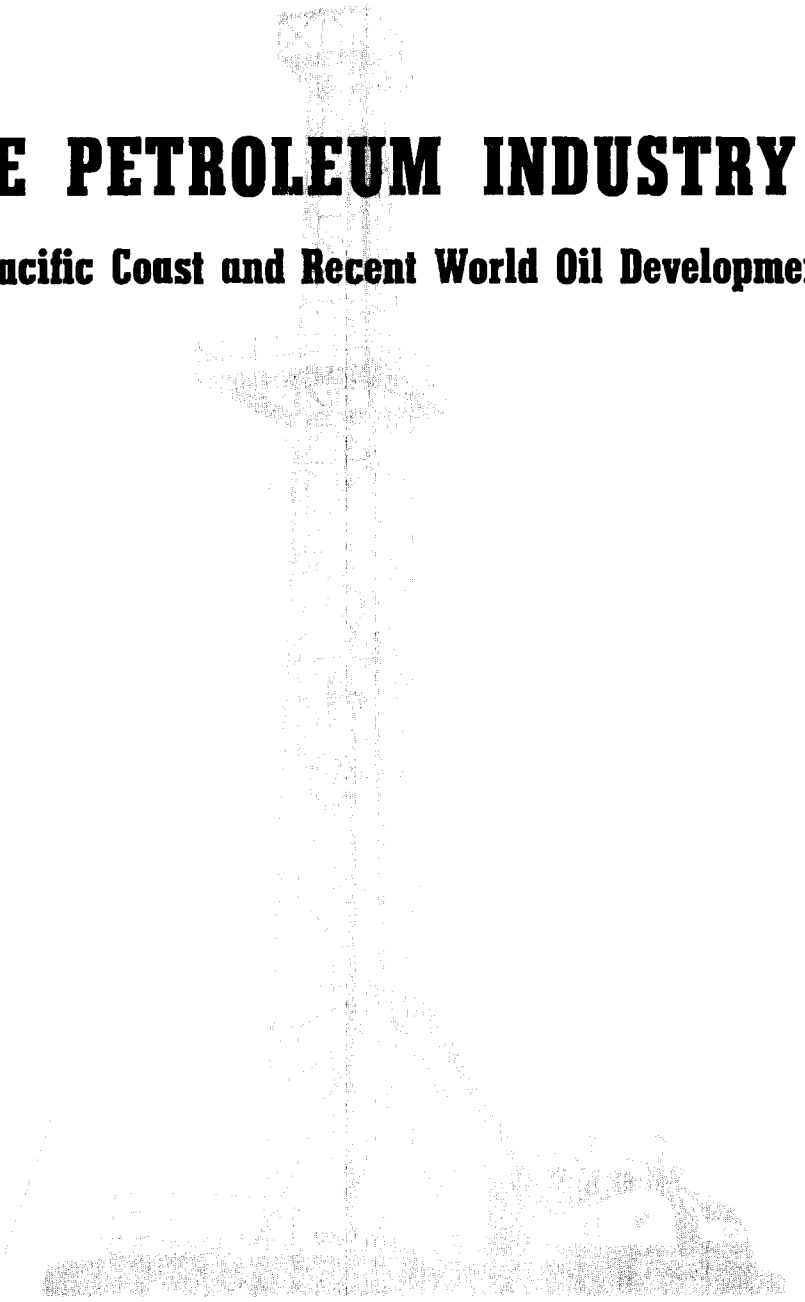
THE PETROLEUM INDUSTRY

on the Pacific Coast and Recent World Oil Developments



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The world petroleum situation has undergone remarkable changes in the past decade. Production and consumption of petroleum have more than doubled. The Middle East has risen to prominence among sources of the world's oil, and its shipments of oil to Europe have displaced a large volume of Western Hemisphere exports. The United States, formerly the world's largest petroleum exporter, is now one of the largest petroleum importers.

The Pacific Coast oil industry has had an important share in these changes. In the two decades before the second World War, production of crude oil on the Coast was far in excess of local demand, and large quantities of both crude oil and gasoline were sold to the rest of the world—often, in fact, practically dumped on the world's markets for whatever price they would bring. By contrast, since the second World War, the demand for petroleum products in the domestic markets normally served by Pacific Coast refiners has been overtaking the locally produced petroleum supply so rapidly that in 1953 the Coast was a net importer of oil. Exports of oil, however, have continued large, so that at the present time the Pacific Coast simultaneously imports and exports oil. One of the reasons for this paradoxical situation is that the Coast produces a large proportion of low gravity crude oil but has refining facilities much better adapted to high gravity crudes. With existing facilities, which are constantly being improved, it is difficult for the industry to meet the market demand for all products without supplementing local supplies of crude with some high gravity crudes, or their equivalent, obtained elsewhere.

The concern over the recent top-heavy inventory situation in the oil industry has made the high level of oil imports into the Pacific Coast a subject of much debate. There are also many other elements in the current inventory problem. The end of active hostilities in Korea, the competitive inroads of natural gas on the oil industry, the accumulation of cracking stocks in anticipation of additions to the refining capacity, and the mildness of the 1953-54 winter have all played some part in the growth of inventories to their present high level. But in spite of the temporary oversupply, the basic problem of the Pacific Coast petroleum industry in its present stage remains one of a shortage of the right kind of locally produced crude oil.

Since it is too soon to appraise them, this study takes no account of the possible effects upon Pacific Coast oil production that may occur in the future as a result of the transfer of title in May 1953 of certain offshore tidelands from the Federal Government to the respective coastal states.

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RECENT WORLD PETROLEUM DEVELOPMENTS

THE past decade has witnessed a remarkable expansion and development of the world's petroleum industry. This expansion has occurred so smoothly and imperceptibly that the community as a whole has probably taken its results for granted without realizing that something like a revolution in basic energy sources has been taking place. Total world production and consumption of petroleum have more than doubled within the past ten years while coal has gained a scant 10 percent. Increasingly the nations of the modern world are turning to petroleum and its associated natural gas as primary sources of heat and power. The search for new oil fields goes on apace in many parts of the globe and important shifts have occurred in the flow of oil in international trade. All signs point to the permanence of these trends, as enormous additional investments continue to be made in enlarging the world's oil producing and marketing facilities.

The reasons for the rapidly accelerating demand for petroleum and natural gas are almost as numerous as the complex activities of modern industrial society itself. The economy and convenience in use of oil and gas for heating purposes and as boiler fuel have played a large part in the displacement of coal. The internal combustion engine, whether using gasoline or diesel fuel, has taken over a considerable fraction of the world's marine transport and an increasing part of its railway traffic. The almost universal use in this country of the automobile and its rapidly increasing use in other countries, especially for highway transport of goods, represents of course a completely new market for energy sources in an application where petroleum products are the only practicable form of power. With the substantially complete economic rehabilitation of the war-damaged countries of Western Europe and with increased industrialization and rising standards of living in many of the "outlying" parts of the world, it is highly probable that total global demand for petroleum and petroleum products will continue to grow at a rate not far short of that experienced during the past decade.

Phenomenal rise of petroleum production in the Middle East

Outstanding among the petroleum developments of the past two decades has been the emergence of the Middle Eastern countries adjoining the Persian Gulf area both as an important source of current new supplies and, even more significantly, as the world's largest concentration of proved petroleum resources and as its potentially greatest oil producer.

Crude oil has been produced in Iran since the year 1913 when the Anglo-Iranian Oil Company began actual shipment following several years of exploratory work. Iraq came into the picture in the early 1930's when pipe lines were completed from the great Kirkuk field to the Mediterranean ports of Haifa in Palestine and Tripoli in Lebanon. By 1935-39 the combined output of these two countries, supplemented by that of Bahrein Island in the Persian Gulf and of Saudi Arabia where American interests had been systematically developing new oil fields of great potential wealth, had increased to over 100 million barrels a year, representing about 5 percent of total world production.

Following completion of the Trans-Arabian Pipe Line from Saudi Arabia to the port of Sidon on the coast of Lebanon late in 1950, Saudi Arabian oil production has expanded at a sensational pace and that country is now ranked among the first four or five crude oil producers of the world. Extending some 1,060 miles across the deserts of four nations, "Tapline" rates as a major engineering and construction project. Its original pumping capacity of 300,000 barrels per day was subsequently increased to permit the delivery of crude at the Mediterranean at a daily rate of about 500,000 barrels, making Tapline by far the world's largest oil transport system.[1]

An equally spectacular development has occurred in the Arab sheikdom of Kuwait on the Persian Gulf, where both British and American interests have been active. Shipments of crude oil from Kuwait began in 1946. Following the nationalization of the Anglo-Iranian Oil Company's properties in Iran in 1951, Kuwait took second place among the Middle Eastern producers and is currently disputing the leadership with Saudi Arabia. The combined output of these two countries, together with that of Iraq, exceeded 715 million barrels in 1952 or more than double the production of California in that year. Increased production from these areas in fact more than offset the loss of the great Iranian oil fields. The aggregate production of this entire group of Middle Eastern countries approximated 780 million barrels in 1952 or about 2,130,000 b/d. This included a small quota from Egypt and a somewhat larger and rapidly growing volume from Qatar, a sheikdom adjoining Bahrein.

Further large expansion of production took place in Iraq in 1953, made possible by the first full year of operation of a new 32-inch pipe line from the Kirkuk field to the port of Banias in Syria. This line, in effect, replaced an older line terminating at Haifa, Israel, which had been shut down since May 1948. Iraq's production jumped nearly 50 percent from 141 million barrels in 1952 to 209 million in 1953. Total Middle Eastern production in 1953 reached 894 million barrels, a rate of almost 2,450,000 b/d. This was approximately 19 percent of the estimated total world output of crude oil in that year. Already by 1950 Middle Eastern production exceeded the total output of all in the South American and Caribbean countries; last year the margin was almost 20 percent.

With the probable early rehabilitation of the great South-Iranian oil field and the resumption of operations by the world's largest refinery at Abadan, supplemented by a new 120,000 barrel per day refinery currently under construction at Aden, there can be little doubt that this

[1] *The Oil and Gas Journal*, January 25, 1954, p. 145.

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whole Middle Eastern area is destined to play an increasingly important role in world oil supplies. This conclusion is reinforced by the enormous size of Middle Eastern reserves which have been proved by the exploratory work of the past few years. These reserves are currently estimated at a figure in excess of 81 billion barrels, or approximately 58 percent of the world's total proved reserves.[1] Reserves of this magnitude could assure production at almost any rate desired, political conditions permitting, depending on the size of the market and the transport facilities available.

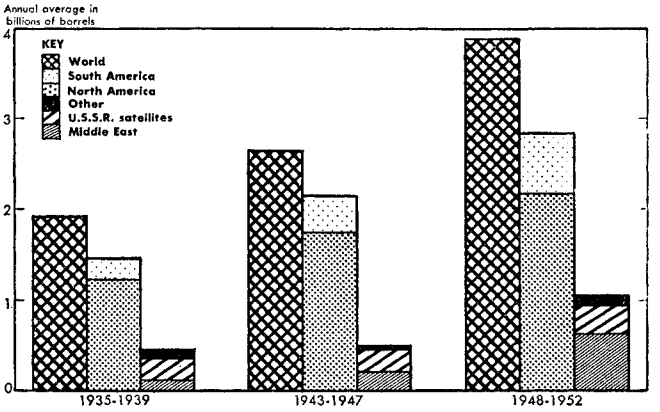
Shifts in the international flow of oil

While large refinery capacity has been installed at the seaports of the Persian Gulf area, chiefly to supply finished products to the markets of Asia and Africa, the great bulk of Middle Eastern oil output seeks its market in crude form or as fuel oil in Western Europe and the Mediterranean countries. Very large additions have been made in recent years to refining facilities in Western Europe and the Far East, much of it representing the investment of American capital. Middle Eastern shipments to European markets have replaced a considerable volume of exports from the Western Hemisphere, chiefly refined products from the United States and crude or fuel oil from the Caribbean area. Substantial quantities of Middle Eastern crude have also reached American refineries on both the Atlantic and Pacific Coasts. The loss of European markets by the Venezuela producers has tended to divert a substantial part of their shipments to the United States, chiefly in the form of heavy fuel oil, a situation which has had serious repercussions upon American producers both of oil and bituminous coal.

[1] *The Oil and Gas Journal, Loc. cit.*

CHART 1

WORLD PRODUCTION OF CRUDE PETROLEUM BY PRINCIPAL AREAS—FIVE YEAR ANNUAL AVERAGES—1935-39, 1943-47, AND 1948-52



Source: United States Department of the Interior, Bureau of Mines, *World Petroleum Statistics.*

PACIFIC COAST OIL INDUSTRY

WHAT are the implications of these developments in the world petroleum situation for the Pacific Coast oil industry? An earlier article in the *Monthly Review*[1] discussed some aspects of this question and pointed up the growing integration in recent years of the oil industry in this area with national and international oil developments. It was indicated that this closer connection has not involved a larger participation by Pacific Coast producers of crude oil and petroleum products in outside markets, but rather the converse. The vigorous growth of domestic demand has been catching up with local supplies of raw material. The unwieldy surpluses of crude which in the past plagued the Pacific Coast industry because of excessive and wasteful rates of production have long since disappeared; during the past three years, in fact, particularly in 1953, California refiners have imported substantial quantities of crude from foreign sources. Some of the markets formerly served by Pacific Coast refineries, chiefly the Intermountain states, are increasingly looking to other regions to supply their requirements for finished products, while the impending new supplies of Alberta crude made possible by the completion late in 1953 of the Trans Mountain Pipe Line will effect far-reaching changes in the production and marketing of petroleum products in the Pacific Northwest.

[1] *Monthly Review*, May 1953, "Pacific Coast Oil Industry in Transition," pp. 61-66. See also the supplement to the *Monthly Review*, November 1950, "Western Power and Fuel Outlook."

Recent changes in raw material sources and markets of Pacific Coast refiners

These developments, together with the rapid increase in the importation of natural gas into California from west Texas and New Mexico and the proposed large-scale supply of natural gas to the Pacific Northwest, either from Texas or from Canada, indicate a significant change in the fuel and energy economy of the Twelfth District. The construction during the last few years of long distance pipe lines to bring crude oil and refined products into the Intermountain and Pacific Northwest areas from such diverse sources as Colorado, Utah, Wyoming, Montana, and Alberta indicates that the use of both "outside" raw materials and finished petroleum products is likely to become a permanent part of the Pacific Coast oil economy. The demand for petroleum products caused by the extraordinary postwar population growth and the rapid industrialization of many parts of the region has begun to outrun the ability of the local industry to produce enough raw material to supply its traditional markets and leave an adequate reserve to take care of emergency requirements. Already some of the more distant markets which Pacific Coast refiners formerly dominated have been relinquished to producers more favorably located with respect to raw materials and transportation costs.

In spite of the "importation" of both crude oil and refined products into the Pacific Coast marketing area,

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California still produces more petroleum than is consumed in the domestic markets regarded by the local refiners as peculiarly their own—the five westernmost states plus Alaska, and Hawaii, and including also normal demand by the Military, much of which is actually shipped to outside points. There is even a regular and substantial volume of local crude petroleum shipped out of the area. How is this anomalous condition to be explained?

A number of influences have combined to produce this seemingly confused and illogical pattern of production and use. Some of the factors which result in apparently inconsistent practices are undoubtedly of a temporary nature and some will yield to technological progress in the industry; others may remain for a long time to come. Among the influences which have contributed in recent years to the apparent anomaly of concurrent "imports" and "exports" may be mentioned: (1) the regular shipment of California crudes to certain outside markets more economically served from this area than from other sources, in some cases involving the possibility of a convenient "back-haul," as illustrated by the shipment of California low-sulphur crudes to Japan incident to bringing cargoes of Eastern Hemisphere crudes to Pacific Coast refineries; (2) the great increase in world oil supplies in 1952-53, associated with the spectacular rise of crude production in the Middle East, already discussed above; (3) increased prices in the United States for both crude oil and refined products following the expiration of price controls in 1953 which stimulated the shipment of "outside" high gravity crudes to California refineries; (4) very low tanker rates in 1953, which made importation a paying proposition, especially where high gravity crudes were involved; (5) the sharp stimulus to military and maritime demand for oil products resulting from the Korean war, which had reduced Pacific Coast refinery stocks to extremely low levels in the winter of 1951-52; (6) the basic characteristics of California crude oils, which run to a relatively high proportion of low gravity crudes, difficult and costly to refine; (7) the relatively backward technological setup of many Pacific Coast refineries, with a high proportion of "straight-run" stills and a low proportion of supplementary cracking facilities; and (8) the structure of the Pacific Coast oil industry, consisting of hundreds of distinct and independent units whose interests are more or less diverse and conflicting, leading to a wide variety of individual practices and policies which are frequently at sharp variance with each other.

Most of the factors listed above are self-explanatory and require little or no elaboration; some of them are likely to be of temporary duration in any event. The last three items, however, call for some further comment.

Peculiar characteristics of California crude oils and the setup of the Pacific Coast refining industry

It has frequently been said that one of the basic problems of the Pacific Coast refining industry is that not enough crude oil *of the right kind* is produced in California. This refers to the well known fact that the output of a considerable number of California oil fields runs to a relatively high proportion of so-called "low gravity" crudes, which are heavier and more viscous than the high gravity or "light" crudes typical of Mid-Continent or Texas production. These low gravity or heavy crudes are intrinsically less desirable than the light crudes because of their relatively low yields of gasoline, diesel oil, and other "light" distillates—which are the higher priced products. Until recent years, in fact, some of the lower gravity California crudes were regularly classified by the Bureau of Mines as "non-gasoline bearing." This did not mean that no gasoline or other light distillates *could* be obtained from such crudes, but that in the stage of refinery technology then current it often paid better to use them as raw material for lubricants and such "low end" products as fuel oil, road oil, or asphalt rather than for straight-run distillation.

It is argued that there is not enough high gravity crude produced in the Pacific Coast area, *i.e.,* California, to provide sufficient raw material for the refineries to produce all the gasoline and other "light" distillates that the market requires. Either local supplies of high gravity crudes must be supplemented by bringing in additional supplies from outside or resort must be had to the lower gravity crudes which represent between 25 and 30 percent of the total annual production of petroleum in California. These low gravity crudes typically yield little gasoline but much heavy "residual" fuel oil.

With the type of equipment traditionally used by most California refineries, the use of heavy crude or low gravity oil as charging stock results in relatively large outputs of so-called "middle distillates" and of "residual," a really heavy fuel oil. To handle the low gravity crudes so as to obtain more of the lighter products requires the supplementary treatment of these refinery residues by methods that are technologically feasible but are relatively costly in capital requirements. The small or moderate size operator in particular would probably find both capital costs and operating costs of such equipment prohibitive. Some of the larger Pacific Coast refining and marketing companies find it necessary to go far afield in order to obtain enough high gravity crude to take care of their customers' needs. The only alternative is to install expensive refinery equipment in order to obtain salable products in the right proportion from the kinds of crude available in the local area. Both procedures are expensive; hence the dilemma.

It may be true that, taken as a whole, Pacific Coast refineries have been relatively slow to adopt generally the more advanced refining techniques employed in other parts of the country to increase the total yield of gasoline and other light distillates obtainable from a given volume of crude oil. It is true, of course, that they have a more refractory and difficult raw material to work with. It is also true that lacking coal of good quality, the Pacific Coast area has been essentially an oil-fuel economy and adequate supplies of fuel oil have been an absolute necessity in the economic development of the region. Hence the average California yields over the past ten or twelve years

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of 36 to 40 barrels of residual fuel oil per 100 barrels of total crude input (including crudes of all gravities), as compared with an over-all national average of about half that figure, were not considered unwelcome as long as an assured market for residual fuel was at hand. That situation is rapidly changing, however, as the market for heavy fuel oil has been increasingly restricted by the rapidly growing use of natural gas in industrial applications and of diesel oil for railway motive power.

The basic processes used to increase the yield of gasoline and other light distillates beyond the results obtained by simple straight-run distillation are known as "cracking." They consist essentially of treating the residues of the distillation process, either by thermal or catalytic methods, so as to break down or crack the hydrocarbon molecules characteristic of the heavy residues into smaller molecules from which more gasoline and other light "fractions" can be obtained.

As compared with other parts of the country, the California oil industry has a relatively low ratio of cracking capacity to total refinery crude capacity. In no year since 1947, for example, has the ratio of refinery cracking capacity to crude oil throughput capacity exceeded 20 percent in the Pacific Coast industry, while for the rest of the country, where higher gravity crudes are more common, the ratio has remained regularly in the range of 28 to 30 percent.

In view of this situation, it is plausibly argued that the basic problem in securing full utilization of California crude—which, to repeat, is produced in ample *quantity*—is the fact that so few Pacific Coast refineries are properly equipped to handle the low gravity crudes which account for approximately 27 percent of the total California crude output. The difficulty is primarily the traditional lack of facilities to convert heavy crudes into light products—distillates and gasoline—on an economical basis. This is essentially a financial problem rather than a technological one; the procedures are well known and adequately tested, as exemplified by the practice of several highly successful units already in operation.[1]

Hence there has been a persistent demand by spokesmen for the independent or small scale crude oil producers that California refinery facilities be revamped to bring their "product mix" more nearly into accord with established demand patterns for the various refined products. Unless this is done, it is argued, the continuing production of some 250,000 barrels per day of California crude of gravities below 20°, representing the output of nearly half the producing oil wells in the state, will inevitably result in recurrent surpluses of heavy fuel oil which will become a drug on the market, repeating the unhappy experiences of 1949-50.[2]

Divergent interests within the Pacific Coast petroleum industry

It is fairly obvious that no simple or easy answer can be given to some of the questions suggested by the foregoing discussion. There is little or no uniformity in the structure of the Pacific Coast oil industry, which consists of hundreds of different units ranging from relatively small independent crude oil producers to huge integrated organizations, some of which operate on a world-wide

[1] With the improved refinery technology of today, more and more light distillates are being obtained from practically all crudes. Only last summer the research department of a large oil company announced the discovery of a new process known as "liquid coking" which may greatly enhance the economic position of the low gravity crudes. This process, which will be commercially available on a license or royalty basis, contemplates the exploitation of very low gravity crudes by methods expected to recover from 10 to 20 percent more gasoline and light heating oils than can be obtained by standard procedures. In effect, the heavy residues left by conventional refining methods are re-refined after being vaporized by the use of hot mobile coke pellets. This fluid coking process is expected to open the way to more effective utilization of many heavy California crudes and oils of very low gravity from certain Canadian fields. See *Oil and Gas Journal,* August 17, 1953, pp. 74-75; November 16, 1953, pp. 181-82 and pp. 200-207.

[2] See pp. 10 and 11. Conventionally the dividing line between high gravity and low gravity crudes is set by the Conservation Committee of California Oil Producers at 20° on the A.P.I. gravity scale. Over the 13 years from 1941 to 1953 for which this group has analyzed production data the trend of heavy crude oil production (*i.e.* oil below 20° gravity) has been sharply upward, rising from 20.7 percent of total California output in 1941 to 27.3 percent in 1953. The number of wells producing heavy oil has also increased much more rapidly than the light oil producers, rising from 42 percent of the total number of producing wells in 1941 to over 48 percent in 1953. See Conservation Committee of California Oil Producers, *Annual Review of California Crude Oil Production, 1952,* Historical Section, p. 14.

TABLE 1

PETROLEUM SUPPLY AND DEMAND POSITION IN DISTRICT FIVE,[1] 1945-1953

(in thousands of barrels per day)

	Production (all liquid hydrocarbons)	Receipts from outside District Five		Total current new supply	Foreign and intercoastal shipments			Increase or decrease in stocks	Domestic demand and losses[2]			Total demand including losses
		Total	Crude		Total	Crude	Other		Total including losses	Military demand net	Civilian including losses	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1945	952	40	18	993	23	11	12	—38	1,007	294	713	1,031
1946	923	17	4	940	59	14	45	+42	839	78	761	898
1947	982	14	4	997	76	17	59	+ 8	914	67	847	990
1948	1,001	15	3	1,016	72	19	53	+44	900	88	812	973
1949	986	23	6	1,009	73	18	55	+50	886	76	810	959
1950	975	16	4	991	142[3]	29[3]	113	—76	925[3]	83[3]	842[3]	1,067
1951	1,052	37	14	1,090	110	23	87	—37	1,017	112	905	1,126
1952	1,064	79	41	1,143	86	18	68	+37	1,020	78	942	1,106
1953	1,085	135	84	1,220	92	16	76	+70	1,060	93	967	1,152

[1] District Five of the United States Bureau of Mines includes California, Oregon, Washington, Arizona, and Nevada.

[2] Includes demand within District Five (including oil company use and bunkers), shipments to Alaska and Hawaii, and rail and truck shipments to United States points outside District Five. Losses in refining and transportation have averaged slightly over 1 percent of "Domestic demand and losses" for the eight-year period 1946 to 1953; losses also include adjustments not otherwise accounted for.

[3] Data differ from those published by the Bureau of Mines because of differences in methods of accounting for military shipments of some 2,636,000 barrels of crude oil to Japan in the early months of 1950. (This is equivalent to an average of 8,318 barrels per day for the year.) It was originally understood that export licenses would be issued for these shipments and that they would therefore be included under export statistics. However, they were officially listed as "Military exports" and were therefore included by the Bureau of Mines publications in "Domestic demand" along with other military business. In the above table they have been *deducted* from columns 9, 10, and 11 and *included* in columns 5 and 6. (See Bureau of Mines *Petroleum Situation in District Five,* No. 235-B, June 12, 1950.)

Note: Figures may not total exactly due to rounding.

Sources: United States Department of the Interior, Bureau of Mines, *Petroleum Situation in District Five* and Conservation Committee of California Oil Producers.

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scale. These various components of the industry frequently have divergent interests and quite different problems. If the entire industry could be operated as a single integrated enterprise, some of the existing anomalies, such as concurrent imports and exports, would probably disappear. But with the situation as it is, one concern may have to bring in the specific raw material it requires from outside sources at the same time that another company has stocks of crude or products accumulating from local sources and may have to seek export markets. There is no "organized" market in crude oil where such temporary deficits and surpluses can be offset. Even if there were such a market, the differences in *kind* of oil would still persist and would probably nullify attempts to balance the "long" and "short" positions of the different units in the industry. Viewed in this light, the aggregate industry statistics, as illustrated by the unprecedented volume of imports in 1953 in the face of rapidly mounting inventories, require careful interpretation.

Every important producing unit in the industry, particularly among the large integrated companies, is differently situated with respect to raw material supply, whether primarily owned outright, controlled by long-term contracts, or purchased from independent producers in the open market. Each concern faces its own distinctive set of conditions in maintaining a proper balance between the flow of various types of raw material it is equipped to handle and the specific requirements of its market outlets. Some of the large marketing companies probably have access to all the high gravity local crude they require—either owned or under contract—while others are in a "deficit" situation, and some few simply cannot produce or buy enough crude of the right kind in the local area to satisfy their total requirements. Hence they resort, whenever conditions are favorable, to outside sources of supply, sometimes to the chagrin of their competitors who may be overstocked.

Some companies again, because their own field operations yield a disproportionately high quantity of low gravity crudes, have found it necessary to install the expensive supplementary refining facilities required to increase the yield of the lighter distillates obtainable even from low gravity oils. Frequently, in order to maintain continuity of refining operations or for reasons of policy, such companies may elect to buy the heavy crude output of independent producers. In either case the added expense involved in providing and operating the extra refining facilities is largely or completely offset by the much lower price of such purchased oil due to the fact that low gravity crudes sell in the open market at sharp discounts below the prices commanded by high gravity crudes. These price differentials, in other words, tend to even up the competitive position of refiners who produce or buy heavy crudes as compared with those who must buy considerable quantities of high gravity oil, whether from local or distant sources. By the same token, these discounts operate to the relative detriment of the non-integrated producer of heavy crude who must sell his output to a refiner or exporter.

Demand for Pacific Coast oils outrunning local supply

Some idea of the rate at which demand for petroleum products in the Pacific Coast area has been overtaking locally produced raw material supplies in the postwar period is given in Table 1 and Chart 2. These exhibits show that District Five's[1] output of petroleum raw materials, consisting of crude oil, condensate, natural gasoline, and liquefied petroleum gases, increased by about 18 percent between 1946 and 1953, rising from an average daily rate of 923,000 barrels in 1946 to 1,085,000 barrels per day in 1953. Demand for petroleum products in the domestic markets normally served by Pacific Coast refiners[2] expanded during the same period by more than 26 percent, rising from about 839,000 b/d in 1946 to over 1,060,000 b/d in 1953. Civilian consumption increased 27 percent, rising from 761,000 b/d in 1946 to 967,000 b/d in 1953. Military demand averaged about 83,000 b/d over the eight years, reaching a postwar peak of 112,000 b/d in 1951.

[1] District Five of the United States Bureau of Mines consists of California, Oregon, Washington, Arizona, and Nevada.
[2] The normal Pacific Coast marketing area consists of the five District Five states, Alaska and Hawaii, and that part of the United States lying east of District Five served by rail and truck shipments but excluding waterborne shipments to the Atlantic Coast.

TABLE 2
PETROLEUM SUPPLY AND DEMAND POSITION IN DISTRICT FIVE,[1] 1953 BY MONTHS
(in thousands of barrels per day)

	Production (all liquid hydrocarbons)	Receipts from outside District Five: Total	Receipts from outside District Five: Crude	Total current new supply	Foreign and intercoastal shipments: Total	Foreign and intercoastal shipments: Crude	Foreign and intercoastal shipments: Other	Increase or decrease in stocks	Domestic demand and losses: Total including losses	Domestic demand and losses: Military demand net	Domestic demand and losses: Civilian including losses	Total demand including losses
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
January	1,076	80	38	1,156	91	17	74	39	1,028	61	967	1,119
February	1,077	66	31	1,143	97	22	75	—44	1,094	80	1,014	1,191
March	1,087	137	91	1,224	96	18	79	84	1,047	79	968	1,144
April	1,079	180	103	1,259	111	23	88	81	1,061	76	985	1,172
May	1,086	185	113	1,271	80	16	64	179	1,022	86	936	1,102
June	1,095	187	125	1,282	91	22	69	144	1,051	99	952	1,141
July	1,086	141	86	1,227	77	19	57	104	1,043	86	957	1,120
August	1,082	158	115	1,240	96	22	74	107	1,034	93	941	1,130
September	1,084	118	82	1,202	91	18	73	56	1,062	91	971	1,152
October	1,084	121	80	1,205	79	8	71	48	1,081	121	960	1,159
November	1,094	138	89	1,231	98	4	94	60	1,068	120	948	1,166
December	1,090	101	52	1,190	96	5	91	—27	1,131	127	1,001	1,227
YEAR	1,085	135	84	1,220	92	16	76	70	1,060	93	967	1,152

[1] District Five of the United States Bureau of Mines consists of California, Oregon, Washington, Arizona, and Nevada.
Note: Figures may not total exactly due to rounding.
Source: United States Department of the Interior, Bureau of Mines, *District Five "Military" and "Civilian" Petroleum Demand* and *Petroleum Situation in District Five.*

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Total demand, foreign and domestic, military and civilian, for District Five petroleum products rose from 898,000 b/d in 1946—the first full year of peace—to 1,152,000 b/d during 1953. For the past four years total demand in District Five has exceeded by a considerable margin even the heavy drafts made in 1945, the year of maximum drain during World War II when military liftings approached a rate of 300,000 b/d or nearly one-third of the total California production of petroleum raw materials in that year. In order to supplement the local output, it became necessary to bring in Texas crude at the rate of 18,000 b/d in 1945; somewhat more than that quantity of finished petroleum products was also brought into District Five from other parts of the country.

Significant changes in the statistical position and business outlook of the oil industry sometimes occur very quickly, especially when the concern is with the sale of fuel oils which must compete with alternative fuels whose supply is subject to irregular fluctuations. Some of these shifts during the years since 1945 are indicated by the figures on demand and inventories included in Table 1. These figures reflect the composite effect of a great variety of influences—general business prosperity or recession, sharp fluctuations in military purchasing, availability of hydroelectric energy and natural gas, and even such factors as unexpected weather variations, particularly the relative mildness or severity of the winter season which may spell the difference between glut and scarcity in the supply of heating oils.

It is evident that, taking crude oil and refined products together, District Five has until the last year or two been a net exporter of oil, particularly if intercoastal shipments to the Atlantic Coast are considered as exports along with foreign shipments. The excess of foreign and intercoastal shipments over receipts from outside points in District Five from 1945 to 1953 are as follows:

(in thousands of barrels per day)

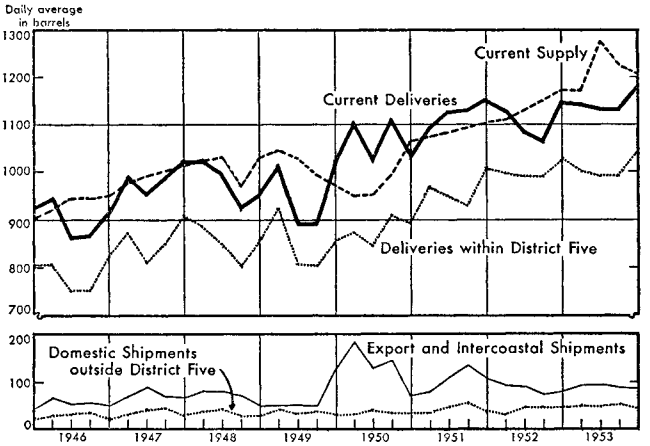
	Total Petroleum	Crude	All Other
1945	— 17	— 7	— 10
1946	42	10	32
1947	62	13	49
1948	57	16	41
1949	50	12	38
1950	126	25	101
1951	73	9	64
1952	7	—23	30
1953	— 43	—68	25

For the seven-year period 1946 to 1952, the excess of foreign and intercoastal shipments over receipts from all outside sources averaged close to 60,000 b/d.[1] About 85 percent of the aggregate excess consisted of refined products, although approximately 20,000 b/d of crude oil have regularly been shipped to offshore markets such as British Columbia, Japan, and other Pacific destinations. In every year, with the apparent exception of 1945, as shown

[1] This quantity was greater than the average rate of output during those years of California's second largest oil field—Ventura—which produced at an average rate of about 57,000 b/d from 1946 to 1952.

CHART 2

PETROLEUM DEMAND AND SUPPLY SITUATION IN DISTRICT FIVE[1]—BY QUARTERS, 1946-1953



[1] District Five of the United States Bureau of Mines consists of California, Oregon, Washington, Arizona, and Nevada.
Source: United States Department of the Interior, Bureau of Mines, *Petroleum Situation in District Five.*

in the last column of the preceding table, shipments of finished petroleum products out of District Five have regularly exceeded receipts of finished products into the area. Most of the huge military purchases of 1945, listed in column 10 of Table 1, were probably destined for out-of-District consumption.

Rapid rise in crude oil imports, 1951-1953

Except for a few months in mid-1945, when California's oil fields could not produce enough crude to meet the wartime requirements of the Pacific Coast refineries, District Five receipts of outside crude did not again reach significant quantities until 1951 when military needs again became insistent. In that year, Pacific Coast refiners brought in from outside sources some 5 million barrels of crude or somewhat over 14,000 b/d, of which nearly 10,000 b/d consisted of foreign oil, almost entirely from Borneo. During the same year about 23,000 b/d of California crude were shipped to points outside District Five. In 1952 for the first time the inflow of crude into the District significantly exceeded the outflow; about 41,000 b/d were brought in—nearly 33,000 b/d from foreign sources —while some 18,000 b/d were shipped out. Borneo, Sumatra, Venezuela, and even Saudi Arabia and Kuwait contributed to the crude supply in 1952.

Receipts of foreign crude, coming almost entirely from such sources as Sumatra and the Middle East, were stepped up sharply early in 1953 and for the nine months from March to November amounted to over 25 million barrels, equivalent to an average rate of nearly 92,000 b/d. This was only a little less than 10 percent of the crude oil output of California during that period. It was substantially larger than the output of the great Ventura oil field in southern California and exceeded the combined production of the two new fields, South Cuyama and San Ardo, with the Elk Hills field thrown in for good measure. The impact of these heavy imports of foreign crude, added

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to the record-breaking output of California's oil fields in 1953, has created something of an inventory problem for the Pacific Coast industry. For the time being, at least, the traditional position of the area as an oil exporter—considering both crude and refined products—has been reversed to that of a net importer.

The sustained high level of crude imports into District Five over the past two years assumes added significance when considered in conjunction with several other factors which have an important bearing on the situation. Among these influences may be mentioned: (1) what has been called the national policy to secure and maintain a safe working margin or "reserve" of facilities for the production, refining, transportation, and storage of approximately a million barrels of oil a day above the normal operating levels of the industry at any given time; (2) the tendency of a competitive industry to run its facilities at a rate approaching capacity operation, lacking the restraints which might be imposed by a legally constituted regulatory or conservation agency; and (3) the failure of demand to reach anticipated levels—due to the mild winter of 1952-53 and the cessation of military operations in Korea.[1] Because of the combination of all these factors, the high level of crude oil imports has undoubtedly contributed to the current large inventories of the oil industry, both locally and nationally.

[1] The winter of 1952-53 was distinctly warmer than normal over a large part of the Pacific Coast area. So far during the present season, data supplied by the United States Weather Bureau and by the largest California gas and electric public utility company indicate appreciably above normal average temperature in California during the months from October 1953 to January 1954.

INVENTORY PROBLEMS, PAST AND PRESENT

THE oil industry has for several months been seriously concerned with a top-heavy inventory situation; it was freely predicted last fall that unless drastic remedies were applied the industry would find itself lucky to get through the winter of 1953-54 without having to make substantial reductions in the prices of its products which might extend all the way back to the basic price of crude petroleum. The remedies most frequently suggested have chiefly to do with the supply side of the price equation and are directed at tighter control of domestic production and, perhaps more widely popular, limitation of foreign imports of crude oil and heavy fuel oil through the imposition of a quota system, the levying of higher import duties, or both. Apparently little expectation was entertained that any significant increase in consumption of petroleum products could be achieved over the short term, although it has been suggested that part of the inventory burden could be shifted to the broad shoulders of Uncle Sam by increasing military purchases. The contingency of an abnormally cold winter season, preferably a dry one with low stream flow and low production of hydroelectric energy, would also not have been unwelcome to many units in the oil industry.

Even in the best of times the industry is faced with a problem of no small magnitude in adjusting the current output and normal inventory build-up of its several major products to meet the shifting and unpredictable demands of the market. This is basically due to the seasonal nature of the demand for heating and fuel oils which fluctuates with the varying intensity or "seasonableness" of the seasons, and which in the aggregate considerably exceeds the demand for gasoline. While gasoline is much the largest single product of the refining industry and by far its most valuable product, it bulks considerably less in quantity, especially in the Pacific Coast area, than heating and fuel oils. Thus, of the total refinery output of District Five in 1953 amounting to 1,085,000 b/d, gasoline represented 456,000 b/d, stove and diesel oil 156,000 b/d, and heavy fuel oil 369,000 b/d. Gasoline accounted for 42 percent of the total output, and the other two major products for 48 percent. While the demand for motor fuel and lubricants is also subject to marked seasonal influences in those parts of the country having severe winter weather, this is a much less important factor in the Pacific Coast region. The consumption of gasoline by private automobiles is apparently also much less influenced than the demand for fuel oils by fluctuations in general business activity.

The fundamental problem for the western refining industry, therefore, in gauging demand and scheduling production is to forecast the probable volume of sales of heating and fuel oils and to provide the requisite quantity well in advance of actual need. This means building up stocks during the off season. The only alternative would be the maintenance of a substantial amount of standby facilities to be operated during the winter months, and then only if the "probable" weather conditions and expected economic factors held constant. This is obviously a prohibitively costly procedure: the only practical course is to make stock additions both of heating oils and of motor fuel during their respective off seasons. This means taking a chance of overproduction—or shortage—from forecast levels of demand.

The memory of heating oil shortages of a few years ago or at least of local transportation difficulties in their geographical distribution, with attendant unfavorable publicity and political heckling, has probably caused many oil companies to go to the opposite extreme in making every possible effort to meet the needs of the community for heating oils and has no doubt contributed to the provision of such stocks in excess of probable actual needs. In any event, it is noteworthy that one of the most troublesome aspects of the current inventory situation in many parts of the country has been the existence of very large stocks of distillate, or light heating oils of the kind widely used in domestic house heating, while demand for these oils was extremely slow during the early stages of the winter season. This repeats the experience of the 1952-53 winter, with the difference that excessive inventories marked the whole of that season. Demand for distillate picked up sharply in the East and Mid-West in January 1954 with

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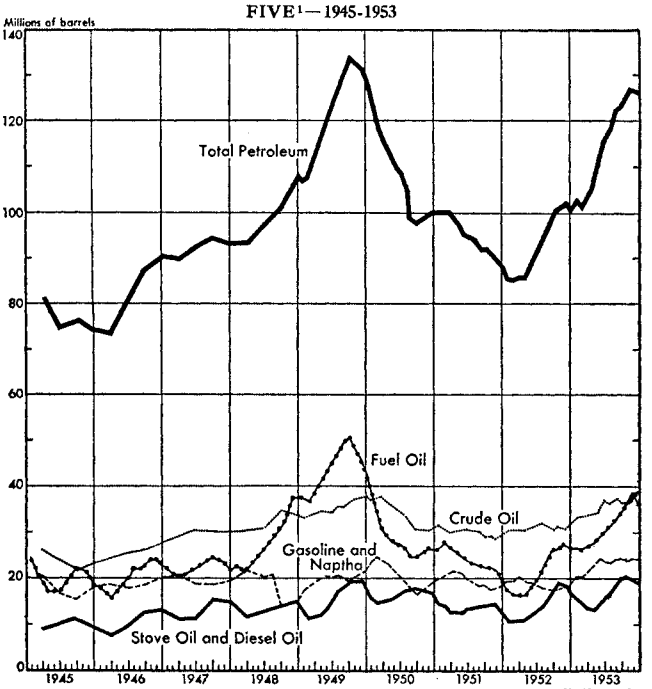
the advent of really cold weather and stocks of these oils were rapidly reduced.

Competition between fuel oil, coal, and natural gas

In many of its uses, including both space heating and as boiler fuel, notably in the generation of electric power by public utility companies, heavy fuel oil is competitive in many parts of the country with both coal and natural gas. Over the years oil and gas have won steadily widening public acceptance in a considerable range of applications, largely at the expense of coal. Many industries as well as public power plants are equipped to use either coal or oil, as in New England and the East generally, or oil or gas, as in California; while in some parts of the country which are served by long-distance natural gas pipe lines from the Texas-Louisiana area, the newer industrial installations can use all three fuels with a minimum of delay in effecting the change-over. In California, in fact, it is a legal requirement, embodied in the contracts of the gas utility companies with their customers and approved by the state regulatory commission, that applicants served under interruptible rate schedules must have standby equipment available for use of other fuels, chiefly oil, as a condition of service. The fact of potential and actual competition of alternative fuels is, therefore, a further complicating factor in the planning of the oil companies to meet the requirements of their industrial customers.[1]

CHART 3

REFINERS' STOCKS OF PETROLEUM IN DISTRICT FIVE[1]—1945-1953



[1] District Five of the United States Bureau of Mines consists of California, Oregon, Washington, Arizona, and Nevada.
Note: Stocks of Fuel Oil and Stove Oil and Diesel Oil include cracking stock.
Source: United States Department of the Interior, Bureau of Mines, *Monthly Petroleum Situation in District Five.*

The situation in 1949

In order to get some perspective on the current inventory and supply position in the Pacific Coast oil industry, it may be helpful to take a brief look at some of the highlights in the industry's experience since World War II.

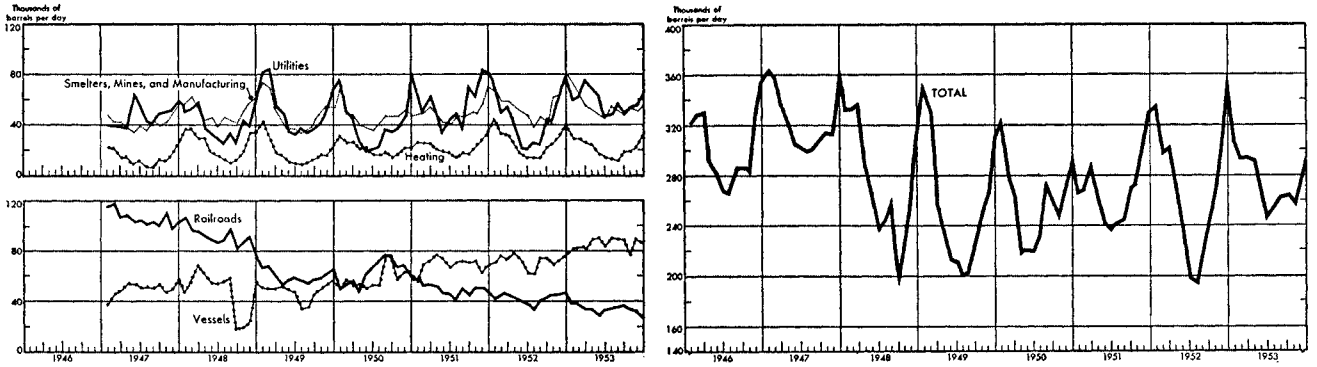
A glance at Charts 2 and 3 will perhaps give a fair working idea of the general course of the demand for and supply of petroleum in the Pacific Coast markets during the postwar period. The inventory breakdown shown by Chart 3 should also help clarify some of the differences between the acute inventory situation which developed in 1948-49 and the position today. Those differences are substantial.

The inventory difficulties of the Pacific Coast oil industry in 1949 sprang from two basic sources: (1) the fact that following the rapid increase in production and consumption of petroleum as the postwar boom got under way after the temporary letdown in 1946, production of oil was maintained at a high level for a considerable time while demand fell away during the business recession of 1949; and (2) the persistent accumulation of heavy fuel oil (and of low gravity crude) greatly in excess of market requirements. The market for heavy fuel oil was stymied at that time as a consequence of the great reduction in

[1] See supplement to *Monthly Review*, November 1950, "Western Power and Fuel Outlook," pp. 14-20.

CHART 4

CIVILIAN DEMAND FOR HEAVY FUEL OIL IN DISTRICT FIVE[1]—1946-1953



[1] District Five of the United States Bureau of Mines consists of California, Oregon, Washington, Arizona, and Nevada.
Source: United States Department of the Interior, Bureau of Mines, *District Five "Military" and "Civilian" Petroleum Demand.*

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naval and merchant shipping activity after 1946, the rapid dieselization of railway motive power, the widening business recession of 1949, and the growing competition of natural gas (Chart 4). Imports of natural gas into California from the San Juan and Permian basins of west Texas and New Mexico were beginning to assume large proportions about that time. The following data indicate the rapidly increasing use of "out of state" gas in California since 1947:[1]

	Cubic feet of gas per day (in thousands)	Equivalent barrels of oil per day
1947	9,590	1,598
1948	179,127	29,854
1949	257,804	42,967
1950	405,586	67,598
1951	667,806	111,301
1952	813,148	135,525
1953 (estimated)	1,000,000	166,667

Imported natural gas represented nearly 25 percent of the total California supply available for general use in 1950; by 1953 this figure had risen to about 50 percent and it promises to increase still further as plans are being pushed by the public utility companies to enlarge the carrying capacity of their pipe lines to permit raising the annual rate of imports from the current level of somewhat above 1 billion cubic feet daily to 1.4 billion cubic feet by early 1955. The increasing availability of this convenient and economical fuel has led to its heavy use by the electric utility companies and general industrial consumers in preference to oil, in addition to serving its primary function as domestic fuel for cooking and heating.[2]

The redundant heavy fuel oil stocks which burdened the Pacific Coast refineries through most of 1949 created a serious problem for the industry. Prices of fuel oils and of low gravity crudes were cut drastically and production of crude was curtailed by shutting in some 3,000 producing wells, chiefly in the fields producing low gravity oil. The problem was finally resolved by shipping large quantities of residual fuel oil to the Atlantic Coast where a long succession of strikes in the bituminous coal mines had created a serious fuel shortage. During the twelve months from October 1949 to September 1950 more than 21 million barrels of heavy fuel oil, or nearly 60,000 b/d, were shipped to the Eastern Seaboard where it found a ready if not particularly profitable market. Considerable quantities of gasoline were also shipped to eastern markets in mid-1950.

Within the twelve-month interval ending September 1950, Pacific Coast refineries' stocks of heavy fuel oil were cut down from a level exceeding 41 million barrels on September 30, 1949 to less than 15 million barrels a year later. District Five stocks of all kinds, including crude and refined products, were reduced from a postwar high in September 1949 of 134 million barrels to less than 98 million in September 1950, a more nearly normal quantity, representing about 90 to 95 days' supply at then existing rates of consumption.

[1] Data for 1947-52 supplied by Gas Supply Department, Southern California Gas Company; 1953 data based on estimates supplied by industry sources.

[2] See Public Utilities Commission, State of California, Decision No. 46537, December 11, 1951, p. 6; Decision No. 49127, September 22, 1953, p. 5.

New Problems Created by International Tensions in 1950-51

Meanwhile the Korean conflict had broken out. The abnormal demand for practically all kinds of petroleum products arising from this occurrence, together with the upset in world oil supplies caused by the cessation of production in Iran in May of 1951, put an additional strain on the resources of the Pacific Coast oil industry. In order to meet these exceptional demands it was necessary to bring in raw material from whatever source available. Rising from an average level of about 17,000 b/d over the five-year period 1946 to 1950, or less than 2 percent of the average annual California production of crude petroleum, total receipts of oil from outside sources, foreign and domestic, by refineries and distributors in District Five attained a rate of 37,000 b/d in 1951 and more than triple that figure in 1953 (Table 1).

Following the intensification of the war in Korea late in 1950, military demands on Pacific Coast refiners became exceptionally heavy in the first half of 1951, rising for the year as a whole to 112,000 b/d—a 42 percent increase over the average level of the previous five years. In addition to strictly military purchases, a great increase in civilian demand resulted from the stepping up of industrial and transportation activity as the defense program got under way, and laid-up ships and steam locomotives were reactivated and returned to service. May of 1951 also saw the shutdown of the world's largest refinery, the Anglo-Iranian plant at Abadan, an event which had world-wide repercussions. Commercial trans-Pacific shipments of California refineries jumped from an average level of about 63,000 b/d in 1946-50 to over 106,000 b/d in 1951.

The drain of the extra demand on the Pacific Coast oil industry caused by the war in Korea and the loss of the Iranian supplies has been estimated by one authority as on the order of 140,000 b/d, or about one-eighth of the total deliveries of the industry in 1951.[1] Coming on the heels of the large intercoastal shipments of the previous year, Pacific Coast refiners' stocks were still further reduced to a level of approximately 85 million barrels in the early months of 1952. Representing only about 75 days' supply, this was too low a level for safety and was a principal factor leading to the large imports of both crude and refined products indicated above.

How the demands were met

How did the West Coast industry meet the extraordinary demands of the last three years? Three principal sources were levied upon: local crude output was stepped up by returning to production the low gravity wells shut in during the 1949-50 crisis and additional wells were brought in, notably in the new Cuyama and San Ardo fields; more raw material was obtained from outside sources; and inventories were drawn down from a level of around 110 million barrels at the eve of the Korean

[1] Robert L. Minckler, President, General Petroleum Corporation, "Oil Supply and Demand in the West," an address before the National Federation of Financial Analysts Societies, San Francisco, California, May 5, 1952.

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outbreak to around 85-86 million in the first quarter of 1952 (Chart 3). The increase in local output of all liquid hydrocarbons from the 1949-50 level of around 980,000 b/d to the 1951-52 level of about 1,060,000 b/d was equivalent to an annual rate of gain of about 40,000 b/d; outside receipts of crude rose from 4,000 b/d in 1950 to 14,000 b/d in 1951 and to 41,000 b/d in 1952; the net draft on stocks between June 1, 1950 and May 1, 1952 was around 24 million barrels, equivalent to an average rate of about 34,400 b/d over the 23-month period.

Because of the heavy concentration of military buying on the West Coast, with about 40 percent of total military purchases of petroleum products being made in this area in 1951, strenuous efforts were made to divert a large part of this business to other parts of the country. Had it not been for the increased participation of Gulf Coast refineries in supplying military requirements in 1952 and the fortunate availability of high gravity crudes from the rapidly developing oil fields of Indonesia and the Middle East, the Pacific Coast refineries might have found it impossible, except at prohibitive costs, to supply the needs of their markets. Making allowance for the partial diversion of military buying, all demands were met, including the shipments already indicated to trans-Pacific markets which would ordinarily have been supplied by the Abadan refinery.

From an over-all standpoint it seems fairly certain that in this period of abnormal demand imports of natural gas and crude oil into the Pacific Coast area in 1951-52 were the saving factors in what might otherwise have been an impossible situation.

Importance of transportation costs

Tanker rates were still very high in 1951 and 1952 following the upsurge caused by the outbreak of the conflict in Korea. These high costs of ocean transport made the importation of crude oil from the Persian Gulf and Indonesia, the principal foreign sources for Pacific Coast refineries, a relatively expensive business in those years, particularly in view of the frozen ceiling prices for petroleum products then in effect. Some of these imports are reported to have involved losses, which had to be accepted more or less as a matter of military necessity. By early 1953, however, the growing surplus of tankers, particularly the construction of "supertankers," had brought about a drastic decline in rates, especially for long-term charters. Tanker rates fell so low in the summer of 1953 that they threatened to put out of business, at least temporarily, the famous Tapline which carrries Saudi Arabian oil a thousand miles across the desert to the Mediterranean Sea, thus eliminating a 7,000-mile round trip via Suez as well as the canal tolls themselves. Owned by four American oil companies and completed in 1950 at a cost of $230 million, Tapline is capable at maximum operating capacity of releasing the equivalent of about 65 normal size tankers for service elsewhere.[1]

The abnormally low tanker rates of 1953, together with increases in posted prices for high gravity crudes in California running in some cases as high as 50 cents per barrel, made the continued import of oil from the Middle East and other surplus regions much more attractive to Pacific Coast refiners.[1] Through much of 1953, in fact, Middle Eastern oil was really "on the bargain table," as other important producing areas in that region stepped up their rate of production to take advantage of the Iranian shutdown. For a time indeed, before Middle Eastern prices were adjusted to the price rises which occurred in this country in February and June, it was cheaper to lay down oil from the Persian Gulf at Atlantic Coast ports than to haul it from the Gulf Coast.[2]

Other considerations leading to imports

The inducement to bring in crude from the Middle East and Indonesia, and to a lesser degree from Venezuela, also probably had some weight with those American oil companies, including a few in the Pacific Coast area, which have made large investments in developing oil fields in those areas. Some Middle Eastern fields in particular are enormously productive; their potential has been rapidly developed during the postwar years and it is only recently that they have begun to make a really substantial contribution to the world's commercial oil supply. The advantage of buying from a subsidiary or affiliated company and thus sharing in intercompany profits probably also plays a part. There is the further consideration, again from a strictly business point of view, that the increasing trend toward nationalization of profitable foreign ventures domesticated in areas having relatively little other sources of revenue may operate to hasten the efforts of the foreign investor to recover his capital investment as rapidly as possible.

Another factor influencing the high rate of crude oil imports during the past two years has been the desire of certain Pacific Coast refiners to rebuild their raw material stocks from the relatively low levels which have marked the entire postwar period as compared with the previous operations of the industry. During the four years 1940-43, for example, when Pacific Coast refineries were using up crude oil at an average annual rate of 602,000 b/d, the industry stocks of crude ranged between 40 million and 50 million barrels, with an over-all monthly average for the four years of 46 million barrels. During the four years 1944-47, crude stocks dropped to an annual range of about 25 to 30 million barrels, with an average inventory of about 27 million, while crude runs to stills had increased to an average rate of 812,000 b/d. By 1948-50, some recovery had occurred in stocks, with crude inventories ranging from 30 to 38 million barrels while crude runs to stills required an average of around 885,000 b/d.

In the two years 1951-52, in contrast, Pacific Coast refineries were consuming crude oil at an average rate of about 972,000 b/d, while refinery stocks of crude never got above 32 million barrels and averaged only about 12

[1] See *The Journal of Commerce*, New York, July 27, 1953.

[1] See *The Economist*, August 1, 1953, pp. 338-9, "Tankers Galore"; August 8, 1953, pp. 401-03, "Too Many Tankers?" (Vol. CLXVIII, Numbers 5736-7).

[2] See *Petroleum Outlook*, Vol. 6, No. 5, May 1953, pp. 41-42.

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TABLE 3
COMPARISON OF REFINERY STOCKS OF CRUDE PETROLEUM AND RATE OF CONSUMPTION, DISTRICT FIVE, 1940-53

	Crude petroleum stocks[1] (in millions of barrels)		Refinery crude input (thousand B/D)
	Range	Monthly average	
1940	47-50	48.7	536
1941	45-49	46.8	568
1942	43-51	47.0	601
1943	40-45	42.9	705
1944	27-35	29.8	792
1945	22-26	23.9	842
1946	24-28	25.6	777
1947	28-31	29.8	835
1948	30-36	32.0	895
1949	33-38	35.4	879
1950	30-38	33.9	880
1951	29-32	30.1	956
1952	30-32	31.2	989
1953	33-38	35.7	1046

[1] Total refinery stocks, regardless of location.
Source: United States Department of the Interior, Bureau of Mines, *The Petroleum Situation in District Five.*

percent above the inventory levels of 1944-47 when refinery input was approximately 160,000 b/d lower than in 1951-52. The basic data for each year from 1940 to 1953 are in Table 3.

Whatever the motivation, the import of foreign crude into the Pacific Coast area by several of the large integrated companies proceeded at a very high rate through a large part of the year 1953. The average daily rate of crude imports in each quarter and for the year as a whole was as follows (in barrels per day):

First quarter	47,522
Second quarter	106,044
Third quarter	87,000
Fourth quarter	70,457
Year 1953	77,841

Imports and inventories

Foreign crude oil imported in 1953 represented between 6 and 7 percent of District Five's total raw material supplies in that year. This contribution to supply, together with substantial imports of petroleum products from other parts of the United States (Table 4 on page 16) and the pushing of California crude production to top-record levels, has led to the recurrence of an inventory problem for Pacific Coast refiners. From a level of around 85 million barrels in the first quarter of 1952, representing about 75 days' supply at then current rates of consumption, refinery stocks of petroleum and petroleum products increased to about 127 million barrels at the end of November 1953. This was equivalent to approximately 110 days' supply at the rate of demand prevailing in 1953. A slight decline occurred during December, but this was more than offset by a rise in January 1954. The total increase over the 21 months from February 1952 to November 1953 represented an average rate of gain of about 65,700 b/d, a figure substantially larger than the average daily output of the Huntington Beach oil field in the Los Angeles basin in the same period. In absolute terms, the level of inventories prevailing in the last quarter of 1953 was the highest since the end of 1949 when the Pacific Coast industry was liquidating its excessive stocks of heavy fuel oil by shipment to the Atlantic Coast at prices reported to have yielded little profit.

Although the 42 million barrel increase in stocks since early 1952 has occasioned some concern in the industry, it cannot be said that total inventories are excessive in the sense that they pose a dangerous threat to the stability of the industry's price structure. What the continuous rise in total stocks through most of the year 1953 probably does indicate is the need for restraint in maintaining the current high rate of crude production in California and a rate of crude imports beyond the need to provide a good working balance of raw material supplies. While the industry generally considers a total inventory equivalent to around 100 days' supply—more or less—to be about "right," the current figure, which is closer to 110 days' supply at the average daily rate of consumption in 1953, cannot be regarded as a clear and present danger. Certainly, as compared with the industry's past experience, current stocks expressed in terms of days' supply would probably be regarded as relatively safe. The present level of inventories in District Five is far below the peaks attained, for example, in 1930 or 1940, whether measured in absolute size or in relation to number of days' supply. The top levels reached in those years—189 million barrels in 1930 and 160 million barrels in 1940—represented 269 days' and 237 days' supply, respectively, figured in terms of average daily demand then existing. While these huge stocks presented a serious challenge, they did not disrupt the industry.

Composition of inventories

Dealing in aggregates, however, fails to get at the heart of the matter, which is the composition of the total inventory rather than its quantity. Herein lies the basic difference between the current position and the inventory situation in 1949, which has already been discussed in some detail. Not only were stocks relatively high in 1949, around 134 million barrels at September 30—the highest level since the second quarter of 1942, but still far below the levels of the early 1930's—but they were badly unbalanced. It was the huge quantity of heavy fuel oil, 41 million barrels, plus nearly as much crude oil, that was the dangerous element in the situation at that time. Gasoline stocks were in excellent shape, just around 20 million barrels, comparing quite favorably with the years 1940 to 1943 when there were fewer cars and trucks on the road and civilian consumption was rationed. Stocks of stove oil and diesel oil were also perhaps somewhat out of line in 1949, but the principal difficulty, to repeat, was an unmanageable quantity of unsalable heavy fuel oil.

In contrast with that picture, District Five refinery stocks are today much better balanced, although elements of potential trouble are not absent. While inventories have built up rapidly over the past two years, the increase has been fairly well distributed among the several components. The restoration of crude oil stocks to a more nearly normal supply has already been discussed in connection with imports; this sector is not considered to present any very

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serious problem. The persistent and contra-seasonal stickiness of gasoline inventories at fairly high levels during the last half of 1953, on the other hand, is causing some concern in the industry; it suggests too uncomfortably the experiences of 1949 which, like the present, was a period of business recession.

The past year has also seen a marked tendency for heating and fuel oils (and their associated "cracking stocks") to get out of line. This resulted in part from the failure of these products to move into consumption at normal rates during the mild winter of 1952-53. In part, the mounting inventories of distillates (stove oil and diesel oil) and more particularly of heavy fuel oil may reflect somewhat lower industrial and public utility demand in 1953 than might have been expected, especially in view of marked industrial growth and greatly enlarged steam electric capacity in this area. Even more, perhaps, the sluggish demand for fuel oil may reflect the greater availability and consequently larger use of natural gas during the past year or more. Favorable weather conditions last year made most of 1953 a good water year both in California and the Pacific Northwest, with resulting high stream flow and high generation of hydroelectric power and relatively less pushing of steam power plants by the electric utilities. Total electric utility power production in the three Pacific Coast states increased nearly 17 percent in 1953 compared with 1952, but in spite of an increase in hydro output of nearly 2.7 billion kilowatt hours, electric utility use of fuel for generation of power increased nearly 55 percent, with natural gas accounting for much the greater part of the gain.

The large increase in cracking stocks over the past two years calls for some comment. Two large California oil companies are currently constructing considerable additions to their refining capacity, with the new units scheduled to come "on stream" sometime during 1954. In anticipation of the need for additional raw material for these facilities, the two companies in question have been quietly accumulating cracking stocks, which account for a considerable part of the build-up in total inventories. Between February 29, 1952 and December 31, 1953, cracking stocks increased from the very low level of 7.0 million barrels to almost 20 million barrels. The difference of nearly 13 million barrels alone accounts for nearly one-third of the entire increase in *all* stocks between the two dates. It should be pointed out, however, that this is really borrowing from the future; while present excess stocks of cracking oils may be considered as "dead" storage at the moment, they will eventually come on the market as finished products when the new refining facilities are put into operation.

Taking as broad a view as possible, it remains true that current inventories are relatively large, not only in the Pacific Coast area but nationally as well. The cessation of the shooting war in Korea, while long foreshadowed, perhaps came before the oil industry was prepared to adjust itself to some diminution in the military and transportation demands for petroleum products. The industry has been under considerable pressure because of national defense considerations to expand its production facilities all the way from crude oil to finished product, and it is perhaps natural that in the existing setup each unit in the industry has felt itself impelled to keep on producing lest its competitors gain a march. At least, this appears to have been the situation in the Pacific Coast area.

An intriguing aspect of the petroleum inventory situation which has received relatively little attention in or out of the industry is the suggestion that to the extent that current excess stocks can be attributed to high rates of domestic crude production in 1952-53, they represent in effect "national defense oil that has been transferred from underground storage to aboveground storage."[1] They constitute current "borrowing" (by the industry) "from the nation's military reserve." It was largely at the behest of the national defense authorities, reflecting the demands of the military, that the oil industry embarked a few years ago on the program of acquiring "at its own expense" a reserve productive capacity—within the limits of maximum efficient rates of production—of a million barrels per day and of maintaining this reserve, again "at its own expense" and somewhat in the role of a trustee, for defense use in the event of a national emergency.[2] This reserve has now largely been created, and the current high level of industry stocks are, to some degree at least, one of its consequences with the industry confronted with the burden of carrying them.

Another malefactor—the weather

In assessing responsibility for the current top-heavy condition of its inventories, a considerable body of opinion in the oil industry finds the real culprit to be not entirely the importers or the crude producers but the weather. An unseasonably mild winter in 1952-53, both in the Pacific Coast area and in the nation at large, left unusually large unsold stocks of heating oils on refiners' hands last spring. These heating oils were naturally slow to move during the off-season—the summer and fall of 1953—and in most areas did not meet an active demand until well into January of this year. At the end of 1953 national stocks of kerosene, distillate (stove oil and diesel oil), and heavy fuel oils had reached a total of about 210 million barrels, exceeding the level of a year earlier by about 8 percent, while the weather was again unseasonably warm.

Superimposed on heating oil stocks was the normal seasonal build-up of gasoline stocks in anticipation of the summer demand. That demand apparently fell considerably short of refiners' hopes and was substantially less than the volume of new current supplies they made available, while military liftings also proved disappointing at least until the final quarter of the year. At the year-end the nation's stocks of gasoline, including natural gasoline, approximated 150 million barrels—a record figure, nearly 24 percent higher than a year earlier.

[1] R. F. Windfohr, President's Address, Annual Meeting Texas Mid-Continent Oil & Gas Association, Houston, Texas, October 6, 1953.
[2] *Ibid.*

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Contrast between methods of meeting inventory problems in Pacific Coast and other oil producing areas

As just indicated, oil inventories have increased in other parts of the country as well as in the Pacific Coast area but more positive action has been taken in those areas to correct the situation. During the four years between May 1950, when national petroleum stocks reached their low point following the recession of 1949, and May 1953, total petroleum inventories gained about 25 percent rising from 548 million barrels to 685 million, the latter figure representing about 93 days' supply at existing rates of consumption. In the six months from May to October there was a further rise, partly seasonal, in total stocks to a figure of 757 million barrels, representing nearly 100 days' supply. Normal seasonal decline brought the year-end figure down to approximately 740 million barrels, still some 60 million above the level of a year earlier. About one-fifth of the net increase from April to December was accounted for by Pacific Coast stocks.

Despite vigorous protests by crude oil producers and royalty beneficiaries and in the face of much political clamor, drastic cutbacks in crude oil production were enforced in the last half of 1953 by state regulation commissions in Texas—which is by far the leading oil producer—and in the important oil states of Louisiana, Oklahoma, and Kansas. In some months Texas producers were limited to less than twenty days of operation and at one period all production was banned in Kansas for a ten-day interval. These restrictions forced a reduction in total output of about 500,000 barrels per day below the rates prevailing in the peak months, June to August. Several of the large integrated oil companies in the Texas and Mid-Continent areas also curtailed their rate of refinery operations in order to check the excessive accumulation of finished products. In California, by contrast, where there is no public regulatory agency, relatively little reduction in output either of crude or of products has occurred; by year-end only one major company had undertaken to curtail its current rate of crude production, and that only in a single field. This reduction was more than offset by increased production by other companies and larger output from other fields, notably in the Elk Hills naval reserve, where some of the shut-in wells had been threatened by water encroachment, with potential permanent loss of oil unless current recovery were stepped up. Meanwhile imports of foreign crude were maintained at relatively high levels until late in the year.

The need for greater flexibility in adjusting supply to demand

Apparently there is a real need in the oil industry for greater flexibility in adjusting current new production to consumers' probable requirements, present and prospective. This is a difficult problem at best and one not likely to be completely mastered in practice, both because of the inherent limitations of long range weather forecasting and because of the practical difficulties in predicting fluctuations in economic conditions and changes in the political and international outlook which affect total demand for the various products of the industry. There would appear, however, to be distinct possibilities of achieving a greater measure of progress in some of these directions, at least, than has been attained so far.

The availability of an abundant supply of crude petroleum from outside sources is stressed by some members of the industry as providing just this desirable element of flexibility in accommodating current supply to fluctuations in market demand or to make good local deficiencies in crude production. It is partly for this reason that these spokesmen, who are in most cases themselves importers, advocate the maximum freedom of opportunity to import foreign oil as a means to insure that flexibility. Advocates of a policy of import restriction, who are largely members of the industry but who are interested chiefly in developing or marketing local supplies of crude oil, would grant the necessity of occasional imports but only to the extent of "supplementing" and never to the point of "supplanting" domestic production. Here the difficulty is partly one of definition but more fundamentally it reflects a basic clash of interest between components of the industry who are differently situated with respect to raw material supplies. It is more than probable that no formula could be devised that would please everybody.

It should also be remembered that flexibility, almost of necessity, tends to operate in one direction only—expansion rather than contraction. It is easier to start than to stop; sometimes easier to keep on importing beyond the point of actual need than to attain a precise balance between total industry supplies and total market requirements at any given time. This is due in part to the competitive setup of the industry and in part to the difficulty of modifying long-term commitments, once they are made, in the light of downward changes in demand. It usually takes some time to readjust arrangements for an import program designed to cover a period of several months or a year ahead. It is not like turning a spigot off or on at will.

Hence it is hardly to be expected that fairly wide fluctuations in oil inventories can be prevented. Nor should inventory fluctuations be avoided: that is what inventories are for—to take up the slack between the constantly changing forces of supply and demand. Perfect balance between these forces is seldom attained in practice in the sense that current demands are precisely matched by current new increments of supply. Whenever large discrepancies appear, corrective forces are inevitably set in motion to restore the balance; meanwhile industry inventories act as a shock absorber, expanding or contracting as the situation requires.

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So long as the basic conditions in an industry are sound there is probably little need to worry too much about inventory fluctuations. Fluctuations beyond the normal range usually correct themselves in time to avoid disastrous consequences. Fundamental soundness can safely be postulated of the American petroleum industry, which is both mature and dynamic. It is perhaps inevitable that, in discharging its twofold function of serving normal civilian needs and at the same time of preparing itself to supply the huge quantities of petroleum products which military and quasi-military operations require, either actually or potentially, the oil industry pendulum should make some wide swings.

Sometimes the very conditions of national defense, while imposing an enormous additional strain on the productive facilities of the industry, may also actually hamper the industry's efforts to increase output because overriding defense requirements for critical materials such as steel may effectively deny the industry the material needed for drilling wells or constructing additional refinery and transport facilities. Once it has equipped itself to carry the extra load, the productive capacity of the industry may easily outrun, for a time, the normal growth of market demand for its products. There is a tendency at such a time for both crude oil and finished products to be produced — or imported — in excess of actual current requirements, and hence for inventories to expand. This seems to be the phase of the cycle which the industry is currently experiencing.

Who is really responsible for excessive inventories?

The Pacific Coast situation well exemplifies the difficulty of securing industry cooperation in effecting prompt adjustment of supply to the requirements of market demand. Opponents of freedom to import seek to lay the blame for the inventory problems of the industry on the excessive imports of their competitors while themselves continuing to produce local crude oil with little or no restraint. From an outsider's standpoint it is somewhat difficult to distinguish between the responsibility of an imported barrel of oil and that of a locally produced barrel in accounting for the total supply. Of course, it is easier to defend the policy of supporting home industry and of giving local employment than to persuade a group of local producers to forego their "legitimate" market in favor of the foreign producer, even though the quality of the respective products may not be identical. Importers, especially of large industrial corporations, frequently incur no little political criticism and run the risk, if opposition becomes vocal enough, of having political action involved to limit their activities.

Be that as it may, the inventory level of 127 million barrels attained by Pacific Coast oil inventories at the end of last October—approximately 120 days' supply—was realized to be probably more than adequate. Late in that month a leading major company, which is the largest importer, announced that it would cut substantially its rate of imports during the final quarter of the year and would make another cut early in 1954. At the same time, the company emphasized that imports of foreign crude would be continued at a rate sufficient to offset the shortage of California crudes available to meet its customers' requirements. It stressed the lack of adequate quantities of local high gravity crude comparable to the foreign crude being imported and maintained that these imports had saved the situation during a period of critical shortage.

TABLE 4
ANALYSIS OF PETROLEUM RECEIPTS INTO DISTRICT FIVE[1]
1949-1953

(in thousands of barrels per day)

	1949	1950	1951	1952	1953
Total receipts	23.2	16.4	37.5	79.4	134.5
Crude	6.3	4.0	14.4	41.1	83.9
All other products	16.9	12.4	23.1	38.2	50.6
Receipts from United States	19.9	16.4	26.0	40.7	55.9
Crude	3.4	4.0	2.9	8.5	6.0
Gasoline[2]	6.8	4.0	11.3	19.6	34.0
Stove oil and diesel oil	3.9	3.0	4.6	7.7	7.7
Lubricating oils	3.7	3.4	4.7	4.4	5.0
All other	2.1	2.0	2.5	0.5	3.2
Foreign imports	3.3	..	11.4	34.6	78.6
Crude	2.9	..	9.9	32.7	77.8
All other	0.4	..	1.5	2.0	0.8

[1] District Five of the United States Bureau of Mines consists of California, Oregon, Washington, Arizona, and Nevada.
[2] Including natural gasoline and liquefied petroleum gases.
Note: Figures may not total exactly because of rounding.
Source: United States Department of the Interior, Bureau of Mines, *Petroleum Situation in District Five.*

This brings us again to the basic problem of the inherent shortage of high gravity crudes in California and the consequent necessity to look to outside sources of supply. From this standpoint, it makes little difference whether that supplementary supply comes from a foreign source or from some other part of the United States. Come it will, for nature abhors a vacuum whether in the economic or in the physical realm. Table 4, showing the receipts of crude and refined petroleum products in the Pacific Coast area drawn from *all* sources during the five-year period from 1949 to 1953, makes it clear that only within the last year have *foreign* imports exceeded "imports" from other sections of the United States. If all imports from foreign sources were banned tomorrow, there can be little doubt that the present importing concerns would probably turn to importing crude oil from Texas which has an enormous potential productive capacity only partly utilized today, whereas in all probability the current forced draft rate of "producibility" in California will taper off during the next few years unless significant new discoveries are made. Texas crude would come either by tanker, in spite of the high cost of operating American flag vessels, or by overland pipe lines—in either case incurring costs considerably greater than those involved in importing oil from foreign sources. The other alternative, already discussed, is the investment of large additional sums by Pacific Coast refiners to equip themselves to process more completely the low gravity oils which in all probability will continue to represent some 25 to 30 percent of California's total crude production—again a costly business. Such investments, to repeat, are being made by leading companies in the industry, but there is still a long way to go and the ultimate financial soundness of such investment may be open to question.

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