STUDY

ON

[illegible] JAPAN [illegible] RUBBER

[illegible] EXECUTIVE SUMMARY

STUDY

ON

IRAN-JAPAN EXPORT REFINERY

BOOK I : EXECUTIVE SUMMARY

March, 1979

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

The government of Japan, at the request of the Government of Iran, has decided to undertake a Study on the Iran-Japan Export Refinery to be constructed on the coast of the Persian Gulf in Bushehr Province of Iran and entrusted its execution to the Japan International Cooperation Agency.

In accordance with the Agreement reached between Iran and Japan at the joint subcommittee meeting for the export refinery project held in February 1978 in Tokyo, the Agency organized a mission headed by Mr. Michiyoshi Kawada, Executive Director of the Japan Cooperation Center for the Middle East, and dispatched it to Tehran for the period from June 7th to June 13th, 1978 to establish the detail study bases.

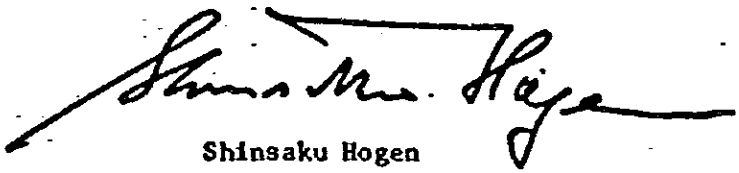
Upon establishment of the study bases, a site survey team visited Bushehr from June 14th to June 26th, 1978 for site reconnaissance, data collection and interviews with the related authorities. Further, for soil investigation, boring tests were made for a total of nine boring points which were selected as potential sites after site reconnaissance.

After returning to Japan, the survey team undertook a detailed analysis of the data collected to facilitate site selection, basic planning and cost estimates for the refinery project, and prepared the report.

This report presents the basic plan for project development, the estimated costs, the economic analysis and the recommendations for implementing the project.

In presenting this report, we would like to express our hearty gratitude to the Iranian authorities concerned for the hospitality extended to the survey team and the cooperation provided to expedite the work.

We hope that this report will serve as a contribution to the Iran-Japan Export Refinery Project, and promote friendship between the two countries.



Shinsaku Hogen
President
Japan International Cooperation Agency

Members of the Study Team

Team Leader — Mr. Shoei Komatsu
Assistant Team Leader — Mr. Kazuo Kosugi

Coordination

Mr. Hiromu Ohori
Mr. Michiyoshi Kawada
Mr. Hideki Otake
Mr. Hachiro Suzuki

Economic Analysis

Mr. Akira Soejima
Mr. Fumio Kishida
Mr. Takao Nakagawa
Mr. Takeo Otsubo
Mr. Masao Tanaka
Mr. Minoru Nagai

Market Study

Mr. Setsuo Takagaki
Mr. Takao Tomitate
Mr. Kazuya Fujime
Mr. Yoshio Hara

Transportation Study

Mr. Akihiro Takei
Mr. Yasutake Maeda
Mr. Kenichi Shiozawa
Mr. Hiroshi Shibata

Refining Technology

Mr. Osamu Uno
Mr. Yoichi Sagoshi
Mr. Sadao Ouchi
Mr. Hiroshi Matsuda
Mr. Shigeyasu Tareto
Mr. Shinichi Fujiwara
Mr. Nobuyuki Hashimoto
Mr. Yukinori Sato

Offsite & Infrastructure

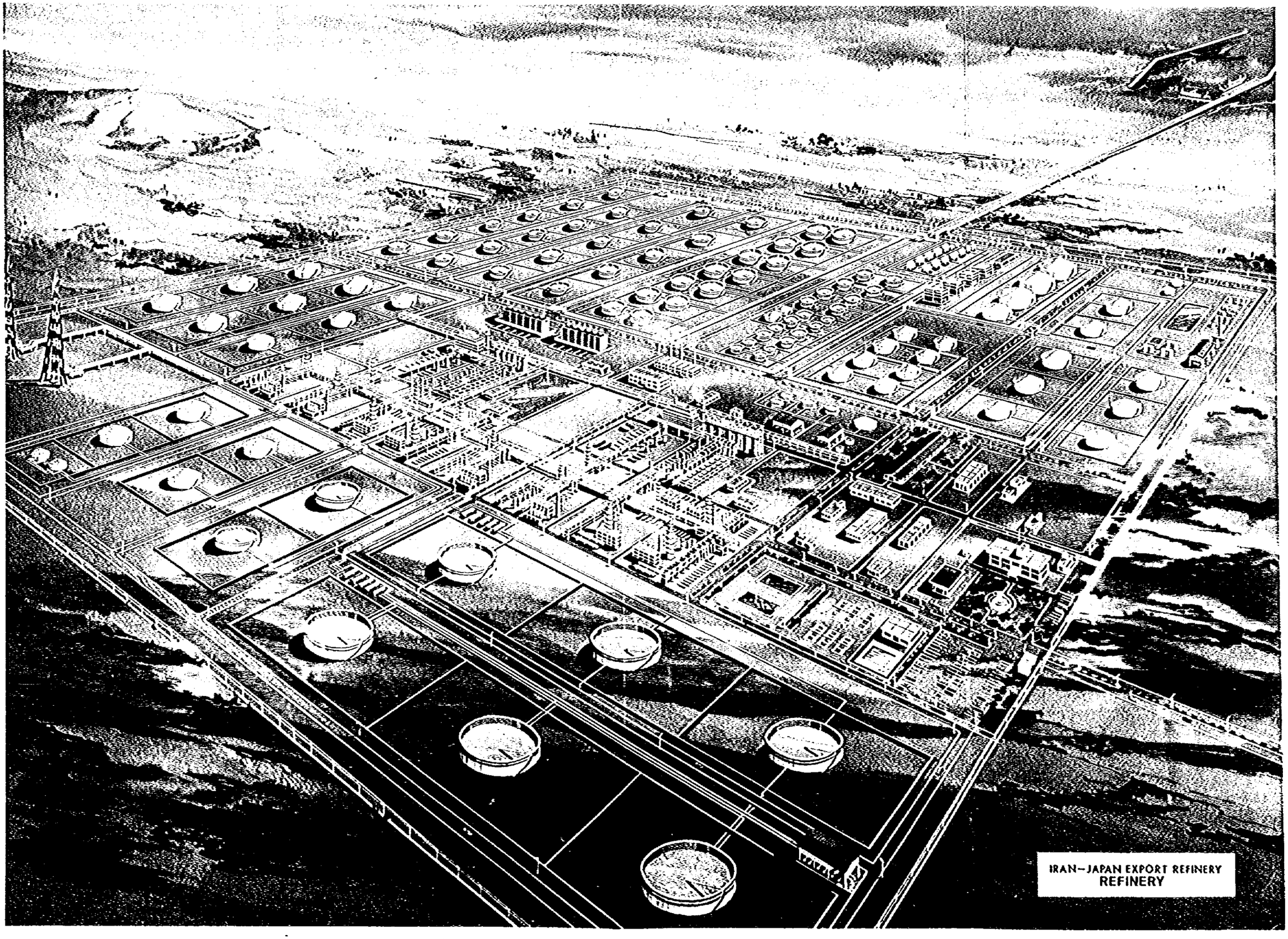
Mr. Sadao Murase
Mr. Masakazu Komori
Mr. Shigeyasu Mori
Mr. Tetsuro Tsutsui
Mr. Toru Takagi
Mr. Koji Yoshioka
Mr. Toshiyuki Nozawa
Mr. Katsutoshi Kutsukake
Mr. Hideo Ikeza
Mr. Fumihiko Tokuho
Mr. Akira Yoshimatsu
Mr. Hiroshi Mori
Mr. Takeshi Yoshida

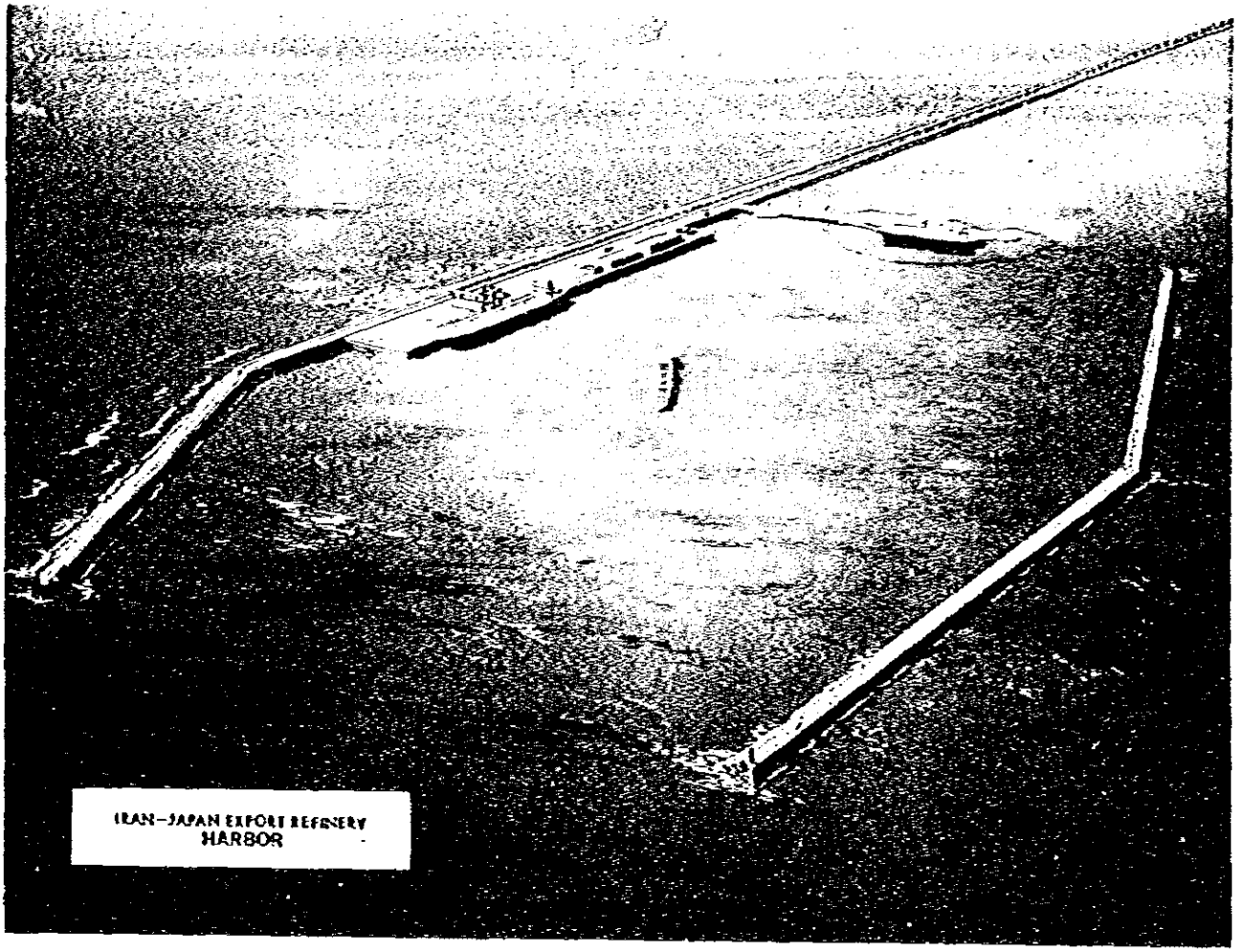
Civil Engineering

Mr. Sunao Yanagawa
Mr. Kunihiko Arai
Mr. Tadashi Hayashi
Mr. Ichisei Tomiyama
Mr. Yukio Aratani

Construction & Cost Estimation

Mr. Eikichi Tanabe
Mr. Haruo Hamanaka
Mr. Yasumasa Fujita
Mr. Yutaka Watanabe


IRAN–JAPAN EXPORT REFINERY
REFINERY


IRAN-JAPAN EXPORT REFINERY
HARBOR

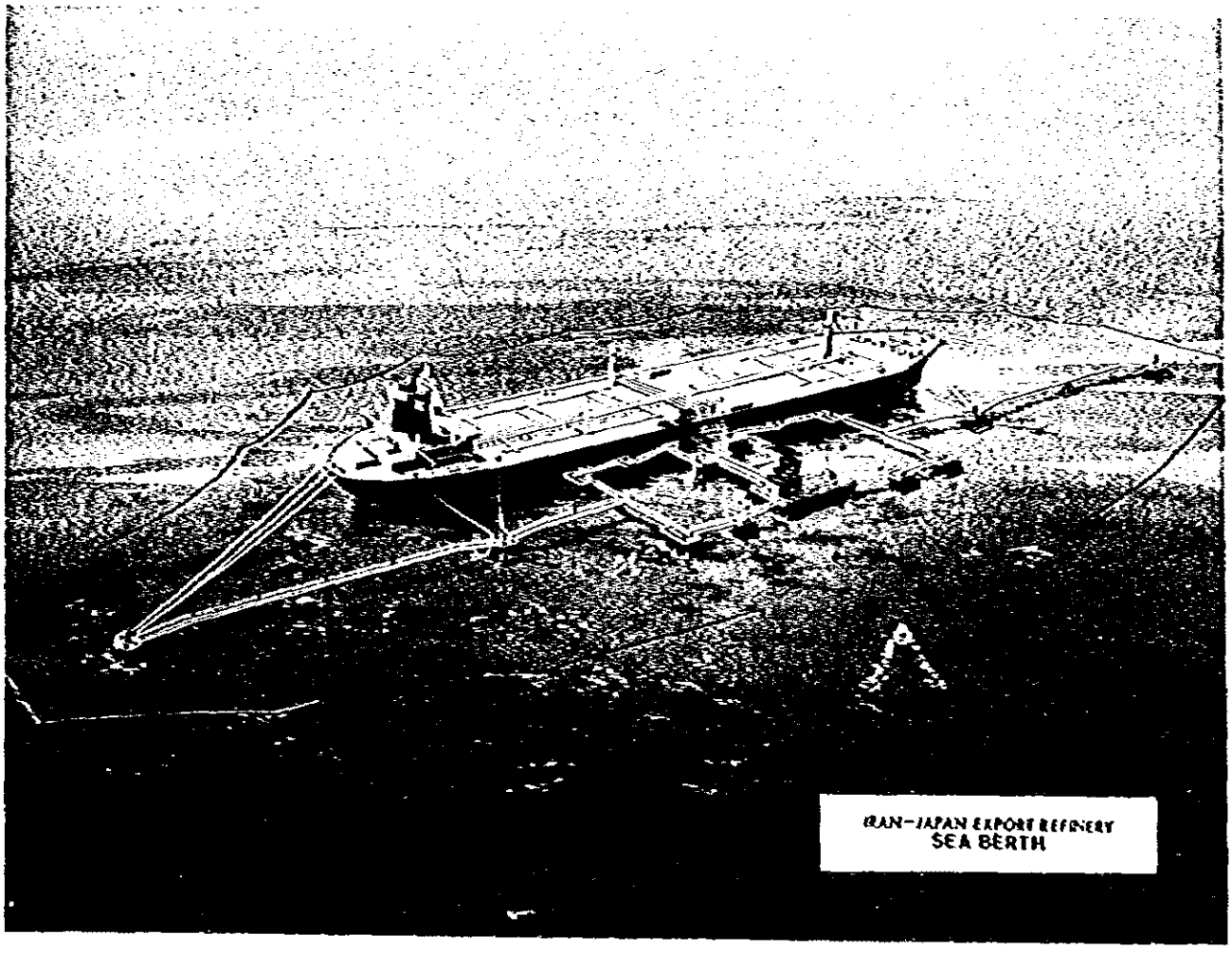

IRAN-JAPAN EXPORT REFINERY
SEA BERTH

TABLE OF CONTENTS

INTRODUCTION

This study is conducted to investigate the technical and economic aspects of the Iran-Japan Export Refinery Project.

A refinery with a capacity of 125,000 BPSD, 250,000 BPSD, or 500,000 BPSD is proposed for construction in Bushehr on the south coast of Iran to refine Iranian crude oils and to export petroleum products to oversea's markets, mainly to Japan. The target date for refinery operation is scheduled in 1983.

As part of the study, studies on external factors such as site survey, transportation study, and market study are conducted to obtain bases for planning the crude oil pipeline, refinery facilities, and marine facilities.

On the facilities mentioned, the investment costs are estimated and complete economic analyses are made.

The results of the study are presented in three volumes. The refinery planning and economic analysis are contained in Book II, "Study Report" and studies on external factors in Book III, "Supplement".

This summary discusses the synopsis of the more important features.

CONCEPT FOR REFINERY PLANNING

■ Refinery Configuration and Capacity

The cases investigated in this study are the following six cases covering two different refinery configurations and three refining capacities:

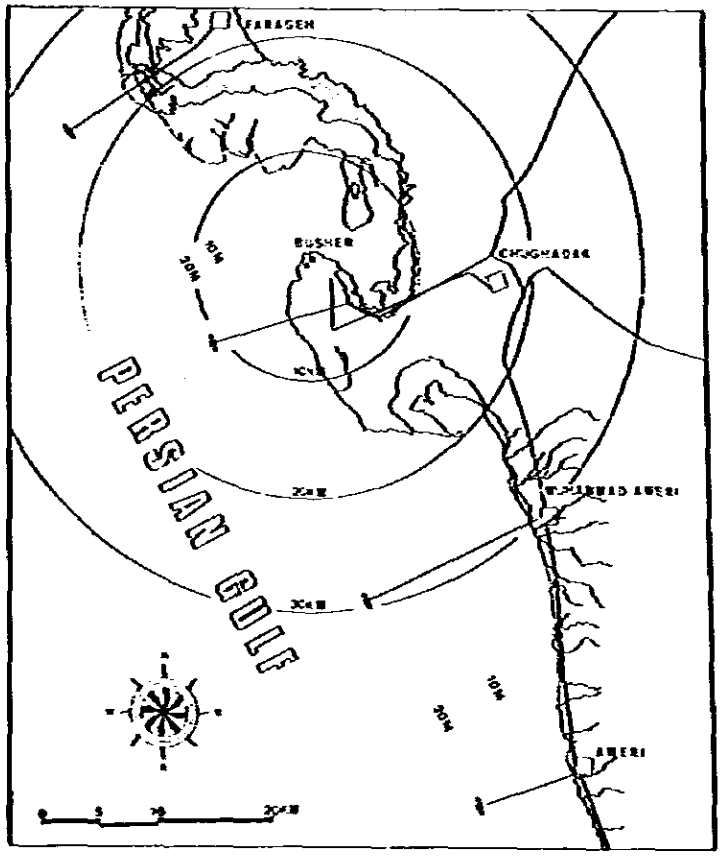
Configuration	Capacity
Hydroskimming	125,000 BPSD 250,000 BPSD 500,000 BPSD
Hydrocracking	125,000 BPSD 250,000 BPSD 500,000 BPSD

The hydroskimming type represents the flow scheme of the existing refineries in Japan while the hydrocracking type represents one considering the market trend towards demand for lighter products.
The refinery configuration and capacity to be employed will be determined after discussions on the results of this study.

■ *Proposed Sites*

The site surveys were made on several sites around Bushehr city where suggested by NIOC.
The information gathered by the survey team were analysed in detail and the four potential sites shown in the map are proposed.
For comparison of the sites, construction cost for each of the sites were calculated for the following facilities:

- Crude oil pipeline
- Accessway
- Site preparation and foundation
- Product shipping facilities
- Marine facilities



The investigation revealed that, among these sites, Muhammad Ameri will be the most suitable site for construction of the refinery.
This judgement is made from an overall evaluation of Muhammad Ameri which turned out to be superior to the other sites, that is the tangible factors reflected in the construction cost and intangibles such as easy access to Bushehr city and wide space of the hinterland. It is noted that investigations in this study is made on the basis that the refinery will be located at Muhammad Ameri.

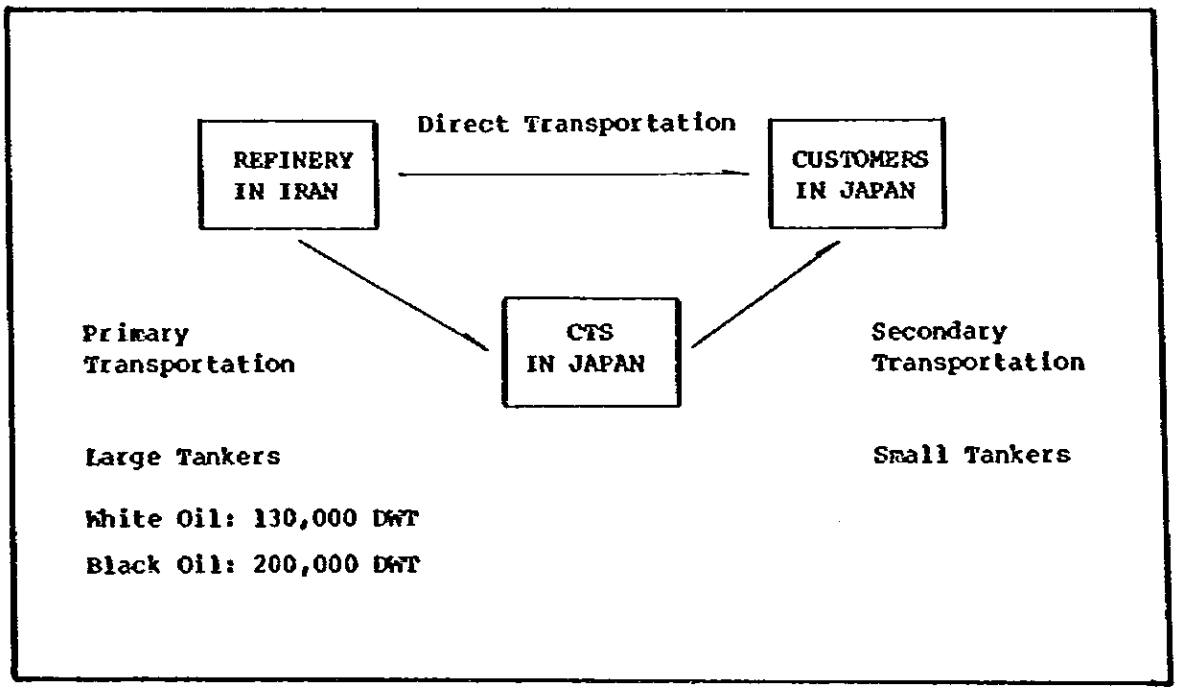
■ Product Transportation

The majority of the current product tankers and their receiving terminals are for small or medium class services up to 50,000 DWT.
Therefore, the following two methods are conceivable as methods of transporting products from Iran to Japan.

(1) Direct Transportation: transporting products from Iran to the existing Japanese unloading ports with small or medium size tankers.

(2) Transportation via CTS (Central Terminal System): transporting products from Iran to CTS capable of receiving large product tankers up to 200,000 DWTs and distributing them to Japanese ports with smaller tankers.

According to the basic concept of this study, the transportation is assumed to be executed via CTS which is to be constructed in Japan.

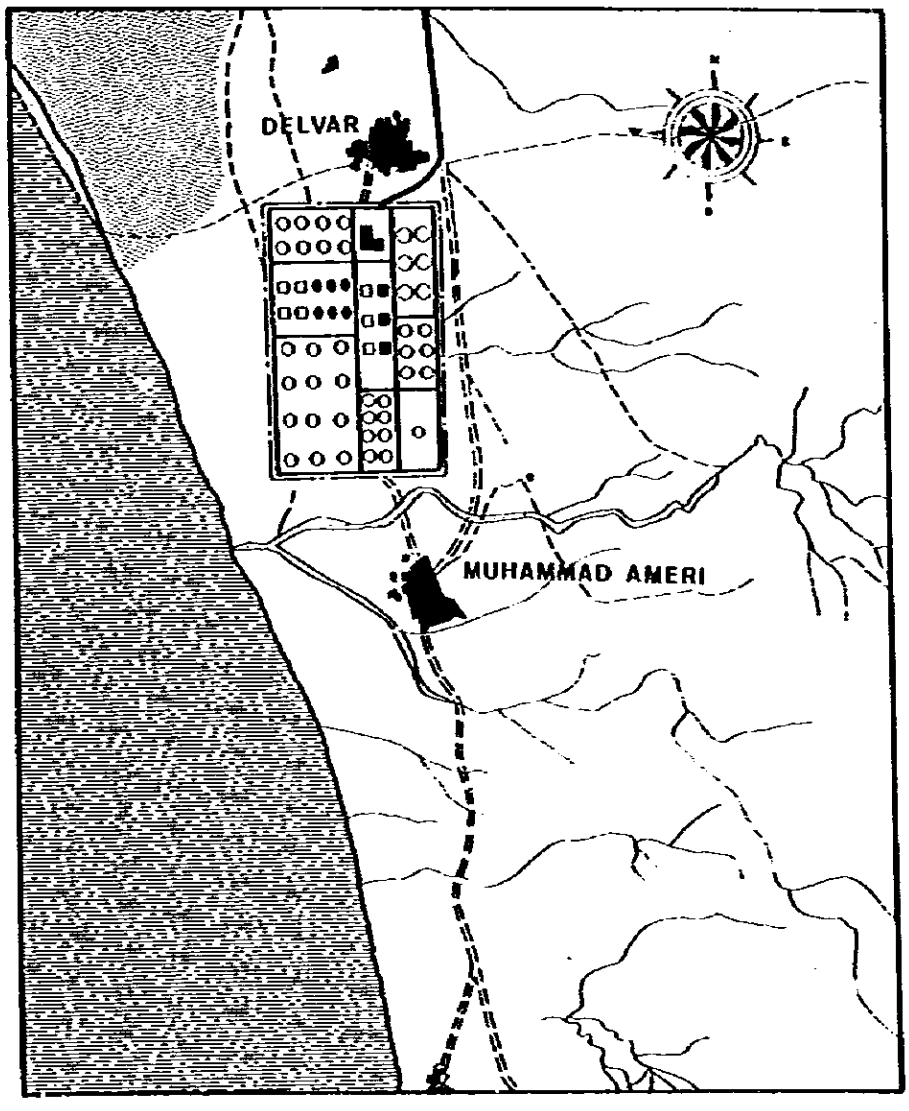


OUTLINE OF PROJECT

■ Refinery Site

Muhammad Ameri, which is proposed as the best site for this project, is located 30 km south-east of Bushehr city and is midway between the Delvar and Muhammad Ameri villages as shown in the site map.

Behind the site, the north end of the Tangestan mountain mass lies about 7 km east and the Karuk mountain area (approx. 300 m above sea level) is nearby. The ground elevation of the site is nearly 8 m above sea level. The distances to Bushehr and the coast are short and this site is favorable with respect to land area conditions including soil type. The sea bed slope near the site is gentle, therefore, the product loading sea berth would have to be constructed about 18 km from the shore to accommodate the draught of the tankers.



■ Crudes and Products

In the refinery, the crude to be processed will be 50 percent Iranian light crude and 50 percent Iranian heavy crude. These will be refined into products such as gasoline, naphtha, kerosene, gas oil, and low sulfur and medium sulfur fuel oils.

Also, bunker fuel oil for tankers transporting the products from this refinery will be supplied from the refinery. Further, sulfur generated in the refining processes will be recovered for export.

Fuels for refinery use are refinery off gas, recovered LPG, and heavy fuel oils.

The daily volumes of the crudes and products for each of the six cases are summarized as follows:

(Unit: BPCD)

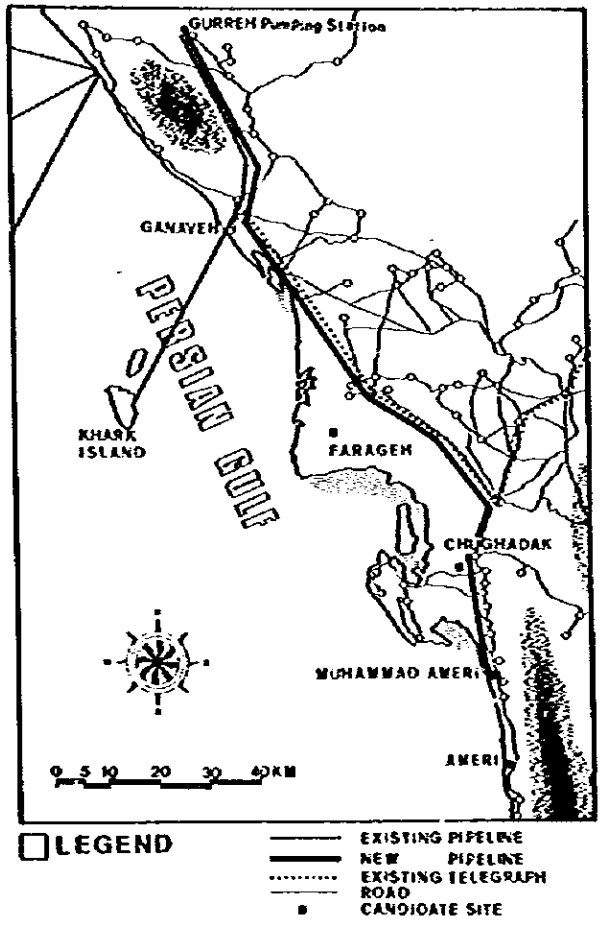
Configuration	Hydroskimming			Hydrocracking		
Capacity, BPSD	125,000	250,000	500,000	125,000	250,000	500,000
CRUDES						
Iranian Light Crude	53,125	106,250	212,500	53,125	106,250	212,500
Iranian Heavy Crude	53,125	106,250	212,500	53,125	106,250	212,500
Total	106,250	212,500	425,000	106,250	212,500	425,000
PRODUCTS						
Gasoline	10,625	21,250	42,500	10,625	21,250	42,500
Naphtha	10,470	20,940	41,880	13,280	26,560	53,120
Kerosene	14,980	29,960	59,920	18,505	37,010	74,020
Gas Oil	22,405	44,810	89,620	26,455	52,910	105,820
Fuel Oil (0.1 S)	29,960	59,920	119,840	21,845	43,690	87,380
Fuel Oil (1.5 S)	7,490	14,980	29,960	5,460	10,920	21,840
Bunker Fuel Oil	3,190	6,380	12,760	3,190	6,380	12,760
Total	99,120	198,240	396,480	99,360	198,720	397,440
Sulfur, TPCD	148	296	592	144	288	576
REFINERY FUEL						
Fuel Gas (EFO)	980	1,960	3,920	1,270	2,540	5,080
Propane	890	1,780	3,560	1,125	2,250	4,500
Butane	960	1,920	3,840	1,275	2,550	5,100
Fuel Oil	4,905	9,810	19,620	5,430	10,860	21,720

■ Facilities : Crude Oil Pipeline

The crude oils to be processed in the refinery are picked-up at the existing Gurreh pump station which is connected to the crude oil shipping terminal on Khark Island.
The planned route for the pipeline is shown on the map.

The pressure of the crude oil at the station is 63 kg/cm^{2}G which enables the crude oil to be transported to the refinery without further pumping. Two pipelines will be constructed for segragated operation of the two Iranian light and Iranian heavy crude oils and be buried underground for the entire distance of 165 Km.

The piping size for the respective cases is given as follows:



Case	Piping Size
125,000 BPSD	16 inches x 2
250,000 BPSD	20 inches x 2
500,000 BPSD	26 inches x 2

■ Facilities : Refinery

The planned configurations for this refinery, which are called hydroskimming and hydrocracking, are characterized by being combined with the key process units.

Those for the hydroskimming case are the atmospheric residue hydrodesulfurizer and the vacuum gas oil hydrodesulfurizer, and those for the hydrocracking case are the atmospheric residue hydrodesulfurizer and the vacuum gas oil hydrocracker.

In principle, the number of trains for the process units is one for the 125,000 and 250,000 BPSD cases, and two for the 500,000 BPSD.

The utilities system is planned to supply utilities such as fresh water, steam, electric power, etc. on a self-supporting basis.

Offsite facilities for crudes and product storage, product blending and shipping, and general services are planned on the basis of the specific and local conditions of this project.

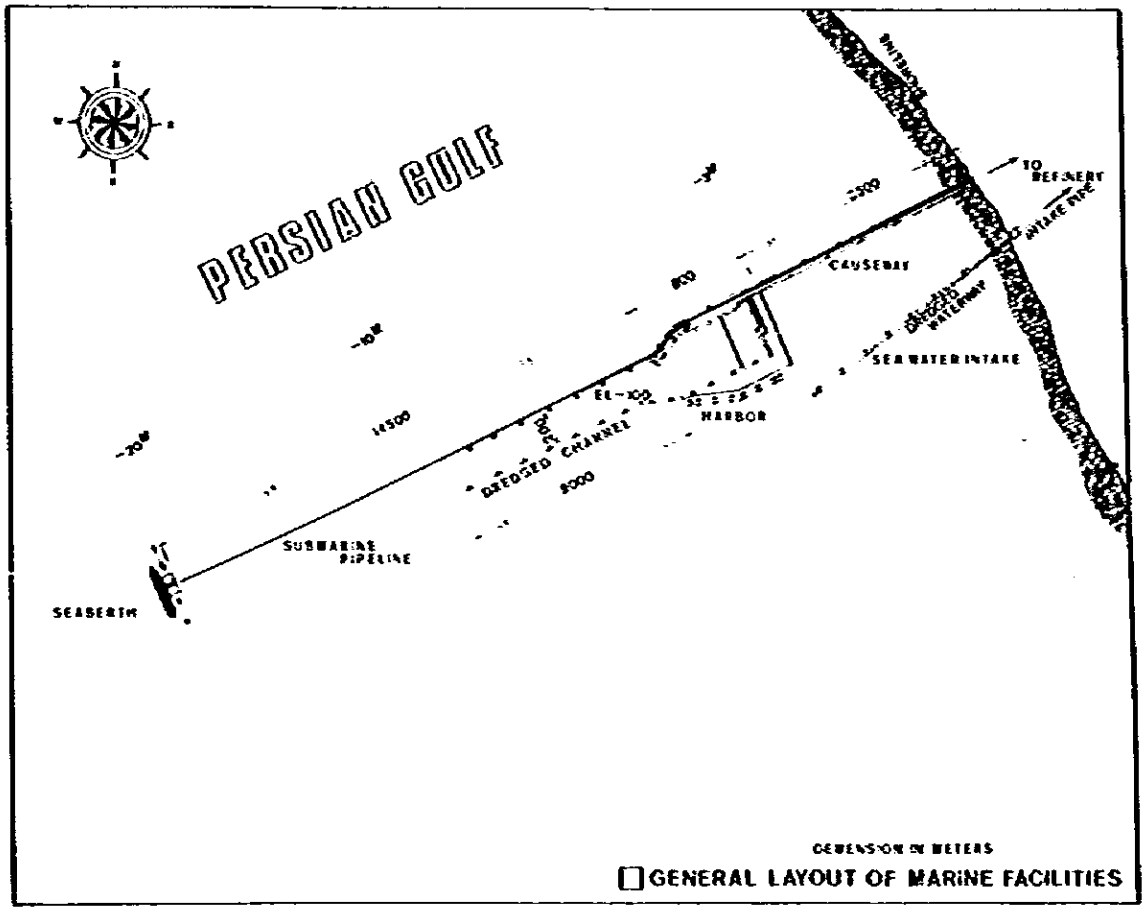
The installed capacity of the planned facilities are summarized as follows:

Configuration		Hydroskimming			Hydrocracking		
Capacity, BPSD		125,000	250,000	500,000	125,000	250,000	500,000
PROCESS UNITS							
Atmos. Crude Distillation	BPSD	125,000x1	125,000x2	125,000x4	125,000x1	125,000x2	125,000x4
Vacuum Flasher	BPSD	14,000x1	27,900x1	27,900x2	19,300x1	38,500x1	38,500x2
Naphtha HDS	BPSD	26,500x1	52,900x1	52,900x2	26,500x1	52,900x1	52,900x2
Catalytic Reformer	BPSD	9,700x1	19,300x1	19,300x2	9,700x1	19,300x1	19,300x2
Kerosene HDS	BPSD	17,700x1	35,300x1	35,300x2	17,700x1	35,300x1	35,300x2
Gas Oil HDS	BPSD	26,900x1	53,800x1	53,800x2	28,900x1	57,700x1	57,700x2
VGO HDS	BPSD	7,200x1	14,300x1	14,300x2	-	-	-
VGO Hydrocracker	BPSD	-	-	-	9,900x1	19,700x1	19,700x2
Atmos. Residue HDS	BPSD	34,900x1	69,800x1	69,800x2	30,300x1	60,600x1	60,600x2
Visbreaker	BPSD	-	-	-	9,400x1	18,800x1	18,800x2
Hydrogen Generator	10^6Nm^3/D	0.83x1	1.66x1	1.66x2	0.55x2	1.10x2	1.10x4
Gas Treater/Sulfur Recov.	TPSD-S	90x2	180x2	180x4	90x2	180x2	180x4
UTILITY SYSTEMS							
Steam Generator	Ton/H	170x3	310x3	490x4	170x3	310x3	490x4
Power Generator	kW	14,000x3	16,000x4	19,000x6	15,000x3	17,000x4	21,000x6
Desalinator	Ton/D	2,400x3	4,700x3	9,100x3	2,700x3	5,200x3	10,200x3
Cooling Water System	Ton/H	18,000x1	17,000x2	17,000x4	20,000x3	19,500x2	19,000x4
Sea Water Intake System	Ton/H	5,000	10,000	20,000	6,000	11,000	21,000
TANKAGE SYSTEM							
Total Tank Capacity	10^3kl	3,667	2,577	4,279	1,737	2,676	4,337
OTHER OFFSITE FACILITIES							

■ Facilities : Marine

As shown in the layout plan, the marine facilities for product shipment and water intake will be constructed in the sea nearest the refinery. Most of the products from the refinery will be shipped at the sea berth which can accommodate 200,000 DWT tankers through the product submarine pipelines.

Solid sulfur and bunker fuel oil will be shipped at the harbor onto 10,000 DWT and 5,000 DWT class carriers, respectively. The harbor will be connected to the refinery with the causeway to be constructed in the sea.



□GENERAL LAYOUT OF MARINE FACILITIES

Sea Berth	Harbor	Causeway	Water Intake
200,000 DWT tanker	Sulfur Loading Wharf	20 m Width	3 m Depth
20 m Water Depth	Bunker Oil Berth	3.5 Km Length	3.5 Km Length
Fixed Dolphin	Common Wharf		
	Small Boat Pier		

■ Refinery Layout

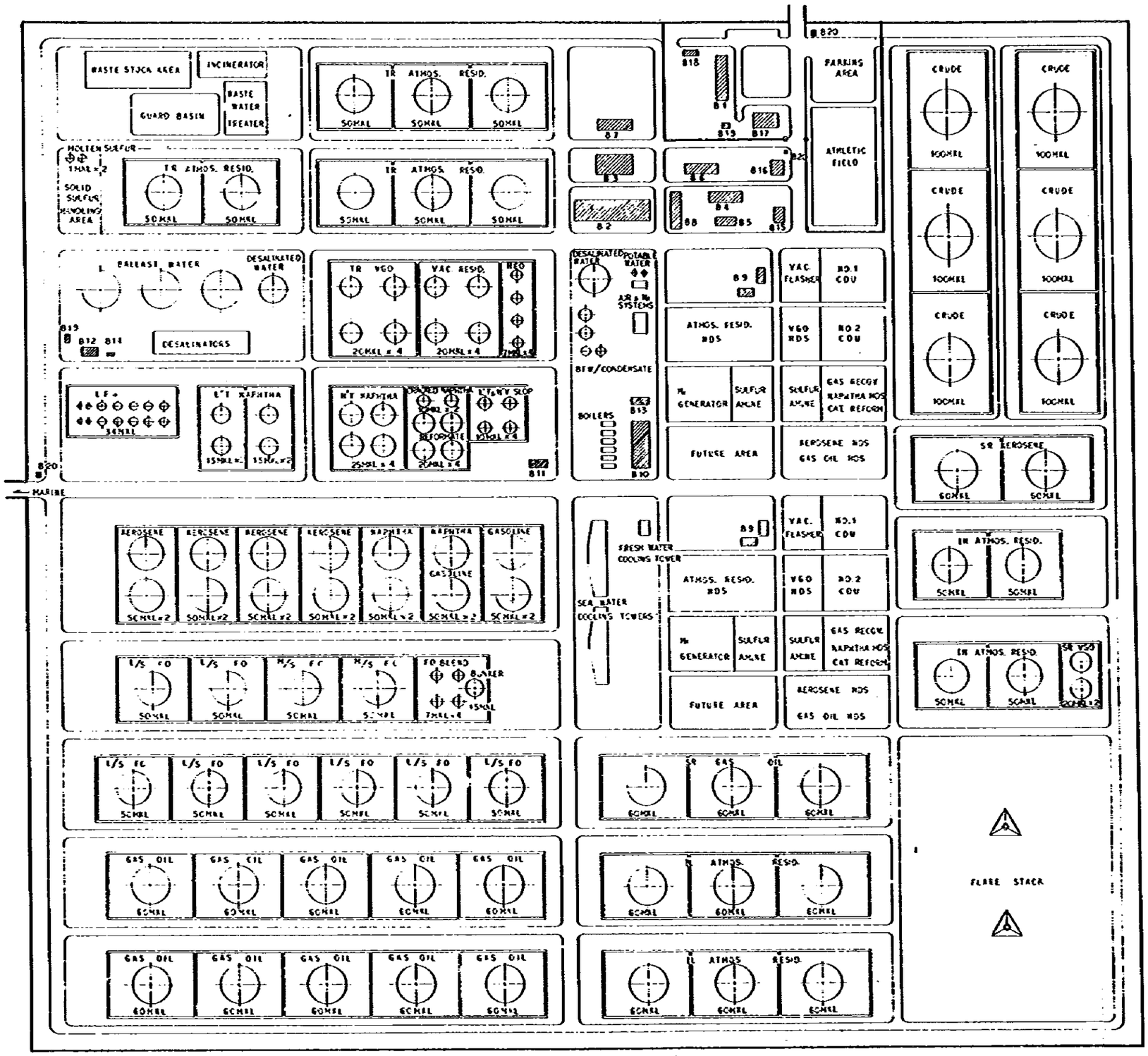
The layout for the 500,000 BPSD hydroskimming refinery is presented on the next page.

The refinery area is basically divided into the six functional areas of administration, process, utility, crude oil storage, product and semi-product storage, and water disposal.

The layout for the 125,000 BPSD or 250,000 BPSD refinery will essentially be the same except for the smaller tankage area and one train process area.

The required area by refinery capacity is estimated as follows:

Refinery Capacity, BPSD	Area Required, 10^6 m^2
125,000	2.1
250,000	2.6
500,000	4.2



BUILDINGS

B1 : ADMINISTRATION BUILDING
B2 : MAINTENANCE SHOP
B3 : SPARE WAREHOUSE
B4 : CATALYST WAREHOUSE
B5 : CHEMICAL WAREHOUSE
B6 : GENERAL WAREHOUSE
B7 : LABORATORY
B8 : ENGINEERING OFFICE
B9 : PROCESS CONTROL ROOMS (4)
B10 : UTILITY CONTROL ROOM
B11 : OFFSITE CONTROL ROOM
B12 : SHIPPING CONTROL ROOM
B13 : POWER HOUSE
B14 : CUSTOM HOUSE
B15 : FIRE HOUSE
B16 : CHANGE HOUSE
B17 : CAFETERIA
B18 : CLINIC
B19 : REST HOUSES (2)
B20 : GATE HOUSES (3)

REQUIRED AREA
$2.015^{M} \times 2.096^{M} = 4,230.000^{M^2}$

IRAN-JAPAN EXPORT REFINERY

REFINERY PLOT PLAN

HYDROSKIMMING : 500,000 BPSD

■ Construction Schedule and Refinery Staff

On the basis of the target dates for commencing basic engineering and for starting refinery operation, time requirements for construction of this project are estimated as follows:

. Refinery Facilities		
- 125,000 BPSD and 250,000 BPSD	:	44 months
- 500,000 BPSD	:	53 months
. Sea Berth	:	36 months
. Harbor, Dredged Channel and Causeway	:	33 months
. Crude Oil Pipeline	:	36 months

This estimation is made on the basis that the accessway to the refinery and the refinery site will have been developed before the refinery construction starts.

The refinery will go onstream within six months after mechanical completion, hence the refinery will come into commercial operation at the 51th month for the 125,000 or 250,000 BPSD refinery and at the 60th month for the 500,000 BPSD from commencement of basic engineering.

The organizational structure and the department functions required for refinery operation were analyzed and the number of refinery employees were estimated for the respective cases.

It is estimated that the refinery with 125,000 or 250,000 BPSD capacity will require about 650 employees and with 500,000 BPSD capacity about 880 employees.

ECONOMICS

■ Introduction

The economic analysis of this study covers the petroleum refining in Iran, the product transportation from Iran to Japan, and the product storage in Japan.

Most of the discussions made in this study are for a petroleum refining venture company in Iran, which involves the following activities:

- Investment to construct refinery
- Purchase of crude oil
- Refining
- Sales of products on an FOB basis

It is assumed that the product transportation from Iran to Japan and the operation of CTS in Japan will be managed by separate venture companies.

Among the following investment items in Iran, items (a), (b), (e) are assumed to be developed by others as industrial infrastructures and item (f) to be developed as social infrastructures.

(a) Crude oil pipeline
(b) Refinery site preparation
(c) Refinery facilities
(d) Product shipping facilities
(e) Marine facilities
(f) Access Road, community and other infrastructures

Investigations for the case when the company will be required to invest for the industrial infrastructures are made in the sentitivity analysis.

■ Construction Cost

The construction cost estimates are based on cost data from silimar projects.

These estimates are prepared on a current-installed-in Japan basis and then adjusted to reflect location factors of Iran and escalation factors from 1978 through 1983.

A summary of the estimates is presented in the following table by classifying the costs into refinery investment and industrial infrastructure.

(Unit: 10^6 US$)

Configuration	Hydroskimming			Hydrocracking		
Capacity, BPSD	125,000	250,000	500,000	125,000	250,000	500,000
INVESTMENT						
Process Units	247.2	409.6	819.2	290.1	482.3	964.5
Utility Systems	112.3	184.6	313.1	118.5	192.9	329.4
Offsite Facilities	278.7	370.0	545.5	286.7	379.9	553.0
Shipping Facilities	189.5	189.5	211.6	189.5	189.5	211.6
Total	827.7	1,153.7	1,889.4	884.8	1,244.6	2,058.5
INFRASTRUCTURE						
Crude Oil Pipeline	54.5	75.7	118.5	54.5	75.7	118.5
Site Preparation	9.5	11.9	19.0	10.0	12.5	20.0
Marine Facilities	124.1	124.1	124.1	124.1	124.1	124.1
Total	188.1	211.7	261.6	188.6	212.3	262.5

■ Capital Requirements and Operating Cost

The capital requirements for a venture company of this project are estimated and presented in the following table.

Among the six items in the capital requirements, items except for working capital are subject to depreciation or amortization as a fixed capital investment.

On the other hand, the seven items in the operating costs are direct operating costs excluding crude oil cost and capital related expenses, and the cost is expressed as cost per crude oil refined.

Configuration	Hydroskimming			Hydrocracking		
Capacity, BPSD	125,000	250,000	500,000	125,000	250,000	500,000
CAPITAL REQUIREMENTS, 10^6 US$						
Construction Cost	827.7	1,153.7	1,689.4	884.8	1,244.6	2,058.5
Paid-up Royalties	1.8	3.6	7.1	2.9	5.8	11.6
Initial Catalyst and Chemicals	6.2	12.3	24.6	7.5	15.0	30.0
Pre-operating Expenses	38.9	39.1	47.7	40.1	40.3	49.6
Interest during Construction	97.2	137.3	233.2	103.6	153.1	256.9
Working Capital	101.8	152.8	245.8	105.5	157.9	251.4
Total	1,073.6	1,498.8	2,445.8	1,144.4	1,616.7	2,658.0
OPERATING COSTS, 10^3 US$/CD						
Salary and Wages	38.6	38.6	52.2	40.8	40.8	55.7
Overhead	16.6	16.6	22.5	17.5	17.5	24.0
Maintenance	53.0	80.4	144.0	58.5	89.5	161.3
Operating Supplies	3.4	4.7	7.8	3.6	5.1	8.4
Corporate Overhead	7.5	7.5	7.5	7.5	7.5	7.5
Insurance	4.4	6.2	10.5	4.7	6.7	11.3
Catalyst and Chemicals	27.8	55.3	110.4	25.8	51.3	102.5
Total	151.3	209.3	354.9	158.4	218.4	370.7
Total Operating Costs US$/BBL of Crude	1.42	0.98	0.84	1.49	1.03	0.87

■ Average Product Cost

To supply guide information for further discussions on the economics of this project, the average product cost was estimated.

The average product cost is calculated on the basis of ex-CTS cost in Japan and on a 1983 freeze basis.

All costs except for crude cost are escalated through 1983 but no escalation is considered after 1983, when the refinery is assumed to start its commercial operation.

The results of the analysis for the six cases are summarized as follows:

(Unit: US$/BBL)

Configuration	Hydroskimming			Hydrocracking		
Capacity, BPSD	125,000	250,000	500,000	125,000	250,000	500,000
Crude Oil Cost (FOB)	12.65	12.65	12.65	12.65	12.65	12.65
Refinery Margin	6.83	5.03	4.42	7.15	5.28	4.65
Operating Costs	1.53	1.06	0.90	1.59	1.10	0.93
Refinery Fuel and Losses	0.91	0.91	0.91	0.88	0.88	0.88
Cost of Working Capital	0.23	0.17	0.14	0.23	0.17	0.14
Capital Recovery	4.16	2.89	2.47	4.45	3.13	2.70
Bunker Fuel Oil Adjustment	0.30	0.25	0.22	0.31	0.25	0.23
Ocean Freight	1.73	1.73	1.73	1.75	1.75	1.75
Import Tariff	0.90	0.90	0.90	0.95	0.95	0.55
CTS Margin	2.28	1.82	1.61	2.28	1.82	1.61
Ex-CTS Required Average Product Price	24.69	22.38	21.53	25.09	22.70	21.84
Av. Product Value in 1983, Japan	17.83	17.83	17.83	17.93	17.93	17.93

In the table, reference is made to the average product value based on the estimated ex-refinery product prices in 1983, Japan.

■ Sensitivity Analysis for Basic Six Cases

To investigate the effects of changes in the major factors which were established as the study bases for the basic six cases, sensitivity analyses were conducted for the following factors:

Item	from	to
Project Life	20 years	15 years
Crude Cost	12.65 $/bbl	±5.0 $/bbl
Tax Holiday	None	10 years
Investment for Industrial Infrastructures	Not included	Included
Plant Cost	Base	±10 percent

(Unit: US$/BBL)

Configuration		Hydroskimming			Hydrocracking		
Capacity, BPSD		125,000	250,000	500,000	125,000	250,000	500,000
ITEMS INVESTIGATED	(a) Project Life	±0.43	±0.29	±0.28	±0.46	±0.33	±0.30
	(b) Crude Cost	±0.42	±0.41	±0.40	±0.41	±0.39	±0.39
	(c) Tax Holiday	-0.33	-0.24	-0.15	-0.36	-0.24	-0.16
	(d) Scope	±0.97	±0.59	±0.36	±0.97	±0.59	±0.37
	(e) Plant Cost	±0.46	±0.34	±0.27	±0.49	±0.36	±0.29
Refinery Gross Margin of Base Cases		6.83	5.03	4.42	7.15	5.28	4.65

■ Sensitivity Analysis for Alternatives

A study was conducted to evaluate the attractiveness of the technical alternatives for refinery design compared with the basic case refineries.

The analysis was made on the 250,000 BPSD refinery basis and the results are expressed as gaps in product costs from the basic cases.

The description of the cases and the results obtained are summarized as follows:

Case Description	Changes from Basic Case	
	Hydroskimming US$/BBL	Hydrocracking US$/BBL
1. Utilities Alternatives		
. Purchase Electric Power (0.05US$/kwh)	-0.18	-0.22
. Purchase Natural Gas (0.20US$/MBTU)	-0.53	-0.51
. Purchase Soft Water (0.50US$/Ton)	-0.11	-0.08
2. Fuel Oil Sulfur Alternatives		
. LS (0.5%S) : MS (1.5%S) = 4:1	-0.22	-0.06
. LS (0.5%S) : MS (2.5%S) = 4:1	-0.04	-0.01
. LS (0.5%S) : MS (1.5%S) = 1:1	-0.05	-0.01
. LS (0.5%S) : MS (2.5%S) = 1:1	-0.21	+0.11
. LS (0.1%S) : MS (2.5%S) = 4:1	+0.10	+0.08
. LS (0.1%S) : MS (2.5%S) = 1:1	+0.34	+0.17
3. Process Alternatives		
. Mixed Crude Operation	+0.04	+0.13
. Crude Process Ratio: IL/IH=6:4	±0	+0.01
. Adoption of Coker	-0.10	+0.27
. Gasoline Production: 5% on Crude Less	+0.37	-
. No Medium Sulfur Fuel Oil Production	-0.01	-
. Utilize Medium Size Tankers	+0.05	+0.07

RECOMMENDATION

In order to achieve efficient and rapid realization of the refinery and the most beneficial return from the project, it is recommended that the following items be discussed and determined as soon as possible:

(1) Identification of policy issues to render the project economically attractive.

(2) Type and capacity of first stage of refinery.

(3) Refinery operation aspects.

- Service factor
- Product quality
- Flexibility
- Location of shipping terminal

(4) Product transportation

- Secondary transportation
- Contamination
- Direct transportation

(5) Joint venture company

(6) Scope of investment

- Infrastructure
- Product carrier
- CTS

(7) Fund-raising, supply and demand program.

(8) Comparison with Japan's expanded and grass roots refineries, etc., to be constructed in future.

(9) Other items for project implementation.