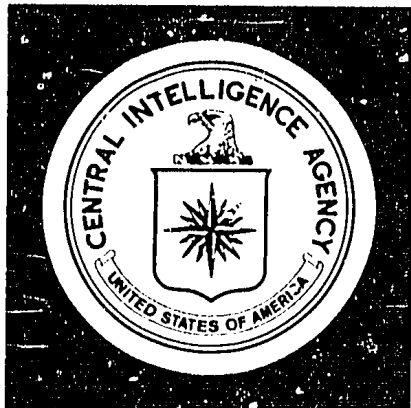


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# Intelligence Handbook

## *Export Refining Centers of the World*

A (ER) 75-66  
June 1975

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**Export Refining Centers  
of the World**

**June 1975**

## EXPORT REFINING CENTERS OF THE WORLD

Five major refining centers scattered around the globe account for two-thirds of all Free World petroleum product exports. Although they have only 25% of Free World refining capacity, these centers have a product export capacity on the order of 8.5 million b/d, in addition to more than one million b/d of bunkers.

**The Caribbean** normally delivers about 80% of its product exports to the United States.

**Rotterdam** sends about 75% of its product exports to West European countries.

**The Persian Gulf** ships almost 50% of its refined exports to Asia, principally to Japan, and the balance to Africa, Western Europe, Latin America, and the United States.

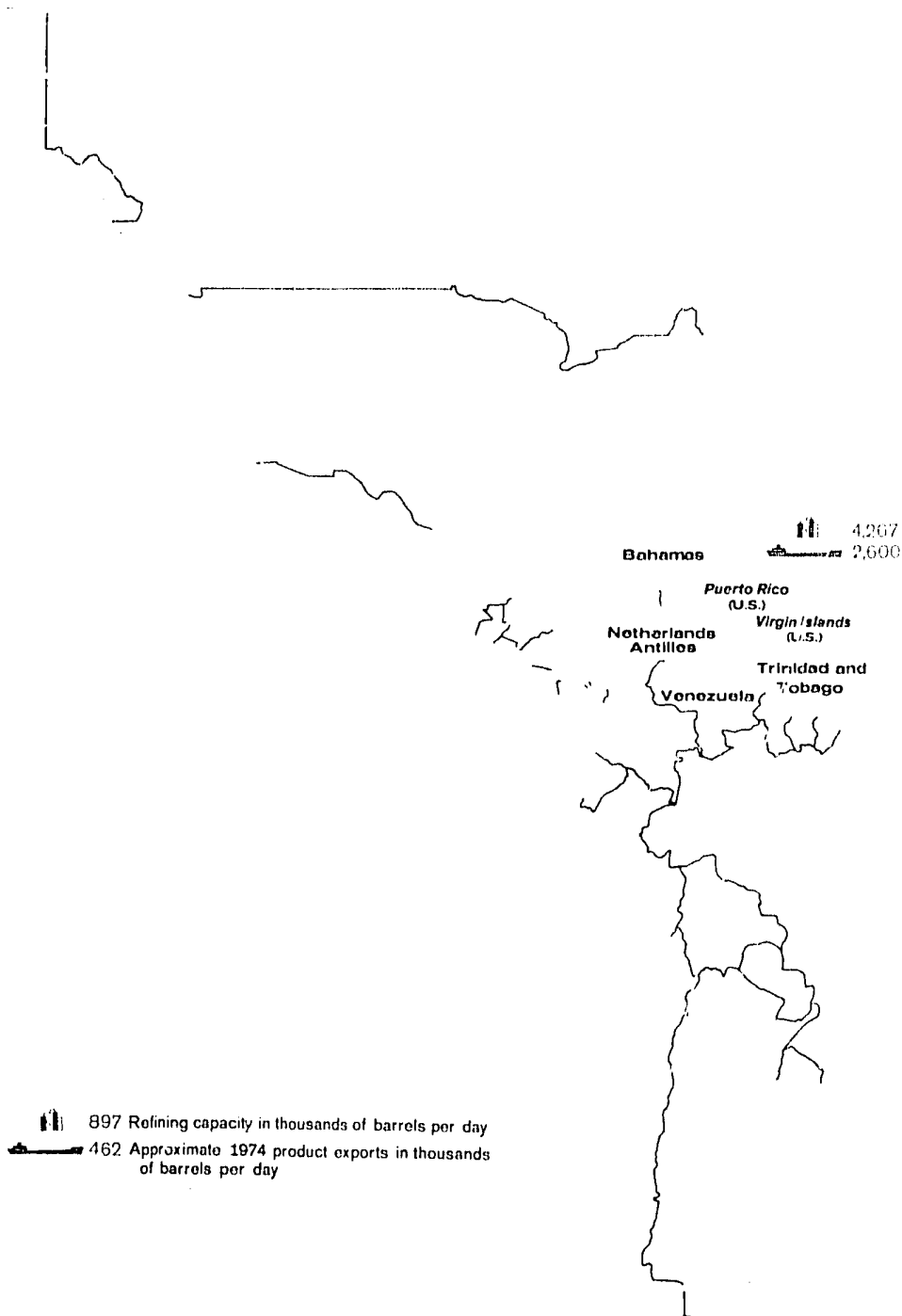
**Italy** delivers about 60% of its product exports to other West European countries and 20% to the United States.

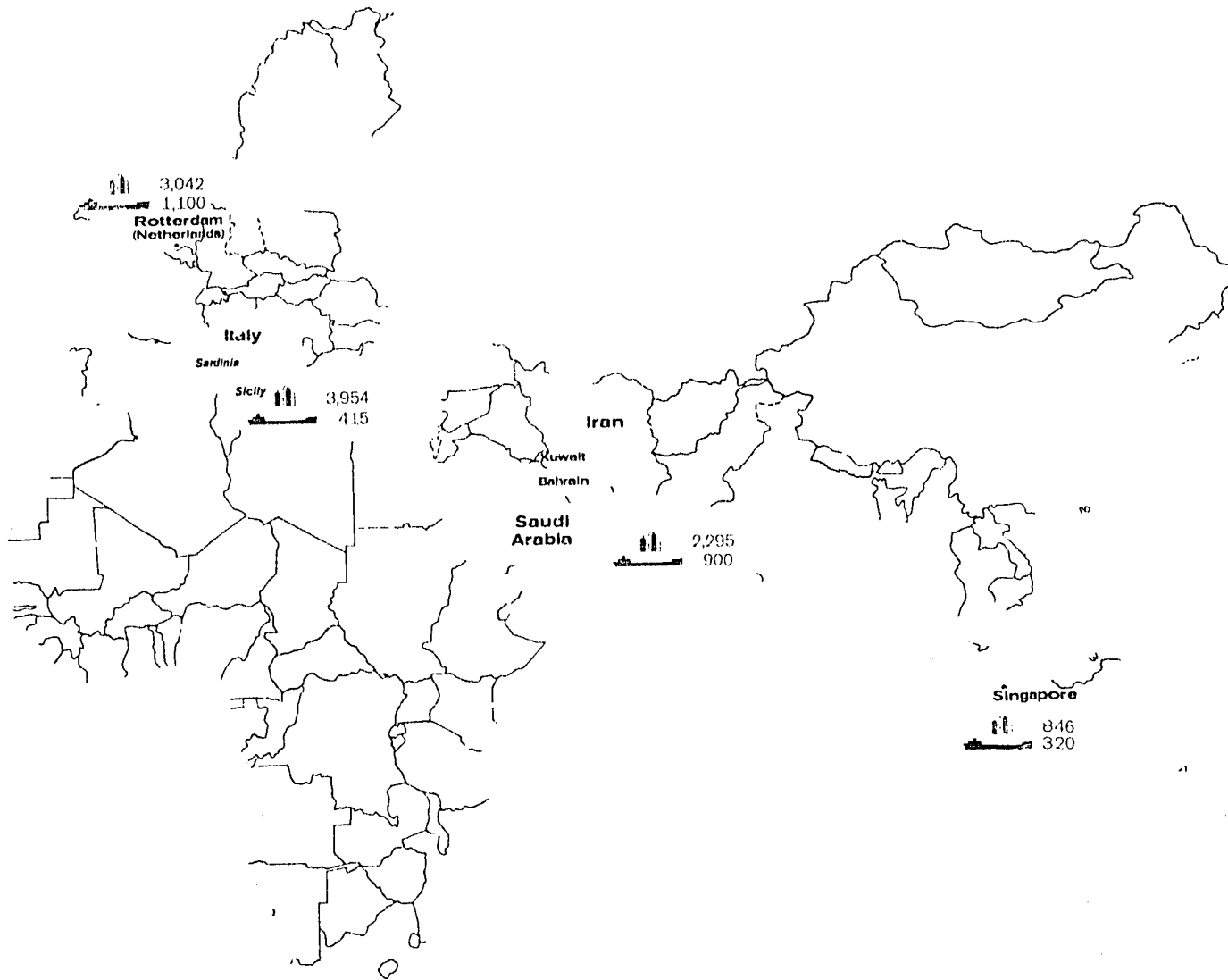
**Singapore** sends almost one-third of its exports to Japan and most of the rest to Southeast Asia.

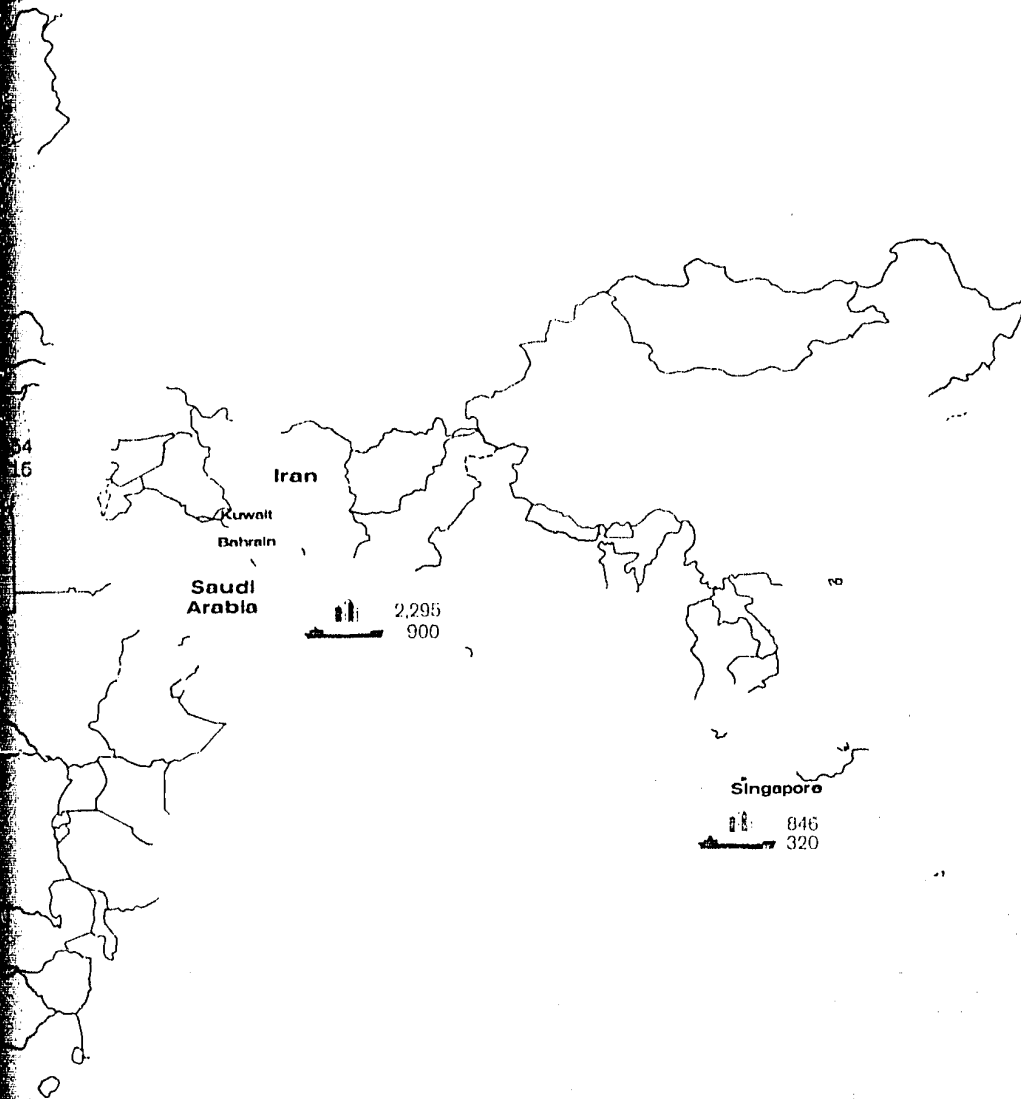
In the Caribbean, refineries in Venezuela, Trinidad, the Netherlands Antilles, and Puerto Rico were set up to operate on crude produced in the region. In recent years, crudes from other areas have supplemented local supply for all but the Venezuelan plants. Newer plants in the Bahamas and Virgin Islands process mainly African and Middle East crudes. Italy and the Netherlands have no significant crude production, and Singapore has none. These centers are almost entirely dependent on imported crude. In contrast, the Persian Gulf refineries operate solely on locally produced crude.

These centers have been operating far below their capacity for the past two years. Reduced throughput reflects slack demand brought on by the economic downturn and two generally mild winters. The Italian center - the hardest hit - has been operating at less than 50% of capacity this year.

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**Export Refining Centers of the World**









## General

The refining capacity of the Caribbean area, 4.3 million b/d, is oriented toward supplying petroleum products to the US east coast. Normally about 80% of Caribbean exports of refined products are shipped to the United States. In 1974, US product imports of 2 million b/d from the Caribbean amounted to 76% of total product imports; this percentage was up from 72% in 1973 despite a 200,000 b/d fall in the absolute volume of product imports from the Caribbean.

Residual fuel oil accounted for nearly 70% (1.4 million b/d) of these US imports in 1974. The Caribbean supplied 87% of US imports of residual fuel oil and 52% of domestic consumption. For a variety of economic reasons, US refineries are designed to produce little or no residual fuel oil. Over the past decade, only 8% of each barrel of crude refined in the United States was sold as residual. This compares with 60% in the Caribbean refineries, many of which were set up with an eye to providing residual to the growing US market.

## Refinery Characteristics

Caribbean refining capacity falls into two categories. The older refineries were set up to process local crudes into a variety of products principally for export to the United States, Western Europe, and Latin America. These refineries, with an aggregate capacity of 2.9 million b/d, are located in Venezuela, Trinidad, and the Netherlands Antilles. In recent years, declining Latin American crude production has forced the importation of crudes from other areas to supplement local crude inputs. The second category includes refineries in the Bahamas, the Virgin Islands, and Puerto Rico. These plants, with a capacity of 1.4 million b/d, were designed mainly to provide fuel oil to the US market. Most of the crude for the Bahamian and Virgin Islands refineries comes from Africa and the Middle East, while Puerto Rico is supplied principally from Venezuela.

## Export Capacity

Consumption in the six Caribbean areas of 685,000 b/d takes up only 16% of their refining capacity, leaving 3.6 million b/d for export.

## Desulfurization Facilities

Some of the refineries have catalytic hydrodesulfurization facilities to remove sulfur from residual fuel oil to meet US environmental standards. These facilities

## Caribbean: Refining Capacity

	Thousand b/d		
	Total Capacity	Domestic Demand	Export Capacity
<b>Total</b>	<b>4,267</b>	<b>685</b>	<b>3,582</b>
Bahamas	500	50	450
Netherlands Antilles	900	75	825
Puerto Rico	284	170 <sup>1</sup>	114
Trinidad	461	50	411
Venezuela	1,532	250	1,282
Virgin Islands	90	90	500

1. Excludes an estimated 30,000 b/d of petrochemical feedstock imports.

are normally operated to reduce 4% sulfur content fuel oil to below 1%, and 2% sulfur content fuel oil to as low as 0.3%, with an approximate 90% yield from the volume of fuel charged. The remainder is gas and residual bottoms.

A second way of producing low-sulfur fuel oil is to charge low-sulfur crude. A third procedure is to blend residual fuel with low-sulfur distillate.

Certain of these refineries have facilities to remove sulfur from distillate. Such facilities would normally reduce a 1% sulfur content material to about 0.2%.

### Caribbean Oil Supply and Demand

The Caribbean depends on imports for about 30% of its supply of crude. In 1974, net oil imports by the six refiners averaged 1.3 million b/d. Domestic production of 3.2 million b/d, almost entirely from Venezuela, provided the remaining 70%. Except for Venezuela and Trinidad, all of the refiners are totally dependent on imported crude. In 1974, Venezuela exported about 60% of its crude production - 1.1 million b/d outside the Caribbean and 700,000 b/d to Caribbean refineries. Trinidad covers about 20% of its refinery output with domestic production.

Prior to the embargo, Arab oil exports to the Caribbean averaged 400,000 b/d, or one-fourth of Caribbean oil imports. During the embargo, however, oil imports were cut by only about 100,000 b/d largely because of increased imports from Iran. Partial data for the post-embargo period indicate that Arab oil now accounts for more than 35% of Caribbean net oil imports, or 500,000 b/d. The increase is largely the result of a tripling of imports from Saudi Arabia compared with the pre-embargo period.

## Caribbean Refining Capacity as of 1 May 1975

	Location	Capacity Thousand b/d	Ownership
<b>Total</b>		<b>4,267</b>	
<b>Bahamas</b>		<b>500</b>	
Bahamas Oil Refining Co.	Freeport	500	New England Petroleum Co. and Standard Oil of California
<b>Netherlands West Indies</b>		<b>900</b>	
Lago Oil and Transport Co.	Aruba	440	Exxon Corp.
Shell Curacao	Curacao	460	Royal Dutch/Shell Group
<b>Puerto Rico</b>		<b>284</b>	
Caribbean Gulf Ref. Co.	Bayamon	38	Gulf Oil Corp.
Commonwealth Oil Ref. Co.	Penuelas	161	Commonwealth Oil Ref. Co.
Yabucoa Sun Oil Co.	Yabucoa	85	Sun Oil Co.
<b>Trinidad</b>		<b>461</b>	
Texaco Trinidad	Pointe-a-Pierre	361	Texaco Inc.
Trinidad and Tobago Oil Co.	Point Fortin	100	Trinidad and Tobago Government
<b>Venezuela</b>		<b>1,532</b>	
Chevron Oil Co. of Venezuela	Bajo Grande	62	Standard Oil Co. of California
Cia. Shell De Venezuela	Cardon	348	Royal Dutch/Shell Group
Cia. Shell De Venezuela	San Lorenzo	32	Royal Dutch/Shell Group
Corp. Venezolana Del Petroleo	Moron	30	Venezuelan Government
Creole Petroleum Corp.	Amuay	630	Exxon Corp.
Creole Petroleum Corp.	Quiriquire	110	Exxon Corp.
Mobil Oil De Venezuela	El Palito	102	Mobil Oil Corp.
Phillips Petroleum Co.	San Roque	5	Phillips Petroleum Co.
Sinclair Venezuelan Oil Co.	El Chaure	40	Atlantic Richfield Co.
Sinclair Venezuelan Oil Co.	El Toreno	5	Atlantic Richfield Co.
Texas Petroleum Co.	Tucupita	10	Texaco Inc.
Venezuela Gulf Ref. Co.	Puerto La Cruz	158	Gulf Oil Corp. and Texaco Inc.
<b>Virgin Islands</b>		<b>590</b>	
Hess Oil Virgin Islands Corp.	St. Croix	590	Amerada Hess Corp.

In 1974, refinery throughput in the six areas averaged about 3.3 million b/d, about 10% below year earlier levels and about three-fourths of capacity. The area consumed about 700,000 b/d, including bunkers, and exported the remaining 2.6 million b/d. In addition, about 1.2 million b/d of crude oil, mostly from Venezuela, was exported outside the Caribbean.

The Caribbean refineries are designed to maximize output of residual fuel oil, the major product demanded by US markets. Normally, the Caribbean refineries produce about 60% residual fuel oil, 10% gasoline, 13% distillate fuel oil, and 17% other products. This compares with a product composition of Caribbean exports to the United States of 69%, 7%, 10%, and 14%, respectively. Because the US market takes a slightly greater proportion of Caribbean residual fuel oil output, domestic demand and other export markets are weighted more toward the higher fractions.

### Venezuela

Venezuelan refining capacity represents more than one-third of the Caribbean area total. The government expects to nationalize the entire petroleum industry this year.

Exxon, the most important refiner, whose two plants total 740,000 b/d, has 230,000 b/d of desulfurization capacity at its Amuay plant for reducing 2% sulfur content fuel oil to 0.3%. Most of this goes to the US east coast. Exxon also has 17,000 b/d of distillate desulfurization capacity.

Shell's two plants total 380,000 b/d. Desulfurization capacity at the Cardon plant consists of 32,000 b/d residual and 44,000 b/d distillate.

The eight plants of the other refining companies, totaling about 410,000 b/d, have only 6,000 b/d distillate desulfurization, located at the Mobil refinery.

All these refineries operate on Venezuelan crude.

### Trinidad

Trinidad's two long-established export refineries operate mostly on imported crude, the bulk coming from Saudi Arabia and Indonesia, where Texaco has important production.

Texaco's big 361,000 b/d refinery normally charges about 80% imported crude. This facility has 80,000 b/d of residual desulfurization and 45,000 b/d of distillate

desulfurization capacity. Its single-point mooring buoy located four miles offshore in 81 feet of water can accommodate tankers of up to 260,000 DWT. The facility also has eight other oil berths. The United States is the refinery's principal export market. Residual fuel oil is the main product.

The 100,000 b/d government refinery processes about two-thirds Trinidad and one-third imported crude. This refinery was acquired by the government in August 1974; Shell, which had owned the refinery for many years, chose to sell out what it considered a marginal operation rather than make substantial new investments in petrochemical facilities as demanded by the government.

Trinidad refineries use a large proportion of imported crude in part because higher quality, low-sulfur crude produced in Trinidad is exported. The principal case is the offshore production of Standard Oil Company of Indiana, which exceeded 100,000 b/d at yearend 1974. The Standard of Indiana crude is shipped to the United States where the value of its yield of light products is higher than would be the case in Trinidad, where facilities are geared to producing mainly heavy fuel oil.

#### Netherlands Antilles

The huge export refineries of Exxon and Shell with combined capacity of 900,000 b/d have been operating in the Netherlands Antilles for decades. They were built to process Venezuelan crude and to supply products to the United States, Eastern Canada, and other Western Hemisphere destinations, as well as to Western Europe.

The Exxon plant has 115,000 b/d of residual and 123,000 b/d of distillate desulfurization capacity. Shell has 25,000 b/d of residual and 100,000 b/d of distillate desulfurization capacity.

Both installations have extensive discharging and loading facilities. They can handle very large crude carriers of up to 500,000 DWT. Shell recently completed a crude oil transshipment terminal which can handle 825,000 b/d destined for the United States. The new terminal can also handle 250,000 b/d for the refinery.

#### Virgin Islands

The Amerada Hess Virgin Islands refinery went on stream in 1967 at 70,000 b/d. It was subsequently expanded in six stages to its present 590,000 b/d. The refinery was built by Hess Oil and Chemical Company, an independent US refiner and marketer specializing in residual fuel oil, to supply the US east coast. In 1969, Hess merged with Amerada Petroleum Corporation, a firm with production in the

## US Oil Imports

Thousand b/d and Percent of Total

	Total	Crude Oil	Total Refined Products	Motor Gasoline	Distillate Fuel Oil	Residual Fuel Oil	Other
1973							
Total	6,256	3,244	3,012	134	392	1,853	633
Percent	100	100	100	100	100	100	100
Total Caribbean	2,577	404	2,173	92	249	1,511	321
Percent	41	12	72	69	64	82	51
Venezuela	1,135	344	791	7	62	603	119
Percent	18	10	26	5	16	33	19
Bahamas	174	....	174	....	22	128	24
Percent	3	....	6	....	6	7	4
Netherlands							
Antilles	585	....	585	16	65	420	78
Percent	9	....	19	12	17	23	12
Trinidad	255	60	195	3	13	137	42
Percent	4	2	7	2	3	7	7
Virgin Islands	329	....	329	14	64	217	34
Percent	5	....	11	11	16	12	5
Puerto Rico	99	....	99	52	23	....	24
Percent	2	....	3	39	6	....	4
Other	3,679	2,840	839	42	143	342	312
Percent	59	88	28	31	36	18	49
1974							
Total	6,088	3,477	2,611	204	281	1,572	554
Percent	100	100	100	100	100	100	100
Total Caribbean	2,372	382	1,990	133	199	1,369	289
Percent	39	11	76	65	71	87	52
Venezuela	980	319	661	11	44	497	109
Percent	16	9	25	5	16	32	20
Bahamas	159	....	159	....	15	110	34
Percent	3	....	6	....	6	7	6
Netherlands							
Antilles	510	....	510	16	46	363	85
Percent	8	....	20	8	16	23	15
Trinidad	241	63	178	16	23	111	28
Percent	4	2	7	8	8	7	5
Virgin Islands	392	....	392	45	46	283	18
Percent	6	....	15	22	16	18	3
Puerto Rico	90	....	90	45	25	5	15
Percent	2	....	3	22	9	Negl.	3
Other	3,716	3,095	621	71	82	203	265
Percent	61	89	24	35	29	13	48

United States, Canada, and Libya. This refinery operates, however, on crude purchased from other sources. It has 95,000 b/d of residual desulfurization capacity.

#### **Bahamas**

The Bahamas Oil Refining Company began refinery operations at 250,000 b/d in mid-1970 and expanded capacity to 500,000 b/d in 1973. At the same time, a 60,000 b/d desulfurizer was completed to improve the company's capability to meet requirements for lower sulfur content fuel oils. The refinery was built specifically to supply residual fuel oils to the US east coast. Its majority owner, New England Petroleum Company, is an important independent US fuel oil marketer that uses this plant as a source of supply. The refinery's main products are low-sulfur residual fuel oil, distillate heating oils, and petrochemical feedstocks.

Two offshore jetties can accommodate incoming crude carriers of up to 400,000 DWT. Product loading facilities consist of eight berths. These are for much smaller vessels, as no US east coast port can at present receive tankers exceeding 60,000 DWT.

#### **Puerto Rico**

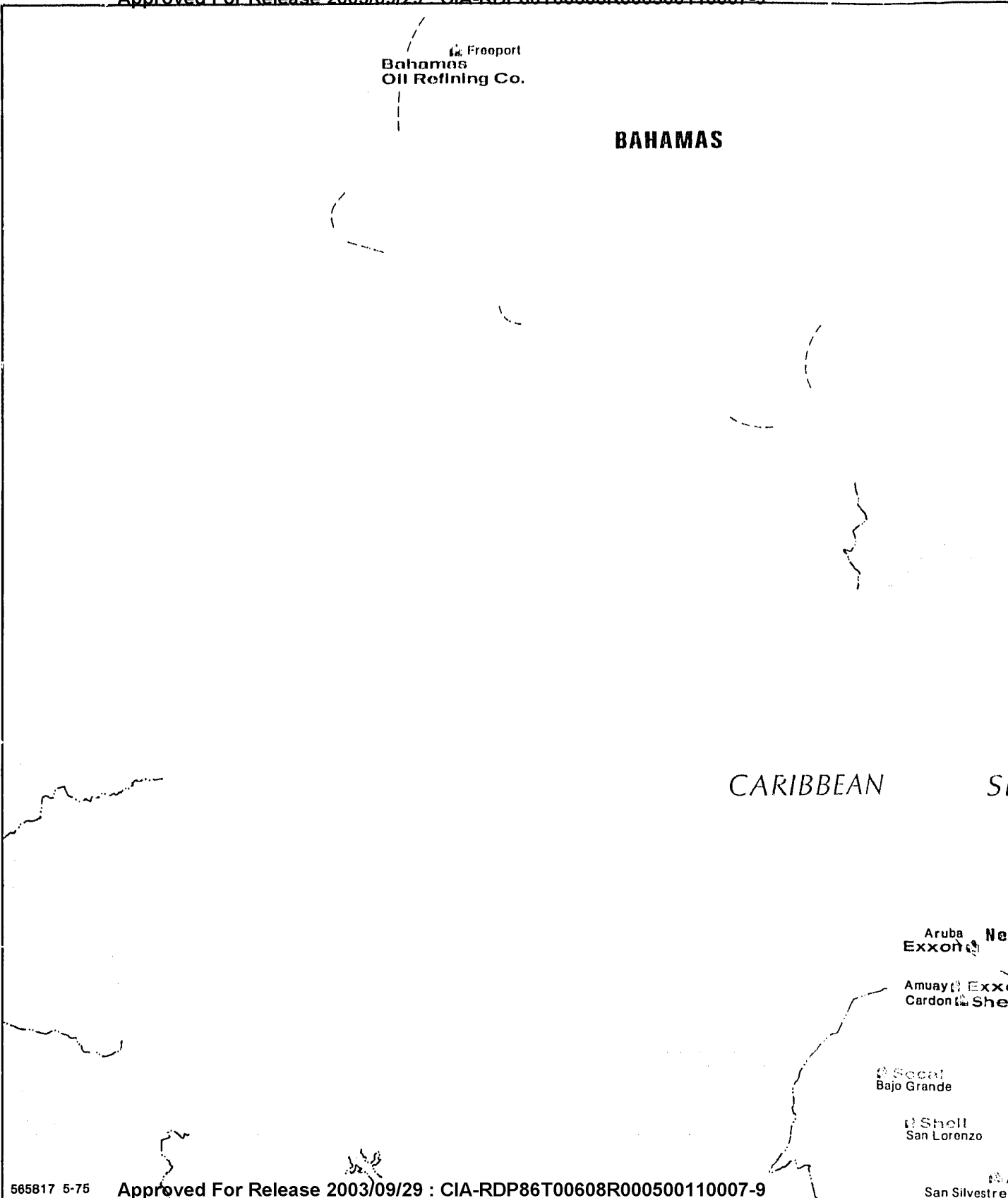
The three Puerto Rican refineries, all built within the past two decades, supply practically all on-island petroleum demand, including petroleum feedstocks to numerous petrochemical plants specifically built to utilize this output. The refineries ship small volumes to the United States.

Commonwealth, an independent whose refinery was built almost 20 years ago, is the main petrochemical supplier. Seven petrochemical plants, either wholly owned or joint ventures, are operating in its complex. The refinery has 88,000 b/d of residual desulfurization capacity.

In addition to supply contracts with Venezuelan producers of crude, Commonwealth has a long-term contract in effect with the Algerian government and another with the Indonesian government on which deliveries are scheduled to start in 1977.

Gulf's small refinery, built in the late 1950s to process Venezuelan crude, has 16,000 b/d of residual desulfurization capacity. The Sun plant was built in the late 1960s to refine Sun Oil's Venezuelan crude production, which could not be imported into the United States because of the Mandatory Import Control Program. It has 8,000 b/d of residual and 12,000 b/d of distillate desulfurization facilities.

\* \* \* \*





# Refineries in the Caribbean

AMAS

ATLANTIC OCEAN

CARIBBEAN SEA

Puerto Rico (U.S.)  
Bayamon Gulf  
Penuelas  
Commonwealth  
Sun  
Yabucoa  
U.S. Virgin Islands  
Hess  
St. Croix

Aruba  
Exxon  
Netherlands Antilles  
Shell  
Curacao  
Amuay  
Exxon  
Cardon  
Shell

Socaf  
Bajo Grande  
Shell  
San Lorenzo

Moron  
El Palito  
Venezuelan Govt.  
Mobil  
Gulf/Texaco  
Puerto La Cruz  
Arco  
El Chaure

VENEZUELA

Arco  
San Silvestre

Pointe-a-Pierre  
Point Fortin  
Quiriquire  
Texaco  
Trinidad and Tobago Govt.  
Phillips  
San Roque  
Texaco  
Tucupita

### General

The great volumes of crude oil and products that flow through Rotterdam have made it one of the petroleum industry's most important international centers. As well as being a refining and transshipment center, Rotterdam is the home of Europe's most important oil brokerage houses. These houses handle trade in oil products on both a contract and spot basis, dealing not only in locally refined products but also placing cargo lots from the USSR, Latin America, the eastern Mediterranean, and elsewhere.

Rotterdam's spot market quotations are often used to estimate international oil price trends, to set contract prices on products, and to determine the value of various types of crude oil. An oil products futures market for gasoline and distillate was set up in 1974 by several brokers and other business interests.

### Refining

Fourteen refineries with combined capacity of 3 million b/d obtain their crude oil by pipeline through the port of Rotterdam. Five of these refineries are in the Rotterdam area, two are elsewhere in the Netherlands, three are in Belgium, and four are in West Germany. These refineries are set up to process mainly sour crude from the Persian Gulf. African sweet crudes currently make up about 20% of inputs.

Current Dutch refining capacity of 2 million b/d, including a small Amsterdam plant that does not receive its crude through Rotterdam, represents 10.5% of West European capacity. Dutch domestic oil consumption accounts for only 6% of Western Europe's total demand, including bunkers, and utilizes only 41% of Dutch capacity at 100% operating rate. Consequently, at full operations, more than half of Dutch refinery output will be exported. Rotterdam normally handles one-third of West European petroleum product export trade. All but about 30,000 b/d of crude oil used in Dutch refineries must be imported.

### Product Mix

The Rotterdam refineries are designed to maximize output of distillate and residual fuel oils, the major products demanded by Dutch and other West European consumers. Figures for the five Rotterdam refineries and the Mobil Amsterdam plant (the CFP Flushing plant was not yet in operation when the figures were compiled) show that the Netherlands refinery yield ran 62% distillate and residual, the same percentage as for all West European refineries combined.

### Desulfurization Capacity

The five Rotterdam refineries have about 160,000 b/d of fuel oil desulfurization capacity and the Amsterdam refinery some 30,000 b/d, the Flushing refinery none, for a Netherlands total of 190,000 b/d; the three Belgian refineries and the four West German plants supplied by pipeline from Rotterdam have 100,000 b/d and 90,000 b/d, respectively. Total desulfurization capacity of the 14 refineries supplied from Rotterdam thus is 380,000 b/d.

The main sour Persian Gulf crudes (Saudi Arabian, Iranian, and Kuwait) yield residual fuel oils with sulfur contents in the range of 2.5% to 4%. Desulfurization facilities that charge such fuel oils are designed to reduce the sulfur content to below 1%.

### Storage

The Rotterdam port area has crude and products storage capacity of 170 million barrels. A transshipment terminal under construction at Massvlakte is expected to add 10 million barrels of storage capacity by the end of this year and another 20 million by the end of 1977, increasing total area capacity to 200 million barrels.

Crude oil and products in storage at Rotterdam fall into four categories:

- Sixty-five days of compulsory (strategic) reserves based on each importer's domestic volume for the previous year. These reserves must be held apart from normal operations and be available at all times. They may be used only at government directive. Compulsory reserves currently are estimated at about 45 million barrels.
- Working stocks of refiners and other importers. Market refineries operating on imported crude normally maintain storage for about 20 days of crude throughput, plus storage for 30 days' output of refined products. Capacity now stands at about 85 million barrels.
- Supplies in transit to other countries. Such supplies may remain in the country for up to 30 days before they must be declared as imports. Volumes in this category cannot be estimated.
- Stocks in storage belonging to companies in other countries, mainly West Germany and Belgium. These crude and product stocks remain in the Netherlands for longer than 30 days, have been declared as imports, and will subsequently be shown as exports. Volumes in this category vary.

## Refineries Supplied by Pipeline from Rotterdam as of 1 January 1975

	Location	Capacity Thousand b/d	Ownership
<b>Total</b>		<b>3,042</b>	
Rotterdam area		<u>1,709</u>	
BP Raffinaderij			
Nederland	Europoort	490	British Petroleum Co.
Chevron Petroleum Mj.	Pernis	300	Standard Oil of California and Texaco
Esso Nederland	Botlek	325	Exxon Corp.
Gulf Oil Raffinaderij	Rozenburg	94	Gulf Oil Corp.
Shell Nederland Raffinaderij	Pernis	500	Royal Dutch/Shell Group
Other Netherlands		<u>255</u>	
Mobil Oil	Amsterdam	125	Mobil Oil Corp.
Total Raff. Nederland	Flushing	130	Cie. Francaise Des Petroles
Belgium		<u>554</u>	
Esso Belgium	Antwerp	93	Exxon Corp.
Soc. Industrielle Belge	Antwerp	321	British Petroleum Co. and Petrofina
Chevron Belgium	Feluy	140	Standard Oil of California
West Germany		<u>524</u>	
Caltex Deutschland	Raunheim (Frankfort)	90	Standard Oil of California and Texaco
Gelsenberg A.G.	Gelsenkirchen	144	Geisenberg A.G. (government 51%)
Deutsche Shell	Godorf	165	Royal Dutch/Shell Group
Union Rheinische	Wesseling	125	Union Rheinische Braunkohlen

## Refinery Output of and Domestic Demand for Refined Products

	Percent			
	Netherlands		Western Europe	
	Refinery Output	Domestic Demand	Refinery Output	Domestic Demand
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
Gasoline	9	10	14	14
Kerosine and jet fuel	7	5	4	4
Distillate fuel oil	28	22	29	30
Residual fuel oil	34	34	33	32
Other products	22	29	20	20

## Port Area

The Rotterdam port area extends from Europoort near the Hook of Holland inland to the city of Rotterdam, a distance of about 25 miles. The port facilities are situated on both sides of the New Rotterdam Waterway, a 17-mile dredged channel beginning at the Hook of Holland, and the New Maas River. These are open connections to the North Sea and the Rhine River. (The waterway leads into the river.)

An extension to the port is under construction through the damming and reclaiming of the Maasvlakte, a shallow area of the North Sea to the south of the New Rotterdam Waterway, adjacent to Europoort.

The oil tanker terminals are located in eight petroleum harbors. Numbers 1 and 2 are at Pernis, well inland along the river; Number 3 is at Botlek, downriver; Numbers 4, 5, 6, and 7 are at Europoort. Number 8 at Maasvlakte is in operation, although only part of the tankage is completed and other parts of the project are still under construction.

The 65-foot-deep New Rotterdam Waterway to Europoort, which is reached by an 8-mile approach channel extending into the North Sea, can be navigated by fully loaded tankers of up to 250,000 DWT capacity. Rotterdam Municipality plans to deepen this channel to 68 feet by the end of this year to give access to Europoort for tankers of up to 275,000 DWT.

Two of the refineries are at Pernis, with one each at Botlek, Rozenburg, and Europoort. The tanker terminals and refineries are connected by pipeline.

## Pipelines to Points Outside Port Area

Four crude oil and two products pipelines for points outside the port area originate in Rotterdam. The most important crude line, the Rotterdam-Rhine Pipeline, 36-inch-diameter, runs east 110 miles through Venlo into West Germany. There it branches south to Godorf and Wesseling with an extension to Raunheim, and northeast to Wesel where it connects with another line to Gelsenkirchen. The entire system has a total length of 283 miles. Current capacity is 460,000 b/d.

A 34-inch-diameter, 65-mile crude line to Antwerp, Belgium, has a current capacity of 560,000 b/d. A 55-mile extension supplies a 140,000 b/d refinery at Feluy.

Netherlands: Oil Flows<sup>1</sup>

Thousand b/d

	Imports		Exports	
	1974 Est. <sup>2</sup>	Pre-Embargo 1973	1974 Est.	Pre-Embargo 1973
<b>Total</b>	<b>2,463</b>	<b>3,225</b>	<b>Total</b>	<b>1,834</b>
Crude oil	2,023	2,862	Crude oil	721
Arab	307	1,999	Western Europe	704
Libya	18	191	Belgium-Luxembourg	254
Syria	4	40	West Germany	358
Iraq	6	17	United Kingdom	29
Saudi Arabia	186	900	Denmark	20
Kuwait	83	559	France	15
Qatar	4	139	Other	28
Abu Dhabi	4	75	Other	17
Algeria	2	36	Refined products	1,113
Other	....	42	Western Europe	862
Iran	1,249	568	Belgium-Luxembourg	100
Nigeria	421	249	France	16
Venezuela	23	18	Italy	2
Other	23	28	Spain	7
Refined products	440	363	United Kingdom	113
Western Europe	227	192	West Germany	443
Belgium-Luxembourg	28	40	Denmark	46
France	18	27	Sweden	59
Italy	73	45	Other	76
Spain	11	14	Other and unknown <sup>3</sup>	251
United Kingdom	50	30		302
West Germany	43	26		
Other	4	10		
Arab	12	45		
Other	201	126		

1. Including oil transshipped.

2. Based on data through September.

3. Including bunkers.

One crude line (26-inch-diameter, 53 miles in length) within the Netherlands supplies a 125,000 b/d refinery in Amsterdam. A second line (24-inch-diameter, 93 miles in length) supplies a 130,000 b/d refinery at Flushing.

The 24-inch products line into West Germany was originally the crude line through Venlo until replaced in 1968 by the present 36-inch. This products line, with capacity of 240,000 b/d, supplies largely the same West German area as the

crude line, but extends southward to Ludwigshafen. A small 8-inch line to the Dutch province of South Limburg (near Liege, Belgium) supplies petrochemical feedstocks to plants in that area.

#### Oil Flows Through Rotterdam, 1974

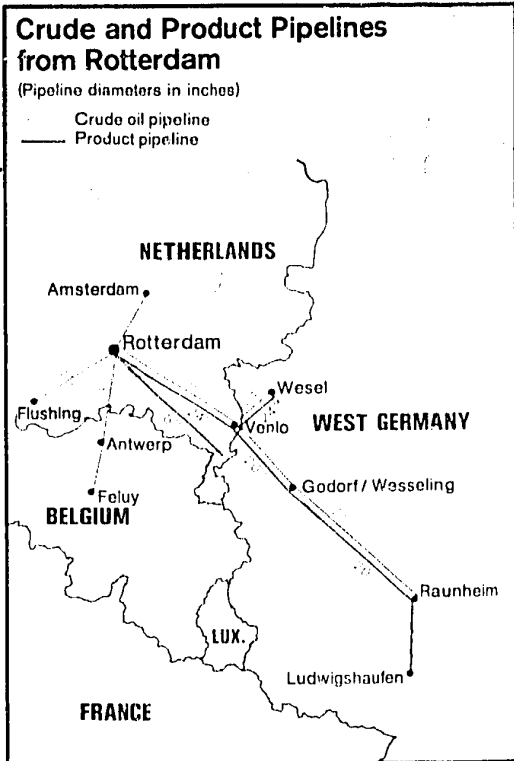
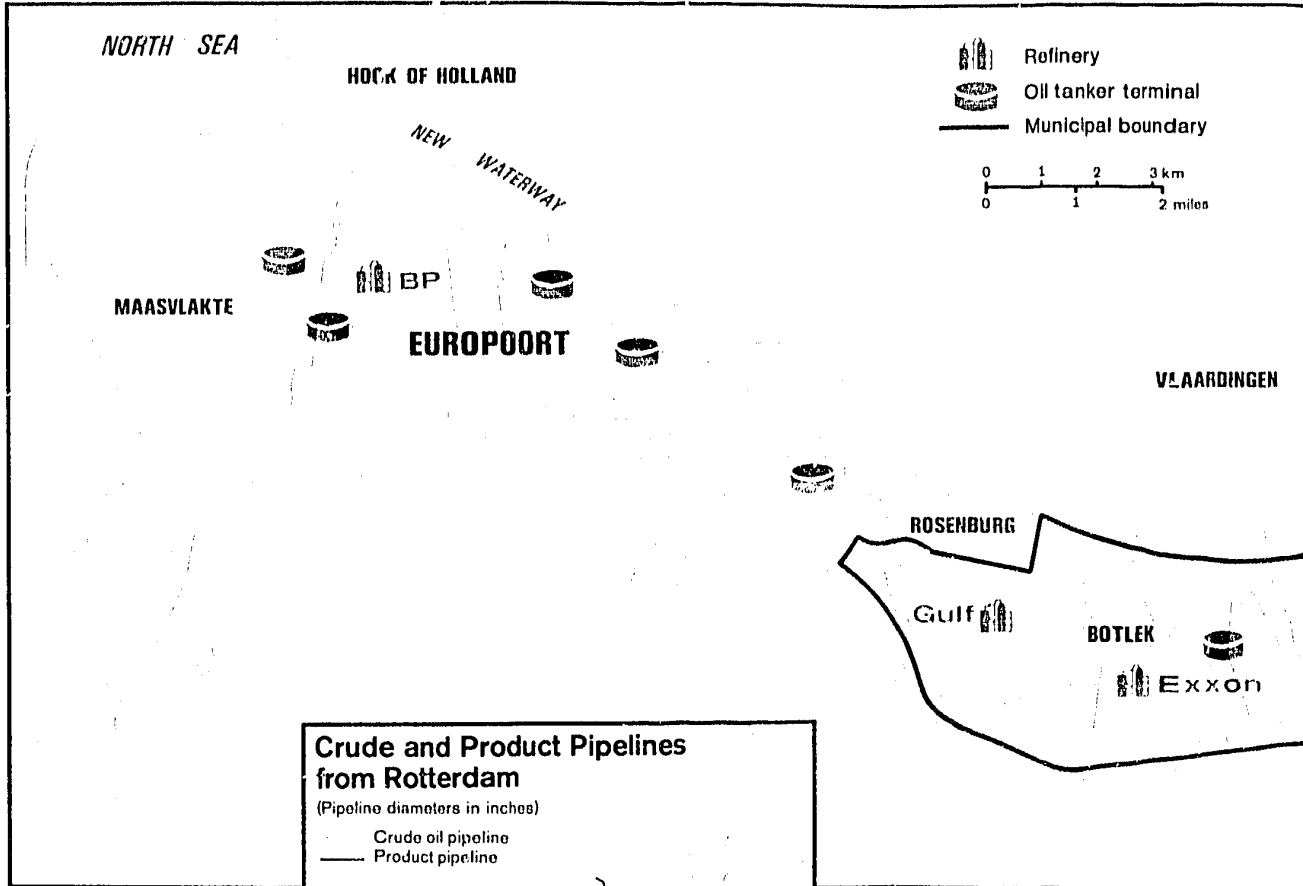
Western Europe depends heavily on the greater Rotterdam area for its oil supplies. Despite the Arab oil embargo, inflows to Rotterdam of crude oil and products amounted to nearly 2.5 million b/d in 1974, or about 17% of West European oil consumption. Inflows of crude oil and products were 2 million b/d and about 400,000 b/d, respectively.

About 600,000 b/d, including refinery fuel losses, was consumed in the Netherlands. The remaining 1.8 million b/d was exported -- 1.1 million b/d of refined products (including bunkers), and 700,000 b/d of crude oil. The Dutch refined about 1.3 million b/d (compared with capacity of 2 million b/d) and transshipped the remaining 700,000 b/d of its crude oil supplies.

European countries received almost all of the outflow from Rotterdam. Belgium and Luxembourg received about 350,000 b/d -- more than 50% of their oil requirements -- and West Germany relied on the Netherlands for 800,000 b/d -- about 30% of its oil imports. Denmark and Sweden obtained between 10% and 20% of their oil supplies from the Netherlands.




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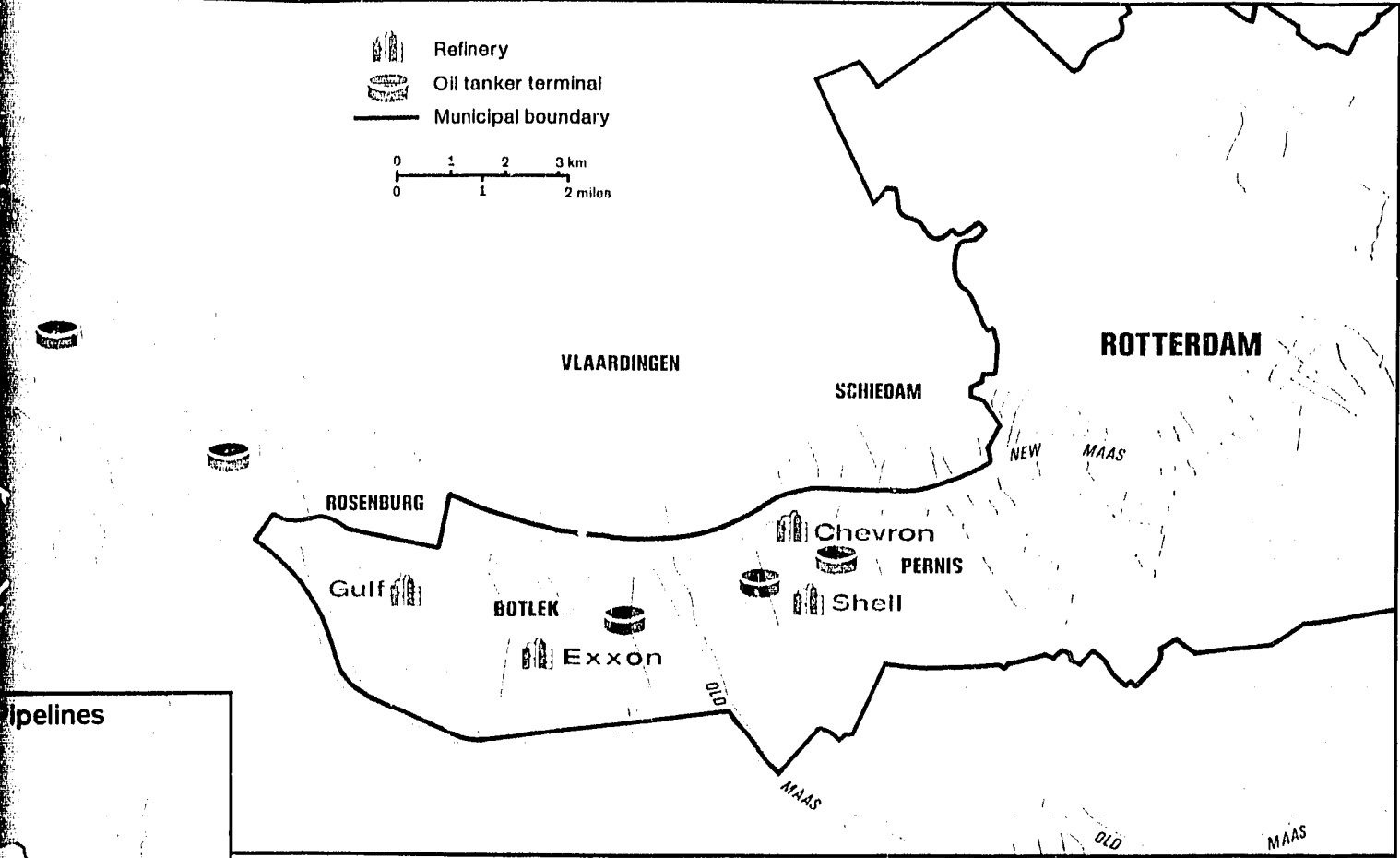
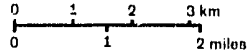
### Petroleum Facilities in the Rotterdam Harbor





# Rotterdam Harbor

-  Refinery
-  Oil tanker terminal
-  Municipal boundary



## Pipelines



## EXPORT REFINERIES OF THE PERSIAN GULF

### General

Four Persian Gulf countries – Bahrain, Iran, Kuwait, and Saudi Arabia – have a combined refining capacity of 2.3 million b/d, or 70% of the Middle East total. This is equivalent to nearly 10% of their productive capacity for crude, 21.6 million b/d.

At the outbreak of World War II, refining capacity in the Middle East was limited to Iran (335,000 b/d) and Bahrain (35,000 b/d). By 1950, Persian Gulf capacity, including new plants in Saudi Arabia and Kuwait, exceeded 800,000 b/d, equivalent to 90% of the Middle East total. Since then, Persian Gulf capacity has increased by 1.5 million b/d, through additions of about 600,000 b/d in Kuwait, 500,000 b/d in Saudi Arabia, 100,000 b/d in Bahrain, and 300,000 b/d in Iran.

Ownership of Persian Gulf refining facilities may well shift almost completely from the foreign-owned international oil companies to the host government during the next decade. (a) Iran has total ownership of its refineries; (b) Kuwait holds about two-thirds ownership of national refining capacity; (c) Saudi Arabia owns two small refineries, but the major plant (Aramco) is still completely foreign-owned; and (d) Bahrain's refinery remains totally in foreign hands.

Refinery throughput in the four countries totaled 1.8 million b/d in 1974. The area consumed about 900,000 b/d including bunkers, which accounted for about half the total. The remaining 900,000 b/d was exported. Nearly 50% of these product exports normally go to the Far East and Asia – principally to Japan; the remainder goes to Africa, Western Europe, Latin America, and the United States.

The refineries are designed to maximize output of residual fuel oil, the major product demanded by Japan and used in bunkering. They normally produce about 50% residual fuel oil – roughly the same proportion as in Japanese oil consumption and in the Gulf's domestic demand.

The Persian Gulf has prospects for a substantial increase in refining capacity through new joint ventures. Iran and Saudi Arabia are interested in constructing new plants in the 250,000 - 500,000 b/d range for completion in 1980 and beyond. One Saudi plant has already been approved in a joint venture with Shell. Iraq, although a major crude producer, is not a factor in Gulf refining. Its single plant in the Gulf area supplies domestic product requirements. Future plans, however, include construction of a 300,000 - 400,000 b/d refinery, whose products would be exported primarily to Japan. The aspirations and plans of the Persian Gulf states could, if fulfilled, result in a doubling of the refining capacity of the area over

	Thousand b/d				
	Saudi Arabia	Iran	Kuwait	Bahrain	Total
<b>Total</b>	<b>750</b>	<b>600</b>	<b>300</b>	<b>170</b>	<b>1,820</b>
Domestic	350	450	100	20	920
Of which:					
Bunkers	200	150	50	20	420
Exports	400	150	200	150	900

**Persian Gulf Refining Capacity as of 1 May 1975**

	Location	Capacity (Thousand b/d)	Ownership
<b>Total</b>		<b>2,295</b>	
<b>Bahrain</b>		<b>250</b>	
Bahrain Petroleum Co.	Awali	250	Texaco and Standard Oil Co. of California
<b>Iran</b>		<b>789</b>	
National Iranian Oil Co.	Abadan	470	Iranian government
National Iranian Oil Co.	Kermanshah	15 <sup>1</sup>	Iranian government
National Iranian Oil Co.	Masjed Soleyman	64 <sup>1</sup>	Iranian government
National Iranian Oil Co.	Shiraz	40 <sup>1</sup>	Iranian government
National Iranian Oil Co.	Tehran	200 <sup>1</sup>	Iranian government
<b>Kuwait</b>		<b>646</b>	
American Independent Oil Co.	Mina Abd Allah	132	R.J. Reynolds Industries
Arabian Oil (Japan)	Ras al Khafji	30	Japanese interests, Kuwaiti and Saudi Arabian governments
Getty Oil Co.	Mina Suud	50	Getty Oil Co.
Kuwait National Petroleum Co.	Ash Shuaybah	134	Kuwaiti government
Kuwait Oil Co.	Mina al Ahmadi	300	Kuwaiti government
<b>Saudi Arabia</b>		<b>610</b>	
Arabian American Oil Co.	Ras Tanura	565	Socal, Texaco, Exxon, Mobil
Juddah Oil Ref.	Juddah	31 <sup>1</sup>	Saudi Arabian government
Riyadh Oil Ref.	Riyadh	14 <sup>1</sup>	Saudi Arabian government

1. Inland refinery; no export facilities.

the next decade. No other major Free World refining area is likely to enjoy a similar rate of expansion.

### Bahrain

The Bahrain export refinery – the only refining facility in this island nation – went on stream in the mid-1930s as a 25,000 b/d plant of Caltex (Texaco and Socal) to supply Eastern Hemisphere markets. In addition to processing Bahrain crude, the plant has for many years processed Saudi Arabian crude received by pipeline from the mainland 25 miles away. In recent years, Bahraini crude production of about 70,000 b/d has met less than one-third of the plant's capacity of 250,000 b/d. Equipment includes 62,000 b/d of fuel oil desulfurization capacity. The products loading terminal at Sitrah has seven tanker berths. Bahrain does not export crude.

The Bahraini government has 60% participation in the Bahrain Petroleum Co.'s crude production and has announced its intention to increase this to 100% this year. The government has stated, however, it does not want participation in the refinery or in Caltex's local marketing system.

In 1972, Caltex and Japanese interests were considering a joint project to double the refinery's size and increase its desulfurization capacity. The additional products were to be shipped to Japan. The project was scrapped because of concern over access to crude and the general safety of the investment.

### Iran

Iranian refining capacity now stands at about 800,000 b/d, or one-third of the total for the Gulf. The only export refinery is at Abadan. Put on stream in 1913 as an 8,000 b/d plant by British Petroleum Co. – the first in the Persian Gulf – it can now process 470,000 b/d. When nationalized in 1951, it was the largest refinery in the world. Following nationalization, it was virtually inactive until 1954, when the Iranian Consortium of 14 companies was formed to operate the properties.

In 1973 the government took over ownership from the Consortium. Under a 20-year contract made at that time, the government agreed to process up to 300,000 b/d of crude for the former Consortium companies on a fee basis. Each company's throughput rights are in accordance with its former ownership share in the Consortium (BP 40%; Shell 14%; Exxon, Texaco, Mobil, Gulf, and Socal 7% each; CFP 6%; and Iricon Agency of 6 companies, 5%). The refinery has no desulfurization facilities.

Because water depth at Abadan, 40 miles inland along a river above the Al Faw bar, is inadequate for modern tankers, all product exports transit Bandar Mah Shar. This terminal, 50 miles from Abadan, is connected by pipelines. It has six berths, which can accommodate ships of up to 60,000 DWT.

Iranian refineries can absorb only about 12% of the nation's maximum crude production. For several years the government has been actively, but unsuccessfully, endeavoring to expand refining capacity on a joint venture basis. In recent months, negotiations on three joint ventures – with Japanese, German, and US interests – have been side-tracked because either the companies were unable to meet the Shah's conditions or Tehran was unwilling to offer concessions on the price of crude. These projects would have tripled refining capacity by adding 1.5 million b/d. In 1972 the Consortium was considering the construction of a major new export refinery as part of its long-term production arrangements; this project was dropped following the government takeover in 1973. The government handles domestic distribution of petroleum products.

#### Kuwait

Kuwait is capable of processing at least 18% of its crude oil production at capacity, including its half of Neutral Zone output. The 300,000 b/d Mina al Ahmadi refinery, the largest in Kuwait, represents 46% of the national refining capacity. Originally built by the Kuwait Oil Co. (Gulf and British Petroleum) in 1950 as a 25,000 b/d plant to provide bunker fuel for crude tankers, it was expanded in several stages into a major export facility. In 1974 the government increased its initial 25% participation in Kuwait Oil Co. to 60% retroactive to 1 January 1974. Then, on 5 March 1975, it took the remaining 40%. Takeover arrangements have not been settled, and the Kuwait Oil Co. is still operating the refinery. The settlement probably will include a processing contract with British Petroleum and Gulf for most or all of the refinery's capacity.

This refinery has no desulfurization equipment. Its product yield is 50% residual fuel, 27% distillate, 20% naphtha, and 3% other products. Mina al Ahmadi is also a major crude oil loading port, having two piers with a total of 12 berths and a sea island that can accommodate two very large crude carriers.

The Ash Shuaybah refinery, built in 1968, is owned entirely by the Kuwaiti National Petroleum Co. (KNPC), which recently nationalized the 40% interest held by the Kuwait general public. Since 1961, KNPC has had the exclusive rights for distribution and sale of petroleum products in Kuwait.

This sophisticated plant was the world's first all-hydrogen refinery, able to process either light or heavy crudes. It uses associated gas from the oilfields for the manufacture of hydrogen used in the hydrocracking of residual fuel oil and heavy distillates and for hydrodesulfurization. Facilities include 48,000 b/d of residual hydrocracking for making distillates from residual; 20,000 b/d of distillate hydrocracking for making gasoline and kerosine from distillates; 85,000 b/d of catalytic hydrotreating for removing sulfur from distillates; and 11,000 b/d of catalytic hydrodesulfurization for removing sulfur from residual. Capacity is to be increased later in 1975 to 180,000 b/d from the current 134,000 b/d.

The American Independent Oil Co. (Aminoil), Arabian Oil Co., and Getty refineries located in Kuwait were built to process the very heavy crudes from production concessions held by these companies in the Kuwait/Saudi Arabia Neutral Zone. Together, they account for one-third of Kuwait's refining capacity.

The Aminoil refinery began as a 30,000 b/d fuel oil plant in 1958, was replaced by a new 100,000 b/d refinery in 1962, and was expanded to its present 132,000 b/d in 1968, when a 32,000 b/d residual desulfurizer was installed. Aminoil refines its entire Neutral Zone crude output as the high sulfur content (4.7%) impedes crude sales to third parties. Under a special arrangement with Aminoil, the Kuwaiti government receives 85% of the realized price on products. Kuwait has chosen to forgo participation. The refinery output is marketed by Aminoil.

Arabian Oil's small plant supplies bunker fuel oil to tankers loading crude. Each government apparently has a 60% participation in its undivided half interest in Arabian Oil's crude production operations, but the refinery is probably still mostly owned and fully operated by the company.

Getty still owns its Kuwait refinery and markets the products. Getty has been negotiating with Saudi Arabia, from whom it holds its Neutral Zone crude concession, with regard to government participation; the matter is pending.

### **Saudi Arabia**

The Saudi government now owns 60% of Aramco's crude oil production and has announced its intention to increase its share to 100% this year. Despite this, according to Mobil Oil Corp., one of the four private Aramco owners, the companies still wholly own and operate the 565,000 b/d Ras Tanura export refinery and expect to continue to do so. This plant, the largest in the Middle East and the third largest in the world, has only 23,000 b/d of desulfurization capacity.

Construction of the Ras Tanura refinery was begun in 1943 at the request, and the active support, of the US government. The plant went on stream at 50,000 b/d shortly before the end of World War II. Capacity was increased to 127,000 b/d by 1949 and to its present size by a number of subsequent expansions.

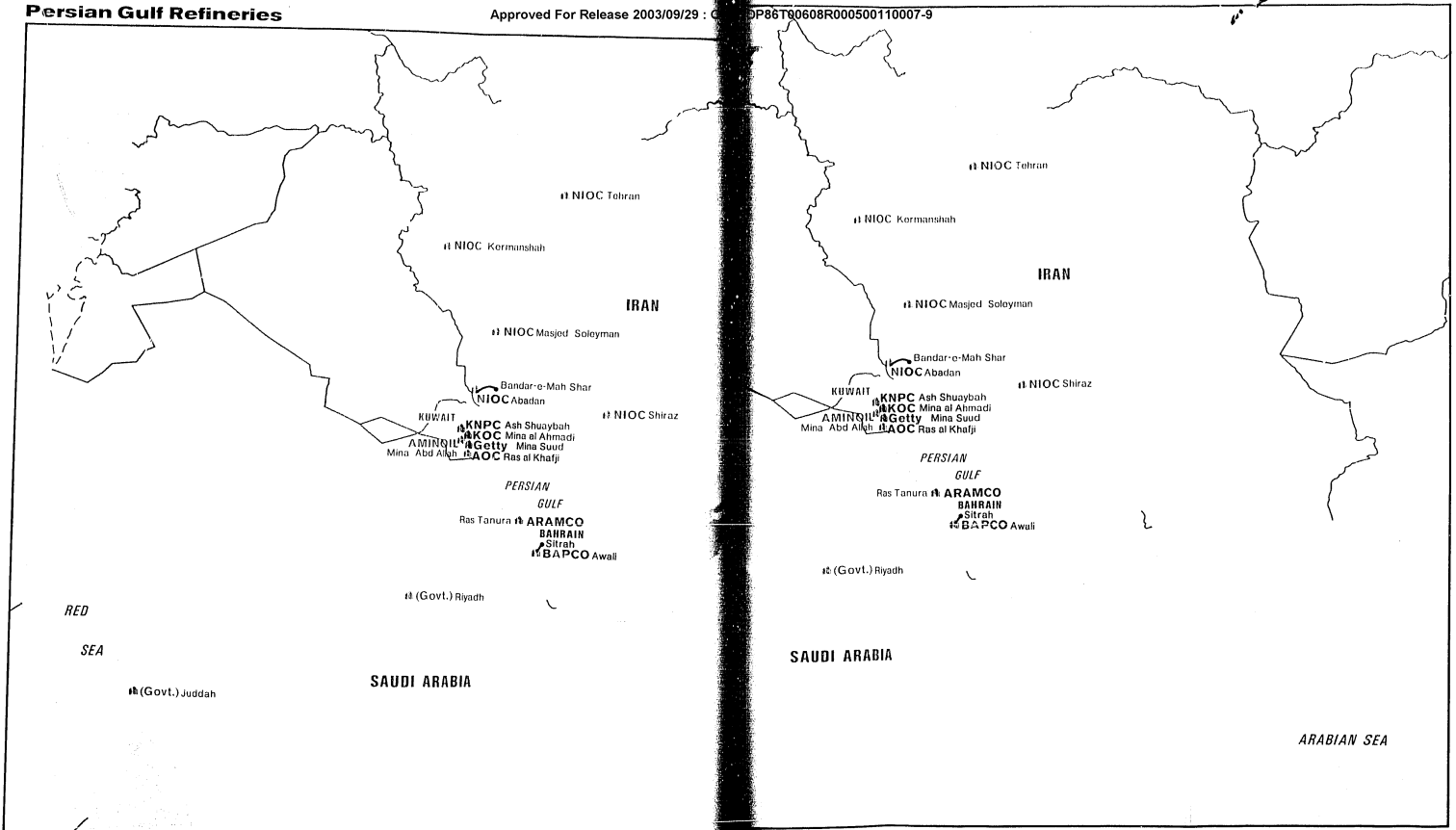
Ras Tanura has numerous facilities for loading crude and products, including two "T" piers with a total of ten berths, and four sea islands with a total of eight berths and 18 mooring dolphins.

Present Saudi refining capacity of 610,000 b/d, including two small inland refineries, equals only 5% of the 11.5 million b/d of crude productive capacity. The government plans to greatly expand refining capacity. In February 1975, it announced approval of a joint venture with the Royal Dutch/Shell group for a \$1 billion plant with a capacity of at least 250,000 b/d. The plant, scheduled for completion in 1980, is to be located at Jubayl, just north of Ras Tanura. Juddah also is interested in building a joint venture refinery on the Red Sea with a capacity of up to 500,000 b/d. A government company handles the distribution of petroleum products within Saudi Arabia.

\* \* \* \*

Persian Gulf Refineries

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**General**

Italy's refining capacity was insignificant before World War II and only 100,000 b/d in 1950. By 1965, it had increased to almost 1.7 million b/d, and today it stands at 4 million b/d, the largest of any West European nation. For two decades, Italy has accounted for more than 20% of Western Europe's refining capacity. At peak operation, Italian refineries have the potential of exporting 45% of their output (1.8 million b/d) after fully satisfying domestic demand. Only about one-sixth of their output (415,000 b/d, excluding bunkers), however, was actually exported in 1974. Because of slackening domestic and foreign demand and drawdowns of product stocks, refinery throughput has run at less than 50% of capacity in 1975. Italy nonetheless remains the second largest export center in Western Europe.

**Italy: Refining Capacity and Export Availability**

	Thousand b/d			
	1955	1965	1969	1974
Refining capacity (1 Jan)	450	1,670	2,630	3,880
Average domestic demand	240	980	1,540	2,100
Potential export availability (at peak operation)	210	690	1,090	1,780

Much of the export capacity is in Sicily and Sardinia, where six large plants totaling 1.6 million b/d have 40% of the country's capacity. These refineries were built to take advantage of location with respect to the Suez Canal and the Mediterranean terminals of crude oil pipelines from Saudi Arabia and Iraq. They now have the further advantage of proximity to North African crudes. At peak, their export trade in refined products exceeded 600,000 b/d, including bunkers.

The island refineries lost an important part of their bunker fuel sales upon the closing of the Suez Canal in June 1967. The reopening of the canal is expected to increase demand for Italian bunkering facilities and partially restore Italian products markets. On the negative side, the pipeline from Saudi Arabia to the Mediterranean port of Sidon was shut down in February 1975, because low tanker rates made the Sidon oil uncompetitive with oil shipped around the Cape from the Persian Gulf to Western Europe.

The Italian refineries maximize output of distillate and residual fuel oils, the major products demanded by West European consumers. Roughly 65% of their output is distillate and residual fuel oil. Similarly, these products account for 65% of West European consumption.

In Europe, Italy is rivaled only by Rotterdam as a major international center for petroleum products. The Italian spot market trades in cargoes from southern Europe, North Africa, and the Black Sea. Brokerage houses in Genoa and Milan handle a major portion of these transactions. Price quotations on spot sales of cargo lots are used to estimate international oil price trends and to set contract prices on products.

### Secondary Processing

Most of the secondary capacity of the Italian refining industry is geared for processing distillate and residual fuel oils. These together account for about 65% of refinery output, compared with about 20% for gasoline, kerosine, and jet fuels and 15% for other products and refinery use. The main secondary processing capacity consists of:

- 490,000 b/d of catalytic hydrotreating for removing sulfur from distillates,
- 400,000 b/d of catalytic hydrodesulfurization for removing sulfur from residual fuel oils,
- 270,000 b/d of catalytic cracking for making diesel fuels, kerosine, and gases (for petrochemical feedstocks) from heavy distillates, and
- 390,000 b/d of catalytic reforming for improving the quality of motor gasoline.

### Trade and Operations

Italy ranks fourth as a Free World center for petroleum product exports. In 1974, Italian exports of refined products excluding bunkers fell by about 20% to 415,000 b/d. Exports declined because of reduced world oil demand, export

controls imposed by the government during the embargo, and low export prices toward the end of last year.

Other European countries – the most important being West Germany, France, the United Kingdom, and Switzerland – normally receive about 60% of Italy's product exports. The United States, however, is the single largest importer of Italian products with about 20% of the volume. Other markets include Africa and the Middle East.

In 1974, refinery throughput fell 7% to 2.4 million b/d, or about 60% of capacity. The trend has continued through the early months of 1975, with refinery throughput averaging only 1.9 million b/d, or less than 50% of capacity. Excess stocks and declining export demand have caused the drop. Italian oil consumption, including 140,000 b/d of bunkers, has remained at about last year's level of 2.1 million b/d.

Italy depends almost entirely on imports for its crude. Domestic production averages only about 20,000 b/d. In 1974, crude oil imports fell 7% to 2.35 million b/d, while product imports rose 40% to 180,000 b/d. We estimate that roughly 85% of the crude came from Arab sources in 1974, with Saudi Arabia and Libya supplying 33% and 23%. Italian product imports come almost entirely from other European countries.

### Ownership

ENI, the national oil company of Italy, has five wholly owned and three partly owned refineries with a total capacity of 647,000 b/d. ENI has been negotiating since last December to sell a 50% interest in three former Shell plants and certain other facilities to the National Iranian Oil Co. ENI wishes to establish an assured source of crude. The matter is stalemated over terms.

In March 1975, ENI announced it plans to invest \$9 billion in exploration, pipelines, distribution, and petrochemicals through 1978, in accordance with the government's 1973 petroleum plan. The investment plan, which envisions a dominate role for ENI in the Italian energy sector, does not include any expenditures for refining capacity.

Five of the seven major international oil companies – Exxon, Gulf, Mobil, Texaco, and Socal – still refine and market in Italy. The other two major internationals – British Petroleum Co. and Shell – have sold their refining and

## Ownership of Italian Refineries

	Short Name	Capacity 1 May 1975 (Thousand b/d)	Percent
<b>Total</b>		<b>3,954</b>	<b>100.0</b>
Italian government company			
Ente Nazionale Idrocarburi	ENI	647	16.4
Private Italian companies		2,179	55.1
Mediterranean Refineries Sicilian			
Petrolfina	Mediterranea	505	12.8
Montedison SPA	Montedison	457	11.6
Societa Per Azione Raffineria Sarde	Saras	360	9.1
Sarom Raffinazione SPA	Sarom	332	8.4
Raffineria Edoardo Garrone	Garrone	147	3.7
Societa Italiana Resin	SIR	119	3.0
Anonima Petroli Italiana	API	81	2.0
Gaeta Industrie Petroli	Gaeta	40	1.0
Sanquirico SPA	Sanquirico	33	0.8
Raffineria Iplom	Iplom	31	0.8
Lombarda Petroli	Lombarda	24	0.6
Raffinerie Dellepiane SPA	Dellepiane	20	0.5
Liquichimica SPA	Liquichimica	12	0.3
Industria Leganti Stradali del Affini	Isea	8	0.2
Societa Petrolifera Italiana	SPI	8	0.2
Raffinerie Oli Lubrificanti	ROL	2	0.1
Foreign-owned international companies		1,128	28.5
Exxon Corp.	Exxon	467	11.8
Cie. Francaise des Petroles	CFP	192	4.9
Mobil Oil Corp.	Mobil	150	3.8
Standard Oil of Indiana	Amoco	100	2.5
Petrofina	Petrofina	64	1.6
Standard Oil of California	Socal	61	1.5
Gulf Oil Corp.	Gulf	60	1.5
Texaco Inc.	Texaco	24	0.6
Phillips Petroleum Co.	Phillips	10	0.3

marketing interests as the result of operating losses stemming from government regulations. British Petroleum, which had been in Italy for 15 years, sold its marketing facilities and 127,000 b/d of refining capacity to Montedison in mid-1973. Shell, after 60 years in Italy, sold its three refineries (with a combined capacity of 270,000 b/d) and its marketing facilities to ENI in January 1974. In January 1975, Gulf sold a 25% share in its 80,000 b/d plant to Mobil. Three

other international companies – Cie. Francaise des Petroles, Petrofina, and Standard Oil of Indiana – have important operations. Phillips is part owner of a small plant.

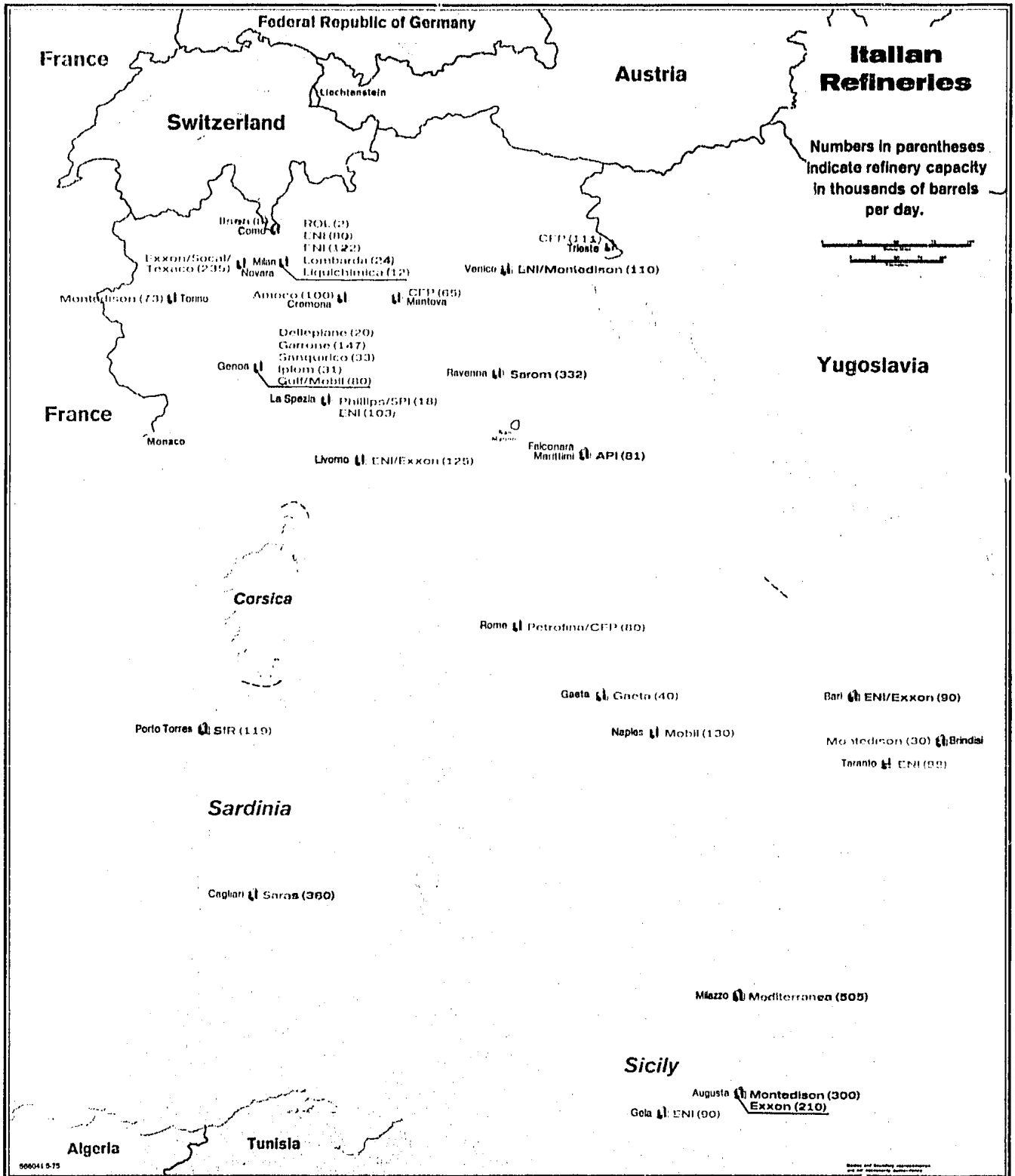
The seven largest privately owned Italian refining companies account for 2 million b/d of capacity, or 50% of the national total. Almost 1.3 million b/d, or two-thirds of their capacity, is located in Sicily and Sardinia. Mediterranea, Saras, and Societa Italiana Resin have a single plant each, all located on the islands. Montedison, Italy's largest company with majority private ownership, has a 300,000 b/d refinery in Sicily as well as 157,000 b/d of capacity in three other plants on the mainland. Montedison also has interests in chemicals, synthetic fibers, and pharmaceuticals. Each of the three other main Italian companies – Sarom, Garrone, and Anonima Petroli Italiana – has a single plant on the mainland. One of the smaller plants, Gaeta (40,000 b/d), was put on stream by Getty in 1957 and sold to Italian interests in the late 1960s.

#### Future of the Industry

In early 1974 a study group within the Italian Ministry of Industry reported that Italy would need at least 5.1 million b/d of refining capacity by 1980 – an increase of 1.1 million b/d, or about 30% over the current level. The group estimated domestic demand for main projects to increase to 3 million b/d in 1980 – about 45% above the 1974 figure. This implies an export capability of about 2.1 million b/d. In light of subsequent developments, the estimated 1980 capacity and demand figures appear too high.

As of September 1974, a total of 16 planned Italian refinery projects were on record – 8 new and 8 expansions – totaling 1.5 million b/d. These projects probably have not advanced beyond the planning stage, largely because of the present slack in Western Europe's refining industry. We have estimated that present refining capacity will exceed estimated average 1975 product demand by 4.6 million b/d. Product demand declined by an estimated 600,000 b/d in 1974 and is expected to show almost no change through 1976.

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## REFINING CENTERS OF THE WORLD: SINGAPORE

### General

Singapore is the world's fourth largest port and the second largest non-US port refining center, after Rotterdam. Its natural deep water harbor and its strategic location astride the Strait of Malacca (the major Middle East/Pacific tanker route) make it a particularly attractive point for refinery operations. Its petroleum products can easily be shipped to customers in Japan and Southeast Asia.

Crude oil refining operations began in 1961 at 30,000 b/d. Capacity has reached about 850,000 b/d and will exceed 1 million b/d later this year, almost one-half of Southeast Asia's total. Desulfurization capacity consists of 90,000 b/d residual and 135,000 b/d distillate. Four major international companies - British Petroleum, Exxon, Mobil, and Shell - and a three-company joint venture own the refining facilities.

Since 1960 the Singapore government has encouraged refinery construction by its liberal tax policy designed to attract new manufacturing. It initially granted the refining industry pioneer status permitting tax-free operations for up to five years. The industry has since matured and no longer enjoys this advantage. Singapore, however, still grants special tax rates on export profits, tax exemption on profits resulting from plant expansion, and accelerated depreciation allowances.

### Oil Supply and Demand

Singapore ranks fifth as a Free World center for petroleum product exports, shipping 320,000 b/d to other markets in 1974. Oil product exports have remained at 1973 levels in contrast to other centers which have experienced declines because of falling world demand. Prior to 1974, Singapore's refinery exports had been growing rapidly, at an average annual rate of 13%. Nearly 30% of these exports normally go to Japan and represent one-fifth of Japanese product imports. Other major markets include Hong Kong, Australia, Malaysia and, until recently, South Vietnam.

As in most export refineries, output of the Singapore facilities is weighted toward residual fuel oil, normally about 40% of output. Domestic demand and

**Singapore: Oil Product Exports  
1974 Estimate**

	Thousand b/d	Percent
<b>Total</b>	<b>320</b>	<b>100</b>
Japan	86	27
Hong Kong	51	16
South Vietnam	42	13
Australia	32	10
Malaysia	26	8
Other	83	26

Japanese purchases are weighted heavily toward residual fuel oil. Heavy fuel oil, largely bunkers, normally accounts for roughly one-half of domestic consumption. In 1974, Singapore's oil consumption, including bunkers, fell 9% to 360,000 b/d.

Singapore depends entirely on imports for its crude. Ninety percent comes from the Middle East, with three countries, Kuwait, Saudi Arabia, and Iran, supplying 28%, 22%, and 22%, respectively, in 1974. Neighboring Indonesia provides less than 5% of requirements, largely because the principal producers in Indonesia -

Texaco and Socal - have no refinery interests in Singapore.

**Shell**

Shell, the first and most important Singapore refiner, put its original plant on stream in 1961 at 30,000 b/d. Through a series of major expansions, it has increased capacity to 350,000 b/d; this will rise to 530,000 b/d in the second half of 1975 when additional construction is completed. Present desulfurization equipment consists of 90,000 b/d for distillate and 20,000 b/d for residual fuel.

Singapore is one of Shell's major receiving and transshipping centers for crude and products from most areas of the world. Its refining and storage facilities, located on Pulau Bukum about five miles from Singapore city, have nine berths for tankers of up to about 85,000 DWT, plus a conventional buoy mooring system that can take tankers of up to 200,000 DWT.

**Exxon**

Exxon began refining operations in Singapore in 1970. Since September 1974, capacity has totaled 230,000 b/d. Refining facilities include 40,000 b/d of distillate desulfurization. The Exxon refinery is located on another island about five miles from the She'' site. The tanker facilities consist of four berths with water depth capable of receiving tankers of up to 85,000 DWT, as well as a single-point mooring buoy for handling tankers of up to 250,000 DWT.



### **Mobil**

Mobil completed a 145,000-b/d expansion in 1973, which increased capacity from 30,000 b/d. The original plant, with capacity of 18,000 b/d, went on stream in 1966. Present desulfurization equipment consists of 30,000 b/d for residual and 5,000 b/d for distillate. The refinery is located in Jurong Industrial Estate on Singapore Island. This is adjacent to a bulk handling port developed by the government 7 miles northwest of Singapore harbor. Its facilities include a single-point mooring buoy 3 miles offshore to accommodate 250,000-DWT tankers.

### **Singapore Petroleum Co.**

Singapore Petroleum Co., the newest refining operation, put its 65,000-b/d plant on stream in the third quarter of 1973. This is a joint venture of the Development Bank of Singapore, a government institution; Summit Industrial Corp., a company owned by Chinese interests from Thailand which also operates a Thai government refinery under contract; and Standard Oil Co. of Indiana.

The refinery is located on an island between the Exxon and Shell refineries. It has 40,000 b/d of residual desulfurization capacity. Tanker facilities consist of three berths which can handle tankers of up to 85,000 DWT.

### **British Petroleum**

The small BP refinery dates back to 1962. Originally owned by Maruzen, a Japanese company, it operated at a loss and was sold to BP. Its current capacity of 26,000 b/d is uneconomical by present day standards. BP and Mitsubishi were considering a joint venture in 1973 to expand capacity to 170,000 b/d. This project did not materialize, largely because of lack of a suitable area for the expansion.

The BP refinery is located on Singapore Island about 5 miles north of Shell's facilities. It has only one jetty for oceangoing tankers of up to 33,000 DWT, plus two jetties for coastal tankers. These facilities are inadequate for modern tankers and oil trade. The refinery has no desulfurization capacity.

### **Expansion Prospects**

Singapore's refining capacity will exceed one million b/d in the second half of this year when Shell's additional facilities begin operations. No further expansion plans are scheduled.

Two projects announced in mid-1974 have been postponed:

- A new 300,000-b/d joint venture refinery by two major Japanese refiners - Maruzen and Daikyo - originally slated for completion in 1977.
- A 135,000-b/d expansion by Singapore Petroleum Co. for which no completion date was announced.

For several years, Singapore's refinery throughput has run well below capacity. Shell's latest expansion, in the face of reduced petroleum export demand, will presumably worsen the excess capacity situation. Most facilities are now operating at less than two-thirds of capacity. Shell's recent offer to lease part of its capacity to the Kuwaiti government was turned down. Even when world demand revives, Singapore will suffer from the trend in Middle Eastern countries toward refining a bigger share of their own crude.

**Singapore: Refining Capacity as of 1 May 1975**

	Location	Capacity (Thousand b/d)	Ownership
<b>Total</b>		<b>846</b>	
BP Refinery Singapore	Tanjong Berlayer	26	British Petroleum Co.
Eso Singapore	Pulau Ayer Chawan	230	Exxon Corp.
Mobil Oil Malaya	Jurong Industrial Estate	175	Mobil Oil Corp.
Shell Eastern Petroleum	Pulau Bukom	350	Royal Dutch/ Shell Group
Singapore Petroleum Co.	Pulau Merlimau	65	Standard Oil of Indiana, one-third; Singapore Government, one-third; and Sum- mit Industrial Corp., one-third

**Navigational Restrictions**

Shallow waters -- only 75 to 80 feet in several places at the southern end of the Strait of Malacca and parts of the Singapore Strait -- limit tanker size to a maximum of 250,000 DWT. At its narrowest point, the Malacca shipping channel

is only 2-1/2 miles wide, and the Singapore shipping channel is only 1 mile wide. These are highly congested waters. Malaysia and Indonesia, which border the Strait of Malacca, have been endeavoring unsuccessfully since 1972 to limit passage to 200,000 tonners. In January 1975 a 237,000-DWT Japanese tanker ran aground on a reef at the southern end of the Strait, rupturing some tanks and spilling about 25,000 barrels of crude.

Despite these conditions, crude shippers to Singapore and Japan continue to use the Malacca route for ships of up to 250,000 DWT. The alternative route via the Lombok and Makasar Straits adds about 1,300 miles and five days to the voyage from the Middle East to Japan.

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**Singapore Refineries**

