owned by Petrobras, and 1 asphalt plant which is also a Petrobras facility. The Petrobras refineries account for 61 percent of the country's daily capacity. 6,p.150-151/ Two major projects are scheduled by Petrobras: construction of a new 90,000-b/d plant for Rio de Janeiro, to be completed in 1959; and an increase in the capacity of the Mataripe refinery to 37,000 b/d. 34/

In September 1956 a new 5,000-b/d refinery started production a few miles east of the city of Manaus in the Amazon valley. It is owned by the Companhia de Petróleo de Amazônia, a privately controlled Brazilian corporation permitted to operate the plant because it was under construction at the time Petrobras was created. Venezuelan crude was used for initial runs, but the main source is expected to be the Ganso Azul field, located on the eastern side of the Andes in Peru, or the Amazon valley itself, should indigenous crude become available in adequate quantity. 37/

Data on Brazil's refineries are given in the following table.

Brazilian Refineries, 1956 6,p.150-151/

Company	Location	Capacity, bbls./stream day	
		Crude distillation	Cracking a/
Companhia de Petróleo de Amazônia	Manaus	5,000	2,500
Distilaria Rio Grandense de Petróleo	Uruguaiana	300	none
Indústrias Matarazzo de Energia	São Paulo	500	none
Iriranga, Companhia Braseira de Petróleos	Rio Grande	7,000	2,000 TC
Refinaria de Petróleos Manguinhos	Rio de Janeiro	10,000	7,000 Vis
Refinaria e Exploracão de Petróleos "União"	Capuava (São Paulo)	20,000	10,000 FCC
Petrobras	Mataripe (near Salvador)	15,000 b/	6,000 TC 7,200 FCC b/
Petrobras	Cubatão (near Santos)	50,000	18,000 TC

Company	Location	Capacity, bbls./stream day: Crude distillation	Cracking a/
Petrobras (Fabrica de Asfalto)	Cubatão	3,500	none
Petrobras	Rio de Janeiro	c/	- -
Totals:		111,300	52,700

a. TC -- thermal cracking; Vis -- visbreaking; FCC -- fluid catalytic cracking.
b. Overall capacity of refinery is being increased to 37,000 b/d, including another 4,800 b/d catalytic cracking capacity.
c. Refinery is scheduled for completion in 1959 and will have a 90,000 b/d capacity.

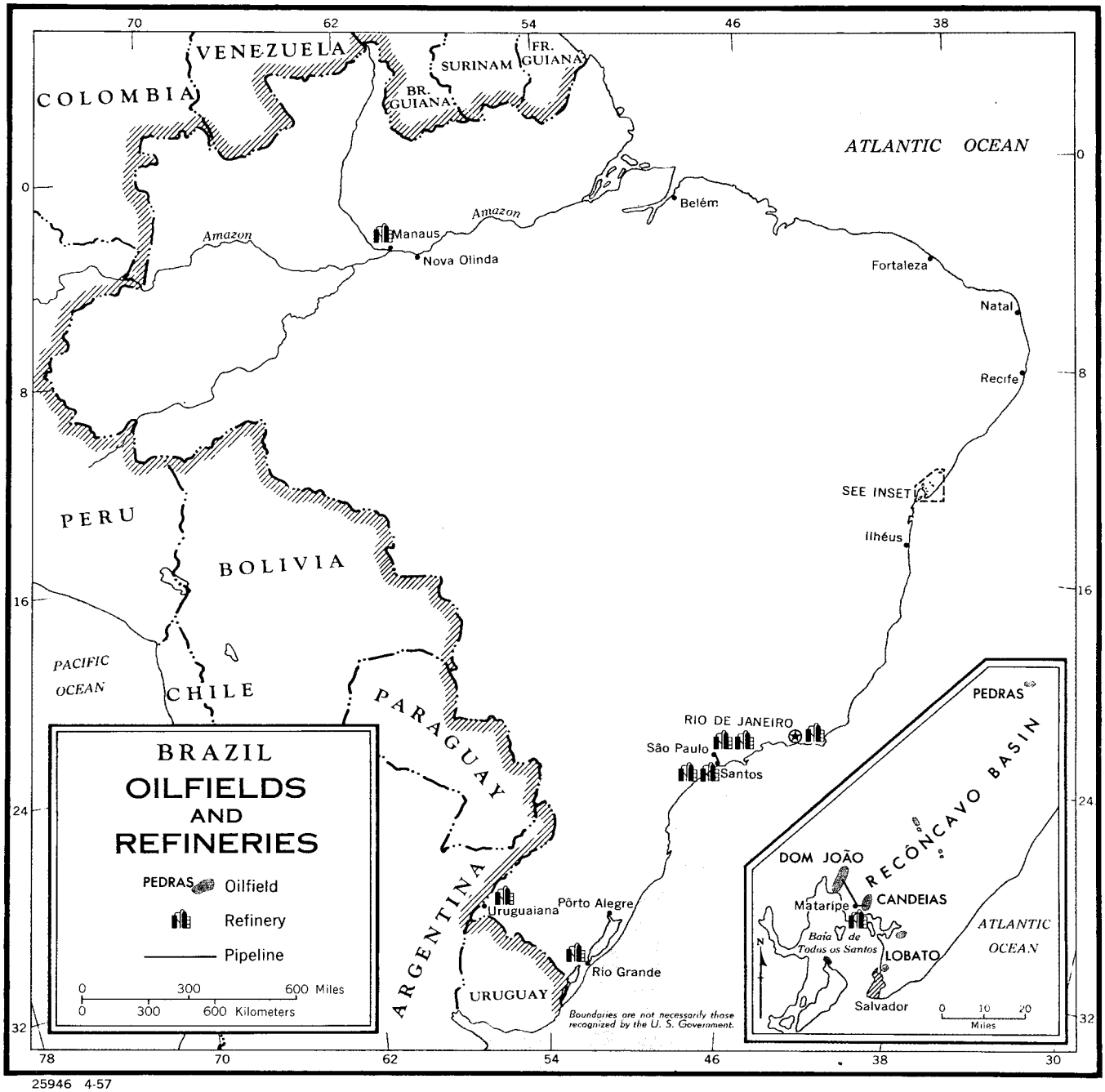
6. Markets and Transportation

The postwar period of economic development in Brazil has been accompanied by a rate of increase in the use of oil products that has been exceeded in only one Western Hemisphere country -- Venezuela. The accompanying growth in Brazilian oil production, however, has been relatively small, and consequently petroleum imports have increased rapidly. During 1955, Brazil imported about 22 million bbls. of crude petroleum, or more than any other Latin American country except Argentina. In that year Brazil produced only 2 million bbls. of crude. 11,p.3/ As of 1956 the gap between supply and demand was still a wide one. Production was only 11 thousand b/d against a demand of 165 thousand b/d. The difficulty of becoming self-sufficient in petroleum will grow rather than diminish; if the demand continues to increase at the present rate, it should reach 264 thousand b/d by 1958. 32/

Venezuela is the principal source of Brazil's imported crude oil. Kuwait and Saudi Arabia, as of the early part of 1956, also supplied a significant amount of crude to Brazil, but no information is available as to the effect of the current Middle East crisis on this source of supply.

In 1955, Brazil imported about 38 million bbls. of refined products, the bulk of which came directly from Venezuela or from Aruba or Curaçao where some of the Venezuelan crude oil is refined. Trinidad, the United States, and Peru also supply Brazil with refined products but in relatively minor amounts. 38/

Transportation and consumption of the crude oil produced in Brazil is limited in general to the area of the producing fields. Because most of the crude oil and petroleum products used in Brazil are imported, the tanker fleets of the government and the various distributing companies are the most important transportation factor. The only major pipeline connects Santos, a port of discharge for imported products, with the industrial area of São Paulo. The remainder of the country is served by railroads, which carry petroleum from the port terminals to the inland terminals and bulk plants. Local distribution from these points is mainly by truck. In the Amazon basin, however, petroleum can be transported via the Amazon River by barge or river tanker. 33,sec 4,p.1/



25946 4-57

D. Chile

1. Geographic Setting of the Oilfields

All the producing oilfields in Chile are in the extreme southern part of the country on the main island of the Tierra del Fuego archipelago. (See map 25948.) The fields are close to the Straits of Magellan, with deep water open the year round. The area is a bleak, windswept, subantarctic plain, which has no apparent future except for mineral extraction and sheep grazing.

2. Status and Development

Petroleum production and refining are relatively recent activities in Chile and thus far have been undertaken on a small scale only. Oil was discovered in Chile in 1945 at Springhill, now called Cerro Manantiales, on the main island of Tierra del Fuego in the southernmost part of the continent. Commercial production did not begin, however, until 1949 when a pipeline was constructed from Manantiales to a storage terminal at Caleta Clarencia. Refining commenced in 1952. Production has increased steadily since the first well was brought in and reached an annual output of 2.5 million bbls. in 1955. Consumption, however, has also been increasing -- from about 8 million bbls. in 1946 to 12.6 million in 1955, or a gain of 55 percent. 1,p.145;39,p.13/

In order to increase production, the Chilean Government has for the last few years been preparing to change its basic petroleum regulations. Up to now, the Government has retained the responsibility for petroleum exploration, production, and refining, although it has permitted private enterprises to distribute petroleum products. The proposed modification would relax the government's monopoly by permitting private capital, both Chilean and foreign, to participate in the search for and development of the nation's petroleum reserves.

However, the part of the national territory that lies between the latitudes of 52° and 56° would continue to be reserved for the exclusive use of Empresa Nacional del Petróleo (ENAP), the government petroleum agency. In effect, this would give the ENAP all the Chilean part of Tierra del Fuego, the only area where crude is being produced, and an additional part of the province of Magallanes. The proposed legislation reportedly was submitted to the Chilean Congress in November 1956. 40/

Because, at present, private enterprise is restricted to the distribution of petroleum, the extent of foreign investment in Chile is relatively small compared with that in other oil-producing countries. Moreover, only one major U.S.-owned petroleum distributor

-- Esso Standard Oil Company (Chile) -- is operating in the country. In 1955 Esso had 37 percent of the market; the Chilean Petroleum Company (Cia. Petróleos de Chile) had 29 percent; and Shell-Mex-Chile, Ltd., a British-Dutch company, had 16 percent. Miscellaneous other companies accounted for the remainder. 39,p.21/

3. Production

Within a few years after discovery of oil in Chile, annual production of crude exceeded a million bbls. Production in 1955 averaged 7,060 b/d, or a total output of 2.5 million bbls. 1,39/ Forecasts for 1956 indicated that total production would be considerably greater, since the daily rate by midyear exceeded 9 thousand bbls. The relative importance, or lack of importance, of Chile's petroleum output is indicated by the fact that the country's total production in 1955 was only slightly more than Venezuela's daily production in that year. 11,p.4/

All production now comes from Tierra del Fuego; the only producing field on the mainland, the Angostura field, was abandoned in 1953. The Sombrero field is by far the most productive; about 40 percent of Chile's cumulative production has come from this one field. The relative importance of this and other Chilean fields is indicated in the following table.

Chilean Oilfields 6,p.148;39,p.14/

Field	Discovery year	Production (bbls.) 1954	% in 1954	Daily rate, 1st half 1956
Sombrero	1950	795,223	45.8	2,510
Victoria Sur	1950	309,337	17.8	970
Manantiales	1945	162,576	9.4	400
Chillán	1953	121,249	7.0	747
Victoria Este	1954	109,077	6.3	305
Victoria Norte	1950	98,466	5.7	186
Chañarcillo	1950	88,439	5.1	405
Chañarcillo Sur	1953	34,874	2.0	120
Cuellén	1954	13,045	.7	491
Side	n.a.	1,807	.1	n.a.
Sombrero Norte	1954	1,308	.1	11
Flamenco	1954	679	insig.	43
Punta Baja	n.a.	222	insig.	n.a.
Calafate	1955	0	0	40
Delgado	1952	n.a.	n.a.	n.a.
Espora	1949	n.a.	n.a.	n.a.
Manantiales Sur	1955	0	0	200
Manzano	1953	n.a.	n.a.	n.a.
Primavera	1954	n.a.	n.a.	n.a.
	Totals:	1,736,302		6,428

4. Reserves

Little is known about the petroleum potential in Chile, but the estimate of crude reserves at the end of 1956 was 25 million bbls. 6,p.105/ The government expects the recently proposed petroleum legislation to stimulate exploration activities and thereby significantly increase the crude-reserve estimate.

Even the southern part of Chile, near the present producing fields, has not yet been thoroughly explored for petroleum prospects, largely because of the budgetary restrictions placed on ENAP. Relatively little is known about petroleum possibilities in other parts of the country, but gas and oil seepages have been reported in various places in northern Chile, and geologists have indicated the existence of likely structures there. Since private exploration is not legally permitted, and ENAP admits it has done "something less than even reconnaissance" in northern Chile, the extent of petroleum resources in that region is undetermined. 41/

Despite the prohibition of such activities, the Union Oil Company of California in 1956 conducted geological studies in the north, and reportedly Standard Oil of California has also done some exploratory work in the area. This unsanctioned activity has been "overlooked" by Chilean officials. 41/

5. Refineries

Chile's processing facilities consist of a new 20,000 b/d refinery at Concón, about 25 miles north of Valparaiso on the coast, and a small (700 b/d) topping plant at Manantiales in Tierra del Fuego. Both are owned by ENAP. The Manantiales plant was completed in 1952; the Concón refinery was completed early in 1955, and by 1956 ENAP was already planning to expand its capacity to 23,000 bbls. The refinery processes both domestically produced crude and crude from Venezuela. The topping plant, which is located near the oilfields, processes only domestic crude. These two plants can supply about 60 percent of Chile's consumption of 34,700 b/d (including 900 bbls. for bunkers). 39,p.18/

6. Markets and Transportation

Until completion of the Concón refinery, most of the crude produced in Chile was exported -- in 1954, about 1 million bbls., most of which went to Uruguay. When the refinery became operational, however, all the excess domestic crude was diverted to it. The only record of any export of petroleum or petroleum products during 1955 and the first half of 1956 was the shipment of propane to Argentina to fulfill a contract between ENAP and the Argentine government. 39,p.16/

Despite a steady increase in crude production, the Chilean oilfields could not meet refinery needs in 1955, and a sizable amount had to be imported. This altered the traditional pattern of imports by substituting crude petroleum for a considerable volume of refined products. Of almost 11 million bbls. of crude oil and refined products imported in 1955, fuel oil comprised about 40 percent; crude oil, 20 percent; and refined products, the remainder. 42/

Virtually all of Chile's imported crude oil and petroleum products are from the Western Hemisphere. In 1955, about one-fourth of the imports came from Venezuela, and the proportion was expected to be increased by a contract between ENAP and Esso Standard Oil Company (Chile) to supply additional crude from Venezuela. The following table indicates the amount of imports supplied to Chile by various sources.

Petroleum Imports by Country of Origin, 1955 39,p.16/

Thousand barrels

Country	Crude oil	Products	Total	Percentage
Venezuela	1,955	980	2,935	27
United States	0	2,320	2,320	21
Aruba	0	2,129	2,129	20
Peru	0	1,952	1,942	18
Curaçao	0	1,357	1,357	13
Saudi Arabia	137	0	137	1
Other	0	25	25	insig.

The principal deep-water terminal facilities for imported petroleum are at or near Antofagasta, Valparaiso, and San Vicente, but facilities and storage tanks are also available elsewhere along the long coastline.

Because Chile is a long, narrow country and most of its population (90 percent) and wealth is concentrated in a central valley, the surface transportation facilities are generally in a north-south pattern focused on the valley. Internal transportation of petroleum is mostly by rail because the roads and pipeline facilities are inadequate; some is transported on the highways by tank cars and flat-top trucks.

Currently, Chile has one main pipeline, 52 miles long, which runs from the Cerro Manantiales field to Caleta Clarencia. At Caleta Clarencia the petroleum is stored in tanks for subsequent shipment by tanker. Another pipeline is planned, which would extend from the Concón refinery to Santiago. 39,p.19/

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E. Colombia

1. Geographic Setting of the Oilfields

The principal oil-producing area in Colombia is in the central part of the Magdalena Valley in north-central Colombia, between the Central and Eastern Cordilleras. (See map 25943.) Along the Río Magdalena the terrain is flat and is covered by jungles and swamps. Away from the river, the land rises gradually until it reaches the foothills of the cordilleras on each side, and the vegetation becomes less dense.

The next most productive area is the Colombian portion of the Maracaibo basin, also an area of dense vegetation; the remainder of this basin -- and the larger part -- lies within Venezuela. Other basins in Colombia are considered to have favorable prospects for the discovery of petroleum, and one has yielded minor quantities of crude, but they have not yet been thoroughly investigated. 43/

2. Status and Development

In Latin America, Colombia ranks third among the oil-producing countries, following Venezuela and Mexico. It is, however, a "poor" third since Colombia produces only about 5 percent as much petroleum as does Venezuela and less than half as much as Mexico.

The development of the Colombian petroleum industry started in 1905 when Roberto de Mares was granted a concession of 2.5 million acres in the middle Magdalena valley. In 1915 the Tropical Oil Company was formed to exploit this concession; subsequently, the company was acquired by the International Petroleum Company, Colombia (Intercol), a subsidiary of the Standard Oil Company of New Jersey. The De Mares concession was the principal producing area in the country until 1952, when its output was surpassed by that of the adjacent Yondó concession.

In 1951 the lease on the De Mares area expired, and the entire concession -- including producing facilities and the Barrancabermeja refinery -- reverted to the Colombian Government. The area is now exploited by the government company, Empresa Colombiana de Petróleos (Ecopetrol), and the refinery has been leased back to Intercol.

The development of a second concession in Colombia began in 1933 when the promising Petrólea field was discovered in the Barco concession, a block of land totaling approximately 1,750,000 acres along the Colombian-Venezuelan border north of Cúcuta. Commercial production did not begin until 1939, when the owners, Socony-Vacuum and The Texas Company, completed a pipeline from Petrólea to the Caribbean coast at Coveñas. In 1946, however, production at the Petrólea field started

to decline, and the field is now considered depleted. Other fields, including the Tibú field, have since been discovered in the Barco concession.

The Yondó concession, located on the west bank of the Río Magdalena opposite the De Mares concession, covers about 116,000 acres. In 1941 the Shell Group discovered the Casabe field in this concession. After 1945, development of the field was rapid, and now Casabe is the leading oilfield in Colombia. 44/

The Difícil concession, an area of 120,000 acres southeast of Barranquilla in the Departamento del Magdalena, is also operated by the Shell Group. To date, the only result of widespread exploration in the area has been the discovery of the Difícil field, in 1943, and it is not an important producer. The Shell Group also controls the Cantagallo concession, an area of about 50,000 acres on the west bank of the Magdalena near Puerto Wilches. Commercial production at the Cantagallo field was started in 1948 but has never been great.

Along the east side of the Río Magdalena, north of La Dorada, is the Terán-Guaguaquí property, covering about 300,000 acres. In 1929 the Texas Petroleum Company purchased this land, along with subsoil rights. The Velásquez field, one of Colombia's most important producers, was discovered on this property in 1945.

As of September 1955, the Colombian Government had granted 6 exploitation and 41 exploration concessions. Except for the government's Ecopetrol holdings at De Mares, all the concessions were held by subsidiaries of major U.S. oil companies or by the Royal Dutch-Shell Group, a Dutch-British firm. The U.S. companies included Texas Petroleum, Socony Mobil Oil, Standard Oil of California, Standard Oil of New Jersey, and Cities Service. 6,p.147/

After 1948 there was a definite decline in foreign investment in Colombia, which had a dampening effect on petroleum exploration. The decreased interest was the result of unsettled conditions within the country, caused by civil and political disturbances, as well as of legislation unfavorable to foreign investment. In 1949, five foreign oil companies withdrew.

Legislative reforms since 1953, along with gradual improvement of political and labor conditions, have again stimulated foreign investment and have resulted in increased exploration and development activities. Attempts have been made to increase the output of existing fields and to bring in new fields. Particular attention has been paid to the Magdalena area, where pipeline and river-transport facilities are already available. Also new areas, including offshore property, are being investigated.

As part of the program to improve the investment climate and to attract foreign capital, the diversified decrees and laws affecting the petroleum industry have been grouped into a single unified Petroleum Code. Also a decree was passed in 1955 which allows the oil industry adequate depletion allowances and more reasonable tax provisions. 43/

3. Production

The prewar peak in crude-oil production in Colombia was reached in 1940, when 25.5 million barrels were produced. After the war, production increased significantly and by 1953 totaled 40 million bbls. This high was followed by a slight decline in 1954, but the total production for 1955 was again 40 million bbls., produced at the rate of 110,000 b/d. In 1956 the rate had increased to 123 thousand b/d, or an annual production of about 46 million bbls. -- a new record. Despite this increase, Colombia's crude-oil production in 1956 accounted for less than 1 percent of the world total. 6,p.104;45/

The leading Colombian producer in 1956 was the Concesionaria de Petróleos Shell-Condor, a subsidiary of Royal Dutch-Shell. Production in its Casabe field, in the Yondó concession, rose from 2 million bbls. in 1945 to 15 million in 1954, making it the most productive field in the country. In 1955, production declined to 12.8 million bbls., and Shell reports that the output is expected to continue to decline. Nevertheless, in 1956 Casabe remained Colombia's most important field, with a daily production of 34 thousand bbls. 6,p.146/

Ecopetrol in 1956 produced about 29,500 b/d from four fields, the best of which was La Cira. Texas Petroleum produced 27,200 b/d, including 26,000 bbls. from the Velásquez field, the second most productive field in Colombia. Colombian Petroleum, owned by Socony Mobil Oil and The Texas Company, averaged about 26,200 b/d from its 10 fields, the best of which are in the Tibú area. International Petroleum (Colombia), a subsidiary of Standard Oil of New Jersey, produced only 800 b/d from the Buturama and Totumal fields. 6,p.147/

The following table provides data on the most important of the 20 fields in operation in Colombia in 1956.

Crude-Oil Production at Major Fields, 1956 6,p.146-147/

Company, field, and discovery year	Number of wells Flowing	Pumping	b/d
Shell-Condor			
Casabe, 1941	2	374	34,619
Yariqui, 1954	3		4,048

Company, field, and discovery year	Number of wells Flowing	Pumping	b/d
Empresa Colombiana de Petróleos			
Infantas, 1918	1	319	7,638
La Cira, 1925	1	741	18,546
Texas Petroleum			
Velásquez, 1945	45	17	26,000
Colombian Petroleum			
Tibú area			
Barco Zone, 1940	23	176	14,383
Uribante Zone, 1942	27	4	5,173

The following table gives data on the amount of crude oil produced by each company.

Crude-Oil Production by Company 1,p.239; 6,p.147/

Company	Total 1955	Daily 1955	Daily 1956
			Barrels
Shell Group	14,702,799	40,282	42,500
Empresa Colombiana de Petróleos	11,254,141	30,833	29,500
Colombian Petroleum	9,440,370	25,864	26,200
Texas Petroleum	3,923,163	10,748	27,200
International Petroleum	42,529	117	800
Totals:	39,363,002	107,844	126,200

4. Reserves

The proved reserves of crude oil in Colombia were estimated to be 530 million bbls. at the beginning of 1955, an increase of 77 percent over the 1950 level. This report was made by the government after a reevaluation of recoverable reserves at known fields. Since there were no new discoveries of major significance during the period, the 1955 estimate is believed by some to be somewhat inflated and

over optimistic. 43/ An authoritative trade journal, however, estimated Colombia's proved reserves as 580 million bbls. at the end of 1955 8,p.141/ and as 650 million at the end of 1956. 6,p.105/ Data are not available to indicate which point of view is correct, but experience has shown that estimates tend to err on the conservative side and that more oil is eventually recovered than was originally thought possible.

The following table indicates the relative importance of the reserve holdings in Colombia as of the beginning of 1955.

Proved Reserves, 1955 43/

Concession or property	Company	Million bbls.
Terán-Guaguaqui, Ortega, Tetuan	Texas Petroleum	187
DeMares	Empresa Colombiana de Petróleos	140
Yondó	Shell Group	127
El Difícil, Cantagallo	Shell Group	10
Barco	Colombian Petroleum	54
Aguachica, Totumal	International Petroleum	12
	Total:	530

The development of the petroleum resources of Colombia has been hindered by the complex topography and subsurface geology. Rugged mountains and tropical jungles, plus the lack of an adequate transportation network in some areas, have complicated investigations and made exploratory and development drilling more costly than in many other countries. A further limiting factor has been the complicated legal concept of subsoil rights, which occasionally has led to lengthy litigation to establish clear ownership of mineral wealth before exploration activities could be undertaken.

The physiographic and geologic features of Colombia are varied and complex. In the western part is an upland region characterized by three Andean ranges: the Western, Central, and Eastern Cordilleras. The first two ranges consist mainly of igneous and metamorphic rocks

and are considered unfavorable for the occurrence of petroleum. The third range contains a great thickness of sedimentary rock, much of which is too highly folded and faulted to offer good petroleum potential.

The remainder of the country consists mainly of lowlands, the most extensive of which are the great eastern plains. Other lowlands are along the Pacific coast, in the northern or Caribbean section, and in the Río Magadalena valley. These lowlands contain 11 basins that are known to be underlain by thick sedimentary rock. Within these basins, which total about 50 million acres, most of the exploratory activity has taken place and most of the petroleum deposits have been found. In only two of the basins, however, have significant commercial deposits been located. The middle Magdalena basin has been the source of most of the crude produced and contains 75 percent of the proved reserves. Next in importance is the Maracaibo basin. A third basin in the upper Magdalena valley has yielded only minor quantities of oil. Elsewhere in Colombia, investigations have indicated the presence of favorable structures, particularly along the Pacific coast and in the Llanos and Caquetá basins in eastern Colombia, but no successful discoveries have yet been made. 43/

5. Refineries

In 1955, domestic refineries produced about 14 million bbls. of refined products -- an increase of 24 percent over 1954, and more than 2 1/2 times the 1946 total. The large Barrancabermeja refinery on the Río Magdalena, which is owned by Ecopetrol and operated by International Petroleum (Intercol), accounted for about 89 percent of the refined products. Intercol's La Dorada refinery furnished 6 percent of the products; the Guamo refinery (Texas Petroleum) and the Tibú refinery (Colombian Petroleum) accounted for 3 and 2 percent, respectively. 43/

Consumption of refined products in Colombia has been increasing steadily for a number of years in keeping with the growing use of automobiles, trucks, and industrial machinery. This trend is expected to continue; sales of motor gasoline alone are expected to increase at an annual rate of almost 10 percent until at least 1960. In order to meet this rapidly rising demand, the Barrancabermeja refinery was expanded in 1954. 46/ The other refineries in Colombia are recent: La Dorada, located about 70 miles northwest of Bogotá, went on stream in 1952; and Guamo, in Tolima, and the Tibú refinery, near the Venezuelan border, started production in 1953.

Even the enlarged facilities of Barrancabermeja are not expected to be adequate to meet the ever-increasing demand. Therefore, the

government authorized Intercol to build a large, new refinery at Mamonal, about 15 miles from Cartagena on the Caribbean. This refinery is scheduled for completion in 1958 and will have a capacity of 26,500 b/d. The new installation will bring the total crude-refining capacity of Colombia to 69,400 b/d, or about 25 million bbls. annually, which should be sufficient to meet anticipated domestic requirements. 43/

The following table indicates the capacity for crude-oil processing in Colombia.

Processing Capacity, 1955 43/

Refinery and company	Capacity (b/d)
Barrancabermeja (Ecopetrol)	37,500
La Dorada (Intercol)	2,200
Guamo (Texas)	1,000
Tibú (Colpet)	2,200
Total:	42,900

6. Markets and Transportation

In 1955 about 25 million bbls. of crude oil, out of a total production of 40 million bbls., were exported from Colombia. 11,p.4/ Half of this amount went to the Netherlands Antilles for processing and re-export; a third went directly to the United States; and most of the remainder was shipped to Trinidad, Canada, the United Kingdom, the Netherlands, Italy, and Uruguay. 43/

Because crude production in the past few years has been inadequate to cover the rapid increase in domestic demand, a significant decline in exports of crude has resulted; 1955 exports were down 17 percent from 1954 and 21 percent from 1953. This is a source of considerable concern to the Colombian Government, since the oil trade is not only an important source of revenue and foreign exchange but also a factor in lessening the danger of fluctuation between boom and depression to which the Colombian economy is susceptible because of its dependence on coffee exports.

In 1955, 4 million bbls. of refined products were imported, principally from the Netherlands Antilles and the United States. The continuing dependence on imports is due not only to the insufficient refinery capacity but also to the fact that certain

regions can be supplied more economically by imports than from the refineries currently operating. The recent expansion of the Barrancabermeja refinery, however, has increased the yield of gasoline and other light products and made possible a reduction in imports. When the new refinery at Mamonal has been completed, imports are expected to decline to a point where only specialty products are involved. 43/

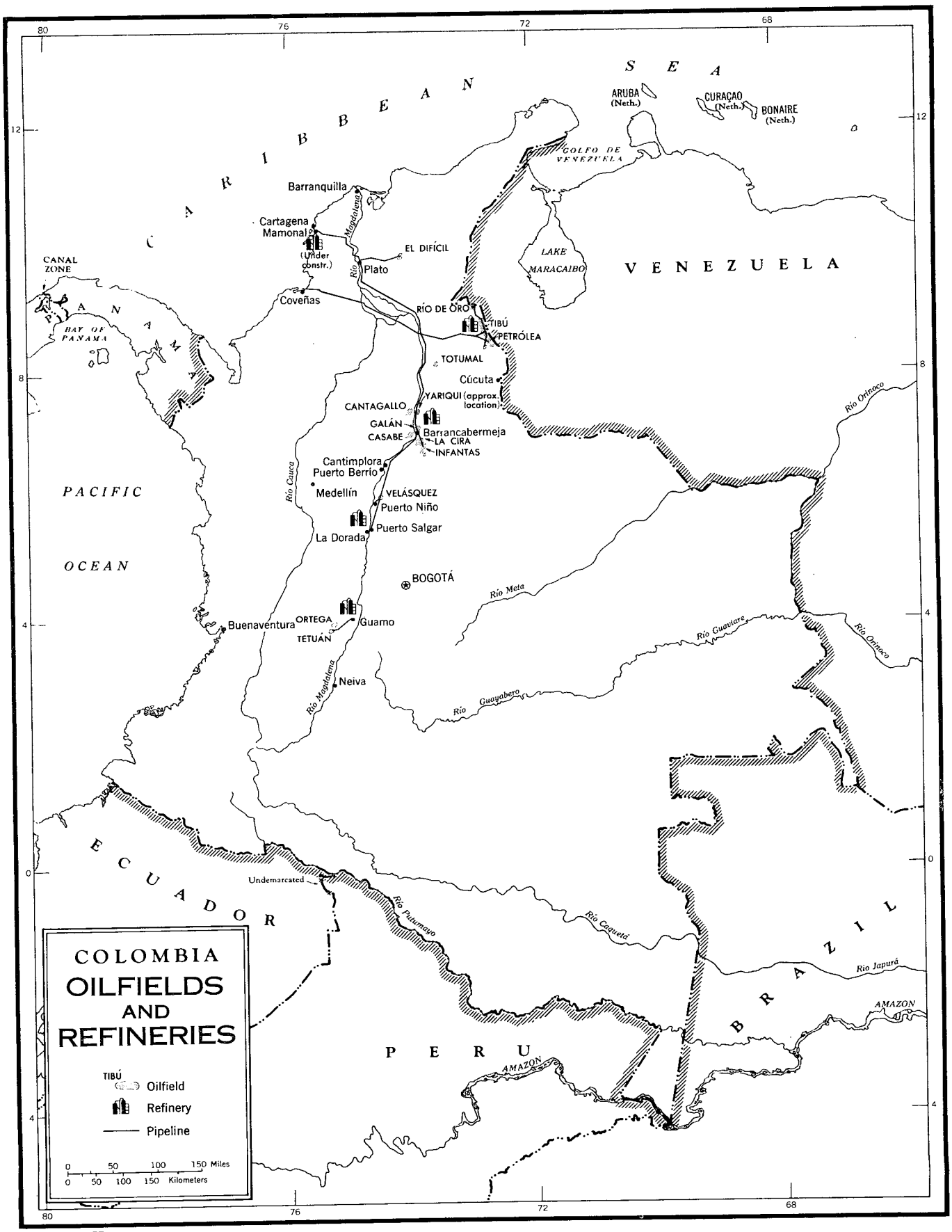
The inland location of fields and refineries, relative to tidewater ports and principal consuming areas, has led to the construction of a network of pipelines for the transport of crude and refined products. Products are also moved by river barge, tank trucks, other trucks, and railroad cars.

In 1955, 10 pipelines -- including 2 common carriers -- were used to move the crude oil. Of the common carriers, the largest is the Andian National Corporation (Andian) line and runs from El Centro in the De Mares concession to the Caribbean coast at Mamonal. The other is the South America Gulf Oil Company (SAGOC) line, which runs from Petrólea in the Barco concession to Coveñas on the Caribbean.

The Ferrocarril del Pacífico is the longest and most important of 15 railroads used to transport petroleum products. This railroad, through connections with other railroads and with roads, links Buenaventura with the Río Magdalena and Bogotá. Tank trucks and other trucks are used for local distribution of bulk and packaged products.

With the exception of pipelines, the cheapest method of transporting petroleum products for long distances in Colombia is via the Río Magdalena. Except during the dry season, the Magdalena is navigable for shallow-draft vessels as far as Neiva. In 1953, 11 river steamers, 11 tug boats, and 73 oil barges were used to transport crude oil and petroleum products. 43/

Although petroleum products are not normally transported by air, this method is not uncommon in Colombia. For example, kerosene and gasoline are frequently supplied by air to outlying areas.



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F. Ecuador

The Ecuadorian oilfields are confined to a small area on the Santa Elena peninsula, on the arid and windswept Pacific coastal plain. (See map 25949.) The producing fields are adjacent to the Pacific Ocean about 90 miles west of Guayaquil, the principal port and commercial city of Ecuador. Oil seepages in this area have been known for centuries (local tradition claims that the Spanish Armada was calked with tar from the peninsula), but the fields were not developed until just before World War I and not until the late 1920's did annual production exceed 1 million bbls. Since then the output has increased gradually, reaching 3 million bbls. a year in 1954 and exceeding 3.5 million bbls. in 1955. 1,p.145/ The 1955 production was at the rate of 9,800 b/d and slightly less than that during 1956. 47/ As of the middle of 1956, Ecuador had produced a cumulative total of about 65 million bbls. of oil. 6,p.105/

The Anglo-Ecuadorian Oilfields Company, owned by British and U.S. interests, was one of the first companies to produce oil in commercial quantities in Ecuador. For a long time it has been the major producer in the country, in 1955 accounting for 70 percent of total crude production. In 1951 the U.S.-owned Manabí Exploration Company began operations in Ecuador and in 1955 accounted for about 15 percent of the nation's total crude output. The remainder of Ecuador's crude is produced by three small domestic companies. 6,p.144-145;48;49/ The crude-oil output of Ecuador's producing companies is indicated in the following table.

Crude-Oil Production, 1955 49/

Company	Barrels
Anglo-Ecuadorian Oilfields, Ltd.	2,474,558
Manabí Exploration Company	561,238
Carolina Oil Company	388,012
Concepción Ecuadorian Oilfields, Ltd.	52,938
Petropolis Oil Company	53,833
Total:	3,530,579

In addition to the oil activities on the Santa Elena peninsula, exploration has been conducted in the Oriente, east of the Andes, by the Shell Oil Company and Standard Oil of New Jersey. After some $44 million had been spent, however, operations were suspended because no worthwhile discoveries had been made. 50/ In 1953 the

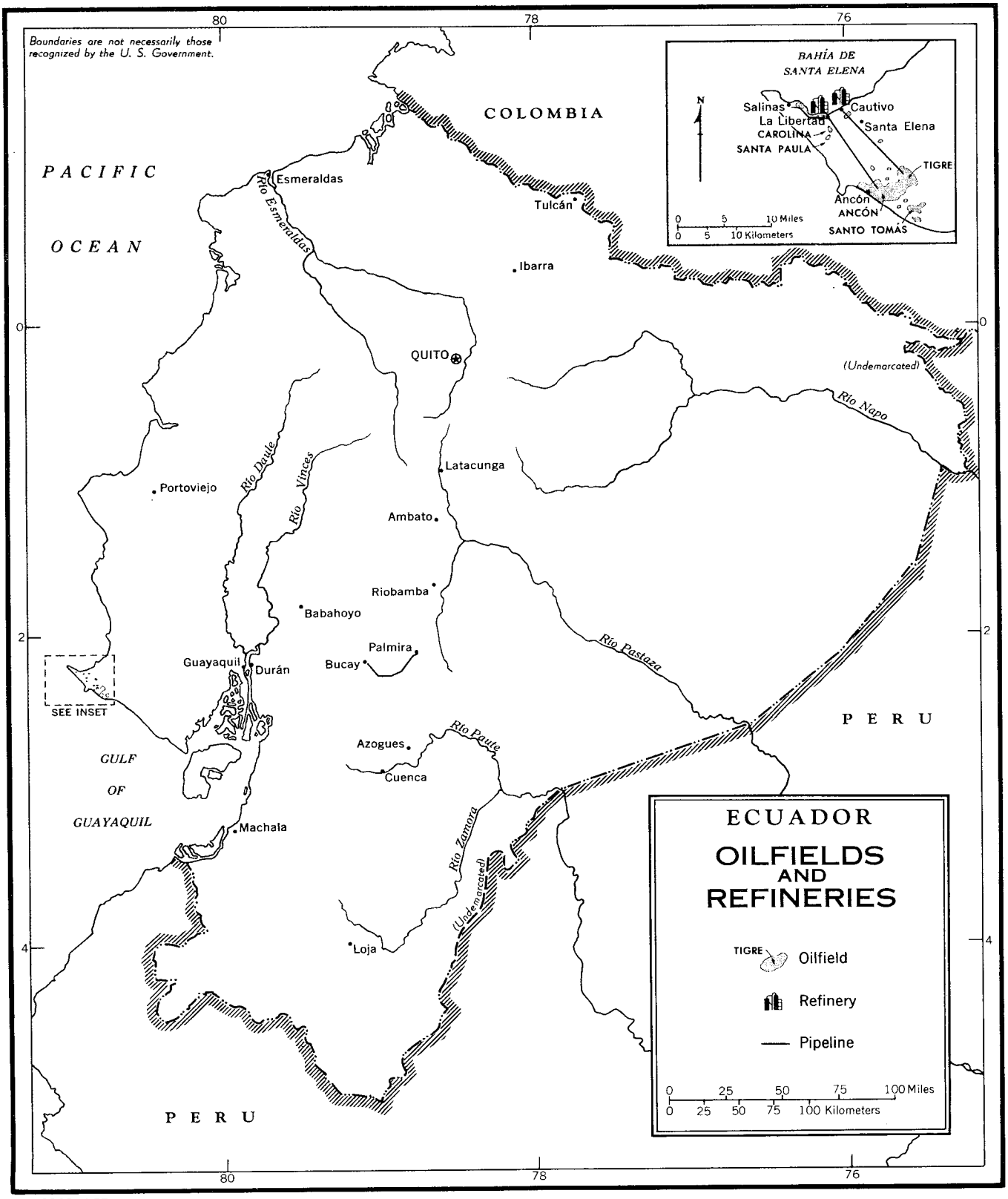
government granted an exploration concession of almost 3 million acres to the California-Ecuador Petroleum Company, a subsidiary of Standard Oil of California. This concession area is located in the western part of the country and in a number of places includes Ecuadorian territorial waters. 51/ In the Santa Elena district both Anglo-Ecuadorian Oilfields and the Manabí Company have maintained aggressive exploration programs.

In 1955, Ecuador's proved reserves were estimated at 25 million bbls. -- an increase of 1.5 million bbls. over 1954. 1,240/ Reserves at the end of 1956 were estimated to be the same as in 1955, despite the fact that approximately 3 million bbls. had been extracted during the year and that no major discoveries have been made in recent years. 6,p.105/

Ecuadorian refining capacity consists of a 6-thousand-b/d plant at La Libertad and a 625-b/d topping plant at Cautivo; the former is owned by Anglo-Ecuadorian, the latter by Manabí. In 1955 these refineries furnished 2 million bbls. of major refined products, against a domestic demand for 2.7 million bbls. 11,p.5,7/ The difference in amount was made up by imports. In early 1956 a contract was signed between Anglo-Ecuadorian and the government, under which the company agreed to build a new oil refinery that will have an initial capacity of 6 thousand b/d. When this refinery is completed, Ecuador is expected to be self-sufficient in all refined products except aviation gasoline. 6,p.145;52/

Because of the current inadequacy in refining facilities, both Anglo-Ecuadorian and Manabí have exported a sizable amount of their crude production. In 1955, about 1.4 million bbls. of crude were exported, and 736 thousand bbls. of refined products were imported. 11, p.3/ Peru was the source of more than half of Ecuador's imported products, most of which consisted of gasoline. 53/

Several short pipelines, none more than 11 miles long, are used by various companies to transport petroleum: from Ancón to La Libertad, by Anglo-Ecuadorian Oilfields; from Santa Paula to Carolina, by the Carolina Oil Company; from Tigre to Cautivo, by Manabí; and from Salinas to La Libertad, by the Petropolis Oil Company. 54/ In addition, a 46-mile pipeline from Bucay to Palmira, paralleling the railroad between Guayaquil and Quito (the capital), was completed in October 1954. This line, one of the world's steepest, carries oil products from the lowland to the Andean plateau, the most difficult part of the route to Quito; eventually it will be extended to Quito. The line is of great importance to the economy of the country, particularly to the highland areas where most of the people live. Refined products are also transported by railroad and truck. 48;55,p.207/



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G. Paraguay

No petroleum is produced in Paraguay, and the country has no oil refineries. All domestic requirements for petroleum products must be satisfied by imports. 56/ There has been speculation, however, concerning the possibility that Bolivian and Argentine oilfields may extend into western Paraguay. Because of this possibility, the Union Oil Company of California in 1944 obtained government authorization to explore for petroleum in the Gran Chaco; in late 1949, however, operations were abandoned, apparently without having found oil in commercial quantities. 57/

H. Peru

1. Geographic Setting of the Oilfields

Currently, almost all of Peru's oil production comes from a small area in the extreme northwestern part of the country along the Pacific coast. (See map 25945.) Specifically, this area includes the adjoining La Brea-Pariñas and Lobitos districts, just north of the Río Chira, which contain most of the fields; and the Zorritos district, some distance north of this main grouping, near the mouth of the Río Tumbes.

The coastal fields lie in a zone about 100 miles long and 20 miles wide between the Pacific beaches and the foot of a spur range extending from the Andes. The entire northwestern coastal region, including the oilfields and the surrounding territory, is characterized by extensive, deeply dissected gravel fans near the mountain front and flat-topped hills between the fans and the ocean. Near the mountains, the gravel fans frequently exceed 1,000 feet in elevation. Most of the hills are less than half that high. Much of the coast is bordered by cliffs, many of which are more than 100 feet in height.

The northwestern region is one of the most arid in the world; rains in the area are spaced as much as 35 years apart, and average annual rainfall is less than 2 inches. Only two streams, the Río Chira and the Río Tumbes, both rising in the Andes, are able to maintain a flow of water to the sea. The Tumbes desert extends from the Ecuadorian border south to the Río Chira and encompasses all the coastal oilfields; the Desierto de Sechura (Sechura Desert) begins just south of the Río Chira and continues southward for about 150 miles. The latter has no producing fields but is believed to have considerable petroleum potential. The principal problem in this desert coastal zone is the scarcity of fresh water, but this has not deterred the orderly development of the oilfields. Furthermore, an important favorable factor for exploitation of these fields is their proximity to the seacoast, with the resultant ease of seaborne transportation; and the importation of all types of equipment has been facilitated and much time has been saved due to the nearness of the ports to the fields.

The La Montaña region, in which the Ganso Azul oilfield is located, extends from the Peruvian Andes eastward and northward to the Brazilian and Colombian borders. It includes the eastern slopes of the Andes proper, the foothills east of the mountains, and extensive lowlands. The region is drained to the north and east by the Amazon and its tributaries. Rainfall in excess of 80 inches per year and the prevalence of high temperatures have resulted in a heavy growth of tropical vegetation throughout the region.

The Ganso Azul oilfield itself is located near Aguas Calientes in the broad valley of the Río Pachitea, a tributary of the Ucayali which joins with the Marañon to form the Amazon. The oilfield is approximately 650 feet above sea level, about 300 miles northeast of Lima and 600 miles upstream from the city of Iquitos. 58/

2. Status and Development

The current status of the Peruvian petroleum industry is characterized by increasing exploratory work on millions of untried acres, on the one hand, and by relatively stable output from old, intensively developed fields, on the other. Exploration is centering on the comparatively inaccessible La Montaña region, east of the Andes. U.S. companies (both major companies and independents) and local Peruvian organizations have applied for, or received, concessions on more than 35 million acres. Interest has shifted to this region because of the disappointing results in the Sechura Desert south of the present producing fields along the Pacific coast. 6,p.149/

Peru was the first Latin American country to produce petroleum, the first well having been drilled in 1863. Not until 1926, however, did annual production exceed 10 million bbls. In the mid-1930's, it reached a peak of 17 million bbls. but by 1941 had declined to about 12 million bbls. Since 1941, production has gradually increased and for the last few years the annual total has been slightly more than 17 million bbls. This amount, however, constitutes less than 1/3 of 1 percent of the world total. 1,p.145/

A new petroleum law passed in 1952 removed many deterrents to development of the petroleum industry in Peru. In contrast to the restrictive laws and regulations previously in effect, the new law, combined with a more realistic administration of its regulatory features, made it practical for both foreign and domestic companies to commence exploration in new areas and made the climate for investment more favorable. Large acreages were made available for exploration, and by 1955 concessions had been granted to 16 companies. 59,p.1/

Prior to enactment of the 1952 petroleum law, only five companies held concession areas or exploration permits in Peru. These companies, which even today account for practically all the crude oil produced in Peru, are: (1) International Petroleum Company (IPC), a subsidiary of Standard Oil of New Jersey; (2) Compañia de Petróleo Ganso Azul, owned by the Texas Gulf Producing Company, the Kendall Refining Company, and other interests; (3) Compañia Petrolera Lobitos, owned by an English concern, Lobitos Oilfields, Ltd.; (4) Empresa Petrolera Fiscal, a Peruvian Government organization; and (5) Compañia Peruana de Petróleo "El Oriente," owned by a private Peruvian corporation. 60,sec 7,p.5/

3. Production

Peruvian output of crude petroleum in 1955 amounted to about 17 million bbls., or 47 thousand b/d -- just slightly more than in the preceding year. Domestic consumption, however, totaled more than 13 million bbls. and, at the current rate of increase, will soon exceed the amount produced. 7,p.37/ In the first 6 months of 1956 the total output increased slightly, to 48 thousand b/d, and reports at the end of the year indicated that the daily average for the full year may have exceeded 50 thousand bbls. 6,p.148/

The Ganso Azul field produced only about 700 b/d during 1955 and the early part of 1956. Toward the end of 1956, however, production was increased to 2,000 b/d, as the result of the opening of the Manaus refinery on the Amazon in Brazil. 6,p.149;7,p.37/

In 1956 the La Brea-Pariñas fields were the source of more than half the crude oil produced in Peru. The Lobitos and El Alto fields were the next most important, contributing about one-third of total Peruvian production. None of the other fields made major contributions to the total output of crude petroleum. The following table gives information on each of Peru's producing oilfields.

Peruvian Oilfields, 1956 6,p.148;60,sec 2,p.3/

Field and discovery year	Operating company	Estimated production (b/d)
La Brea-Pariñas, 1888	International Petroleum Co.	28,050
Lobitos, 1902	Cia. Petrolera Lobitos	10,320
Area of joint development a/	IPC/Lobitos	1,516
Area "A" a/	IPC/Lobitos	1,528
El Alto, 1910	Cia. Petrolera Lobitos	5,940
Concesión Patria, 1943	Empresa Petrolera Fiscal	1,714
Los Órganos, 1946	Cia. Petrolera Lobitos	1,455
Ganso Azul, 1938	Cia. de Petróleo Ganso Azul	900
Tablazo, 1955	n.a.	400
Mirador, 1955	Cia. Petrolera Peruana	224
Sector Peru, 1953	Empresa Petrolera Fiscal	127
Zorritos, 1863	Empresa Petrolera Fiscal	34
Copé, 1938	Empresa Petrolera Fiscal	4
	Total:	52,192

a. These two areas are extensions of the Lobitos producing area that are being developed by IPC on a 50-50 basis for Cia. Petrolera Lobitos. The amounts given represent IPC's 50 percent of production; the other part is included in the amount listed for the main Lobitos field.

The relative importance of each of the companies operating in Peru is indicated in the following table. Several of the companies listed are newcomers in Peruvian petroleum production: the Compañia Petrolera Peruana's development of its Mirador field, a southern extension of the La Brea-Pariñas fields, has proved encouraging; in the northern coastal area east of the Lobitos field, the Peruvian Pacific Petroleum Company, a subsidiary of Cities Service and Richfield, has completed a number of productive wells; and the Douglas Oil Company of California has been active, with very limited success, in some offshore drillings.

Crude-Oil Production by Company, 1955 1,p.242-243/

Company	Av. b/d	Annual (bbls.)
International Petroleum Co. a/	31,013	11,319,658
Cia. Petrolera Lobitos a/	13,600	4,964,099
Empresa Petrolera Fiscal	1,623	592,384
Cia. de Petroleo Ganso Azul	719	262,413
Petrolera Peruana	196	71,529
Peruvian Pacific Petroleum Co.	53	19,261
Douglas Oil Co.	44	16,190
Totals:	47,248	17,245,534

a. Includes 50-percent share in joint-operations areas.

4. Reserves

Before the new Peruvian petroleum law was passed in 1952, legal obstacles to new concessions and government restrictions on private petroleum activities limited exploration of potential oil-bearing areas. These prospective areas include 7.5 million acres in the northern coastal zone near the principal producing fields, 2 million acres in the Sierra between the Andes and the coastal plains, and 100 million acres in the La Montaña area beyond the Andes. 59,p.1/

Intensive exploration activity by foreign concessionnaires in the Sechura Desert followed the passage of the 1952 law and the granting of concessions. An estimated $20 million was spent in 1953 and 1954 for surveys, roads, drilling, and other exploratory work. Despite this activity all holes drilled were dry, and by the end of 1954 interest in exploration had definitely shifted from the coastal to the eastern zone. As of the end of 1956, no significant oilfields had been discovered in any of the new exploration areas. 59,p.7/

Wells drilled either as extensions of the producing areas or as tests of new zones within established producing fields, however,

resulted in a considerable increase in Peru's proved reserves. In 1947, the reserves had been estimated at 150 million bbls.; by the end of 1956, the estimate had been raised to 275 million bbls. 6,p.105; 60,sec 1, p. 10-15/

"Proved" prospecting areas include the currently producing districts in the northern part of the coastal region and in the La Montaña. The coastal La Brea-Pariñas district includes a dozen or more fields in a compact group just north of the Río Chira, all lying within 20 miles of the coast. The Lobitos district, adjoining La Brea-Pariñas on the north, includes 10 producing fields. The Zorritos district is located farthest north along the coast and includes 2 fields. The Aguas Calientes district, in the La Montaña region near the eastern base of the Andes, has only the Ganso Azul field.

The areas considered "favorable" for petroleum prospecting include the territory adjacent to the proved districts and an enlongated area northwest of Lake Titicaca. The areas in Peru classified as "possible" for prospecting occupy more than half the country. They include all the La Montaña region beyond the proved or favorable areas, large parts of the Andes, a narrow strip of territory in the coastal region southwest of the city of Pisco, and much of the Continental Shelf. 60,sec 1, p.8-9 and fig 10/

As mentioned previously, intensive exploration has been undertaken by various companies in the Sechura Desert, in the extreme northern part of the coastal area, and on the continental shelf, but all these efforts have met with such disappointing results that exploration work there has almost ceased. The development of Peru's petroleum reserves in the immediate future, therefore, will depend largely on the outcome of current exploration activities in the La Montaña region. This region has the largest concession area in South America, totaling about 35 million acres. 1,p.244;7,p.36-37/

5. Refineries

Refining activity in Peru is concentrated in IPC's refinery at the seaport town of Talara on the northwest coast. This refinery has a crude capacity of about 44 thousand b/d, or about 95 percent of the country's present operating capacity. The refinery processes crude piped from the nearby oilfields of La Brea-Pariñas and Lobitos. 6,p.149;60,sec 3, p.1-3/

Empresa Fiscal's refinery, which had been at Villar near Zorritos on Peru's northwest coast, was dismantled and shipped up the Amazon to Iquitos in the La Montaña region. There it was rebuilt for a 1,200-b/d topping capacity and was put on stream

in February 1956. This refinery processes crude from the Ganso Azul oilfield. 7,p.57/

A small refinery of 1,000-b/d crude capacity is located at Aguas Calientes in eastern Peru near the Ganso Azul field. It is owned by the Compañia de Petróleo Ganso Azul. This refinery may not be in operation, however, reports early in 1956 indicated that the output would be cut back or halted once the Iquitos refinery got into full production. 61/

At the end of 1956, plans for construction of a 2,000-b/d refinery at the port of Pisco, about 150 miles south of Lima, were still in a preliminary stage. Reports indicate that success of the project is doubtful because of the low ceiling prices for petroleum products in Peru and the relatively high prices for imported crude, on which it would have to depend. Another deterrent is the fact that the search for oil in the Pisco region has been abandoned. 7,p.57; 60,sec 3,p.3/

The following table provides data on Peru's refineries.

Peruvian Refineries, 1956 6,p.149/

Company	Location	Capacity (bbls. per stream day) Crude distillation	Cracking
International Petroleum Co.	Talara	44,000	15,200 TC a/
Empresa Petrolera Fiscal	Iquitos	1,200	0
Cia. de Petróleo Ganso Azul	Aguas Calientes	1,000	0
	Totals:	46,200	15,200

a. TC -- Thermal cracking.

6. Markets and Transportation

Expanding demand, almost stationary production, and declining exports have been characteristic of Peruvian oil operations for more than a decade. Continuing economic development has led to constant increases in domestic requirements for oil products; between 1936 and 1946, domestic consumption doubled, and between 1946 and 1956 it more than doubled. 7,p.36;59,p.7/ On the other hand, government policy prior to 1952 discouraged possible expansion in oil production. As the result, the amount of petroleum available for export has been greatly reduced; in 1936, 83 percent of the total indigenous supply of crude oil and refined products was exported, but by 1946 exports had declined to 56 percent and 1955 to 40 percent. 60,sec 6,p.1;62/

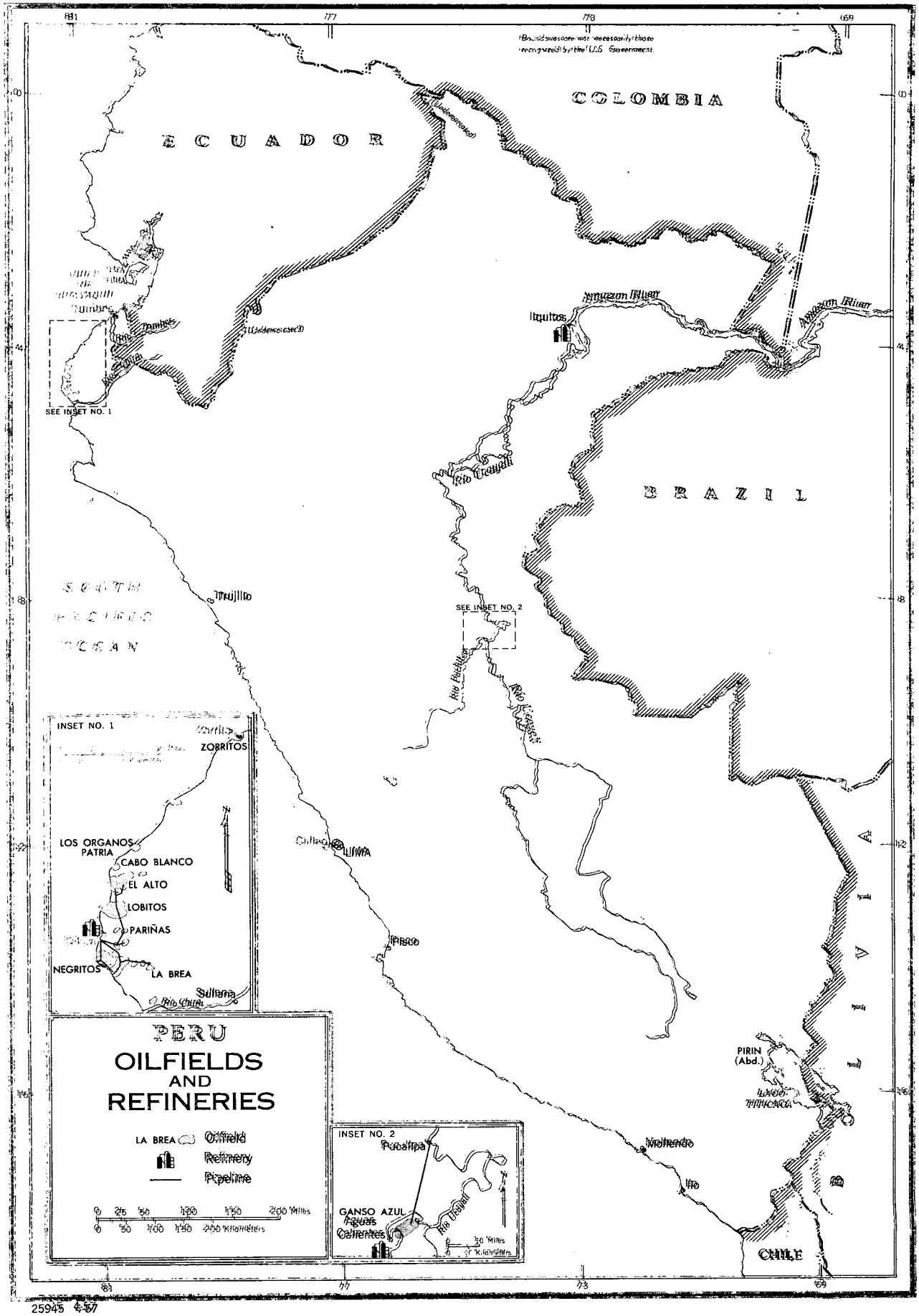
Prior to World War II only about one-third of the Peruvian crude-oil production was refined domestically, but since then the amount refined has exceeded 80 percent of the total annual production. This change reflects not only the increased need for refined products in the home market but also a greater demand in neighboring countries, such as Bolivia and Chile. These countries furnish ready markets for the output of the Talara refinery. 60,sec 6,p.6/

In 1955 Peru exported about 2.5 million bbls. of crude oil and 4.5 million bbls. of refined products; in the same year, 1.25 million bbls. of refined products were imported. 62/ In 1953, the most recent year for which detailed market information is available, all the exported crude (about 2.5 million bbls.) was sent to Argentina, the United Kingdom, and Uruguay. This pattern of crude-oil exports was influenced by several commercial and governmental agreements or considerations. For example, the Compañia Petrolera Lobitos regularly exports its crude to the parent company's refinery in the United Kingdom; and the governments of Peru and Argentina have a barter arrangement that involves export of Peruvian crude. 60,sec 6, p.5-6/

Before and shortly after World War II, a number of Latin American countries and even European and Asiatic countries received part of Peru's exportable surplus of refined petroleum products. In recent years, the total supply has moved to a few nearby countries, particularly Chile, Bolivia, and Ecuador.

Most of Peru's crude oil is transported by pipeline from the oilfields to the refinery at Talara or to the loading terminals at Talara, Cabo Blanco, and Lobitos. Since all the fields except Ganso Azul are near the northwest coast, only relatively short pipelines are required. In eastern Peru, crude oil is transported from the Ganso Azul field via a new 46-mile pipeline to (1) the small refinery at Aguas Calientes or (2) the port of Pucallpa on the Río Ucayali, from which it is shipped by barge to the refineries or storage facilities at Iquitos (600 miles away) or Manaus (1,800 miles). 61/

Refined products are transported, via coastal waterways, from the Talara refinery terminal to the storage facilities along the Peruvian coast. Products are also moved by railroad and highway, but the volume handled is limited because of the lack of a continuous railroad system and the sparseness of paved roads leading inland from the Pan American Highway, which extends along the Pacific coast. In eastern Peru, refined products are shipped by river. 60,sec 4,p.1-3/



25945 4-57

I. Uruguay

Uruguay has neither any crude-oil production nor proved petroleum resources. However, the state-owned Administración de Combustibles, Alcohol y Portland (ANCAP) has contracted with a U.S. firm for exploratory work in various parts of the country. As of late 1956, four test wells had been drilled and, though the wells were dry, some noncommercial oil "shows" were encountered. 6,p.155/

The country's only refinery, operated by ANCAP, has a capacity of 28,000 b/d and is located at La Teja, near Montevideo. In mid-1956, the refinery was processing approximately 25,000 b/d of crude oil imported from Venezuela and the Middle East. 1,p.244/

J. Venezuela

1. Geographic Setting of the Oilfields

The regions of Venezuela that are of greatest significance for petroleum are the Maracaibo basin, the Falcón region, and the Orinoco basin. (See map 25942.) The Maracaibo basin, a well-defined structural and topographic depression in western Venezuela, is bordered on the west by the Sierra de Perija, on the south by the Venezuelan Andes, and on the east by the lowlands and hills of the Falcón region. Lago de Maracaibo, which covers an area of about 6,300 square miles, in the central part of the basin, is directly connected with the Caribbean Sea, but it is never more than slightly brackish because of the inflowing rivers. The terrain is relatively flat throughout the basin, but the climate and vegetation vary greatly from place to place. In the south, heavy rainfall causes a dense growth of tropical forest, and swamps are numerous and extensive. Toward the north, the decrease in rainfall results in a gradual transition to dry scrub forests and sandy wastes, and both the temperatures and the humidity are consistently high.

East of the Maracaibo basin and north of the Venezuelan Andes and the Coast Range is the Falcón region, which contains the Coro Lowlands (including the Paraguaná Peninsula) and the Segovia Highlands. The lowlands consist of a narrow belt of arid, sandy plains and dune-covered wastes that parallels the sea from the Maracaibo basin eastward to the Golfo (Gulf) Triste near Puerto Cabello. The highlands include plateaus averaging less than 2,000 feet in elevation which are interspersed with ranges of hills or low mountains. They are not so dry as the lowlands and, consequently, support more vegetation.

The Orinoco basin, both a structural and topographic depression, lies almost entirely in the interior of Venezuela. It extends from the delta of the Río Orinoco on the east into Colombia on the west. On the north it is bounded by the Coast Range and on the south by the Guayana Highlands. This vast depression is divided into two subsidiary basins: on the west, the Apure basin, currently an insignificant producer of petroleum; and on the east, the Maturín basin, second only to the Maracaibo basin in petroleum production.

The areal extent of the Orinoco basin is almost the same as that of the well-known Llanos, or Great Plains. The gently rolling, grass-covered surface is interrupted only occasionally by slightly higher areas. During the 5-month rainy season the rivers are unable to carry off all the water, and vast areas are inundated; during the dry season, however, only the larger rivers continue to flow freely. Insects of many species breed in the stagnant waters

or rank grasses. They not only cause discomfort but also spread a variety of diseases.

2. Status and Development

Venezuela possesses one of the world's major petroleum industries and is the world's largest exporter of petroleum. Its production is second only to that of the United States, and its proved reserves are estimated to rank sixth in the world. 1,p.123,144/ At the end of 1956, Venezuela's proved reserves were reported to be 13.2 billion bbls. of crude petroleum; those of the United States were estimated at 32.8 billion bbls. Although Venezuela's petroleum industry is still devoted mainly to the production of crude petroleum, its refining capacity is being expanded and at the end of 1956 was the sixth largest in the world. 6,p.105-106/

As the magnitude of this industry would suggest, petroleum is immensely important in the economic life of Venezuela. In value, the crude and refined products of the petroleum industry account for approximately 40 percent of Venezuela's gross national product, about 95 percent of its exports, and about 60 percent of its government revenues. Approximately 57,000 persons are directly engaged in the industry, and its growth has been accompanied by general industrial expansion and diversification. 63,p.2/

This impressive industrial development started before the turn of the century when a small Venezuelan company drilled a few wells and produced and refined oil for local consumption as illuminating oil. The earliest commercial field of importance was Mene Grande, near the eastern shore of Lake Maracaibo, discovered by a subsidiary of the Royal Dutch-Shell group in 1914.

The history of the search for oil in Venezuela and the development of the industry has had three distinct phases: (1) wildcatting in the areas of surface seepages; (2) the search for oil in the Llanos of eastern Venezuela by the extensive use of geophysical methods; and (3) the search for oil by deeper drilling in already productive areas.

In the first phase, British and North American wildcatters went through Venezuela "leaving a train of oilfields in their wake." This period marks the turning point in Venezuelan history, for it changed a pastoral country into a major producer of one of the world's prime commodities. During this period, at least 50 companies scoured the country for oil, but only a few were really successful: the Royal Dutch-Shell group; Lago Petroleum and Standard Oil of Venezuela (now merged into Creole Petroleum, a subsidiary of Standard Oil of New Jersey); and what is now Mene Grande Oil Company, a subsidiary

of the Gulf Oil Corporation. These companies are still the "Big Three" in Venezuelan oil, and their production far outshadows that of all the other companies combined.

The second phase, the search for oil in the Llanos where there are neither oil seepages nor exposed rock outcrops, was made possible by the development of geophysics and the increased knowledge of the geology of the country. Both the Gulf Oil Company and Standard Oil of New Jersey were successful in this search, which also brought highways, medical facilities, and new cities to eastern Venezuela.

The third phase, the search for oil beneath the known oilfields, started in 1937 and resulted in numerous important discoveries. Standard and Gulf were also leaders in this phase of development. 2,p.72-73/

The rapid development of the Venezuelan petroleum industry has been aided by the adoption of far-reaching and generally favorable legislation governing the industry. In the fields of labor and taxation, somewhat burdensome restrictions have been imposed; but the great expansion of oil operations, the profitable returns on capital investment, and the continually increasing number of companies active in Venezuela are indications of an atmosphere conducive to development of the industry. 64,sec 7,p.1/

Perhaps no small measure of the credit for the present prosperity of the petroleum industry in Venezuela should be given to the spirit of cooperation that exists between industrial and government administrators. A recent American Embassy despatch notes that "There has been no change in the cordial and effective relations generally existing in the day to day working conditions between industry staff and officers of the Ministry of Mines and Hydrocarbons. This is generally true, not only as regards relationships at Caracas headquarters, but also extends to district offices and field installations." 63,p.9/

Of the 3 firms that control most of the Venezuelan petroleum industry, 2 are U.S. owned and 1 is British-Dutch. The largest of the U.S. companies is the Creole Petroleum Corporation, an affiliate of Standard Oil of New Jersey; the second most important is the Mene Grande Oil Company, a subsidiary of the Gulf Oil Corporation. The British-Dutch group is represented by the Royal Dutch-Shell Company. Other companies operating in Venezuela, most of which are U.S. enterprises, account for about 10 percent of crude production. 65/

The relative importance of 14 companies that account for virtually all petroleum activity in Venezuela is shown in the following table.

Crude-Oil Production in Venezuela, 1955 1,p.250/

Company	Production (thousand bbls.)	% of total production (approx.)
Creole Petroleum	358,563	46
Shell de Venezuela	221,708	28
Mene Grande Oil	115,607	15
Socony Mobile Oil	25,553	3
Texas Petroleum	17,507	2
Richmond Exploration	16,458	2
Sinclair Oil and Refining	9,030	1
Petrolera Las Mercedes	8,895	1
Venezuelan Atlantic Refining	7,197	-1
Phillips Petroleum	3,374	-1
Pantepec Oil	2,768	-1
Talon Petroleum	618	-1
Coro Petroleum	59	-1
Caracas Petroleum	45	-1
Total:	787,382	

3. Production

a. General

Venezuela ranks second only to the United States in the production of crude oil. In 1955, Venezuelan production totaled 787 million bbls. (2,157,000 b/d), or approximately 14 percent of total world production; U.S. production for that year was 2.4 billion bbls. (6,806,000 b/d). 1,p.144-145/

Annual crude production in Venezuela first exceeded a million bbls. in 1921 and since then has increased rapidly. In 1928 it passed the 100 million mark and by 1950 was well over a half billion. The 1955 total production was almost 14 percent over that of 1954, which was also a good year. Data for all of 1956 are not yet available, but more than 430 million bbls. were produced during the first half of the year; 66/ and during the latter part of the year the shortage of oil caused by the crisis in the Middle East acted as an additional stimulus to production.

Taking the August 1956 production of 2,484,000 b/d as a base, it has been estimated that crude production could be increased 95,000 b/d in 1 or 2 weeks, 200,000 b/d in 3 months, and 523,000 b/d in 1 year. These estimates include (1) about 20,000 b/d of crude not currently available because of insufficient pipeline capacity,

but which could be promptly supplied in an emergency by increasing pumping pressures, and (2) 10,000 b/d of the 3-month total and 20,000 b/d of the 1-year total that would depend on pipeline expansion. No other limitations on availability due to capacity of pipelines or other handling facilities are anticipated. 67/

Commercial production began in 1917 with the exploitation of the Mene Grande field, located in western Venezuela about 9 miles inland from the eastern shore of Lake Maracaibo. Additional fields around the lake were discovered during the following decade, and every year the crude output increased. Until 1928 the Maracaibo fields accounted for practically all of Venezuela's production.

The discovery of the Quiriquire field in 1928 marked the entry of eastern Venezuela into oil production. Despite the subsequent discovery of a large number of fields scattered throughout the states of Guárico, Anzoátegui, Monagas, and the territory of Delta Amacuro, eastern Venezuela has not been able to match the productive capacity of the western part of the country. In 1956, the eastern fields produced about 689,000 b/d, or less than 40 percent of the 1,793,000 barrels produced in western Venezuela. 6,p.142,145/

In 1956 Venezuela had approximately 100 producing fields. Some of the fields are contiguous, however, and are actually different districts of single fields; they have individual names chiefly because they are owned or operated by different companies. Twenty-one of these fields are in western Venezuela, primarily in the Maracaibo basin. Of those in eastern Venezuela, two-thirds are in the state of Anzoátegui. 64,sec 2,p.3/

Principal Oilfields in Venezuela, 1956 6,p.142-145/

Name of field and discovery year	No. of wells Flowing	No. of wells Pumping	Daily production (bbls.)
Western Venezuela			
Lagunillas, 1926	264	1,083	636,901
Bachaquero, 1930	218	1,216	382,878
Tia Juana, 1928	191	1,085	244,421
Concesiones Lacustres, 1947	71		131,874
La Paz, 1925	21	61	98,392
Mara, 1945	27	23	79,053
Cabimas, 1917	133	744	71,445
Boscán, 1946		151	50,731
Mene Grande, 1914	3	462	40,092
El Cubo, 1916	28	116	19,569
La Concepción, 1935	18	61	13,021
Pueblo Viejo, 1940	19	20	9,510

Name of field and discovery year	No. of wells Flowing	Pumping	Daily production (bbls.)
Eastern Venezuela			
Nipa, 1945	163	34	71,037
Quiriquire, 1928		491	65,055
Oficina, 1937	107	197	55,952
Guara, 1942	114	117	46,935
Chimire, 1948	93	11	39,398
Zeta, 1954	64	3	35,255
Santa Rosa, 1941	66	3	32,244
Soto, 1949	78	26	31,289
Dacion, 1951	61	23	29,790
Mata, 1951	52		24,899
Las Mercedes, 1942	100	53	23,616
Santa Barbara, 1941	85	112	23,585
Oscurote, 1953	35		18,919
Leona, 1938	33	17	15,793
Santa Ana, 1936	30	5	11,446
Pedernales, 1933	20		10,698
Boca, 1951	30	3	10,732

b. The Major Oil-producing Areas

(1) The Maracaibo Basin

The Bolívar coastal fields in the Maracaibo basin averaged more than a million bbls. a day in 1956, or more than half the entire production for Venezuela. 6,p.142/ They are generally referred to, from north to south, as the Cabimas, Tia Juana, Lagunillas, Pueblo Viejo, and Bachaquero fields. Actually, they can be considered one large field because the geological conditions controlling the accumulation of petroleum are very similar throughout. The fields extend along the eastern shore of Lake Maracaibo for about 43 miles and also into the lake for a considerable distance. In general, the Venezuelan Oil Concessions Limited (Shell) controls the shore areas of these fields, and the Mene Grande Oil Company (Gulf) and the Creole Petroleum Corporation (Standard Oil of New Jersey) operate the lake portions. 64,sec 2,p.3/

The location of the Bolivar coastal fields is highly favorable for the large-scale production and transportation of petroleum. Large ocean going tankers have not been able to enter Lake Maracaibo because of a sandbar at its entrance, but smaller, shallow-draft tankers have been used successfully to transport the oil from the lake area to ports where it can be transferred to the large tankers.

At one time these small tankers were the only means of transporting the oil, but they now serve to augment the large-capacity pipelines that extend to facilities on the Paraguaná Peninsula. Recently the Venezuelan Government completed a channel of 35-foot depth that will enable oceangoing tankers to reach the docking facilities at La Salina, Maracaibo, and other loading points and carry out a full cargo. 1,p.248/ The oil companies plan, however, to maintain their shallow-draft fleets until satisfactory maintenance of the new channel is assured. 68/

Early development of the shore portions of the fields was difficult because of the low, swampy terrain, which hampered construction and road building. Also, the fact that the fields extend well out into the lake has made necessary the development of techniques that have added considerably to the cost of production of crude.

The Mene Grande field is located southeast of the Bolívar coastal fields, about 12 miles inland from the lake shore, and is controlled by the Caribbean Petroleum Company (Shell). The field is favorably located close to lake transportation. The northern part of the field is in hilly terrain; in the south, the surface is low and swampy and dikes have been constructed to contain river flood waters.

The Boscán field is on the western side of the lake, 25 miles southwest of the city of Maracaibo, and is well situated for the production and transportation of petroleum. The field is in a low, partially brush-covered area and is close to the paved highway from Maracaibo to Machiques. The Richmond Exploration Company (Standard Oil of California) operates the field.

The La Concepción and the La Paz fields are located a few miles west of Maracaibo, with which they are connected by a paved highway. Both are controlled by Venezuelan Oil Concessions (Shell). The fields are well situated, requiring only a relatively short pipeline to the lake terminal. The hot, dry climate is no deterrent to operations.

The important Mara field, located 30 miles northwest of Maracaibo, is shared by the Creole, Mene Grande, Shell Caribbean, and Texas companies. Production from this field has increased rapidly since the first discovery well was drilled in 1945; production in mid-1955 was at the rate of almost 100,000 b/d -- but in 1956 dropped to about 80,000 b/d. 6,p.142;8,p.189/ The field is on a low plain that presents no obstacles to oilfield operations and is well located with reference to terminal outlet and paved roads.

(2) The Falcón Region

The largest producer in the Falcón region is the Cumarebo field, which is of minor importance, however, when compared with the fields in the Maracaibo Basin. The field is located practically on the coast, thus assuring a ready outlet for the oil. Because rainfall is slight and temperatures are high, most of the foodstuffs needed to sustain operations must be imported. The field is operated by Creole.

(3) The Apure Basin

The relatively small Silvestre and Barinas fields are the only known commercial fields in this isolated area, about 100 miles southeast of Lake Maracaibo on the southern or inland side of the massive Venezuelan Andes. This region is the least explored of the sedimentary basins of Venezuela. Except for the isolated and inaccessible position, operating conditions are similar to those in other parts of the great-plains area of Venezuela. A pipeline from Silvestre to the Caribbean coast is scheduled to be put into operation in 1958 and should result in a significant expansion of production in the area. 6,p.145/

(4) The Maturín Basin

During the last 15 years many fields have been discovered in the states of Guárico, Anzoátegui, Monagas, and the territory of Delta Amacuro, all in eastern Venezuela. In 1940 there were only 10 producing fields in this region; at the end of 1956, there were 77. 6,p.144-145/

The Las Mercedes field, located in the central part of Guárico, is by far the most important producer in the state. 8,p.190/ It is operated by the Sociedad Anónima Petrolera Las Mercedes, a firm owned jointly by the Texas Company and the Caracas Petroleum Company. The distance from the marine terminal at Puerto La Cruz on the Caribbean necessitated the construction of an extensive highway system and a pipeline of considerable length. These operations were facilitated by the level, open terrain, however, as are the other oilfield operations in the area.

In the south-central part of Anzoátegui, known as the Greater Oficina area, are numerous large and small fields which are of major significance to the Venezuelan oil industry. The biggest producers among these fields are the Chimire, Guara, Nipa, Oficina, and Soto fields. In July 1955, each of these fields was producing more than 30,000 b/d. 8,p.190/ Most of the concessions in the Greater Oficina area are held by the Mene Grande Oil Company or jointly by Mene Grande

and Creole. A small part of the acreage is controlled by Socony-Vacuum Oil Company of Venezuela. Since the fields are located about 100 miles from the marine terminal at Puerto La Cruz, a long pipeline had to be built before the crude could be exported. Also an all-weather highway had to be constructed to carry supplies and equipment. The flat terrain and sparse vegetation have facilitated road and camp construction, however, and enable derricks and other equipment to be skidded from one well location to another. The climate is consistently hot and the annual rainfall averages about 45 inches, most of which falls in the May-to-October rainy season.

Other important producers in eastern Venezuela are the Jusepín-Santa Bárbara fields -- a number of contiguous fields in northwestern Monagas -- and the Quiriquire fields in the northern part of the same state. The terrain of the Jusepín-Santa Bárbara fields presents no obstacles to oilfield operations; the land is open plains country, for the most part, and rainfall is not heavy. The Quiriquire field, one of Venezuela's largest, is in a heavily forested region, but otherwise operating conditions are relatively easy. The climate is hot but not disagreeable. Numerous companies have interests in these fields, including Creole, Phillips, Sinclair, Atlantic, and Mene Grande.

4. Reserves

Over the past decade, the estimate of Venezuela's crude reserves has almost doubled. In 1945 Venezuela was thought to have about 7 billion bbls. of crude reserves; by the end of 1956, this figure had been increased to 13.2 billion. The latter estimate represented about 6 percent of the total world reserves. Only Kuwait, Saudi Arabia, the United States, Iran, and Iraq were estimated to have greater reserves. 6,p.105-106/

A recent analysis of crude-oil reserves held by each company and in each field is not available, but a 1950 estimate of the relative importance of reserve holdings and of fields is believed to be essentially correct. That estimate emphasized the predominance of Creole and Shell: the two companies held more than 75 percent of the reserves of the country. Mene Grande was a "poor" third, with only 7 percent. The areal distribution of the reserves is also lopsided. The Bolívar coastal fields, in the Maricaibo basin, contained almost half of Venezuela's calculated reserves; the other western Venezuela fields accounted for an additional 20 percent, and all the eastern fields combined contained less than 30 percent. 64, sec 1,p.19-20/ Since this estimate was made, the increased activity and the discovery of several new fields in eastern Venezuela have probably somewhat changed the relative importance of this part of the country, but the change in proved reserves is believed to be slight.

As of the end of 1955, the total area covered by oil concessions was 14.5 million acres, or about 16.8 percent of Venezuela's total prospective petroliferous area of 86 million acres. 1,p.247/ In 1956 additional concessions were granted by the Venezuelan Government -- for the first time since 1945 -- and these have opened the way to significant future increases in the proved reserves of the nation. 63,p.12/ The new concessions have stimulated fierce competition among the oil companies for the semiproved acreage of Lake Maracaibo. Concession blocks were also awarded in the states of Apure and Táchira. Successful companies offered more than $300 million and high royalty commitments for a total of about 900,000 acres. 6,p.142-143/ The government expressed the intention of granting a total of between 5 million and 7.3 million acres in various parts of the country. 1,p.248/

The parts of Venezuela underlain by igneous and metamorphic rocks can be classified as unfavorable for the generation and accumulation of petroleum. The regions underlain by sedimentary rocks may be classified as "proved," "favorable," "possible," or "unfavorable." The proved category includes the fields that are producing or capable of production. Favorable areas are in the vicinity of proved fields, providing the geologic characteristics are similar. In the favorable category are: the Maracaibo Basin; the Maturín Basin, including the Orinoco Delta; and the Coro Lowlands of the Falcón Region, excluding the Paraguaná Peninsula. In the possible category are parts of the sedimentary basins where commercial fields do not yet exist but where geologic conditions indicate that such accumulations may be found; these include the Apure Basin and the Segovia Highlands of the Falcón Region. Areas in which the sedimentary sections are too thin, or where the geologic structure is totally unsuitable to generate and accumulate petroleum, are classified as unfavorable; these are the Venezuelan Andes, the Coast Range, the Guayana Highlands, the Sierra de Perijá, and the Paraguaná Peninsula. 64, sec 1,p.9/

As a result of the extensive geologic and geophysical mapping undertaken in Venezuela, the general geology of the country is well known. The Maracaibo Basin, where the first oilfields were discovered, is the most intensively explored of the oil areas in Venezuela. The Apure Basin is the last of the favorable or possible petroliferous areas to be explored. 64,sec 1,p.10/ Although at one time the Apure Basin appeared to be the least promising of the petroliferous basins, interest in the area currently runs second only to that in the Maracaibo Basin, and geologic estimates range from hopeful to very enthusiastic. 63,p.12/

5. Refineries

At the end of 1956, Venezuela ranked sixth in refinery capacity among the free nations of the world. Its 605,000-b/d crude capacity

was about 3 percent of the world's total and slightly more than 6 percent of that of the United States. If one extends the daily capacity to include that of refineries in the Netherlands Antilles (on Aruba and Curaçao) that are closely related to and dependent upon Venezuelan crude production, the amount is more than doubled. In mid-1956 this "comprehensive" total was 1,255,000 b/d, or almost 7 percent of the world's total, making the combined area second only to the United States in refinery capacity. 6,p.104-105/

Both geography and politics played roles in retarding the development of petroleum refining in Venezuela. The first oilfields in the country were in the Maracaibo Basin but, as previously stated, the exit from Lake Maracaibo was too shallow to accommodate large oceangoing vessels. As the result, on the islands of Aruba and Curaçao in the Netherlands Antilles, where the oil was carried for transshipment, one of the world's largest refining industries developed. These refineries could have been established on the mainland, but the companies involved (first, the Royal Dutch-Shell and, later, Standard Oil of Indiana) preferred the less stormy political climate of the Dutch islands.

Until recently the nearby island facilities had the effect of precluding the establishment of more than a few small refineries in western Venezuela. By the time large-scale production began in eastern Venezuela, the Aruba and Curaçao facilities were available to refine petroleum from the new fields. Despite this, however, a major refinery was constructed in 1930 at Caripito on the Río San Juan at the deep-water terminal of pipelines leading from the important field of Quiriquire and other major fields in the state of Monagas. This refinery, built by Standard Oil of New Jersey, gave Venezuela its first significant refinery capacity.

The biggest year in the growth of Venezuela's refinery capacity was 1950, when four new refineries were completed. The rapid increase in capacity that year was a result of the Hydrocarbon Law of 1943, which provided that the government may require that a portion of the crude production from concessions granted after that date be refined in Venezuela. Subsequent regulations fixed this portion at 10 percent. 64,sec 3,p.1/ On the concessions granted in 1956, however, companies were obliged to agree to a 15-percent domestic refinery obligation. 63,p.9/

Although Venezuela's refining capacity has more than quadrupled since 1948, it has not caught up with the constantly expanding crude-oil production. Currently, about 25 percent of the crude oil produced is refined. In mid-1956, fuel oil accounted for about 60 percent of the refinery output, gas oil and diesel oil for 18 percent, motor fuels and special napthas for 12 percent, and all other products for the remainder. 63,p.7/

The following table gives data on the Venezuelan and Netherlands Antilles refineries, as of the end of 1956.

Refineries 6,p.143,154,157-162/

Company and refinery location	Bbls. per stream day Crude distillation	Cracking a/
Venezuela		
Creole Petroleum (Standard Oil of New Jersey)		
Amuay	235,500	
Caripito	68,000	36,000 Vis
Shell de Venezuela		
Cardón	145,000	25,000 TC
San Lorenzo	38,000	
Venezuela Gulf Refining		
Puerto La Cruz	59,000	14,500 Vis
Venezuela Petroleum (Sinclair)		
Puerto La Cruz	35,000	12,000 Vis
Richmond Exploration (Standard Oil of California)		
Bajo Grande	10,000	
Texas Petroleum		
Tucupita	10,000	
Phillips Petroleum		
San Roque	3,200	
Colon Development (Shell)		
Calvario	1,000	
Casigua	300	
La Rivera	300	
Totals:	605,300	87,500
Netherlands Antilles		
Lago Oil and Transport (Standard Oil of New Jersey)		
Aruba	440,000	43,000 FCC 340,000 Vis
N.V. Curacaosche Pet. Industrie Mij. (Royal Dutch-Shell)		
Curaçao	210,000	120,000 TC
Totals:	650,000	503,000
Grand Totals:	1,255,300	590,500

a. TC -- Thermal cracking; Vis -- Visbreaking; FCC -- Fluid catalytic cracking.

6. Markets

For a number of years Venezuela has been the largest exporter of petroleum in the world, and the volume has been steadily increasing. In 1950, Venezuela exported 452 million bbls. of crude petroleum; 69/ by 1955 the figure had reached 594 million. 11,p.3/ In the first half of 1956 some 324 million bbls. had been exported, an increase of almost 12 percent over the comparable period in 1955. 63,p.4/

The nearby islands of Aruba and Curaçao receive substantial quantities of the Venezuelan petroleum for refining and re-export, although shipments to these islands in recent years have declined significantly in proportion to total Venezuelan exports. In 1949, about 58 percent of Venezuela's exports of both crude oil and oil products went to Aruba and Curaçao; 64,sec 6,p.1/ by the first half of 1956 the percentage had dropped to 38. The United States was the second greatest market, receiving about 28 percent of these exports between January and June 1956. Canada, Europe, and Latin America accounted for the remainder. 63,p.4/

In terms of crude exports alone, the first 6 months of 1956 were marked by a continued decline in percentage of shipments to the Netherlands Antilles, the United States, and Canada, although the actual volume of shipments was greater than for the comparable 1955 period. Exports to Europe increased significantly, the Netherlands and the United Kingdom being the principal purchasers. The Latin American countries, particularly Brazil, also increased their imports from Venezuela. Crude exports are shown in the following table.

Exports of Crude Petroleum 63,p.5/

Destination	Jan.-Jun. 1956 (million bbls.)	% of total
Aruba	88.16	27.18
Curaçao	59.69	18.40
United States	76.63	23.62
Canada	34.29	10.57
Europe	29.99	9.25
Latin America	25.97	8.01
British West Indies	7.72	2.38
Others	1.90	0.59
Total:	324.35	

Exports of refined petroleum products continued to increase in 1956 in keeping with the increase in refinery throughout. Total refined products exported during the first half of 1956 reached 78 million bbls., an increase of almost 13 percent over the same period for the previous year. The United States is Venezuela's best customer, principally for fuel oil, taking 44 percent of the total export of refined products. The United Kingdom ranked second with 10 percent, and the Netherlands Antilles was third with 7 percent. Other principal buyers included Brazil, Sweden, Argentina, Cuba, and Puerto Rico. 63,p.6/

Domestic consumers require only a fraction of the country's production; as Venezuela has become more industrialized, however, the portion of the petroleum output used domestically has increased. In 1946, the domestic requirement was about 24,000 b/d, or 2.2 percent of the total supply. In 1955 the requirement had reached 127,000 b/d, or 5.8 percent of a much increased supply. 1,p.149/

7. Transportation

At the end of 1955, Venezuela's network of pipelines totaled about 2,150 miles. Two new crude lines, one a 16-mile line from Bachaquero to Lagunillas in western Venezuela and the other a 94-mile line from Temblador to Caripito in eastern Venezuela, were planned for 1956. 1,p.248;70/

Much of the petroleum produced in the Maracaibo Basin is moved via pipeline directly to the large facilities on the Paraguaná Peninsula, as well as to terminals on the lake for transshipment via tanker. In eastern Venezuela, pipelines are used to move crude oil from field storage tanks to deep-water terminals and refineries on the Caribbean coast near Puerto La Cruz. These pipelines originate in the Las Mercedes area fields in the state of Guárico; in the Anzoátegui fields; and in the Monagas fields. In addition, an important line extends from the Monagas fields northeastward to Caripito on the Río San Juan. 71/

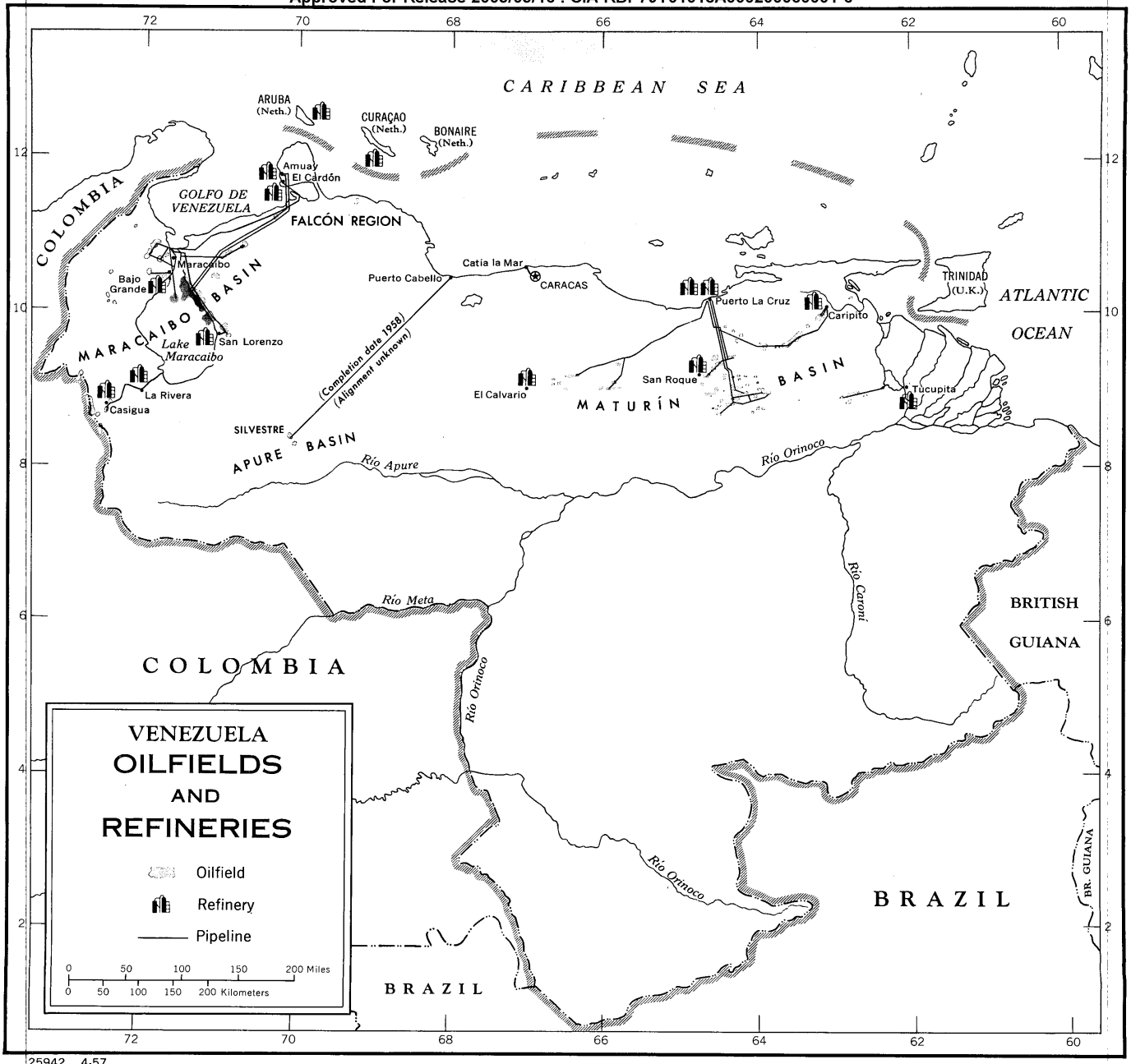
In April 1956, plans were announced for the construction of a 211-mile crude pipeline from the Silvestre field in southwestern Venezuela, near Barinas, to Puerto Cabello on the coast. 1,p.248/ Initially the line will carry 100,000 b/d and will be of great aid in the development of this isolated area. The line is scheduled for operation in 1958. 6,p.145/

Movement of Lake Maracaibo crude during the past few years has been mainly by pipeline. In 1949, Creole completed a line to the Amuay refinery on the Paraguaná Peninsula; the next year, Shell constructed a line to the Cardón refinery on the same peninsula.

Despite the considerable capacity of these pipelines, shallow-draft tankers must still be used to carry oil in excess of pipeline capacity to the refineries and to deep-water facilities.

The Venezuelan Government has recently completed the dredging of a 35-foot deep, 46-mile channel (begun in 1953) from the Gulf of Venezuela into Lake Maracaibo, which will convert La Salina and Maracaibo to deep-water ports. Formerly, Lake Maracaibo traffic was restricted to ships of from 13- to 18-foot draft. The new channel will help open up western Venezuela to world trade, both for imports of needed equipment and for exports of oil. 1,p.248/ The oil companies plan to maintain their shallow-draft fleets until the transition to supertanker movement of the excess crude is assured by satisfactory maintenance of the new channel. 68/

Detailed information on highway transport of petroleum is not available, but highways are known to be second only to pipelines as a means of supplying domestic requirements. Only a small amount of crude oil and refined products is moved by rail, primarily because of the extremely limited railroad network. 70/



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II. Mexico

1. Geographic Setting of the Oilfields

Mexico's three petroleum producing regions are strung disjointedly along the Gulf of Mexico coastal plain. (See map 25941.) This location on or close to the coast is favorable for the export market. On the other hand, this concentration of fields does not facilitate distribution of crude oil and products to the interior of the country where most of the people live and the domestic demand is greatest; and the high elevation and rugged terrain of the interior make the construction and operation of pipelines from the coastal fields extremely difficult.

The northeastern fields are located near the Rio Grande in the state of Tamaulipas, a sparsely settled, semiarid region, with a natural vegetation cover of desert shrubs and grasses. The favorable terrain and climate of this region have made operating conditions far less difficult than elsewhere in Mexico.

The most productive Mexican oilfields to date are located in an elongated region that extends roughly from the city of Tampico southward to and beyond Tuxpan and Poza Rica. This is a hot, wet area that supports a vegetation cover of both forests and grasses. Periodically the heavy rainfall hampers oilfield operations, particularly drilling, and occasionally hurricanes have completely disrupted activities.

The Isthmus of Tehuantepec region, the other major area of petroleum production, has an even more unfavorable physical environment for oilfield operations. This region is also hot and wet, and the natural vegetation is primarily luxuriant tropical forest which severely handicaps petroleum exploration and transport facilities.

2. Status and Development

The development and current status of the Mexican petroleum industry are the direct result of action taken by the Mexican Government in 1938. In that year the property of the 17 foreign companies controlling almost all of Mexico's production of oil was expropriated, and the mold for the future development of the industry was established.

The first of a long series of problems following expropriation was the legal status of the industry. President Cardenas offered to indemnify the oil companies for the surface equipment taken but not

for the proved oil reserves in the soil; the companies claimed that such a settlement was completely inadequate. From these opposing positions, words and legal treatises were exchanged until 1942 when the U.S. Government and the oil companies finally reached an agreement with the Mexican Government. In 1947 the British Government also reached an agreement with the Mexican Government. 72/

At the time of expropriation, an agency of the Mexican Government, Petróleos Mexicanos (Pemex), was established to control practically all the exploratory, drilling, producing, refining, and marketing activities in the country.* Pemex still holds a monopoly over the entire oil industry with the exception of retail distribution and a relatively small group of importers representing U.S. concerns. Six men comprise the directorate of this organization: four are cabinet officers and the others are appointed by the President of Mexico. A director general, responsible for day-to-day operations also is appointed by the President.

Pemex has a weak financial position caused by (1) having to make various large payments to the government, such as taxes and royalties and subsidies to other government agencies, and (2) being charged with the entire cost of expropriation, a debt of approximately $120,825,000 in terms of U.S. monetary value. Pemex's major source of income is the sale of petroleum and its products. This source, however, is limited by the low wholesale and retail prices of petroleum and petroleum products established by government decree. Since it has become a government policy to provide the Mexican economy with inexpensive petroleum products, the fixed prices do not always reflect a fair return to Pemex; in fact, in certain areas, Pemex has actually distributed petroleum products at a loss. Another source of income consists of subsidies granted to Pemex by the government in the form of rebates on certain taxes.

The government depends upon Pemex for a large share of its revenue. Because of this drain on its financial resources, Pemex has of necessity had to devote a major portion of its inadequate surplus capital to the exploitation of known oilfields, leaving a limited amount to finance exploration for new fields.

Pemex has an adequate supply of labor, but from the viewpoint of efficiency and productivity there is much to be desired. Overall production of the labor force decreased from an average of 3,559 bbls. of crude oil per year per employee in 1937 to 3,091 bbls. in

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1952. Various Pemex officials have admitted that, even with a labor force of 25,000 (1953 estimate), they do not have enough trained technicians to accomplish all that needs to be done. To obviate this shortcoming and increase the efficiency of the labor force, Pemex has started a technological institute for the training of petroleum technicians and provides scholarships for its employees.

Because of labor's original role in providing the legal basis for oil expropriation and the emphasis in Mexico on workers' participation in the conduct of public enterprise, the petroleum workers' union in 1938 was in a strong position to dictate the manner in which the government was to conduct the industry. As the result of labor's misuse of its power, however, conditions in the oil industry became chaotic, inept union leaders stepped into many of the most responsible and lucrative positions, the labor force was expanded, nepotism was rampant, and discipline practically disappeared. This situation forced the government to take a more direct and firmer control of the industry, and since 1941 the management of Pemex has been able to control labor with some degree of success. Also, it has recently become evident that labor is becoming more conservative in its demands and is tending toward a middle-of-the-road course. Despite this conservative trend, labor's strong position has resulted in excessive labor costs to Pemex and has prevented a more efficient and orderly operation of the industry.

Investment of foreign capital in the Mexican petroleum industry is very limited because of the restrictive provisions of the Mexican constitution and petroleum laws. In order to accelerate its drilling program, however, Pemex has engaged the services of foreign drilling contractors who are assigned areas in which to drill on a contract basis. In addition, Pemex has also been assisted by U.S. equipment and construction companies.

In summary, the development of the petroleum industry in Mexico has been retarded by the adoption of far-reaching and generally unfavorable constitutional and legislative provisions governing the industry, the lack of technical knowledge, and the shortage of capital required to finance rehabilitation and expansion. As a result, Mexico's relative importance as an oil-producing nation has diminished. Recent developments, however, including the discovery of new fields, indicate an improved situation in the near future. For example, the Mexican oil industry underwent a general expansion during 1955 as refining capacity rose and new pipelines were opened to accommodate increased crude production. 8,p.177/ Production during the first half of 1956, exceeded even the 1955 record. 1,p.212/

3. Production

Production of petroleum on a commercial scale in Mexico began in 1901. The story of the next 20 years is a saga of fabulous oil strikes that resulted in yields of amounts previously unheard of, which escaped with such speed and violence as to be uncontrollable. One unexpected gusher ran uncontrolled for 6 months, overflowed hastily constructed earthen reservoirs of more than 3-million-bbl. capacity, followed the Río Tuxpan 34 miles to the sea, ruined fishing banks and oyster beds in the vicinity, and created a threat of fire that jeopardized the entire area. 74,p.52/

The nation's output skyrocketed so that by 1918 Mexico ranked second in the world with a production of almost 64 million bbls. This position was held until 1928 when Venezuelan production of almost 106 million bbls. surpassed Mexico's 50 million bbls. for the year. Mexico's record year was 1921, when 193 million bbls. were produced. Thereafter the decline in production was almost as sharp as the initial rise. By 1932, production was less than 33 million bbls., and Mexico ranked seventh in world production. 74,p.52/

After 1932, annual production increased slowly until 1938, the year of expropriation. That year brought a drop in production of more than 8 million bbls., or about 18 percent. This sharp decrease reflected both the world boycott imposed on Mexican oil by the expropriated companies and the confusion and inefficient operation. For the same reasons, production during the first 3 years of operation by Pemex was relatively slow. In 1942, production took another sharp drop -- to less than 35 million bbls. -- and throughout the war period was very slow. This slump resulted from (1) the loss of foreign markets because of inadequate shipping facilities, (2) Germany's submarine campaign, and (3) inability to get necessary refining equipment because of shortages of material and the continued hostility of large influential companies in the United States. 74,p.55/ In the postwar period, Pemex began active development of the great Poza Rica field and increased exploratory activity, and production increased. In 1946 the output of crude exceeded 49 million bbls., and by 1951 it had climbed to more than 77 million bbls. Production declined slightly in 1952 and made a more significant drop in 1953. After this 2-year decline, however, 1954 was a banner year, when crude production rose to more than 83 million bbls. The following year the Mexican oil industry underwent a general expansion, including enlarging of the refining capacity and constructing of new pipelines. 8,p.177/ Annual crude production for 1955 was an impressive 91 million bbls., or an increase of 6.8 percent over the 1954 total. 75/

Despite the promising trend and a 1956 annual production of 94 million bbls. 75/ -- the highest in almost 30 years -- Mexico

still has far to go to reattain the position she held in the early 1920's. In 1921, Mexico produced more than 25 percent of the world crude-oil production; in recent years, less than 2 percent of the world total has originated in Mexico. This lowly status, of course, is more a reflection of new oil discoveries in other parts of the world (for example, the Middle East) than it is an indication of a slump in Mexican production. 1,p.144-145/

Mexico's northeastern oilfields in the state of Tamaulipas, are mostly gas and distillate fields, although increasing amounts of crude have been discovered in recent years. The principal crude-producing fields are located in the Tampico-Tuxpan region in the state of Veracruz. That area supplies the oil consumed in the interior of Mexico, is a source of crude exports, and accounts for approximately 85 percent of total production. 8,p.177/ Most of the Isthmus fields are grouped east, southeast, and south of the city of Coatzacoalcos, Veracruz; the remainder are located about 120 miles to the east in the Tabasco-Campeche basin.

The following table indicates the relative importance of Mexico's oilfields in 1955.

Mexican Oilfields 8,p.178/

Region and fields	Discovery year	No. of wells Flowing	Pumping	Shut in	Jul. 1955 b/d (av.)
Northeastern region					
Northeastern fields	1948	48	11	0	3,574
Tampico-Tuxpan region (including Veracruz dist.)					
Poza Rica	1930	146	32	0	98,430
New Golden Lane	1952	58	0	0	76,186
Pánuco-Ébano	1901	413	50	0	19,361
Golden Lane	1908	264	6	0	17,611
Hidalgo-Guerrero	1954	15	0	0	12,627
Veracruz	1953	2	0	11	5,575
Isthmus of Tehuantepec					
Isthmus and Tabasco	1911	95	318	0	21,668
Totals:		1,041	417	11	255,032

4. Reserves

In the last few years, estimates of the crude-oil reserves in Mexico have been increased. At the end of 1945, Mexico's reserves

were estimated at 870 million bbls. 55,p.170/ By the end of 1953, the estimate was increased to 1.4 billion bbls.; 76/ by mid-1955, to some 2 billion bbls.; and in mid-1956, to 2.5 billion bbls. The last figure represents about 1.25 percent of the total world reserves of crude petroleum. 1,p.123/ Much of the increase has been achieved by extending the productive limits of the Poza Rica field by the drilling of field extension wells. Also, discoveries of new fields in northeastern Mexico, the Isthmus region, and the Golden Lane area in the state of Veracruz have contributed to the increase in known reserves. 73,sec 1,p.1/*

Geologically, the only part of Mexico that can be considered favorable for the commercial accumulation of petroleum and natural gas is a relatively narrow strip along the Gulf coastal plain. A number of basins containing petroleum and natural-gas deposits have been found in this area, and prospects for additional discoveries are good. In northeastern Mexico is the Burgos basin, part of the Rio Grande embayment of Texas where gas-distillate fields and a few oilfields have been found. To the south, between the towns of Tampico and Tuxpan, is the Tampico basin, where most of the producing fields are located and from which comes the greater proportion of Mexico's oil production. South of the Tampico basin is the Veracruz basin, an area containing very favorable prospects. In the Isthmus of Tehuantepec are the Isthmian saline basin and the larger Tabasco-Campeche basin, in both of which production of petroleum and natural gas has been proved. Geological conditions in these basins are favorable for additional discoveries.

In addition to the above-mentioned basins, some areas possessing less promising geological conditions are classified as possible petroliferous areas. In Coahuila and eastern Chihuahua a large area appears to have geological conditions similar to the parts of west Texas in which many oilfields occur. North of Tampico and south of the Burgos basin is the Tamaulipas shelf, an area of complex structures and many oil seepages. The Yucatan Peninsula also warrants further testing. The San Sabastian Vizcaino basin on the west side of the peninsula of Lower California offers limited prospects for deposits of oil.

The geology of the remainder of Mexico is unfavorable for the occurrence of commercial oil or gas pools. This large non-petroliferous area -- estimated to cover about three-quarters of the areal extent of the country -- is underlain in part by igneous and metamorphic

rocks in which the accumulation of oil and gas is highly improbable and in part by sedimentary rocks which are so highly indurated, folded, and faulted as to preclude the existence of petroleum.

5. Refineries

Since expropriation of the petroleum industry, the expansion and improvement of facilities has been one of the Mexican Government's principal objectives. In the period 1938-50, expenditures on refineries were the largest single item among Pemex investments, totaling some 29 percent of all government investments in the industry. The refineries built before expropriation were intended to serve export markets and were constructed on the Gulf coast far from consumer centers. When taken over by the government, they were in a state of deterioration and their combined daily processing capacity was only 102,000 bbls. Since then, additions and new construction have more than quadrupled the capacity of the refining system. The new plants in the interior of the country, near Mexico City and Salamanca, Guanajuato, represent about one-third of the total refining capacity. 77/

Pemex has eight refineries in operation. Their combined crude capacity, as of mid-1956, was 428,500 b/d. 78/ Production at the same time was only 249,764 b/d, or about 58 percent of capacity. 79/

Mexican Refineries, 1956 78/

Company	Plant Location	Crude Capacity	Plant Type a/	Cracking Capacity b/
Petróleos Mexicanos	Árbol Grande, Tamps.	40,000	SAL	0
" "	Atzcapotzalco, D. F.	100,000	SCA	14,500T
" "	Ciudad Madero, Tamps.	85,000	SCA	6,000T
" "	Mata Redonda, Veracruz	14,000	SC	6,000T
" "	Minatitlán, Veracruz	50,000	SC	15,000C
" "	Poza Rica, Veracruz	94,500	S	0
" "	Reinosa, Tamps.	7,000	S	0
" "	Salamanca, Guanajuato	38,000	Comp.	5,000T
	Totals:	428,500		46,500

a. S -- skimming; A -- asphalt; L -- lubricating; C -- cracking; Comp. -- complete.
b. T -- thermal; C -- catalytic.

More than 75 percent of the country's demand for petroleum products is concentrated in the high central plateau. It is apparent, therefore, that existing refinery capacity is disadvantageously located with respect to demand; consequently, either the crude must

be moved long distances to supply the inland refineries, or the refined products must be transported from the coastal refineries to inland consuming areas. 73,sec 3,p.1/

In recent years Pemex has made considerable progress in relocating, modernizing, and expanding refining capacity to keep pace with the accelerated demand for petroleum products, but additional expansion of existing refineries and construction of new ones are needed. Because of the lack of certain types of refining facilities, more than 10 percent of the domestic demand for petroleum products in 1955 had to be met by imports, even though the production of crude exceeds national consumption by more than 10 million bbls. a year. 73,sec 3,p.1/ Domestic demand is increasing daily and is particularly high for gasoline and other light products. The available refinery facilities leave Mexico with surpluses of residual products that cannot be absorbed by the nation and with a shortage of light products that must be imported. With adequate installations, these residual surpluses could furnish raw material for products now imported. 79/ Pemex is continuing to expand refinery facilities to correct this disparity, and construction of a new catalytic cracker at the Atzcapotzalco refinery was begun in the summer of 1956. As recently as October 1956, however, an American Embassy representative noted that additional refinery capacity is urgently needed -- particularly to treat heavy oils, much of the production of which is currently being sold as low-value fuel oil. 80/

6. Markets and Transportation

For many years, Mexico's foreign trade in oil was very important. In fact, one of the complaints against the private oil companies was that the industry was geared to export and that, consequently, Mexico retained insufficient oil for her own needs. This complaint, of course, ignored the benefits of international trade and the purchase of imports that was made possible by the revenue from exports.

The expropriation in 1938, however, seriously affected Mexico's trade in oil. One development was that foreign companies openly announced their intent to boycott Mexican oil exports. Largely as a result of this boycott, the amount of oil exported dropped from 25 million bbls. in 1937 to less than 15 million bbls. in 1938. 74,p.112/ The boycott was shortlived, however. In 1939, world markets for Mexican petroleum began to reopen, and in 1940 the United States alone took almost 16 million bbls., or more than 75 percent of the total petroleum exports. During and after the war, the United States continued as Mexico's best foreign customer. 74,p.114/

It has always been the policy of the Mexican Government to emphasize the domestic market and to exploit the export market

primarily as an outlet for surpluses. This policy, in combination with the boycott and, during World War II, the lack of shipping facilities, caused a radical shift in the direction of flow of Mexican petroleum. In 1936, only 41 percent of the crude oil produced was consumed at home. In 1939, home consumption was 50 percent, and in subsequent years it has remained well over this figure. A wartime high point was reached in 1943 when 94 percent of the crude oil produced was consumed in Mexico. 74,p.115/ After World War II, the percentage declined somewhat, but during 1953, 1954, and 1955 approximately 95 percent of the crude produced was consumed locally. 11,p.3;81;82,p.4/

Exports of crude petroleum in recent years have varied from a high of about 17 million bbls. in 1951 83/ to a low of slightly more than 3 million bbls. in 1953. Since 1953, the trend has been upward: 3 million in 1953, 4.5 million in 1954, and 5.5 million in 1955. 11,p.3;81;82,p.4/ Most of the exported crude has gone to the east coast of the United States. 1,p.136/

The internal movement of oil is one of Pemex's most difficult tasks, despite the more than 2,000 miles of pipeline in operation in the country. The area containing the producing oilfields accounts for only about one-third of Mexico's consumption of petroleum products. To move the petroleum to the area of major consumption, two pipelines were built, one to Mexico City and the other to Salamanca. Both of these lines had to be built across the Sierra Madre Oriental. From an elevation of nearly sea level at Poza Rica, the Mexico City pipeline climbs to an elevation of 8,300 feet and requires 9 pumping stations; the Salamanca line rises to 8,700 feet and has 7 pumping stations. Not only does this rough terrain cause difficult maintenance problems, but the torrential rains frequently create landslides that cause breaks in the pipelines. 73,sec 4,p.1-4/

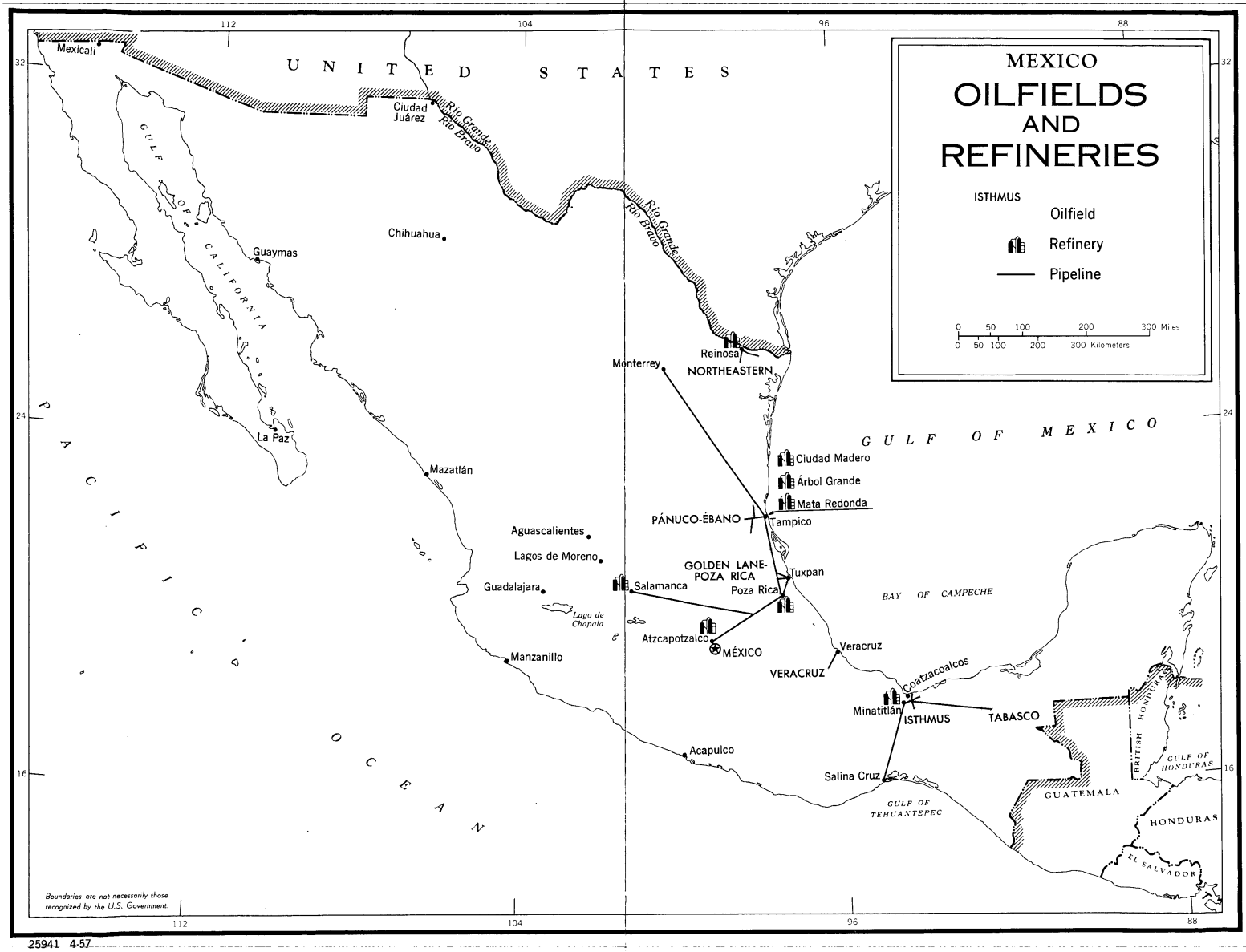
One of the most important additions to the pipeline network is a 155-mile products line (completed in 1951) across the Isthmus of Tehuantepec from Minatitlan, near Coatzacoalcos, to Salina Cruz on the Pacific coast. The capacity of the line, however, is insufficient to meet the requirements of the western part of the country which, particularly in the northwestern and northern border states, depends upon supplies from the United States. 77/ Another pipeline, from Tampico to Monterrey, was scheduled to start operating in May 1956. This line will make Monterrey an important distributing center for petroleum products in the northern part of the country. 84/

The railroads in Mexico are also used to transport crude petroleum and refined products. In 1938, at the time of expropriation, 738 tank cars were in operation on the Mexican railroads. By 1950 the number had increased to 1,888, and the total capacity had increased

from 161,000 to 426,000 bbls. The tank cars are performing excellent service, but the entire railroad system has slowed down in recent years and is in drastic need of major renovation. Thus, even though more tank cars are in use, the rate of delivery has decreased. 73, sec 4,p.4/

Trucks fitted with special tanks are used to transport crude petroleum and refined products on the highways. In 1938 Pemex had 295 tank trucks, with a total capacity of about 5,000 bbls.; by 1950 the number of tank trucks had been almost doubled -- to 560 -- and the total capacity was over 5 times as much -- 26,000 bbls. 73,sec 4, p.4/

Since the expropriation in 1938, Pemex has been building up its fleet of vessels, both barges and seagoing tankers, engaged in the transportation of crude petroleum and refined products. The capacity of the fleet was increased from 168,000 bbls. in 1938 to 1,452,000 in 1950. It has been further increased since 1950, but information on the extent of the increment is not available. Some heavy equipment and petroleum are also moved by barge on the few inland waterways of the country. 73,sec 4,p.5/


MEXICO
OILFIELDS
AND
REFINERIES
ISTHMUS
Oilfield
Refinery
Pipeline
0 50 100 200 300 Miles
0 50 100 200 300 Kilometers
UNITED STATES
Mexicali
Ciudad Juárez
Río Grande
Río Bravo
Chihuahua
Guaymas
GULF OF CALIFORNIA
La Paz
Mazatlán
Aguascalientes
Lagos de Moreno
Guadalajara
Lago de Chapala
Manzanillo
Acapulco
PACIFIC OCEAN
Monterrey
Reinosa
NORTHEASTERN
GULF OF MEXICO
Ciudad Madero
Árbol Grande
Mata Redonda
PÁNUCO-ÉBANO
Tampico
GOLDEN LANE-POZA RICA
Tuxpan
Poza Rica
Salamanca
Atzcapotzalco
MÉXICO
VERACRUZ
Veracruz
BAY OF CAMPECHE
Coatzacoalcos
Minatitlán
ISTHMUS
TABASCO
Salina Cruz
GULF OF TEHUANTEPEC
BRITISH HONDURAS
GULF OF HONDURAS
GUATEMALA
HONDURAS
EL SALVADOR
Boundaries are not necessarily those recognized by the U.S. Government.
112
104
96
88
32
24
16

25941 4-57

III. Central America and Panama

A. General

The desire to find additional oil reserves in the Western Hemisphere has increased the interest in Central America, hitherto a comparatively neglected area in terms of oil exploration. Although oil has never been produced commercially in Central America, all the countries except El Salvador are known to have areas where the geologic structures indicate the likelihood or at least the possibility of the existence of petroleum. 85/ Factors increasing the interest in oil prospects in Central America range from improved conditions for private capital operations, as in Guatemala, to the actual discovery of oil, as in Costa Rica. A brief summary of the petroleum situation in Panama and in each Central American country with the exception of El Salvador is given on the pages following.

B. British Honduras

The British Honduras Gulf Oil Company, a subsidiary of the Gulf Oil Corporation, has been exploring for petroleum in British Honduras since 1950 86/ but as of the early part of 1957 had discovered no oil. In 1955, Gulf drilled a test well in the Yalbac area, about 50 miles southwest of Belize, but later abandoned it. Another test well was drilled in 1956, this one near the village of Hillbank about 25 miles north of Yalbac, but it also proved unsuccessful. 87/ Despite these failures, Gulf has announced that it intends to continue exploration activities in the colony. 88/ The geologist in charge has stated that data collected during the current tests and during the extensive surveys made by Gulf between 1952 and 1955 indicate the presence of oil in the northern half of British Honduras. He also reported that oil may exist in the coastal shelf and in a small area in the extreme southern part of the colony. 87/

If oil is discovered in British Honduras, one result may well be a renewed attempt by Guatemala to assert its claim to the colony. Reportedly, the Guatemalan Government has already warned the Gulf Company that it does not recognize the company's agreement with the British colonial authorities, and that any oil discovered in British Honduras would "rightfully belong to Guatemala." 89/

C. Costa Rica

The Compañia Petrolera de Costa Rica, a subsidiary of the Union Oil Company of California, in 1956 made the first discovery of oil in Central America. The well is 16 miles from the Caribbean coast and less than a mile from the Panama border. 6,p.153/ The discovery well, the fourth drilled by Union Oil on its 3.5-million-acre concession, was soon abandoned as noncommercial. 1,p.215;85/ A fifth well initially encountered salt-water infiltration, but the problem was overcome and the well was shown to have a productive capacity of about 200 b/d. 90/ Further drilling will be necessary to evaluate the find, but it appears to be the most significant yet made in Central America. 85/

The Costa Rican Ministry of Agriculture and Industries is preparing specifications for concession bids in the provinces of Heredia, Alajuela, Puntarenas, and San José as a result of the interest shown by at least nine oil companies. Seven of the nine are U.S. firms, the others European. As of January 1957, the Union Oil Company was the only firm holding petroleum exploration and exploitation rights in Costa Rica. The new concession grants will be based on the basic petroleum legislation being prepared by the Ministry for submission to the Legislative Assembly in the early part of 1957. The new petroleum law will be patterned very closely after Bolivia's petroleum legislation. 91,92/

D. Guatemala

In 1955 the Government of Guatemala issued a new petroleum code which rescinded a 1949 law that was designed by the prior leftist regime to make untenable any investment of private capital in exploration for or development of Guatemala's oil resources. Since the promulgation of the new code, which welcomes private investment, at least 29 groups have applied for exploration concessions. 1,p.214/ By late November 1956, exploration rights had been parceled out for more than 8.5 million acres. Companies applying for concessions included several Guatemalan and other Central American groups, a number of independent U.S. oil firms, and such major concerns as Union Oil of California, Standard Oil of Ohio, Standard Oil of New Jersey, Texas Petroleum, Sun Oil, Amerada Petroleum, Atlantic Refining, and Royal Dutch-Shell. Most of the concessions are for areas in the northern lowland, in the department of El Petén, a vast, forest-covered plateau encompassing about one-third of the total area of the country. 6,p.154/ Concessions have also been requested in the neighboring departments of Alta Verapaz, Izabal, and El Quiché. 93/

Exploratory work is expected to proceed slowly because of the difficult terrain. Complications may also result from Guatemala's claim that British Honduras is rightfully her territory. On the basis of this claim, the Guatemalan Government may refuse to permit the importation of oilfield supplies and equipment and the export of oil through British Honduras, the shortest route to and from the Caribbean.

E. Honduras

In 1954 the Government of Honduras enacted a petroleum law, but it has done little else to encourage petroleum exploration. 85/ A 48-million-acre exploration concession along the northern coast, consisting of 14 million acres on land and the remainder offshore, has been acquired by a Texas firm. The concession, governing the search for oil, gas, coal, iron, sulphur, and manganese, is for 20 years. 1,p.215;94/ Drilling operations were reported to be in progress in mid-1956. 85/

F. Nicaragua

An outmoded mining code (there is no separate petroleum law) has discouraged major oil companies from taking an active interest in Nicaragua, although Gulf Oil carried out a seismorgraphic survey there in 1946. The government, however, has been working on a new natural-resources law that reportedly will offer greater inducements for petroleum exploration. 85/ The new law is scheduled for enactment during 1957. 95/

The only known petroleum concession in Nicaragua is owned by the Waterford Oil Company, a U.S. firm, which controls most of the Nicaraguan Atlantic coastal shelf, an area of approximately 10 million acres. Drilling was started during the early part of 1957, in the Cayos Miskito area, about 25 miles offshore and 45 miles northeast of Puerto Cabezas. 95/

G. Panama

The discovery of oil in 1956 in adjacent Costa Rica spurred interest in Panama's oil potential. The Union Oil Company of California, which made the Costa Rican find, planned to start work in 1957 on a 350,000-acre concession that adjoins its Costa Rican acreage. At least five other oil companies, all U.S. firms, also planned to begin activities in Panama in 1957. 6,p.153-154/ One company, a subsidiary of the International Oil and Metals Corporation of Los Angeles, completed initial surveys and one test hole in the Darién area during 1956. 85/

For a number of years there has been much speculation about oil possibilities in Panama, and some exploration has been undertaken, but no oil has been produced in commercial quantities. There are six sedimentary basins in which the accumulation of oil would be possible. Of these, Darién, David, and Bocas del Toro are believed to be the most favorable. Almost the entire land area of Panama, as well as offshore strips, are under lease for petroleum exploration. 96/

Contracts were signed in May 1956 between the Government of Panama and two U.S.-owned Panamanian companies for the construction of petroleum refineries in Panama. 97/ One of the companies, Refinería Panamá, plans to build its refinery at Las Minas Bay in the province of Colón. The plant is to have a 70,000-b/d capacity and will cost some $50 million. Under the terms of the contract, the company must begin refining petroleum not later than February 1959. The second company, Refinería y Petroquímica de Panamá, plans to build a 55,000-b/d refinery, also in the province of Colón. Construction on this plant was scheduled to begin in 1957, but no completion date has been announced. 98/

IV. The Caribbean

A. Barbados 99/

Between 1920 and 1950, the British Union Oil Company had a monopoly on prospecting rights for petroleum on Barbados, an island in the British West Indies about 200 miles northeast of Trinidad. During this period the company drilled more than 50 wells without finding petroleum; one natural-gas well was its sole success. In 1950, the Barbados Government enacted the Petroleum Act which, in effect, rescinded the prospecting monopoly granted to British Union. The company was, instead, given a prospecting license over approximately half the 166-square-mile island. Concession rights to the remainder of the island were acquired by the Gulf Oil Company.

Recently British Union relinquished its prospecting license. The primary remaining assets of the company -- now called Barbados Union -- consist of a small refinery, which processes crude oil from Trinidad, and a few service outlets for the products obtained. On an island that has not yet shown an interest in octane, the company appears to be holding its tiny corner of the market against the three large international distributors, Shell, Esso, and Regent.

The Barbados Gulf Oil Company, a Gulf Oil subsidiary, has conducted exploratory surveys on various parts of the island and has spent $4 million wildcatting. As yet, however, no crude oil has been found. Of five test wells drilled, the first contained natural gas and was sold to a government-owned utility; the next two were dry; the fourth struck a limited, high-pressure gas reservoir containing noncommercial quantities; and in January 1957 the fifth well was close to the projected minimum depth of 12,000 feet. Whether or not the company will extend its license to cover the acreage yielded by British Union probably depends on the results of the last well.

B. Cuba

Four producing oilfields are located in Cuba, three in the central part of the island and the other a few miles east of the capital. (See map 25951.) The Jatibonico field is in Camagüey Province; Jarahueca and Motembo are in Las Villas Province; and the Habana field is in Habana Province. Motembo produces natural naphtha, and the others are crude-oil producers. 100/ In each of these fields, the rolling or slightly hilly terrain and the mild climate present few obstacles to development of the petroleum resources.

The existence of petroleum in Cuba has been known for almost a century, but not until the late 1930's did annual production exceed 100,000 bbls. Production slowly increased to a peak of 300,000 bbls. in 1947 and then declined to a mere 17,000 bbls. in 1953. 1,p.145/

The first discovery of sedimentary oil in Cuba in May 1954 resulted in considerable excitement in Cuban and foreign oil circles. This discovery plus a new law designed to stimulate oil exploration in Cuba touched off the biggest oil boom in the island's history. 101/ Output increased significantly in 1954, but the effects of the new discovery and the new law were more evident in 1955. Production in that year reached 380,000 bbls. -- more than 6 times the amount produced in 1954. 1,p.145/ The upward trend continued through 1956, although the tempo abated somewhat; total annual production for the year was 540,000 bbls., or nearly 10 times the 1954 output. 102/

Cuba's oil history before the recent boom had been largely negative. From 1865 until 1954, only 3 small fields had been found -- Bacuranao, Motembo, and Jarahueca -- producing a total of some 3 million bbls. From 1930 to 1951, Standard Oil of New Jersey, Atlantic, Shell, and Gulf drilled 27 major exploratory wells without finding producers; subsequently, all but Gulf withdrew from further exploration. 103/

After most of the major oil companies had departed, independents and groups of independents became increasingly interested in Cuban oil prospects. Cubans themselves provided a major part of the initiative that touched off the present boom. Probably in no other Latin American country has national private enterprise participated to such an extent in the risky business of wildcatting. The independent firms were attracted by vast, undrilled, prospective oil lands governed by a favorable oil law. In addition, the geographical location is ideal: Cuba is closer to the east-coast markets of the United States than are the Gulf-coast or Caribbean competitors; and it has proximity to equipment-supply sources, which means low exploration costs, particularly since the terrain of Cuba is as

easy to explore as that of Florida and is easier than many parts of Louisiana. Also, there is a domestic market that currently has to be supplied by imports. 103/

The Cuban Government was eager to encourage the new industry, which could mean the deliverance of Cuba from complete dependence on its one-crop sugar economy. As a step in this direction, the government bought a rig to make deep drilling equipment available to independents. Technicians from the United States, working for an independent Cuban concern, used the government-owned rig to drill a deep test well a few miles from the town of Jatibonico. 104/ On 1 May 1954 the well was completed as a 250-bbl. producer, and the oil rush was on. 103/

The Jatibonico field was a relatively minor discovery as oilfields go, but the new well was heralded as the first to produce from nonserpentine, sedimentary rock and the first in the southern part of the island. Thus, an entirely new light was thrown on the exploration situation. The discovery confirmed in part the new theories of geologists that had led them to turn south, and it signaled the beginning of the extensive exploration that was to follow. 103/

To provide additional incentive for wildcatting, the Cuban Government also reduced concession rentals, exempted exploration companies from many taxes, and established a policy of making exploration loans to be repaid with oil. 103/

The boom created by the independents has brought back the major companies that abandoned Cuba and has attracted a large number of other companies, both "majors" and independents. At the end of 1956, at least 35 companies were actively engaged in exploration, including a dozen Cuban firms. 6,p.152/ Additional property acquisitions during the latter part of 1956 put the major companies in the forefront, however, continuing an apparent trend toward such concentration. 102/ The company that has the biggest exploration budget is Stanolind Oil and Gas, a subsidiary of Standard Oil of Indiana. Stanolind plans to spend $10 million in a 5-year program which has 4 more years to go. In 1955, just when the initial fervor of the oil boom was beginning to cool, the company acquired concession rights to some 12 million acres -- an area equivalent to almost half the island's entire acreage. 105/ This spectacular indication of confidence in Cuba's oil potential has done much to maintain the interest of other companies in Cuban oil prospects.

One explanation for the return of the large oil companies is the belief that many of the wells drilled in Cuba 20 years ago would have been producers if drilled today, by modern methods. Another

reason seems to be that the prospects for important discoveries are becoming more favorable with each addition to the knowledge of the geology of the island. 103/

The Jatibonico oilfield is located several miles northeast of the town of Jatibonico, in the western end of Camagüey Province, central Cuba. Production from this field has increased from 10,000 bbls. in 1954, when the field was discovered, to almost 300,000 bbls. in 1955, 100/ to just short of 400,000 in 1956. 106/ More than half of Cuba's crude oil comes from this one field.

The so-called Habana field lies across the bay from the city of Habana and actually includes three separate but adjacent oilfields: Bacuranao, Cruz Verde, and Santa Maria del Mar. These fields produced a combined total of 1,500 bbls. in 1954, 21,000 in 1955, and 110,000 in 1956. Most of this output has come from the Cruz Verde and Santa Maria del Mar fields. 100,106/

About 12 miles northwest of Jatibonico, in Las Villas Province, is the Jarahueca oilfield. Production from this field amounted to 40,000 bbls. in 1954; increased to 55,000 in 1955; 100/ and declined to about 30,000 in 1956. 106/

As previously stated, the Motembo field, which is located in the northern part of Las Villas Province, produces natural naphtha. Production has been relatively stable, averaging between 6,000 and 6,500 bbls. in 1954, 1955, and 1956. 100,106/

Opinions differ as to the extent of Cuba's petroleum reserves. The editors of the Cuban Petroleum News Digest consider that Cuba has no proved reserves as such, but rather that it has a probable future production of oil. They claim that the Cuban fields are not susceptible to generally accepted methods of determining reserves but that Cuba had a potential production of 3 million bbls. as of the end of 1955. 100/ A second reliable source credits Cuba with reserves of 4 million bbls. as of December 1956. 6,p.105/

At the end of 1955, Cuba had three operating refineries. Esso Belot Refinery, across the bay from the city of Habana, had an 8,700-b/d capacity; Refinería Cabaiguán, in the town of Cabaiguán, Las Villas Province, 2,000 b/d; and the Refinadora Bacuranao, a small topping plant near the Bacuranao oilfield, 300 b/d. The total crude charging capacity was 11,000 b/d; 1955 runs to stills totaled 9,000 bbls. 100/

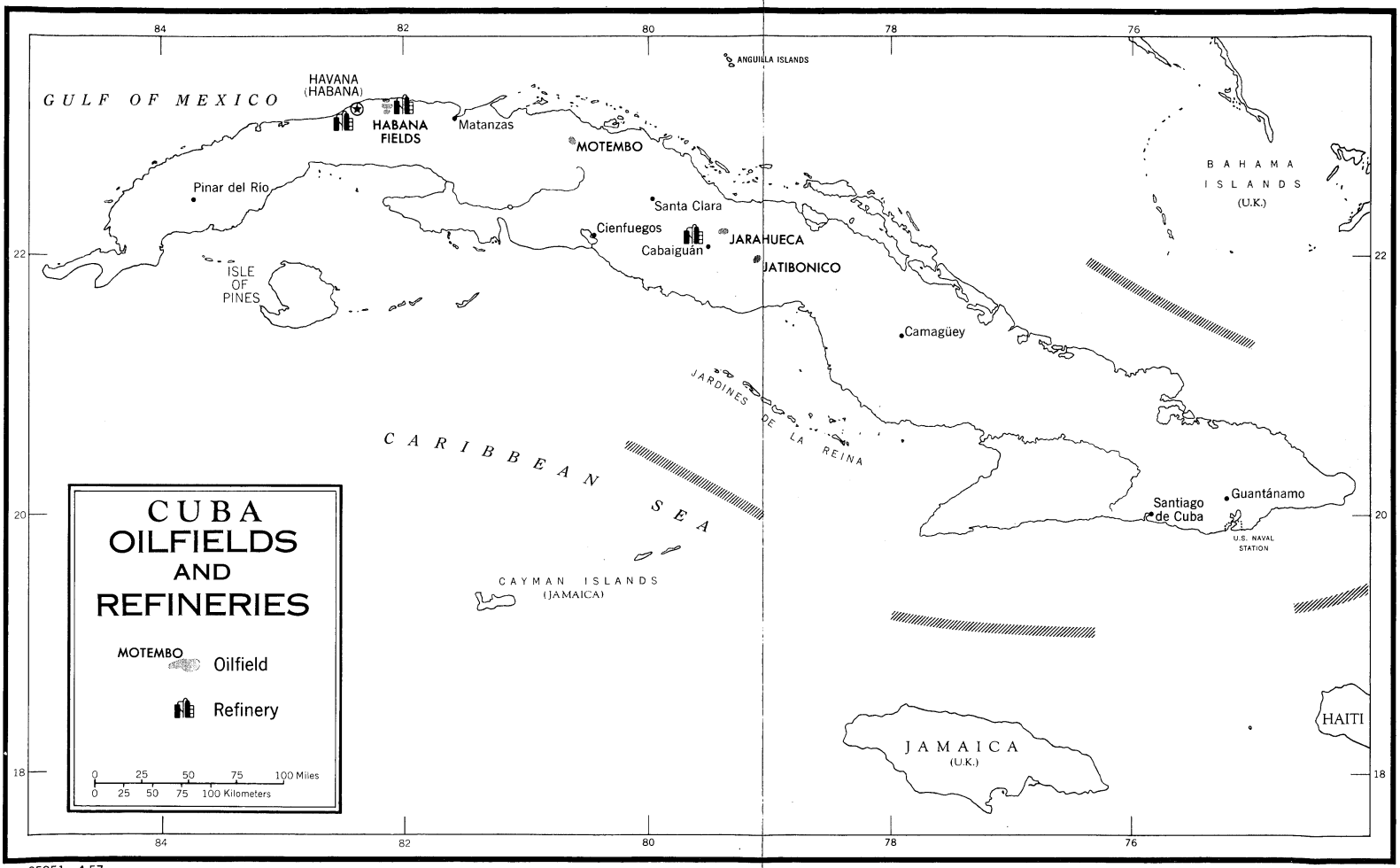
To meet the growing demand for petroleum products, several companies are active in a $70 million refinery-construction program which will increase Cuba's capacity eightfold. 102/ A 5,000-bbl.

refinery is planned for the Cienfuegos industrial district; a 20,000-bbl. refinery constructed by the Texas Company at Santiago de Cuba is expected to be in operation in 1957; the Belot refinery is to be enlarged to a 30,000-bbl. capacity and should be operating at the increased capacity in 1957; and the Shell company is working on a 27,000-bbl. refinery near the Esso Belot plant. The Shell refinery also is scheduled for operation in 1957. 100/

When the new refineries are completed, Cuba will have a daily refinery capacity of approximately 85,000 bbls. Much of this product will be exported, inasmuch as requirements of the domestic market are only about 60,000 b/d. All three major companies -- Texas, Shell, and Esso -- expect to export part of their production. 100/

Despite an impressive increase in the amount of crude oil produced in Cuba in 1956, the output amounted to only 9 days' consumption requirements. Practically all the petroleum used in Cuba is still imported, and no petroleum is exported. 102/

Cuba has an adequate road network for transportation of petroleum and petroleum products. At the end of 1955, there were no petroleum pipelines and, inasmuch as domestic production is relatively minor, it was not expected that any would be constructed in the near future. 102/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GULF OF MEXICO
HAVANA (HABANA)
HABANA FIELDS
Matanzas
MOTEMBO
ANGUILLA ISLANDS
BAHAMA ISLANDS (U.K.)
Pinar del Río
Santa Clara
Cienfuegos
Cabaiguán
JARAHUECA
JATIBONICO
ISLE OF PINES
Camagüey
JARDINES DE LA REINA
CARIBBEAN SEA
Santiago de Cuba
Guantánamo
U.S. NAVAL STATION
CAYMAN ISLANDS (JAMAICA)
HAITI
JAMAICA (U.K.)
CUBA
OILFIELDS
AND
REFINERIES
MOTEMBO
Oilfield
Refinery
0 25 50 75 100 Miles
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C. Dominican Republic

Currently, petroleum is not produced in commercial quantities in the Dominican Republic despite the fact that indications of the existence of oil in the country have been noted for many years. Reportedly, a U.S. company drilled exploratory wells in the provinces of Azua and Barahona, in the southwestern part of the country, in the 1940's. Some of these wells produced oil, but because of their low productivity and the high sulphur content of the oil, further development of the wells was not considered worthwhile. 107/

Even before this drilling program, the Azua area had attracted the attention of oil prospectors. An authoritative study published in 1921 states that six wells, several of which produced some oil, had been drilled near the Azua oil seepages. Apparently production from these wells was inadequate for commercial development, since the study notes that there was considerable difference of opinion as to the results obtained. 108/

In 1954, press reports indicated that the Government of the Dominican Republic had signed a contract with a group of Mexican petroleum technicians to explore the petroleum resources of the Dominican Republic as part of an overall plan for geological exploration. Another press report noted that the Mexican technicians had initiated surveys in the Azua area. 107/

In 1956 U.S. oil firms showed indications of a growing interest in petroleum prospects in the Dominican Republic. Some concern was evidenced, however, over the 1956 enactment of a petroleum law that places petroleum exploration, exploitation, and development in the category of a public utility and therefore subject to close and unpredictable government regulation. This concern was illustrated by the decision of the Shamrock Oil Company of Texas to suspend negotiations for a concession owing to the lack of clear assurances regarding any future operations. 109/

D. Haiti

As an eastward extension of the Cuban geologic environment, Haiti may merit, but has never received, detailed petroleum exploration. Test wells have been drilled but there has never been any commercial production of petroleum in the country. 3,p.48/

In 1955 the first of three scheduled test wells was drilled by a Texas firm on the Ile de la Gonave, an elongated island about 32 miles northwest of Port-au-Prince. This well, located in the northwestern part of the island, was abandoned because of mechanical difficulties. In mid-1956 another test well was being drilled about halfway up the slope of the island, but the results of this test are not yet available. A third well was scheduled to be drilled on the highest part of the island as soon as the second well reached its projected depth of 8,000 feet. 110/

Petroleum exploration surveys were made during the 1940's in various parts of mainland Haiti, including the Cul-de-Sac Plain, the Artibonite Plain, the Central Plain, and the Les Cayes Plain. At least four test wells were drilled, but no oil was encountered. 6,p.155/

E. Jamaica

Some exploration for petroleum has been undertaken in Jamaica and a basic petroleum law has been in existence for almost 20 years, but no commercially productive deposits have yet been proved. 111/

In 1955, Base Metals Mining Corporation of Toronto, Canada, drilled a test well at Negril Spots, in the western part of the island. The well, though dry, had encouraging "shows" of petroleum and indicated a favorable geologic situation. In 1956 the Standard Oil Company of Indiana acquired Base Metals' exclusive exploratory rights to the entire island of Jamaica and the submerged offshore lands, 1,p.214/ although Base Metals retained some interest in the concession. 112/

Jamaica Stanolind Oil Company, a Standard of Indiana subsidiary, has conducted intensive geological and geophysical surveys and in June 1956 began drilling a test well on Santa Cruz Mountain, 60 miles west of Kingston and about 45 miles southeast of the Base Metals test site. 1,p.214/

F. Netherlands Antilles

No crude oil is produced in the Netherlands Antilles but the world's leading export refining industry is located on the islands of Aruba and Curaçao. The Aruba refinery of Lago Oil and Transport Company (a Canadian corporation and wholly owned subsidiary of Standard Oil of New Jersey) has a capacity of 440,000 b/d. The Curaçao plant of N. V. Curacaosche Petroleum Industrie Maatschappij (Royal Dutch-Shell) has a capacity of 210,000 b/d. Both refineries use Venezuelan crude. 6,p.155/

(For further details concerning these refineries, see section on refineries under "Venezuela.")

G. Puerto Rico

Crude oil has never been produced in commercial quantities in Puerto Rico, and the prospects of finding oil on the island have not been considered favorable. Nevertheless, an oil and gas concession for more than 1,000 square miles in Puerto Rico was awarded in 1956 to an independent oil firm. The concession permits exploration along the island's north and south coasts, including adjacent water areas. Reportedly, the first test well will be drilled near Ponce, on the southern side of the island. 113/

Puerto Rico's first petroleum refinery, a 13,500-b/d plant at San Juan, was opened in 1955 by the Caribbean Refinery Company, which is owned by several oil companies and other investors. The second refinery, with a capacity of 23,520 b/d, went on stream in 1956. This plant is located at Guayanilla Bay and is owned by the Commonwealth Oil Refinery Company. Also, Puerto Rico has a major expansion program underway, which is to include construction of a 35,280-b/d crude unit, a 26,800-b/d vacuum distillation unit, and a 26,800-b/d catalytic cracker. 6,p.153/

H. Trinidad

1. Geographic Setting of the Oilfields

Trinidad is divided into five topographic regions that extend in an east-west direction across the island, roughly parallel to each other. These comprise 3 ranges of hills and mountains, separated by 2 belts of relatively low, flat land; from north to south, they are the Northern Range, the Northern Basin, the Central Range, the Southern Basin, and the Southern Range.

Most of the oil-producing fields of Trinidad are concentrated in the western end of the Southern Basin and in the hills of the Southern Range. (See map 25944.) The remaining parts of the island, with the exception of the mountainous area in the north, may be considered as potential oil territory. Prospects for the discovery of significant quantities of oil are also favorable in the offshore areas of Trinidad, particularly in the Gulf of Paria which lies between Trinidad and Venezuela. 114,sec 1,p.1/

2. Status and Development

Trinidad produces less than 1/2 of 1 percent of the total world production of crude oil, but it ranks high among the producing areas of the British Empire and is therefore an important source of oil for the sterling bloc. The island's petroleum industry is also of considerable importance to the domestic economy of Trinidad. It is the colony's principal industry and contributes about one-third of the total revenue received by the government. 114,sec 2,p.1;sec 7,p.1/

The many surface indications of petroleum in Trinidad aroused interest at an early date. The first well was drilled in 1866, but not until 1907 was the first commercial well completed. 3,p.85/ Since then, 23 fields have been discovered.

The Trinidad oil industry has been developed largely by British companies. Until 1945, only citizens of the United Kingdom could obtain leases or concessions in Trinidad. Since then, others have been permitted to obtain concessions if their countries of origin grant similar privileges to British citizens. 114,sec 7,p.1/

A relatively stable political situation, an adequate transportation network, and favorable terrain have permitted exploratory and development work to be pushed ahead rather vigorously. Thus, despite depletion of older fields in recent years, production has been increasing at a fairly constant rate. 114,sec 1,p.8/

3. Production

Trinidad's yearly crude-oil production increased steadily in the years prior to World War II -- from 9 million bbls. in 1930 to more than 22 million in 1940. Production declined slightly during the war, mainly because Trinidad was unable to obtain sufficient equipment and supplies for exploratory drilling. As a result, no new sources of production were found. 114,sec 2,p.1/ For 5 years after the war the amount of crude produced declined still further, but since 1950 the total has been increasing about 5 percent each year, reaching a peak of almost 25 million bbls. in 1955. 1,p.145/ Information is not yet available on the total amount produced in 1956, but the production rate has increased considerably. In 1955, the daily rate was 68,000 bbls.; 8,p.141/ in September 1956, the daily output had passed the 80,000-bbl. mark. The gains have resulted from intensive development drilling. 6,p.152/

According to some reports, the peak production from the Trinidad oilfields has passed. Consequently, the oil companies are emphasizing exploration, not only on the island but also in the offshore areas, in the hope of offsetting the impending production decline. 114,sec 2, p.1/ This program is already showing signs of success; for example, important discoveries have been made in the Gulf of Paria. 1,p.218/

The oilfields in the Southern Basin in southwestern Trinidad account for more than 90 percent of the island's production. Most of the remaining crude comes from the Guayaguayare fields in the southeast. 114,sec 2,p.2/ The following table gives data on the production of Trinidad's major fields.

Crude-Oil Production of Major Fields 6,p.150;8,p.192/

Field and year of discovery	Production in b/d First half 1955 a/	1956
Brighton-Vessigny, 1908	2,843	n.a.
Forest Reserve-Apex-San Francique, 1913	26,100	174
Guayaguayare, 1902	1,908	n.a.
Kern-Parry Lands-Cruse, 1913	8,554	n.a.
Ortoire, 1952	n.a.	4,246
Palo Seco-Los Bajos, 1926	4,598	n.a.
Peñal-Barrackpore, 1918	9,517	6,645
Point Fortin, Point Liguare, 1908	5,635	8,806
Quarry-Coora-Quinam-Morne Diablo, 1936	6,031	n.a.

a.Data not available for last half of 1955.

Two companies, Trinidad Oil (formerly Trinidad Leaseholds) and United British Oilfields of Trinidad, have dominated the island's oil industry. In 1955, their fields furnished more than half the total crude-oil production. 1,p.222/ Trinidad Oil was British owned until 1956, when it was sold -- despite a storm of protest in the British Parliament -- to the Texas Company, a U.S. firm. 6,p.151/ United British Oilfields is owned and managed by one of the parent companies of the Royal Dutch-Shell Group. According to available information, the Standard Oil Company of California is the only other U.S. company that has major investments in the Trinidad oil industry. 114,sec 7,p.3/

The following table contains data on the amount of crude-oil produced by each company in Trinidad.

Crude-Oil Production by Company, 1955 1,p.222/

Company	Bbls.
Trinidad Leaseholds	6,464,290
United British Oilfields Trinidad	6,544,501
Trinidad Petroleum Development	3,522,143
Apex (Trinidad) Oilfields	3,005,101
Trinidad Central Oilfields	1,465,134
Antilles Petroleum	1,298,637
Kern Trinidad Oilfields	964,799
Siparia Trinidad Oilfields	826,792
Trinidad Northern Areas	438,703
Premier Consolidated Oilfields	365,615
C. D. Jones	90
Total:	24,895,805

4. Reserves

The proved reserves of crude petroleum in Trinidad were estimated at 285 million bbls. at the end of 1956. 6,p.105/ On the basis of the estimated extent of "probable" petroliferous sediments, it appears that future discoveries in Trinidad (including both land areas and submerged areas) could at least equal the proved reserves. Therefore, an estimate of the total probable reserves could reach 600 million bbls., half of which might be developed in the offshore areas. 114, sec 1,p.8-9/

Based on available geologic information, all of Trinidad south of the Central Range may be considered "favorable" for the existence of petroleum in commercial quantities. This area is underlain by the same kind of geologic formations as in the producing fields.

"Favorable" structures also have been located under the Gulf of Paria, which lies between the producing areas of eastern Venezuela and those of southwestern Trinidad. 114,sec 1,p.3/ Many believe that the best prospects for developing substantial additional reserves lie in this offshore area. Among the best wells on the island are those drilled under the gulf from onshore sites. 6,p.122/

"Possible" petroleum areas include the Central Range and the Northern Basin. The Northern Range is the only part of Trinidad that is considered "unfavorable" for the discovery of petroleum. 114,sec 1,p.3-4/

5. Refineries

Of the three refineries on the island, the largest is located at Pointe-à-Pierre, about 30 miles south of Port-of-Spain on the west coast. This refinery was constructed by the Trinidad Oil Company, Ltd. (formerly Trinidad Leaseholds, Ltd.), but in 1956 it was sold, along with other assets, to the Texas Company. 6,p.151/ The second largest refinery is at Point Fortin, about 20 miles southwest of Pointe-à-Pierre. It is owned by the Shell Group and is operated by a subsidiary, the United British Oilfields of Trinidad, Ltd. The other refinery is a small topping plant at Brighton, located about midway between Pointe-à-Pierre and Point Fortin on the Gulf of Paria. This refinery, operated by Brighton Terminal, Ltd., a U.S. firm, obtains some of its crude oil from Trinidad and some from Venezuela. 114,sec 3,p.2-3/

The following table indicates the capacities of these refineries as of the end of 1956.

Refineries 6,p.151/

Company and location	Capacity, bbls. per stream day	
	Crude distillation	Cracking a/
The Trinidad Oil Co., Ltd. (Pointe-à-Pierre)	100,000	30,000 Vis 25,000 FCC
Shell Trinidad, Ltd. (Point Fortin)	33,000	
Brighton Terminal, Ltd. (Brighton)	4,000	
Totals:	137,000	55,000

a.Vis -- visbreaking; FCC -- fluid catalytic cracking.

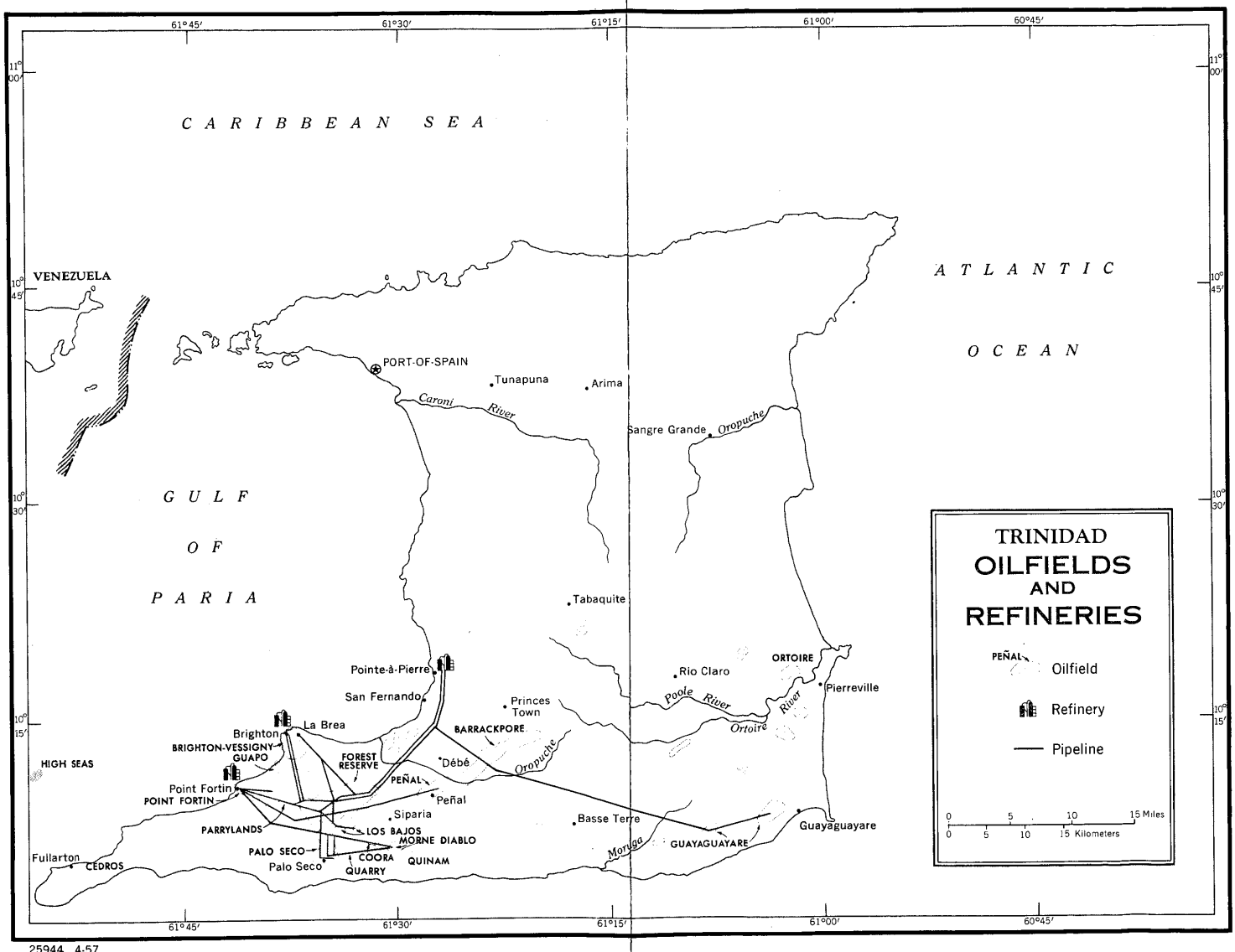
6. Markets and Transportation

Since Trinidad's internal market for petroleum requires only a small proportion of the total production, most of the island's crude oil and refined products are exported. External markets and the bunker trade absorb over 90 percent of the oil produced. 114,sec 6,p.1/

In 1955 Trinidad exported about 3 million bbls. of crude petroleum. 11,p.3/ Information is not available on the destination of petroleum in that year, but Canada has consistently been Trinidad's best customer since World War II. 114,sec 6,p.2/ Exports of refined products, which actually sustain the Trinidad oil industry, went primarily to the United Kingdom, but substantial amounts have been sent to Argentina, Brazil, and numerous other markets. 114,sec 6,p.4/ In 1954, major refined products totaled about 35 million bbls., most of which were exported or used in the bunker trade. 82,p.6/

Trinidad imported 18 million bbls. of crude oil in 1955 for processing and reexport. 11,p.3/ Most of this crude, which was brought in to maintain refinery operation, came from Venezuela. 114,sec 6,p.2/ Few refined products are imported.

All the crude oil produced in Trinidad is transported from the fields by pipeline. Since the fields are close together and near the refineries and terminals, the pipelines are shorter than those in most oil-producing countries. Railroads and highways play only a minor role in the transportation of petroleum on the island. 114, sec 4,p.1/



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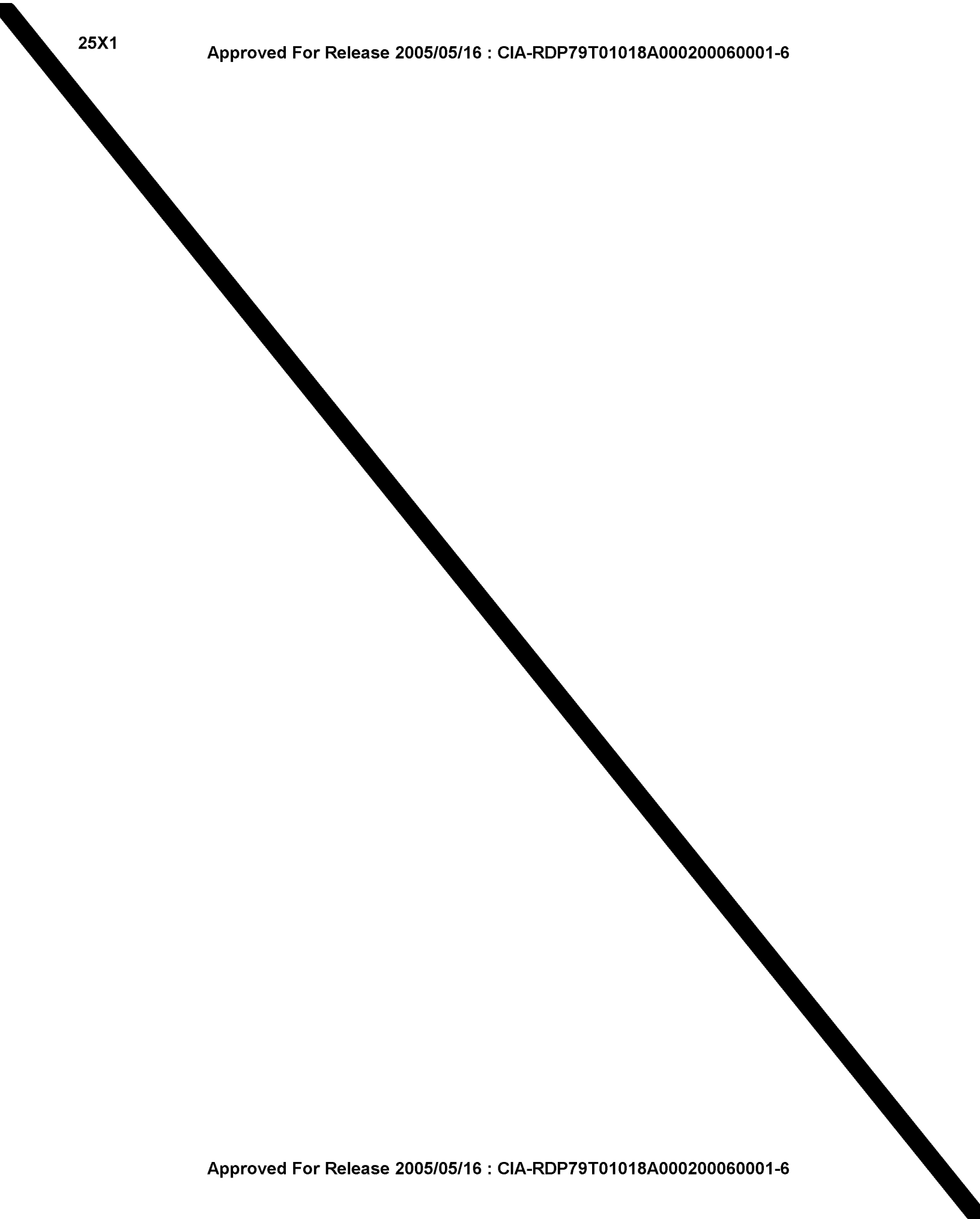

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Petroleum information is not only readily available but voluminous for Venezuela, Mexico, Colombia, and other countries where the petroleum industry has considerable national and international importance. For countries where petroleum is of minor significance, data are fragmentary but are sufficiently complete for purposes of this study.

For all the countries, source material on the geographic setting of the oilfields was adequate and for the most part thoroughly reliable. Information on the development and current status of the petroleum industries for most of the countries considered was available in a number of authoritative sources. Petroleum production figures varied somewhat from source to source and were not always as detailed or as up-to-date as might have been desired, but the gaps and inconsistencies were of relatively minor significance. Estimates of the petroleum reserves were far from uniform; where major differences of opinion were encountered, the conflicting viewpoints were included in the study and, where possible, the reasons for these differences were stated. Detailed information on refineries was readily available in various sources but the information was not always in agreement, particularly as to capacities. This lack of uniformity was to be expected because a major refinery expansion program is underway in Latin America and changes are occurring almost daily. Data on the principal markets for Latin American petroleum and petroleum products were less readily available and less complete than for any other subject considered in the study. Sufficient reliable information was obtained, however, to present an overall view of the market situation. Pipeline information was reliable and in sufficient detail; data on the movement of petroleum by road and railroad was fragmentary but these means of transportation are relatively unimportant so far as the petroleum industry in most of the countries considered in this study is concerned.

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