

- Justifying flash temperature on crude distillation tower with overflash meter
- (3) Improvement of reaction and solvent systems
 - Change of acid gas absorbent from MEA to ADIP
 - H₂/HC mol ratio reduction on catalytic reformer
- (4) Utility control
 - Optimum operation condition on cooling system
 - Measures in tank yards
 - Control by electricity and steam energy balance
- (5) Prevention of high temperature energy loss
 - Waste heat recovery on furnace and boiler
- (6) Prevention of Medium temperature energy loss
 - Medium temperature waste heat recovery
 - Improvement of heat exchanger layout on crude distillation unit
- (7) Rationalization in energy conservation and utilization
 - Pump impeller improvement for energy saving
 - Turbine driven pump revolution speed control
- (8) Rationalization of refining processes
 - Hot charge for catalytic reformer
 - Using hydrotreating process for Kerosene and Gas Oil upgrading
- (9) Others

2.6 Engineering Study

Engineering study is carried out for such areas as described in item

2.5. Engineering study provides following information:

- Lay out
- Flow sheet
- P&I diagram
- Heat and material balance
- Equipment list with specifications
- Utility required
- Energy saving
- Manning schedule
- Construction Schedule
- Pollution control

2.7 Capital Requirement

2.8 Economic Study

Economic study is carried out using information specified in item 2.6, 2.7. Costs required for modification are estimated and energy saving effects are evaluated. The economic viability shall be discussed not only based on economic profitability but also based on other socio-economic criteria and national economic objectives.

2.9 Financing Study

Possible financing sources and their conditions are investigated. This study is closely related to the economic study.

2.10 Recommendation

Recommendation for energy conservation is made by evaluating the Feasibility Study in terms of technology, operation, economics and financing.

3. Example of Organization for Energy Conservation in Japanese Refinery

4. Future Outlook on Energy Conservation In Japan

DISCUSSION PAPER
FOR
THE PROJECT IDENTIFICATION MISSION
IN
MINING, INDUSTRY AND POWER DEVELOPMENT
IN
THE SULTANATE OF OMAN
(POWER AND DESALINATION PLANTS)

FEBRUARY 1993

JAPAN INTERNATIONAL COOPERATION AGENCY

This present project identification mission is an official mission dispatched by the Japan International Cooperation Agency (herein referred to as JICA), headed by Mr. Kei-ichi Takeda, Deputy General Manager of the Mining and Industrial Development Study Department of JICA. The purpose of the mission is to obtain information and data, through thorough discussions with the authorities concerned of the Government of the Sultanate of Oman (herein referred to as the Sultanate) and surveys on the concerned facilities and locations, so that the mission may be able to identify, with an additional analysis of the information and data in Japan, appropriate projects for the development study in the fields of energy, mining and industry, which the Government of Japan may be able to extend to the Sultanate.

The subjects the mission wishes to cover are petroleum refining, petrochemical industry, development of manufacturing industries in general, and power and desalination plants. The mission includes experts in these respective fields so that the discussions and surveys of the concerned locations may be very fruitful ones. A questionnaire listing items of interest has been sent to the Government of the Sultanate in advance to assist the officials of the Sultanate to be well prepared for the meetings. As has already been officially advised through the diplomatic channel, the mission is scheduled to visit the Ministry of Foreign Affairs, the Development Council, the Ministry of Commerce and Industry, the Ministry of Electricity and Water, the Ministry of Petroleum and Minerals, the Mina al Fahal Petroleum Refinery, and the power and desalination plants.

The mission has prepared three sets of discussion papers, one for petroleum refining and petrochemical industry, another for development of manufacturing industries, and the other for power and desalination plants. This present discussion paper concerns the power and desalination plants.

1 Schedule for the Project Identification Mission

The following schedule has been proposed.

Thr. 11/2

Arrival in the Sultanate

Fri. 12/2	Internal meeting
Sat. 13/2	Visit to the Embassy of Japan, the Development Council, the Ministry of Foreign Affairs
Sun. 14/2	Meeting with the Ministry of Petroleum and Minerals
Mon. 15/2	Ditto
Tue. 16/2	Visit to the Mina al Fahal Refinery
Wed. 17/2	Meeting with the Ministry of Commerce and Industry
Thr. 18/2	Internal meeting

The members in charge of petroleum refining, petrochemical industry and industrial development leave the Sultanate.

The member in charge of power generation and water resources development joins the mission.

Fri. 19/2	Internal meeting
Sat. 20/2	Meeting with the Ministry of Electricity and Water
Sun. 21/2	Visit to the Desalination-power generation plant
Mon. 22/2	Meeting with the Ministry of Electricity and Water,
Tue. 23/2	Meeting with the Development Council, meeting with the Embassy of Japan

The mission leaves the Sultanate.

2 JICA's Scheme for Technical Cooperation

The standard flow of Development Study by JICA follows the following process.

1. Project Identification
2. Request
3. Decision on Study Execution
4. Preparatory Study
5. Formation of Study Team

6. Field Survey
7. Analysis and Study in Japan
8. Presentation of Final Report

3 Major Themes for Discussion

A questionnaire has already been sent to the Government of the Sultanate to facilitate discussions. The discussions could proceed in accordance with the questionnaire. JICA has tentatively prepared a scope of study for this feasibility study for the purpose of proceeding with the discussions with the authorities concerned, thereby clarifying the needs of the Government of the Sultanate. The major items for discussions on power and desalination plants are as follows:

1. Background and necessity for the construction of power and desalination plants
2. Basic policy towards solutions of the problems
3. Natural and social conditions of the site (Barka and Sohar)
4. Electricity supply system
5. Water supply system
6. Method of cost estimation

4 Scope of Study

The following scope of study on power and desalination plants may be considered as a typical example for this kind of feasibility study. JICA trusts that this scope of study, though tentative, will serve as the basis for discussion and will help clarify the needs of the Government of the Sultanate. In case the Government of Japan takes up the feasibility study on power and desalination plants, upon receiving the application from the Government of the Sultanate, JICA's preparatory mission will be dispatched to finalize the scope of study with the Government of the Sultanate.

1. Background and Objectives

(1) Background

National policy, present situation, necessity, etc.

(2) Objectives

2. Natural and Social Conditions

(1) Natural Conditions

Location, geographical features, climate, etc.

(2) Social Conditions

Accessibility, infrastructure, etc.

3. Electricity Demand and Supply for the Present and in Future, and Power Development Program

(1) Existing Power Facilities

(2) Characteristics of Load Variation

(3) Load Forecast

4. Water Demand and Supply for the Present and in Future, and Desalination Plant Construction Program

(1) Existing Water Supply System

(2) Characteristics of Water Demand Variation

(3) Water Demand Forecast

5. Selection of Plant Site

(1) Conditions for Site Selection

(2) Topography and Geology

- (3) Sea Water Quality
 - (4) Supply of Fuel
 - (5) Environmental Impact
6. Selection of Type and Unit Capacity of Power and Desalination Plants
 - (1) Planning Conditions
 - (2) Selection of Power Plant Type and Unit Capacity
 - (3) Selection of Desalination Plant Type and Unit Capacity
7. Conceptual Design of Power Plant
 - (1) Basic Concept
 - (2) Conceptual Design of Power Generation Equipment
Turbines, condenser, control system, electrical circuit system, cooling water system, connection to transmission line, equipment layout
8. Conceptual Design of Desalination Plant
 - (1) Basic Concept
 - (2) Conceptual Design of Desalination Equipment
General specifications, process description, equipment specifications, connection to water distribution, equipment layout
9. Conceptual Designs of Civil and Architectural Facilities
 - (1) Layout of Civil and Architectural Facilities
 - (2) Conceptual Design of Intake Facilities
 - (3) Conceptual Design of Equipment Foundations
 - (4) Conceptual Design of principal Buildings
10. Operation and Maintenance Personnel
 - (1) Administrative Organization
 - (2) Job Assignment
 - (3) Personnel Qualification
11. Plant Construction Schedule
12. Construction Cost Estimate
 - (1) Conditions for Estimate

(2) Estimated Construction Cost

13. Recommendation

QUESTIONNAIRE

FOR

THE PROJECT IDENTIFICATION MISSION

IN

MINING, INDUSTRY AND POWER DEVELOPMENT

IN

THE SULTANATE OF OMAN

FEBRUARY 1993

JAPAN INTERNATIONAL COOPERATION AGENCY

1 Petroleum Refining

1-1 Background

The Sultanate established in 1983 the Mina al Fahal Refinery with a capacity of 50,000 barrels per stream day (BPSD), based on the recommendation by the "Feasibility Study on a Refinery Construction Plan in Oman" by JICA. The refining capacity in terms of atmospheric crude oil distillation was increased in 1987 by 80,000 BPSD.

The mission understands that the Mina al Fahal Refinery now consists of the following facilities:

Topping Plant, BPSD	80,000
Naphtha HDS, BPSD	21,000
Catalytic Reformer, BPSD	16,000
Kerosene Sweetening, BPSD	10,000
LPG, tons/day	282
Sulfur Recovery, tons/day	5
Utilities Facilities	
Offsite Facilities	

Recently, it is desired that the refinery should be better equipped to improve efficiency of production, to cope with varying demands for the products, to improve the system for ensuring safety of operation and to protect the environments. It is also considered necessary to formulate a long-term strategy about meeting the forecast demands.

1-2 Items of Questions

1-2-1 Please state (1) the basic policy regarding petroleum refining, (2) plans for the future, and (3) the problems the Mina al Fahal Refinery is now suffering from, specifically:

- (1) Debottlenecking of the Mina al Fahal Refinery
- (2) Expansion Plan of the Mina al Fahal Refinery
 - A. Crude Oil Treating Capacity

- B. Installation of a Heavy Oil Cracking or Conversion Plant
- C. Others
- (3) New Refinery Construction Plan
- (4) Improvement of the Products Qualities
 - A. Gasoline
 - B. Jet Fuel
 - C. Kerosene
 - D. Gas Oil
- (5) Saving of Energy on Refinery Operation and Improvement of the Operating Efficiency
- (6) Improvement of Environmental Protection
- (7) Safety Measures
- (8) Modernization of Plant Operating System by Using Computers
- (9) Others

1-2-2 Information and Data concerning Petroleum Industry

Since the Mina al Fahal Refinery has been in operation for years, the rather detailed information is requested. To facilitate meetings blank tables are prepared to fill in.

- (1) Petroleum Products Demand in Oman - Past Table 1
- (2) Petroleum Products Demand in Oman - Future Table 2
- (3) Petroleum Products Import - Past Table 3
- (4) Petroleum Products Import - Future Table 4
- (5) Petroleum Products Export - Past Table 5
- (6) Petroleum Products Export - Future Table 6
- (7) Crude Oil Processing and Products Supply in the Oman Refinery- Past Table 7
- (8) Crude Oil Processing and Products Supply in the Oman Refinery- Future Table 8
- (9) Long Term Production Forecast of Oman Crude Table 9
- (10) Characteristics of Oman Crude
 - A. Crude Oil Characteristic Table 10
 - B. Light Hydrocarbons Table 10
 - C. Fraction Data Table 11
- (11) Specification of Petroleum Products - Now and Future Table 12

(12)	Prices of Petroleum Products and Crude Oil at the Mina al Fahal Refinery - Past and Future	Table 13
(13)	Retail Prices of Petroleum Products in Oman	Table 14
(14)	Oman Refinery Block Flow Diagram	Fig.-1
(15)	Refinery Process Unit Configuration and Capacity	Table 15
(16)	Oman Refinery Plot Plan	
(17)	Process Flow Sheet	
(18)	Main Operating Conditions	
(19)	Utilities Consumption in the plant and prices	Table 16
(20)	Purchasing Fuel Gas Amount, Specification and Price	
(21)	Flexibilities on Plant Operation for Changing Through-put, Yield of Fraction, Severity (RON on Reformate), etc.	
(22)	Outline of offsite facilities	
	Tankage and Oil Handling Flow Diagram	Fig.-2
	Tankage List	Table 17
(23)	Outline of Utility Facilities	
	A. Utility Balance	Table 18
	B. Utility Facilities Summary	Table 19
(24)	Environmental Protection	
	A. SO _x and NO _x Emission	Table 20
	B. Outline of Flare Stack System	
	- Block Flow Diagram of Exhaust Gas	
	- Flow Rate	
	- Flare Stack Height	
	- Location in the Refinery	
	C. Outline of Sour Water Stripper System	
	- Block Flow Diagram of Sour Water	
	- Flow Rate	
	- Stripper Operation Condition	
	D. Outline of Waste Water Treatment System	
	- Block Flow Diagram of Clean Water	
	- Block Flow Diagram of Oily Water	
	- Flow Rate of Oily Water	
	- Waste Water Treating Facilities	
	- Properties of Waste Water	Table 21
	- Location Map of Sea Water Intake and Waste Water Discharge	
	E. Outline of Acid Gas Treating System	

- Block Flow Diagram of Refinery Fuel Gas and Acid Gas
- Topics of Sulfur Recovery Plant (Operating Load, Properties of Product Sulfur Seal System of Sulfur Tank, etc.)
- Treating Method of Tail Gas
- F. Odor Problems
 - Location Map of the Dwelling Zone around the Refinery
 - Complains about Odor from the Refinery
- G. Refinery Waste Disposal
 - Spent Soda
 - Spent Catalyst
 - Tank Sludge
 - PPI Sludge
 - Others
- (25) Safety Measures
 - A. Major Examples of Accidents
 - B. Examples of the Plant Operation Shutdown
 - C. Annual Maintenance Cost Table 22
 - D. Refinery Organization Fig.-3
 - E. Manning List for Each Department Tables 23A
and 23B
- (26) Land Plan for the Expansion of the Mina al Fahal Refinery or a New Refinery
- (27) Energy Supply Strategy in Oman
 - Sharing of Natural Gas Source and Petroleum Products Source Table 24
 - Possibility of the Diffusing the CNG Motor Vehicles and/or LPG Motor Vehicles
- (28) Study Reports on Refinery Modernization, Upgrading and etc. for Reference Materials
- 1-2-3 Construction of additional storage capacity for strategic petroleum products

2 Petrochemical Industries

2-1 Backgrounds

It is reported that the non-associated gas reserves of the Sultanate were 7.08 thousand cubic feet (tcf) and the associated gas reserves were 2.83 tcf as of 1992.

With 64 fields on yearend 1990, the production of oil averaged a record 652,000 b/d and the use of associated gas for fuel, injection, and other oil field purposes rose to 295 MMcfd, representing about 81 percent of the associated gas produced.

Meanwhile, the consumption of natural gas for public utilities and others is estimated at about 403 MMcfd (147 billion cf/year) for the year 2000; therefore, the natural gas resources will be exhausted in about 30 years.

In the prefeasibility study report submitted by JICA in 1978, it is said that installation of a petrochemical complex centered on an ethylene plant and an LNG export project are not recommended; while on the other hand, production of ammonia and urea would be feasible on condition that reasonable prices and long-term sales contracts are materialized.

However, a report by an international organization submitted in 1990 indicates that installation of a petrochemical complex centered on an ethylene plant of a 100,000-tpa capacity will be feasible but says that production of ammonia or urea is not recommended on the ground that production capacity of these products is already globally surplus, but a methanol project is worth being further investigated. The report obviously reflects the estimated proved natural gas reserves which had increased more than three times since the JICA's prefeasibility study was prepared.

2-2 Confirmation of Natural Gas Resources

Generally speaking, the natural gas resources of the Sultanate

are not as large as those of other countries in the Middle East. Therefore, firm estimate of natural gas reserves is primarily needed in planning industrialization of a country based on natural gas utilization. Therefore, the information of the following items is requested.

- (1) Locations of gas fields/Estimated proved reserves
- (2) Available amounts of associated gas except for the those utilized for enhanced oil recovery
- (3) Present status of pipeline grid to connect each source of gas

2-3 LNG Export Project and Extraction of Heavier Components from Natural Gas Stream for Petrochemical Feedstock

It is reported that an LNG export project is being planned and that the liquefaction capacity of the project is 5,000,000 tons per year; the feedstock will be supplied from newly developed gas wells. In connection with this project the following information is requested.

- (1) The amounts of heavier components such as ethane, propane and butane to be extracted from the natural gas stream for petrochemical feedstock
- (2) Progress of project
 - A. Basic project scheme
 - Gas gathering station
 - Liquefaction site
 - Shipping port
 - B. Liquefaction capacity
 - C. Customers
 - D. Percentage of equity
 - E. Partners
 - F. Financing scheme

2-4 Status of Polyolefins Project

It is reported that a polyolefins project will be materialized during the period of fourth five-year plan in accordance with a recommendation by the international organization.

Towards the end of the 1980s, the market of petrochemical products was brisk. A number of petrochemical companies expanded their existing facilities or constructed new plants for manufacturing not only LDPE, HDPE and PP, but ethylene itself. Afterwards these products have become surplus and the over-production capacity resulted in the fall in the prices. Perhaps, this trend may be reversed around 1995. With the above in mind the following information is requested in connection with the Fifth Five-Year Development Plan for the years in 1996 and afterwards.

- (1) Trend of price, supply and demand of each product on which these projects are evaluated
- (2) Feedstock price at battery limit of the complex
- (3) Alternative development plans of downstream petrochemical industries other than polyethylene and polypropylene

2-5 Methanol Project

It is reported that a methanol project is now under study. Production of methanol has been highlighted as the source of MTBE and the production capacity is rapidly increasing worldwide.

Therefore, this situation should be carefully considered. The policy of the Sultanate on the following items is requested for presentation.

- (1) Export of methanol
- (2) Production of derivatives

2-6 Concept of Chemical Refinery

As an alternative case, combination of a refinery and a polyole-

fins complex should be studied to enhance the efficiency in the investment for polyolefins complex. In this case, not only propane and butane, but naphtha is a potential feedstock to the polyolefin complex and propylene from an FCC unit will also be an attractive feedstock. In this regard the following question is asked.

- (1) Priority of constructing ethylene plant in the future industrialization plan of the Sultanate Oman

2-7 Development of Downstream Plant Configuration

Now ethylene is easily available in the worldwide market, although it is the most principal of the basic raw materials for petrochemical products. Therefore, production of resins may be advisable by importing cheap ethylene and other raw materials from the worldwide market.

However, some kind of materials can be produced if the production of these materials is attractive from economical viewpoint. In this connection the following question is asked.

- (1) Oman's interest in this concept

2-8 Importation of Petrochemical Products

Information and data on the importation of petrochemical products would be of useful measures to evaluate the magnitude and range of the domestic market for petrochemical products, with respect to the preliminary assessment of feasibility of import-substitute industries in particular. For this reason the following information and data are requested.

- (1) Relevant information and data on customs clearance for the past five years

2-9 Others

The following questions are asked.

- (1) Energy consumption statistics from 1980 through 1992, oil, gas, electricity and others
- (2) Authorized trend forecast of energy demand of the Sultanate of Oman, oil, gas, electricity and others
- (3) Status of UNIDO's study for the Fourth Five-Year Development Plan

3 Industrial Development

3-1 Background

The Japan International Cooperation Agency conducted a master plan study entitled "The Prefeasibility Study for Industrial Development in the Sultanate of Oman" in 1978. The prefeasibility study investigated feasibility of development in such fields of industry as manufacture of construction materials, ceramic industries, metal and plastics processing, petroleum and natural gas, desalination, and small-scale shipbuilding industry. The prefeasibility study identified the 14 projects; namely, (1) secondary processing of cement, (2) marble processing, (3) limestone- and dolomite-based industries, (4) ALC products, (5) ceramic tiles, (6) brick burning, (7) glass products, (8) porcelains, (9) copper products, (10) plastic products, (11) petroleum refining, (12) natural gas utilization, (13) desalination of sea water and its byproducts utilization, and (14) small-scale fishing boat building industry.

While the prefeasibility study was conducted, the Sultanate was implementing the first Five-Year Development Plan which started in 1976, marking a concrete step towards a more systematic national industrial development. Throughout the successive five-year development plans until the present Fourth Plan, the Sultanate has successfully realized a number of large industrial projects as well as promoted a large number of small- and medium-scale industries. Especially noteworthy among them are construction of a petroleum refinery, a copper smelter, cement works, and industrial sites.

The international organization has contributed to the formulation of the present Fourth Five-Year Plan. In contrast to the remarkable progress in petroleum refining and copper smelting, the development of manufacturing industry is lagging behind except those small-scale industries for the manufacture of construction materials.

Questions are asked from the viewpoints of (1) following up of JICA's prefeasibility study done in 1978, (2) development of manufacturing industries based on mineral resources, (3) improvement of

social and administrative structure needed for the promotion of industrialization, and (4) promotion of small-scale industries in the existing and planned industrial zones.

3-2 Basic Policy and Strategy

The mission would like to be informed about the basic policy and strategy for promoting manufacturing industries in the Sultanate and problems that are considered to be hampering their smooth development.

3-3 The Fifth Five-Year Development Plan

The following questions are asked about the forthcoming Fifth Five-Year Development Plan.

- (1) The major policy priorities
- (2) Necessity of a comprehensive master plan study such as that done by JICA in 1978 for the formulation of the Fifth Five-Year Development Plan
- (3) Priority projects of the Ministry of Commerce and Industry
- (4) Allocation of funds for the industrial development program

3-4 Following up of JICA's Prefeasibility Study

Please indicate the present status and plans for the following industrial sectors that were recommended by the JICA's study but have remained unpromoted.

- (1) Ceramic industry
- (2) Small-scale shipbuilding industry
- (3) Sea water byproduct utilization
- (4) Ceramic tiles
- (5) Limestone- and dolomite-based industries
- (6) ALC products

3-5 Development of Mineral Resource-based Industries

A report by an international organization submitted in 1990 entitled "DOWNSTREAM PROCESSING OF OMAN'S NATURAL GAS" indicates possibility for promotion of the following (1) and (2) industries. It is reported that production of natural gypsum is contemplated. Please indicate the opinions of the Ministry of Commerce and Industry on them.

- (1) Magnesia refractories from dolomite
- (2) Recovery of potash and other chemicals from brines
- (3) Production of natural gypsum
- (4) Other resource-based industries

3-6 Improvement of Social and Administrative Functions

Please indicate the necessity of establishing an Industrial Statistical and Information System and a System of Industrial Standards.

3-7 Promotion of Small-scale Industries

Please explain the present status of development of small-scale industries and problems hampering their development.

- (1) Development of industrial zones
- (2) Present status of small-scale industries within the existing industrial zones
- (3) Present status of small-scale industries outside the existing industrial zones
- (4) Development plans of new industrial zones
- (5) Industries to be invited to new industrial zones

3-8 UNIDO's Study for the Fourth Five-Year Development Plan

Please explain the present status of the study.

4 Power and Desalination Plants

4-1 Background

Demands of electricity and fresh water have been increasing rapidly in the capital and Sohar areas, while supply systems cannot catch up with them. Consequently, it is essential that the urgent needs should be met and that the most suitable supply systems should be established from a long-term viewpoint. According to the Fourth Five-Year Plan, the GDP of power and water is expected to grow from 55 million RO in 1991 to 73 million RO in 1995 with average annual increase by 7 %. The following questions will be instrumental in letting the mission fully understand the problem.

4-2 Items of Questions

4-2-1 General

- (1) Please explain the comprehensive plan on power and water supply systems at Barka and Sohar in the future.
- (2) Please inform us of the relation between the power and desalination development programs at Barka and Sohar, and the Fourth Five-Year Plan.
- (3) Which do you want to put emphasis on, power or water?
- (4) Please let us know whether the feasibility study for the power and desalination complex at Barka is a re-review of the 1985 study or brand-new.
- (5) Does the power and desalination complex at Barka cover the capital area including Ghubrah?
- (6) We wonder whether the power and desalination complex at Sohar is associated with the capital area or not.
- (7) Please explain the necessity and urgency of the Barka and

Sohar plant complexes.

- (8) Please explain the MEW organization.

4-2-2 Basic Policy

- (1) What is priority in deciding the optimal system among costs (capital, operation and maintenance), reliability and manpower requirement?
- (2) Do you have any plan on Omanization in power generation and desalination?
- (3) What do you think the balance between productivity and environmental protection?
- (4) What is the policy for well water usage?
- (5) What water quality do you expect in connection with safety of drinking water?

4-2-3 Information and Data

We would like to know the following information and data concerning the Barka and Sohar plant complexes

- (1) Natural and Social Conditions of the Sites (Barka and Sohar)

- 1) Natural

Location, geographical and geological features, climate, etc.

- 2) Social and Economic

Infrastructure, population, economic activities

- 3) Fuel supply

- (2) Electricity Supply System

- 1) Existing Power Facilities

a. Barka and Capital Area

b. Sohar

2) Power Demand and Supply

a. Barka and Capital Area

b. Sohar

Including monthly and daily load variations

3) Load Forecast and Required Capacity

Urgent needs and future expansion

4) Requirements for the areas if any

(3) Water Supply System

1) Water Resources

Well water quality and quantity, brackish, etc.

2) Existing Water Supply Systems

3) Existing Desalination Plants

4) Water Demand and Supply

Including monthly and daily demand variations

5) Forecast of Water Demand and Required Capacity

Urgent needs and future expansion

6) Requirement for the Areas if any

(4) Method of Cost Estimation

Interest rate, depreciation period, labor cost, fuel cost, etc.

Table 1 Petroleum Products Demand in Oman - Past

(Unit: 10³ barrels)

Annual Consumption	LPG	Aviation Gasoline	Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy-Fuel Oil	Marine Bunker Oil	Total	Bitumen (10 ³ Tons)	Lubricating Oil
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												
1991												
1992												

Table 2 Petroleum Products Demand in Oman - Future

(Unit: 10³ barrels)

Forecast Demand	LPG	Aviation Gasoline	Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy-Fuel Oil	Marine Bunker Oil	Total	Bitumen (10 ³ Tons)	Lubricating Oil
1993												
1994												
1995												
1996												
1997												
1998												
1999												
2000												
2001												
2002												

Table 3 Petroleum Products Import in Oman - Past

(Unit: 10³ barrels)

Annual Import	LPG	Aviation Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy-Fuel Oil	Marine Bunker Oil	Naphtha	Bitumen (10 ³ Tons)	Lubricating Oil
1983											
1984											
1985											
1986											
1987											
1988											
1989											
1990											
1991											
1992											

Table 4 Petroleum Products Import in Oman - Future

(Unit: 10³ barrels)

Forecast Import	LPG	Aviation Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy-Fuel Oil	Marine Bunker Oil	Naphtha	Bitumen (10 ³ Tons)	Lubricating Oil
1993											
1994											
1995											
1996											
1997											
1998											
1999											
2000											
2001											
2002											

Table 5 Petroleum Products Export in Oman - Past

(Unit: 10³ barrels)

Annual Export	LPG	Aviation Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy-Fuel Oil	Marine Bunker Naphtha Oil	Bitumen (10 ³ Tons)	Lubricating Oil
1983										
1984										
1985										
1986										
1987										
1988										
1989										
1990										
1991										
1992										

Table 6 Petroleum Products Export in Oman - Future

(Unit: 10³ barrels)

Forecast Export	LPG	Aviation Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy-Fuel Oil	Marine Bunker Naphtha Oil	Bitumen (10 ³ Tons)	Lubricating Oil
1993										
1994										
1995										
1996										
1997										
1998										
1999										
2000										
2001										
2002										

Table 7 Crude Oil Processing and Products Supply in the Oman Refinery - Past

(Unit: 10³ barrels)

	Oman Crude Oil	Others Crude Oil	Fuel Gas	LPG Gas	Aviation Gasoline	Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy- Fuel Oil	Marine Bunker Oil	Total
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													

Table 8 Crude Oil Processing and Products Supply in the Oman Refinery - Future

(Unit: 10³ barrels)

	Oman Crude Oil	Others Crude Oil	Fuel Gas	LPG Gas	Aviation Gasoline	Premium Gasoline	Regular Gasoline	JET A-1*	Domestic Kerosene	Gas Oil	Industrial Heavy- Fuel Oil	Marine Bunker Oil	Total
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
2001													
2002													

Table 9 Long Term Production Forecast of Oman Crude

(Unit: 10⁶ Bbl or 1000 B/D)

Fields	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Proved Recoverable Reserves																				
@1992																				
Fahud																				
Natih																				
Yibal																				
Al Huwaisah																				
Lekhwair																				
Saih Nihayda																				
Saih Rawl																				
Ghaba North																				
Qarn Alam/Habur																				
Marmul																				
Birba																				
Qaharir																				
Amal																				
Rahab																				
Sub-Total																				
NGL/LPG (Yibal, Fahud, Saih Rawl)																				
Total Oman (Producing Fields)																				
Exploration Success No.1																				
Exploration Success No.2																				
Exploration Success No.3																				
Exploration Success No.4																				
Grand Total Oman																				

Table 10 Characteristics of Oman Crude

(1) CRUDE OIL CHARACTERISTICS

Specific Gravity, 15/4C

API Gravity, 60F

Kin. Viscosity at 50F, cst

Kin. Viscosity at 100F, cst

Sulfur, % wt

Pour Point, C(F)

Total Acid Number, mg. KOH/g

(2) LIGHT HYDROCARBONS

(% wt. on crude oil)

C₂ minus

C₃

iC₄

nC₄

iC₅

nC₅

Cyclo C₅

nC₆

Benzene

Other C₆

Table 11 Characteristics of Oman Crude

(3) FRACTION DATA	C5-65	65-100	100-150	150-200	200-250	250-300	300-350	>350	350-550
Fractions C									
Yield on crude, % wt.									
Yield on crude, % vol.									
Position in crude oil, % wt.									
Mid yield on crude oil, % wt.									
Specific gravity, 15/4C									
Kin. viscosity at 100F, cst.									
Kin. viscosity at 210F, cst.									
Sulfur, wt. %									
Wax content, % wt.									
Pour point, C(F)									
Research ON clear									
Paraffins/Naphthenes/Aromatics									
% wt.									
Aromatics, % vol.									
Smoke point, mm									
Freezing point, C									
Calc. cetane index									

Table 12 Specification of Petroleum Products - Now and Future

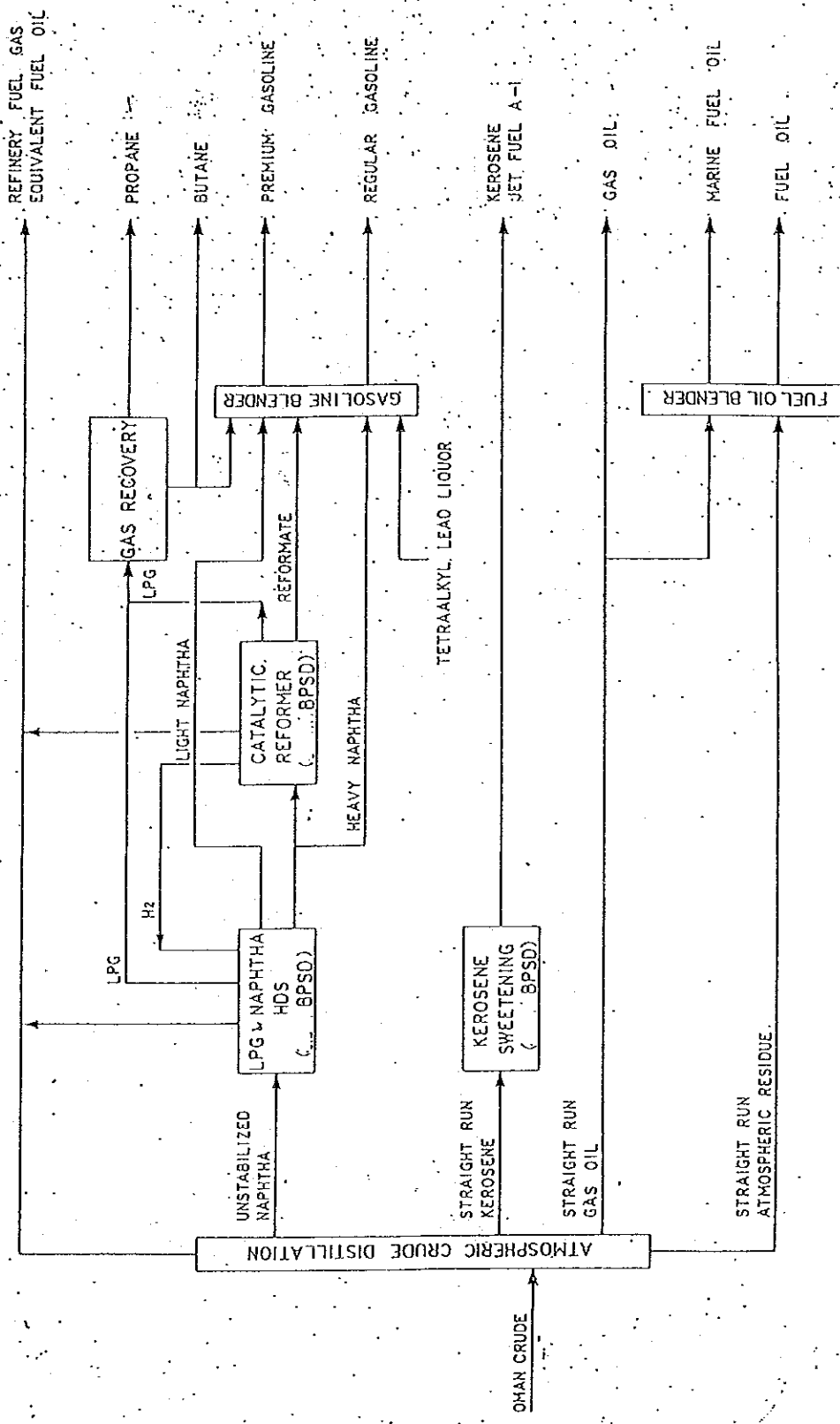
Products	Properties	Specification	Specification
		Now	Future
Premium Gasoline	Research Octane No. Lead Content, GPb/l End Point, C(ASTM D-86) Density @15C, kg/l		
Regular Gasoline	Research Octane No. Lead Content, GPb/l End Point, C(ASTM D-86) Density @15C, kg/l		
Kerosene	Flash Point, C Smoke Point, mm Sulfur Content, wt % ASTM Distillation 95%, C(D-86)		
Jet A-1	Specific Gravity Flash Point, C Freezing Point, C Sulfur, wt % Aromatic Content, vol %		
Gas Oil	Specific Gravity Flash Point, C Sulfur Content, wt % Cetane Number Viscosity @38C, cst		
Marine Fuel Oil	Flash Point, C Sulfur Content, wt % Viscosity @50C, cst Pour Point, C		
Industrial Heavy Fuel Oil	Flash Point, C Sulfur Content, wt % Viscosity @50C, cst Pour Point, C Carbon Residue, wt %		

Table 13 Prices of Petroleum Products and Crude Oil
at the Mina al Fahal Refinery

	Unit	1983	1988	1993	—
LPG	Baisas/kilogram				
Aviation Gasoline	Baisas/liter				
Premium Motor Gasoline	"				
Regular Motor Gasoline	"				
Domestic Kerosene	"				
Jet A-1	"				
Gas Oil	"				
Marine Bunker Oil	"				
Industrial Heavy Fuel Oil	"				
Naphtha	"				
Crude Oil					
Oman	"				
Others	"				

Table 14 Retail Prices of Petroleum Products in Oman

	Unit	1983	1988	1993	—
Premium Motor Gasoline	Baisas/liter				
Regular Motor Gasoline	"				
Domestic Kerosene	"				
Gas Oil	"				
Industrial Heavy Fuel Oil	"				
LPG	Baisas/kilogram				



UNIT: BPSD

OMAN REFINERY PROJECT
BLOCK FLOW DIAGRAM
FIG. 1

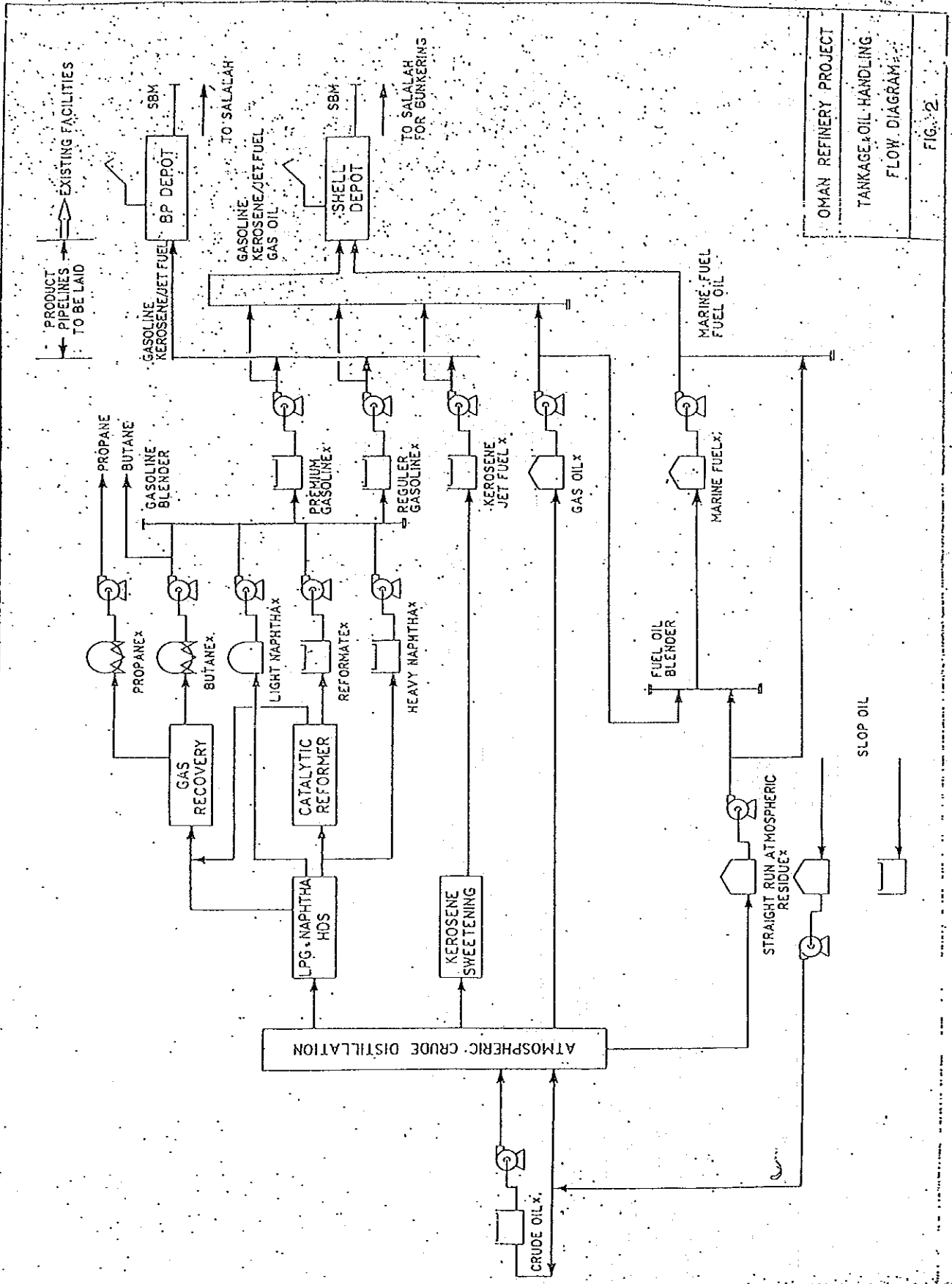
Table 15 Refinery Process Unit Configuration and Capacity

(Unit: BPSD)

	1982	1987	1993	—
Crude Atmospheric Distillation Unit				
LPG/Naphtha Hydrodesulfurization Unit				
Naphtha Catalytic Reforming Unit				
Kerosene Sweetening Unit				
LPG Recovery Unit				
Sulphur Recovery Unit				

Table 16 Utilities Consumption in the Plant and Prices

	Electricity	Fuel	Steam	Cooling Water (Fresh Water)	Cooling Water (Sea Water)
	KWH/D	10 ⁶ Kcal/D	Ton/D	Ton/D	Ton/D
Crude Atmospheric Distillation Unit					
LPG/Naphtha Hydrodesulfurization Unit					
Naphtha Catalytic Reforming Unit					
Kerosene Sweetening Unit					
LPG Recovery Unit					
Sulphur Recovery Unit					
Price					
	Baisas/KWH	Baisas/Kcal	Baisas/Ton	Baisas/Ton	Baisas/Ton



OMAN REFINERY PROJECT
TANKAGE & OIL HANDLING
FLOW DIAGRAM

FIG. 2

Table 17 Tankage List

		(Mina Al Fahal Area)		Oman Refinery Co.	
		PDO	SHELL	BP	
KL	NO.	KL	NO.	KL	NO.
KL	NO.	KL	NO.	KL	NO.
					Notes
Crude					
Gasoline					
Kerosene/Jet A-1					
Gas Oil					
Marine Bunker Fuel & Heavy Oil					
Propane					
Butane					
Lt.Naphtha					
Reformate					
Hy.Naphtha					
Reduced Crude					
Lt.Slop					
Hy.Slop					
Sulphur					

Notes: FR: FLOATING ROOF TANK DOME: DOME ROOF TANKE M: TANK MIXER
 CR: CONE ROOF TANK SP : SPHERICAL TANK

Table 18 Utility Balance

	Electricity (KW)	Fuel (10 ⁶ Kcal/Hr.)	HP	MP	LP	Condensate	BFW	Industrial Water (Ton/Hr.)	Sea Water (Ton/Hr.)	Drinking Water (Ton/Hr.)
On-Site Total										
Off-Site Total										
Utility Facilities										
Steam Generation System										
Power Generation System										
Steam Turbin										
Gas Turbin										
Desalinator										
Sea Water Intake										
Others										
Utility Facilities Total										
Supply for Outside User										
Total										

Table 19 Utility Facilities Summary

	Specification
1. Steam System	
Steam Generator	
Boiler	
Others	
Deaerator	
2. Electric Power System	
Steam Turbine Generator	
Gas Turbine Generator	
Diesel Engine Generator*	
Power Engine Generator	
Distribution Facility	
3. Water System	
Sea Water Intake	
Desalinator	
Cooling Water Distribution	
Mech. C.W. (Fresh Water) System	
Fresh Water Receiving Facility	
Demineralizer	
4. Others	
Air System	
Fuel Gas System	
Inert Gas System	

Table 20 SOx and NOx Emission

Stack	Boiler Furnace Flare etc.	Flue Gas Rate m ³ /H	Temp. C	O ₂ Content %	SOx Content ppm	NOx Content ppm	Stack Height m
-------	---------------------------------	---------------------------------------	------------	--------------------------------	-----------------------	-----------------------	----------------------

Table 21 Properties of Waste Water

	Inlet of Waste Water Treating Unit	Outlet of Waste Water Treating Unit
PH		
BOD	mg/l	
COD	mg/l	
SS	mg/l	
H-hexane extract	mg/l	
Phenol	mg/l	
H ₂ S		
NH ₃		
Amine		
NaSH (Sodium hydrosulfide)		
HaSR (Sodium mercaptides)		
Inorganic chemicals		

Remark: N-hexane extract Max.

Mean.

Min.

Table 22 Annual Maintenance Cost

Unit	Cost Omani rial/year
Crude Atmospheric Distillation Unit	
LPG/Naphtha Hydrodesulfurization Unit	
Naphtha Catalytic Reforming Unit	
Kerosene Sweetening Unit	
LPG Recovery Unit	
Sulphur Recovery Unit	
Onsite Total	
<hr/>	
Offsite Total	
<hr/>	
1. Steam System	
Steam Generator	
Boiler	
Others	
Deaerator	
2. Electric Power System	
Steam Turbine Generator	
Gas Turbine Generator	
Diesel Engine Generator*	
Power Engine Generator	
Distribution Facility	
3. Water System	
Sea Water Intake	
Desalinators	
Cooling Water Distribution	
Mech. C.W.(Fresh Water) System	
Fresh Water Receiving Facility	
Demineralizer	
4. Others	
Air System	
Fuel Gas System	
Inert Gas System	
Utilities Total	

FIG. 3 ORGANIZATION CHART

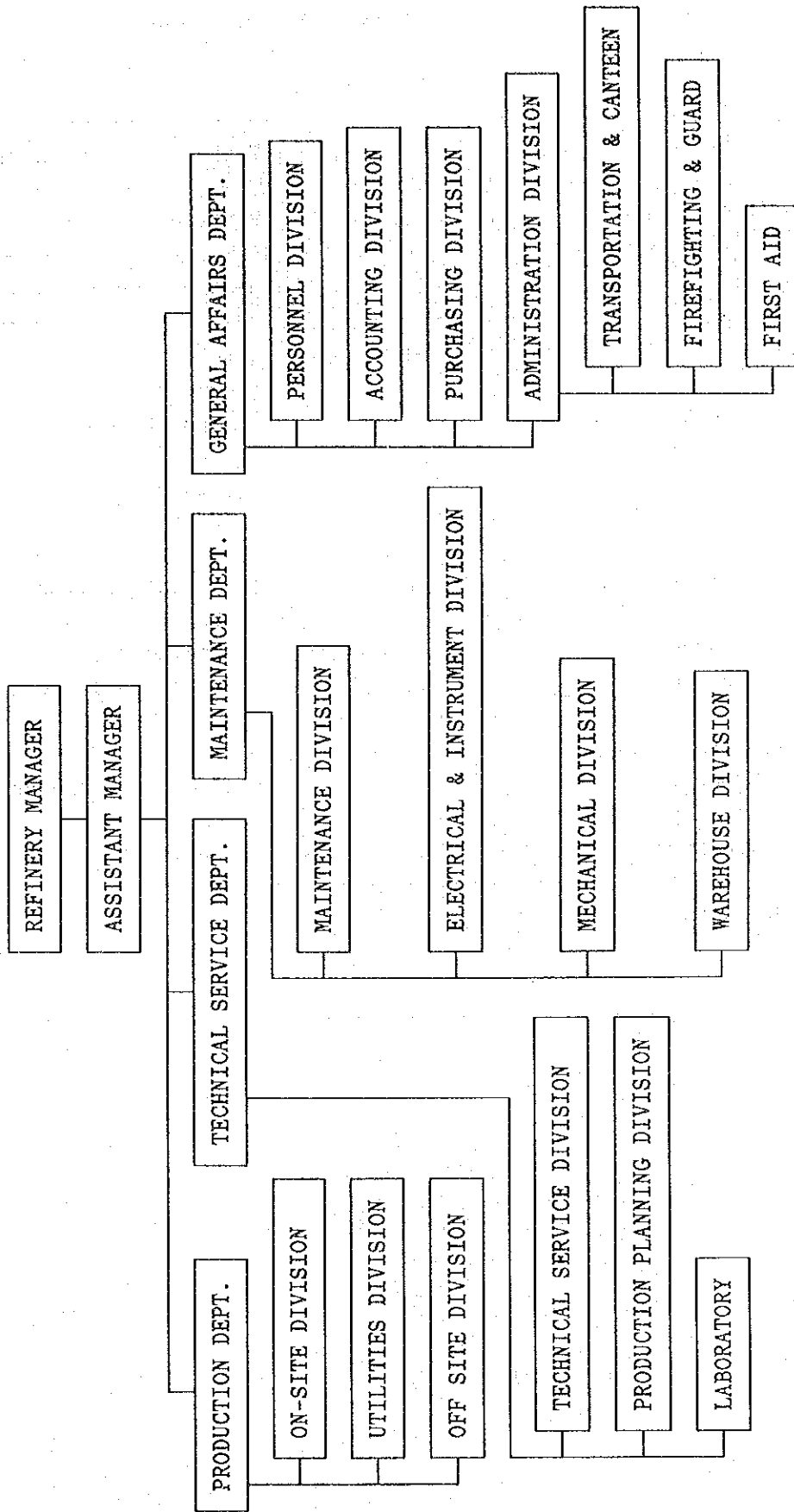


Table 23A Manning Plan

Production Department			Technical Service Department		
Position	Day	Shift	Position		
Manager and Assistant			Manager and Assistant		
Clerk			Clerk		
On-Site Division			Laboratory		
		Supervisor			Chief
		Foreman			Tester
		Operator			Clerk
Utilities Division			Technical Service Division		
		Supervisor			Chief
		Foreman			Engineer
		Operator			Draftman & Technician
					Clerk
Off-Site Division			Production Planning Division		
		Supervisor			Chief
		Foreman			Engineer
		Operator			
Sub Total			Total		
Total					

Table 23B Manning Plan

Maintenance Department		General Affairs Department	
Position		Position	Day Shift
Manager		Manager	
Clerk		Assistant	
Maintenance Division		Clerk	
Chief		Purchasing Division	
Foreman		Chief & Assistant	
Technician		Staff	
Clerk		Clerk	
Electrical & Instrument Division		Accounting Division	
Chief		Chief & Assistant	
Foreman		Accountant	
Technician		Cashier	
Clerk		Clerk	
Mechanical Division		Administration Division	
Chief		Chief	
Foreman		- First Aid	
Technician		Nurse	
Clerk		Clerk	
Warehouse Division		- Fire-Fighting & Guard	
Chief		Chief	
Staff		Firmen	
Clerk		Guard	
Sub Total		- Transportation & Canteen	
Total		Chief	
		Tel. Operation	
		Driver	
		Canteen	
		Clerk	
		Sweeper	
		Sub Total	
		Total	

Table 24 Natural Gas and Petroleum Products Consumption
(NG) (Pet.)

Unit: NG 10⁶SCF
Pet. 10³barrels

Sector	1989		1992		1997		2002	
	NG	Pet.	NG	Pet.	NG	Pet.	NG	Pet.
Agriculture & Fisheries								
Petroleum & Mining								
Manufacturing								
Construction								
Transport & Communication								
Electricity & Water								
Commerce & Trade								
Banking								
Ownership of Housing								
Public Administration & Defence								
Service & Other Sectors								

JICA Development Study
on Industrial Development
- Reply to Questionnaire

Feb. 17, 1993

Directorate General of Industry
Ministry of Commerce & Industry
Sultanate of Oman

I. Basic policy and strategy for the development of manufacturing industries and problems that are considered to be hampering their smooth development.

Our basic policy and strategy for promoting manufacturing industries in the Sultanate are follows :

1. His Majesty's Word

We are carrying on our duties under the wise leadership of His Majesty and his supreme objectives are clearly expressed in the following.

The first Five-Year Economic Development Plan (1976 - 1980)

His Majesty the Sultan Summarized the tasks in his first public statement following his accession to power, in the following words: "I promise you that the first task I am determined to undertake is to start as soon as possible to establish a modern government. I shall do my best to work to secure a happy life and better future prospects for all. It is the the duty of every one of you to assist in the realization of this objective".

The Fourth Five -Year Economic Development Plan (1991 - 1995)

" . . . We intend to introduce our Fourth Development Plan next year. We have commanded that priority must be given to the completion and furtherance of our development programmes in their respective areas; especially those in urgent need of new projects and services.

At the same time, we stress the importance of more intensive effort, in this coming era, to develop the economy of our country, through carefully prepared programmes to achieve greater economic growth..."

2. The Basics of the Fourth Five -Year Development Plan (1991-1995)

The basics of our development plan is being decided in line with H.M's supreme objectives as follows:

Introduction :

Following its establishment by the Royal Decree No. 41/74 issued on 1st December, 1974, the Development Council attached special importance to the specification of the "economic development policies and targets". On 9th February, 1975 the Council sanctioned the bases for future development, which in fact, represented an integral development strategy. The strategy was the foundation of preparation of the First Five-Year Development Plan in Oman (1976 - 1980) and the subsequent five-year development plans.

The strategy included ten primary items :

- i. To develop new sources of national income in order to back up the oil revenue and replace it in the future.
- ii. To enhance investment income-generating projects, particularly investment in industries, mining, agriculture and fisheries.
- iii. To ensure geographical distribution of investment for the benefit of all parts and people of the country to eliminate disparity in the standards of living between regions. Priority is to be given to the less developed areas.
- iv. To enhance and develop the present population centers, safeguard them from mass migrations to the densely populated centers and conserve the environment.
- v. To give due attention to the development of national water resources, as water is a vital element for sustained economic development and growth.
- vi. To develop national human resources, so that they can play a full roll in Oman's economy.
- vii. To complete the nation's infrastructure.
- viii. To promote the local commercial activity, eliminate the transport and storage difficulties and various deficiencies that affect market operation and free competition.
- ix. To complement the components of a free economy based on free competitive private sector, through incentives and tax exemptions, provision of soft loans for productive projects and co-financing of vial projects as commensurate with government's available resources.
- x. To enhance the efficiency of the government's administrative machinery.

The following was added only in the third five - year economic development plan (1986-1990).

- xii. To intensify regional economic cooperation among G.C.C. member states. The establishment of the Council is considered a fundamental step towards the integration and coordination in strategies, policies and programmes of the member states, to guarantee the realization of progress, growth and prosperity for all the G.C.C. member states.

3. The role of the Ministry of Commerce and Industry

To generate new sources of income in order to back up the oil revenue and replace it in the future. The long - term strategy for industrial development as laid down by the ministry of Commerce & Industry (MCI) is :-

- i. Rapid development of viable industries preferably utilizing indigenous raw materials.
- ii. To provide required infrastructure, to develop proven reserves for minerals, undertake feasibility studies, make available incentives and soft loans, and train Omani manpower for industrial development; and to encourage through private initiative the private sector to participate in the foregoing.
- iii. Develop large-scale basic heavy industries based on indigenous raw materials and resources by the public sector, in absence of private sector initiative and privates when conditions permit.

4. Industrial Strategy

The industrial strategy gives priority to the following industries;

- A. Local raw materials
- B. Import Substitution
- C. Export - Oriented
- D. Related to oil or petrochemical industries
- E. Related to health and Ministry of Defence
- F. Related to foods industries
- G. Industries of new technology
- H. Traditional industries related to Omani customs

Based on the established criteria, the Ministry is now conducting a survey to locate which industries should be particularly encouraged in Oman.

II. Policy priorities for the development of manufacturing industries in the forthcoming Fifth Five - Year Development Plan

- (1) The major policy priorities
- (2) Necessity of a comprehensive master plan study such as that done by JICA in 1978 for the formulation of the Fifth Five - Year Development Plan
- (3) Priority projects of the Ministry of Commerce and Industry
- (4) Allocation of funds for the industrial development program

1. Necessity of a comprehensive master plan

Items (1), (3) and (4) are to be studied and established from now.

Item (1) is to be dealt with by Development Council and, as for Items (3) and (4), we are now requesting JICA to draft the plan.

Regarding Item (2), Necessity of comprehensive master plan such as that done by JICA in 1978 for the formulation of the Fifth Five - Year Development plan, the necessity is as follows:

- (1) The Ministry does not have any.
- (2) The Ministry has to draft the plan to be integrated into the Fifth Five - Year Development plan (1996 - 2,000).

For your information, "Industrial Master plan (1991 -2005) " drawn up by UNIDO in Nov. 1990 covers the targets and concrete plans (Projects, programmes and schemes) only for the fourth five year (1991 - 1995) and, as for the years onwards (1996 -2005), it refers to the targets only and there are no concrete plans in it.

So, industrial plan to be drawn - up (1996 - 2000) should be a concrete one.

2. Grounds for our request to JICA

- (1) We have highly evaluated "Prefeasibility Study for Industrial Development - Sultanate of Oman" done by JICA in 1978 because of its strategic approach and clear-cut recommendations.

(2) We would benefit from the experience of the advanced industrial countries in the world.

(3) JICA is well aware of the industrial situation of Oman through the conduct of prefeasibility study of 1978 and through dispatch of JICA experts to Oman. We have now two (2) long-term experts in IDU and another two (2) in ISU.

3. Principal policy recommendations done by UNIDO

For your information, the principal policy recommendations done by UNIDO in Nov. 1990 for the years from 1991 -2005 were as follows :

1. Export Promotion
2. Industrial Promotion
3. Industrial Development Fund
4. Joint - Ventures and Direct Foreign Investment
5. Omanization
6. Industrial Surveys

III. Following up of the prefeasibility Study of 1978 by JICA

The present status and plans for the industrial sectors that were recommended by the JICA's study but has remained unpromoted are as follows :

1. Ceramic industry

We have received license application from one private sector investor and this application is being processed. Another two (2) applicants also will be receiving project reservation soon.

Assesement of ceramic production in Oman was conducted by a UNIDO expert between August 3 and September 3, 1992 and it was concluded that traditional ceramics could be developed into a more viable industry through technical support, design input, quality controls, marketing support and financial assistance for training.

New deposits of kaolin which is indispensible materials for modernized ceramics have been located in the southern part of Oman and some samples collected are being analysed. Ministry of Petroleum and Mineral Resources is conducting a further study on the availability and quality of kaolin in Oman.

2. Small -scale ship building industry

No progress has been made.

3. Sea water by product utilization

No progress has been made.

4. Ceramic tiles

As expressed in the above " Ceramic Industry"

5. Limestone - and dolomite - based industries

Regarding limestone - based industries, we have now two cement factories in Oman i.e Oman Cement Company and Raysut Cement Company as follows.

. Oman Cement Company

Start of production	:	Jan. 1, 1984
Capital	:	RO 56,000,000
Production (Designed)	:	624,000 Tons
Employee (End of 1991)	:	295

. Raysut Cement Company

Start of production : Jan. 7, 1984
Capital : RO 18,900,000
Production (Designed) : 220,000 Tons
Employee (End of 1991) : 177

Expansion of both factories are now under study to cope with the sharp increase in demand.

Regarding dolomite -based industries, dolomite deposit quality study is being carried out.

6. ALC products

No progress has been made.

IV. Development of Mineral Resource-based Industries

- (1) Magnesia refractories from dolomite
- (2) Recovery of potash and other chemicals from brines
- (3) Production of natural gypsum
- (4) Other resource - based industries

Regarding item (1). As mentioned in III. 5, dolomite deposit quality study is being carried out.

As for item (2), drilling and other studies are being carried out.

As for item (3), one extracting unit exists in Dhofar region. Another license application for 100 % export has been approved.

V. Improvement of Social and Administrative Functions

Necessity of establishing an Industrial Statistics and Information system and a system of Industrial Standards

1. Necessity of establishing an Industrial Statistics and Information System.

It is the primary strategy to develop new resources of national income in order to back up the oil revenue and replace it in the future and development of viable industries is the main task of the DGI.

In the execution of our industrial policies, two matters become critical.

- (1) Determination of industrialization, say what kinds of industries shall be promoted and developed and how this should be carried out.
- (2) Understanding the effects of the policy.

To monitor the actual industrial situation, establishment of an industrial statistics and information system is indispensable.

The situation in Oman is that only limited statistics on the activities of industries are available while progress appears to have been substantial.

It was decided to establish the Industrial Statistical Unit (ISU) within the DGI in 1987 to be responsible for the ordered arrangement of the necessary statistics and information.

In 1989, we requested JICA to conduct a development study on the establishment of ISIC (Industrial Statistics and Information Centre) whose main tasks will be the collection of information, development of data processing system and conduct of industrial statistics surveys and the final report was completed last year, in March, 1992.

Under guidance of two JICA long-term experts now with ISU and a number of short-term experts dispatched to the unit according to the needs of the work, ISU is now preparing for the establishment of ISIC. ISU staff have been also sent to Japan for JICA training.

2. Necessity of establishing a system of industrial standards.

This is a question to be answered by the Directorate General of Specifications and Measurements. We understand the Directorate did it yesterday to your satisfaction.

VI. Promotion of Small-scale Industries

1. Development of industrial zones

(1) Rusayl Industrial Estate

Rusayl Industrial Estate Authority (RIEA) was established in 1983 under Royal Decree No. 51/83 and officially inaugurated as part of the 15th National Day celebrations in 1985. The Estate situated in wadi Rusayl about 45 kilometers from Muscat, covers 100 hectares.

Licensed concerns choose either to lease plots of land and construct their own plants, or to lease ready-made factories. Infrastructural facilities provided by the RIEA include all basic services such as water, electricity and gas supplies, a telecommunications system, sewage treatment plant and a modern road network. Other facilities include a cafeteria, bank, post office, clinic, car park and a mosque. A standby generator capable of supplying the needs of the estate is available in the event of a power failure.

Today, a number of factories are operating.

Companies Started

1984	3
1985	9
1986	5
1987	8
1988	10
1989	6
1990	1
1991	9
1992	2
<hr/> Total	53

In order to meet the increasing demand for the factories, it was decided that the total area of the estate be increased by another 60 hectares. The construction will start by 1994 and the number of industries at Rusayl is expected to exceed 100 by the end of the Forth Five - Year plan (=1995).

(2) Sohar and Raysut Industrial Estates

The setting up of industries in various regions is one of the top priorities among the development strategies. In line with the strategy, Sohar and Raysut Industrial Estates were inaugurated as part of the 22nd National celebrations last year, in Nov. 1992.

i. Sohar Industrial Estate

The Sohar estate, 218 km from Muscat, and just north of Sohar town itself, eventually occupy 275 hectares. The first phase IA is under construction now and will see the development of 26.6 hectares for approximately 50 projects by April, this year, 1993.

ii. Raysut Industrial Estate

The Raysut Estate is 2 km from the coast, 6 km from the Raysut sea port and 15 km from the Salalah airport. The total area of the estate is nearly 100 hectares but around 31 hectares have been developed in the first phase.

2. Present status of small - scale industries within the existing industrial zones.

If small-scale industries (SIE) are defined as enterprises employing less than 10 people and less than RO 25,000 of capital, SIE are not common. There are a few SIE in the existing industrial zone (RIEA)

The SIE status by regional dispersion and by activities in 1990 are as the table - 1 & 2.

For your information, operating industries in the Rusayl Industrial Estate by activities are as follows:

	(As of Jan. 1993)
Manufacture of Food and Beverage	6
Textile Wearing & Leather	9
Wood & Wooden Products	0
Paper & Paper Products, Printing & Publishing	3
Chemical & Chemical Products	12
Non - Metallic, Mineral Products	4
Basic Metal Industries	2
Fabricated Metal Products	14
Other Manufacturing Industries	3
<hr/>	
Total	53

3. Present status of small - scale industries within the existing industrial zones

As the above.

4. Development plans of new industrial zones

Site selection study for industrial estate in Sur, Nizwa, Buraimi and Musandam has been completed.

5. Industries to be invited to new industrial zones.

(1) Sohar Area, including Industrial Estate

- . Natural Fertilizer Project
- . Bee Honey Project
- . Mayonaise Project
- . Lime Marmalade Project
- . Concrete Roofing Tiles Project
- . Gypsum Tiles Project
- . PVC Windows Project
- . Plastic Suitcases/ Briefcases Project
- . Toothpaste Project
- . Small Toolroom Centre Project

(2) Raysut Area, including Industrial Estate

- . Natural Fertilizer Project
- . Bee Honey Project
- . Mini - Dairy Project
- . Expanded Grain Biscuit Project
- . Ice-Cream Cones Project
- . Meat Processing Project
- . Concrete Roofing Tiles Project
- . Gypsum Tiles Project
- . Spectacle Frames Project
- . Small Toolroom Centre Project

(3) Muscat, Sohar, Raysut and anywhere, including Industrial Estate

- . Alkyd Resins
- . Box Files
- . Calcium Chloride
- . Ceiling Fans
- . Dolls
- . Electronic Weighing Scales
- . Exhaust Fans
- . Ferrous Foundry
- . Incense Sticks
- . Kraft Paper from Carton Waste
- . LPG Stoves
- . Non - Ferrous Foundry
- . Safety Gloves
- . Screws
- . Sodium Silicate
- . Spectacle Frames
- . Stoneware Articles
- . Surgical Cotton & Bandages
- . T.V. Antenna
- . Welding Electrodes

VII. Ministry and other offices in charge, counterpart agency to JICA's study

Responsible Agency : Directorate General of Industry,
Ministry of Commerce & Industry
P.O.Box 550, Muscat,
Sultanate of Oman

Table 1 Regional dispersion of SIE

(Number and regional distribution of industrial establishments, by volume of investment (in 1000 O.R.), 1990)				
	<25	25-100	>100	Total
Total	2,803	198	213	3,012
Of which established in :				
• Capital Area	297	107	155	559
• Battinah (incl. Rustaq, Nakhal)	464	25	14	503
• Musandam	4	-	-	4
• Buraimi	45	4	7	56
• Dhakhirah	79	3	2	84
• Dakhiliyah	202	8	9	219
• Alwasta	160	9	1	170
• Sharqiya & Jamlat (incl. Masirah Isl.)	288	13	5	308
• Southern Region	239	27	20	286
• Location not identified	825	-	-	825
Total number of establishments	2,803	198	213	3,012

Source : Industrial Statistics Unit, MCI.

Table 2

Divisions of Industrial Enterprises in Omsk, by volume of investment (in '000 O.R.)

<u>Field of activity</u>	<u>Number of establishments</u>			<u>Total</u>
	<u><25</u>	<u>25-100</u>	<u>>100</u>	
1. Food & beverages	61	33	36	130
2. Textiles, wearing apparel & footwear	2	1	12	15
3. Wood & wood products, including furniture	666	23	12	701
4. Paper & paper products, printing and publishing	1	13	17	31
5. Chemicals & products incl. petroleum and plastic products	3	5	30	38
6. Non-metallic mineral products (excl. petroleum)	1436	72	71	1581
of which :				
- concrete blocks	1436	71	63	1570
7. Non-ferrous metals	-	-	2	2
8. Fabricated metal products, machinery and equipment	428	48	31	505
of which :				
- furniture & fixtures	21	-	2	23
- structural metal prod.	210	24	14	248
- fabricated metal prod.	194	19	6	219
9. Other manufacturing	4	3	2	9
Total number of manufacturing establishments	2803	196	213	3012

Source : Industrial Statistics Unit, MCI.

Table 3

GPD by Major Sector

(RO Million)

	1976		1980		1985		1990	
		%		%		%		%
1. Petroleum Sector	517.5	58.52	1,279.5	62.01	1675.1	48.50	1,990.3	49.14
2. Non-Petroleum Sector	373.2	42.20	800.0	38.77	1801.2	52.15	2,149.3	
Agriculture & Fishing	18.3	2.07	52.6	2.54	93.7	2.71	133.8	3.30
Mining & Quarring	—	—	1.0	0.04	8.8	0.26	11.9	0.29
Manufacturing Industries	4.3	0.49	15.6	0.78	82.3	2.38	152.4	3.76
Electricity & Water	6.4	0.72	16.0	0.78	36.8	1.07	59.7	1.47
Construction	88.5	10.01	117.8	5.71	242.2	7.01	123.3	3.05
Wholesale & Retail Trade Hotels & Restaurant	76.5	8.65	188.3	9.13	428.0	12.39	468.5	11.57
Transport, Storage & Communication	13.5	1.53	38.3	1.86	99.6	2.88	129.3	3.19
Banking, Insurance & Business Services	25.9	2.93	55.9	2.71	136.5	3.95	166.2	4.10
Ownership of Dwellings	66.1	7.47	106.9	5.18	159.4	4.62	188.5	4.66
Community & Personal Services	4.4	0.50	13.0	0.63	36.0	1.04	57.1	1.41
Producers of Government Services	69.3	7.83	194.6	9.43	477.9	13.84	658.6	16.26
Others	- 6.4	- 0.72	- 16.0	- 0.78	- 22.5	- 0.65	- 88.9	- 2.20
Total	884.3	100.00	2063.5	100.00	3453.8	100.00	4050.7	100.00

Table 4

APPENDIX I

GDP by Major Sectors at Current Prices During the Fourth Five-Year Development Plan (1991-1995) and Targeted Average Annual Growth Rates Compared to the Rates Achieved in the Third Five-Year Development Plan

(RO Million)

Third Five-Year Plan's Average Annual Growth Rates* %	Major Sectors	Fourth Five-Year Plan					Fourth Five-Year Plan's Average Annual Growth Rates %
		1991	1992	1993	1994	1995	
	1. Oil Sectors						
(1.2)	Crude Oil	1,633	1,717	1,794	1,870	1,950	4.9
5.0	Natural Gas	51	55	60	65	71	9.1
(1.1)	Total Oil Sectors	1,684	1,772	1,854	1,935	2,021	4.9
	2. Non-Oil Sectors						
	a. Commodity Production Sectors :						
9.2	- Mining	15	16	18	20	22	9.5
5.3	- Agriculture	94	100	107	114	121	6.6
5.8	- Fisheries	41	45	49	54	59	9.8
12.9	- Manufacturing	170	192	216	244	275	12.7
7.0	- Electricity & Water	55	59	63	68	73	7.0
(13.3)	- Construction	168	182	203	225	249	14.0
0.3	a) Subtotal	543	594	656	725	799	11.1
	b. Services Producing Sectors						
5.5	- Government Services	646	669	693	717	742	3.5
1.7	- Other Services	994	1,067	1,143	1,224	1,312	7.6
3.1	b) Subtotal	1,640	1,736	1,836	1,941	2,054	6.0
2.4	3. Total Non-Oil Sectors (a + b)	2,183	2,330	2,492	2,666	2,853	7.3
..	4. (-) Imputed Banking Service Charges (+) Custom Duties	(75)	(80)	(86)	(92)	(97)	..
0.4	5. Total GDP at Current Prices (1 + 3 - 4)	3,792	4,022	4,260	4,509	4,777	6.3

* Preliminary Estimates

O.R price \$20/bbl
production... 682,000 B/D

SGRF & Contingency Fund

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