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STAFF APPRAISAL REPORT

THAILAND

BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

April 17, 1985

Industry Department

CURRENCY EQUIVALENTS
(As of April 1985)

1	Baht	=	US$0.037
27	Baht	=	US$1.00

WEIGHTS AND MEASURES

1 Barrel (bbl) of Crude Oil (0.85 Specific Gravity/34° API)	=	0.136 Metric Ton (t)
1 Barrel (bbl)	=	0.159 Cubic Meter (m^3)
1 British Thermal Unit (Btu)	=	0.252 Kilocalories(kcal)
1 Cubic Foot (cu ft)	=	0.028 Cubic Meter(m^3)
1 Gallon (US)	=	3.785 Liters (1)
1 Metric Ton of Crude Oil	=	44.4 x 10^6 Btu (typical)
1 Mile	=	1.609 Kilometers (km)
1 Standard Cubic Foot (SCF) of Natural Gas	=	1,000 Btu (typical)
1 Ton of Oil Equivalent (toe)	=	10.415 x 10^6 Kcal

PRINCIPAL ABBREVIATIONS AND ACRONYMS USED

bbls	-	barrels
BCP	-	Bangchak Petroleum Company Ltd.
BOR	-	Bangchak Oil Refinery
bpcd	-	Barrels per calendar day
bpsd	-	Barrels per stream day
CEF	-	Consultant Engineering Firm
DED	-	Defense Energy Department, Ministry of Defense
DMR	-	Department of Mineral Resources
EGAT	-	Electricity Generating Authority of Thailand
NEA	-	National Energy Administration
NESDB	-	National Economic and Social Development Board
NPPC	-	National Petroleum Policy Committee
PEA	-	Provincial Electricity Authority
PTT	-	Petroleum Authority of Thailand
RTG	-	Royal Thai Government
SAL	-	Structural Adjustment Loan
SCFD	-	Standard Cubic Feet per Day
toe	-	Ton of oil equivalent
TORC	-	Thai Oil Refinery Company
tpy	-	Tons per year

FISCAL YEAR

RTG: October 1 - September 30
BCP: January 1 - December 31

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BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

Loan and Project Summary

Borrower:	Bangchak Petroleum Company Ltd. (BCP)
Guarantor:	Kingdom of Thailand
Loan Amount:	US$85.0 million equivalent
Terms:	15 years including 5 years of grace at Bank's standard variable interest rate.
Guarantee Fee:	10% of Bank's standard variable interest rate.
Project Description:	The proposed project supports the Government's program to make the Bangchak oil refinery financially viable through corporate and financial restructuring and physical rehabilitation. In order to ensure sound management of the refinery, the Government has established BCP, a fully autonomous and commercial company, to operate and manage the refinery. The Government appointed a strong board of directors and a managing director who is BCP's chief operating officer. In addition, a management and operations team from Caltex Petroleum Corporation (US) was appointed for in-line positions directly under the managing director. The proposed project covers the physical rehabilitation of the refinery, operations and infrastructure improvement, energy conservation and engineering and management assistance. A study will be undertaken to determine further modifications required to ensure that the product mix of all refineries in Thailand will be in balance with the projected demand profile for petroleum products in the country.
Risks:	The project does not face any significant risks that would impede its efficient implementation. The technologies that will be used are commercially proven. Comprehensive repair and maintenance and staff training programs are provided for in the project. Environmental safeguards have been incorporated in the project through (i) infrastructure improvements to minimize the oil sludge being dumped into ponds; and (ii) installation of a new sulphur plant to lower discharge of sulphur oxide. Marketing and distribution systems in Thailand are well-coordinated. BCP's corporate and financial structure is sound and adequate measures are provided in the project to maintain the company's satisfactory performance.

Estimated Costs:

	Foreign	Local [a/]	Total
	-- US$ million equivalent --		
Refinery rehabilitation	48.1	7.6	55.7
Energy conservation	6.7	0.6	7.3
Infrastructure improvement	5.9	2.6	8.5
Training	1.3	0.2	1.5
Project engineering and management	12.5	-	12.5
Operations and management assistance	4.2	0.9	5.1
Techno-economic study	1.6	0.2	1.8
Base Cost	80.3	12.1	92.4
Contingencies:			
Physical	8.0	1.2	9.2
Price	17.5	2.1	19.6
Totalled Installed Cost	105.8	15.4	121.2
Interest during construction			
- Bank-financed	10.0	-	10.0
- Other	11.4	1.2	12.6
Total Financing Required	127.2	16.6	143.8

Financing Plan:

	US$ million	%
Long-Term Debt:		
IBRD	85.0	59.1
Suppliers' credit	30.8	21.4
Commercial banks	13.0	9.1
Total	128.8	89.6
Equity Contributions:		
Ministry of Finance	7.5	5.2
Krung Thai Bank	7.5	5.2
Total	15.0	10.4
Total Financing	143.8	100.0

a/ Including taxes and duties of US$8.0 million.

Estimated Disbursements (US$ million):

Bank FY	1986	1987	1988	1989	1990
Annual	15.0	23.9	21.8	15.9	8.4
Cumulative	15.0	38.9	60.7	76.6	85.0

Economic Rate of Return: 28%

IBRD Map No. 17351R

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BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

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This Report was prepared by Mrs. Priscilla Urbano and Messrs. Ladkasa Wijetilleke and Julio Gamba of the Industry Department. Mesdames M. Greaves, A. Johnson, E. George, and C. Lawrence provided word processing and secretarial assistance in the preparation of the report.

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DOCUMENTS AVAILABLE IN THE PROJECT FILE

Reference	Title, Authors and Date
A.	Detailed Historical Financial Statements of BOR.
B.	Report on the Infrastructure Requirements of BOR, Mr. Tudor Gunawardhana, December 1982.
C.	Refinery Inspection Report, Chiyoda Engineering and Construction Co., December 1982.
D.	Petroleum Authority of Thailand Act, 1978
E.	Analysis of BOR Institutional Framework and Capitalization, Bank Staff, December 1982, May 1983 and December 1983.
F.	Itemized Summary of Rehabilitation Program, September 1983

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BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

I. INTRODUCTION

1.01 The Royal Thai Government (RTG) has requested Bank assistance for the financing and implementation of the Bangchak Oil Refinery Restructuring Project (the Project). The Project will (i) assist the Government in carrying out a program of physical, organizational, management and financial restructuring of the state-owned Bangchak Oil Refinery (BOR); (ii) reduce the cost of meeting the petroleum requirements of Thailand in the short- to medium-term; and (iii) determine the modifications required in Thailand's refineries to balance national demand and supply of petroleum products in the long-run. BOR is expected to play a pivotal role in the development of Thailand's refinery subsector. Under the provisions of the Fifth National Economic and Social Development Plan (1982-1986), RTG attaches highest priority to investments in the energy sector to promote efficient use of available resources and thereby reduce the country's dependence on energy imports. In the petroleum sector, the rationalization of the country's oil refining capacity is an important objective towards which the Project is expected to make a significant contribution. This Project is also regarded by the Government as a model for future reforms of state economic enterprises in Thailand.

1.02 The proposed Project is an integral part of RTG's program of corporate and financial restructuring, and physical rehabilitation of BOR. This program, which is aimed primarily at making the refinery financially viable, was developed and is being implemented closely with the Bank. As a first step, BOR, which had been run in the past as a Government dependency under the Ministry of Defense, has been established as a fully autonomous and commercial company. The company, known as the Bangchak Petroleum Co., Ltd. (BCP), will be responsible for the refinery's management and operations and the implementation of the Project. The refinery's past accumulated losses, which were then financed by the Petroleum Authority of Thailand (PTT), have been paid off through PTT's issuance of 20-year floating rate notes of up to US$145 million guaranteed by the Government. The Government will be fully responsible for the servicing of the notes. In addition, BCP has obtained a credit line of up to US$120 million to support its working capital needs. A total of US$126 million was provided as equity by RTG (US$82.5 million), Krung Thai Bank, a Government-owned commercial bank (US$7.5 million), and PTT (US$36 million). This Project, which covers the physical rehabilitation of BCP, will complete the restructuring program, and will be instrumental in setting the refinery on the path of financial viability. The physical rehabilitation will have a total installed cost of US$121.1 million. Including interest during construction, total financing required will amount to US$143.8 million, of which US$127.2 million (88%) is in foreign exchange. The proposed Bank loan of US$85 million, which will be the first Bank operation in the refinery subsector in Thailand, will provide 59% of the financing requirements, or 67% of the foreign exchange needs. The balance of US$58.8

million will be provided through suppliers' credits (US$30.8 million), commercial banks (US$13 million), and equity contributions from the Government (US$7.5 million) and Krung Thai Bank (US$7.5 million).

1.03 The establishment of BCP as an independent commercial entity is regarded as a first step to attract private equity into the refinery. Various private companies were approached by the Government in connection with equity financing for the new company. However, these companies declined to provide equity at this time in view of the poor physical state of the refinery. After the refinery has been rehabilitated and made financially viable under the proposed Project, it is expected that the private sector will participate in a subsequent project involving the installation of secondary conversion facilities. A feasibility study to determine the most economic conversion configuration is included in the proposed Project.

1.04 The Project was identified by a Bank mission to Thailand in September 1982. It was prepared by the Ministry of Finance, and BOR with the assistance, at various stages, of Lummus Operating Associates (US), Chiyoda Chemical Construction Co. (Japan) and Mitsubishi Oil Co. (Japan). The Project was appraised in November-December 1982 by Messrs. J.R. Gamba (Chief), L. Wijetilleke, and Ms. P. Urbano (IND); Mr. J. Correia Da Silva (LEG); and Messrs. T. Gunawardhana and S. Valaisathian (Consultants). Appraisal follow-up missions visited Thailand in 1983 and 1984 to finalize the institutional and Project implementation arrangements.

II. THE ENERGY SECTOR

A. Introduction

2.01 Over the last two decades, Thailand has been almost totally dependent on imported petroleum for its primary energy requirements. In 1980, imported petroleum accounted for about 76% of the country's total energy requirements; hydroelectricity provided 3%; coal/lignite, 3%; fuel wood and charcoal, 11%; and bagasse, 7%. The import bill for petroleum in 1980, which amounted to US$2.6 billion, represented 31% of total imports and absorbed 45% of the economy's export earnings. The availability of large quantities of natural gas since 1981, however, is expected to have a major structural impact on energy sources in the 1980s. Natural gas use has already lowered the share of primary energy supplied by petroleum from 82% in 1970 to 56% in 1983. By 1985, with increased production of natural gas and the completion of an ongoing liquified petroleum gas project, the share of petroleum in total energy requirements is expected to fall even further. This rapid decline in share will affect principally the demand for fuel oil, which will be replaced with natural gas, and to a lesser extent gasoline, high-speed automotive diesel oil and kerosene. The resulting change in demand profile for petroleum products cannot be economically met by the existing refineries unless appropriate changes in their production pattern are made. The Thai Oil Refinery Company (TORC),

which has the same distillation capacity as BCP, has already embarked on a refinery modification project, which includes a hydrocracker. Esso Refinery, on the other hand, recently completed a project which only expanded its crude distillation capacity with no change the yield pattern. BCP's current plans include only the rehabilitation of existing facilities supported by this Project. Even after the completion of these projects, a deficit in middle distillate products and a surplus in fuel oil are still projected in the future. In order to balance national supply and demand in the future, it is therefore necessary for Thailand to consider adding secondary conversion facilities. Techno-economic studies to establish the optimal conversion scheme are included in this Project.

B. Historical Energy Consumption

2.02 Over the past decade, consumption of primary energy in Thailand increased at an average annual rate of 9.6%--from 5.4 million tons of oil equivalent (toe) in 1970 to 14.4 million toe in 1980--as shown on the following page. Growth of energy consumption was fast during much of the 1970s as a result of rapid growth in and structural transformation of the economy. The latter included the expansion of commercial agriculture with heavier reliance on truck transportation and a rapidly expanding road network, rapid growth of the industrial and service sectors, and higher personal incomes leading to more intensive private use of energy for automobiles, air conditioners, lighting and home appliances. The continued growth in energy consumption was also due to the fact that domestic energy prices were not adjusted in line with the escalation of international oil prices which occurred in the 1970s. Since domestic energy resources remained underdeveloped, most of the growth in energy demand spilled over into rapidly expanding energy imports (mostly petroleum). In 1978, energy imports accounted for 21% of total imports and absorbed 28% of export earnings. After the second oil shock, the share of Thailand's energy imports in total imports increased to 31%, and 45% of the economy's export earnings were required to finance energy imports alone in 1980. In recent years, the Government initiated a series of steps to reduce oil consumption: more rational pricing policies were implemented and energy conservation measures were introduced. These measures, along with the development of indigenous energy sources, especially natural gas and lignite, have succeeded in reducing the share of petroleum fuels in total energy consumption from 83% in 1978 to 76% in 1980 and further to 56% in 1983.

2.03 The structural transformation of the economy in the 1970s resulted in significant changes in the sectoral composition of energy consumption. With the rapid expansion of the country's road network, the transportation sector continued to account for the greater share of total energy consumption. Through special legislation and regulations for energy conservation introduced since 1978, however, the sector's share in total energy consumption declined from 34% in 1977 to 31% in 1983, as shown on the following page. The power sector, on the other hand, increased its

Thailand - Consumption of Primary Energy, 1970-1983
(in million tons of oil equivalent)

	1970	%	1980	%	1983	%	Average Annual Increase, % 1970-80	1980-83
Petroleum	4.4	81	11.0	76	11.1	56	9.6	0.6
Hydroelectricity	0.5	9	0.5	4	1.1	5	-	30.1
Coal and Lignite	0.2	4	0.4	3	0.7	4	7.2	20.5
Bagasse	0.2	4	0.6	4	1.1	5	11.6	22.4
Charcoal, Fuelwood and Paddy Husk	0.1	2	1.9	13	4.6	23	34.2	34.3
Natural Gas	-	-	-	-	1.4	7	-	-
Total	5.4	100	14.4	100	20.0	100	10.3	11.6

Source: National Energy Administration (NEA)

share from 20% in 1977 to 23% in 1983. This increase was brought about by the availability of larger quantities of coal and lignite for power generation. The domestic, commercial and service sectors more than doubled their combined share in consumption from 9% in 1977 to 25% in 1983 in direct response to higher personal incomes which allowed increased private use of energy. The industrial sector's share declined from 28% in 1977 to 14% in 1983 due principally to more efficient energy utilization.

Thailand - Energy Consumption by Sector, 1977 and 1983

Sector	1977 Millions of toe	1977 % of Total	1983 Millions of toe	1983 % of Total
Transportation	3.8	33.6	6.2	31.0
Power	2.2	19.6	4.6	23.0
Domestic, Commercial, and Others	1.0	8.8	5.0	25.0
Industry	3.2	28.3	2.9	14.5
Agriculture	1.0	8.8	1.2	6.0
Construction	0.1	0.9	0.1	0.5
Total	11.3	100.0	20.0	100.0

2.04 Prospects for reducing Thailand's dependence on imported energy in the 1980s are good. The Government's policy is to reduce Thailand's dependence on imported energy by (a) expanded development of indigenous energy resources such as natural gas, lignite and hydro; (b) continuing to pursue rational pricing policies; and (c) conservation programs. Based on

the development of the natural gas and lignite resources proven to date and on the continued expansion of its hydro potential, the Government estimates that Thailand can reduce its share of imported energy for power generation from about 71% in FY81 to less than 20% in FY90. However, except with substantial increase in the natural gas and lignite reserves or development of international hydro potential, Thailand will re-emerge in the 1990s as a major importer of energy for its power sector. In transportation and industry, the other large energy consuming sectors, the prospects for converting to other energy forms are rather limited. Thus, there is a need to curtail energy demand and encourage greater energy conservation. This matter is discussed further in paras 2.12 to 2.14 below.

C. Energy Resources

1. Natural Gas

2.05 Proven and probable economically recoverable natural gas reserves in Thailand are currently indicated to be about 5.5 trillion cubic feet (tcf), of which about 3 tcf are proven and under development. These estimates have been revised downward from those made previously, as field performance now indicates that the recoverable fraction of in-place reserves will be far lower than originally expected, and, in fact, lower than that for most gas fields in other countries. Latest data suggests that the ultimate economically recoverable reserves (including those yet to be discovered) could be in the range of 12-24 tcf. By the end of this decade, natural gas production is expected to reach some 550 million cubic feet per day (MMCFD), equivalent to some 6 million toe per annum. About 40% of the projected total power generation could be thermal stations using natural gas, thereby reducing substantially fuel oil demand.

2. Oil

2.06 Exploration in Thailand has recently led to expectations of domestic production of oil and natural gas liquids beyond what was thought possible when the Fifth Plan was prepared. Proved economically recoverable reserves of petroleum liquids (oil and gas condensate) are presently estimated at about 140 million barrels (bbls). Current production is about 30,000 barrels per day (bpd). Subject to continued efforts and timely development of future discoveries, production in 1990 is expected to range between 30-45,000 bpd. The ultimate liquid resource, including that yet to be discovered, could be in the range of 0.7-1.5 billion bbls based on present information. In addition to these crude oil deposits, there are oil shale deposits in Tak Province near the Burmese border with an estimated yield of about 10 million toe per year. The Department of Mineral Resources (DMR), with the assistance of the Federal Republic of Germany, has initiated studies to determine the technical feasibility and economic viability of developing these oil shale resources. However, at current and projected crude oil prices until the end of this century, oil shale development is unlikely to be economically viable in Thailand.

3. Lignite Reserves

2.07 Recent drillings indicate that Thailand's lignite deposits are substantially larger than previously anticipated. However, lignite is relatively uneconomical to transport because of its high moisture and ash content, while its tendency to decompose and self-ignite in open air makes it unsafe to store. Hence, in Thailand as elsewhere, lignite is used almost exclusively for large-scale pit head power generation. The presently known lignite reserves totalling 859 million tons are located at Mae Moh (814 million tons), Krabi (20 million tons), Li (10 million tons) and various other locations. About 350 million tons of the reserves at Mae Moh are measured and sufficient to sustain a total generating capacity of 1,725 MW for about 25 years. By 1990, about 25% of the total power generation of the Electricity Generating Authority of Thailand (EGAT) is expected to be from lignite-fired thermal stations.

4. Hydro Potential

2.08 The total hydroelectric potential of Thailand's rivers is estimated at about 9,300 MW, not including the potential of 25,000 MW from the international rivers (Mekong and Salween), whose development is at present unlikely due to major political and social obstacles. About 1,380 MW of hydropower capacity are now in operation, 2,100 MW are under construction, and about 2,500 MW in 25 projects are in stages of identification or feasibility study. Mini-hydro potential, estimated at about 3,290 MW, exists at over one hundred sites. According to current plans, hydropower production will increase at an average annual rate of about 7% from 1985 onwards and is expected to supply about 35% of electricity generation in 1990.

5. Other Energy Resources

2.09 Thailand's other energy resources include fuelwood and possibly geothermal energy. Fuelwood resources, once plentiful, are rapidly depleting and deforestation is becoming a serious problem. Geothermal exploration is being carried out by EGAT in the northern part of Thailand near Chiang Mai.

D. Projected Commercial Energy Balance

2.10 Over the last two decades commercial energy consumption (petroleum, hydro and lignite) increased at an average rate of 12.4% p.a. from 1.6 million toe in 1960 to 16.6 million toe in 1980. GDP growth during that period averaged 7.4% p.a., indicating an average energy demand elasticity with respect to GDP of about 1.68. However, this elasticity dropped substantially from a high value of 1.85 in the early 1960s to 1.2 in the late 1970s. Energy consumption trends since 1980 have shown further weakening of the relationship between GDP and energy demand growth, as has been the case elsewhere in developing and industrialized countries alike. Assuming that conservation measures are carried out effectively, including continued timely adjustments of domestic energy prices in line with any

future increases in international prices, and that as a result the energy efficiency of the Thai economy will further improve, this elasticity is projected to drop to about 1.0 during the next 10 years. GDP is projected to grow at 6.1% p.a. during 1985-90 and at 6.0% p.a. between 1990-95, while total energy consumption growth during 1985-95 is estimated to be about 6.1% p.a., as shown on the following page.

2.11 The relatively modest energy consumption growth is expected to be accompanied by a significant structural shift in the composition of energy sources during the 1980s. The most significant change would be the increased availability of domestic natural gas which will displace petroleum sources used by industry and for electricity generation. On the basis of reasonable assumptions regarding likely gas availability and utilization, gas consumption is projected to increase its share in total commercial energy consumption from 10% in 1983 to 21% in 1985 and 24% by 1990. Lignite consumption is also expected to post a rapid growth rate during the 1980s in line with increases in domestic production capacity and power generation requirements. Oil consumption, in contrast, is projected to increase at a slow rate of 3% p.a. during 1985-90 compared to 8% during 1970-83. As a result, the share of oil in total primary commercial energy demand would drop from 76% in 1980 to 64% in 1985, 57% in 1990, and 46% by 1995. This projected decline in share reflects the significant substitution of fuel oil and diesel oil (about 5 million tons and 0.6 million tons per year, respectively, by 1990) by natural gas and lignite for power generation.

E. Scope for Energy Substitution and Conservation

2.12 The Government has exerted efforts to improve energy demand management mainly through pricing policies and regulatory measures. In energy pricing, RTG has generally followed a policy of passing on to the consumer increases in energy costs by way of general price increases and specific taxes on higher consumption. Special legislation and regulations for energy conservation introduced since 1975[1/] include: (i) instructions to Government agencies to reduce oil and electricity consumption by 10%; (ii) regulations to reduce use of electricity during peak-hour periods; (iii) traffic laws aimed at reducing traffic bottlenecks in Bangkok; (iv) regulations to reduce business hours of gasoline service stations; (v) restrictions on purchases by the Government of automobiles with engine capacities higher than 1300 cc; and (vi) concessions, in the form of exemptions from import duties and business taxes on import of energy saving equipment, extended by the Board of Investments to promote energy conservation in industries. In addition, public education campaigns are conducted by the Government and industrial organizations to develop awareness of energy conservation.

1/ "Energy Conservation in Thailand," NEA, 1981.

Thailand - Commercial Energy Balance, 1981-95
(in million tons of oil equivalent)

	Actual		Projected			Average Annual Growth Rate, %	
	1981	1983	1985	1990	1995	1985-90	1990-95
Consumption	11.8	14.3	16.0	20.8	28.9	5.4	6.8
Oil	10.3	11.1	10.3	11.9	13.2	2.9	2.1
Natural Gas and Condensate	0.1	1.4	3.4	5.0	10.2	8.0	15.3
Hydroelectric Power	0.9	1.1	1.3	1.5	2.2	2.9	8.0
Coal and Lignite	0.5	0.7	1.0	2.4	3.3	19.1	6.6
Domestic Production	1.3	3.3	6.5	10.2	17.5	9.4	11.4
Oil	--	0.3	1.0	1.5	2.0	8.4	5.9
Natural Gas and Condensate	0.1	1.4	3.4	5.0	10.2	8.0	15.3
Hydroelectric Power	0.7	0.9	1.2	1.4	2.1	3.1	8.4
Coal and Lignite	0.5	0.7	0.9	2.3	3.2	26.4	6.8
Net Imports	10.5	11.0	9.5	10.6	11.4	2.2	1.5
Oil	10.3	10.8	9.3	10.4	11.2	2.3	1.5
Hydroelectric Power	0.2	0.2	0.1	0.1	0.1	-	-
Coal	-	-	0.1	0.1	0.1	-	-

Source: NEA and staff estimates.

2.13 The energy conservation achieved so far has been mainly through avoidance of waste and adoption of "in-house" improvements by energy users. Such improvements consist of low-cost simple changes in procedures and practices of energy utilization such as pre-heating of boiler water, plugging of leaks, and changing of thermostat settings. Subsequent stages of conservation would require modifications to equipment as well as to industrial processing configurations to improve energy efficiency. These would include repair/modifications/replacements of ancillary equipment, installation of additional equipment to recover waste-heat, changes to plant lay-outs and improvements to enable the use of more economical fuels such as coal or natural gas. Although further energy conservation would require greater efforts and additional investment, substantial energy savings would result in the overall economy. Review of energy utilization practices and the energy efficiencies obtained in various sectors of the economy indicate that the potential exists to realize energy savings of as much as 20-25% in the future[2/].

2/ "Energy Saving Scheme for Thailand," March 1982, UNDP/UNIDO.

2.14 In recognition of the potential for achieving additional energy conservation, the Government is keen on improving its programs and policies in energy conservation and has formulated an Energy Conservation Plan for 1982-86. The Plan envisages: (i) completion of detailed energy audits of 600 factories; (ii) as part of its structural adjustment program with the Bank, establishment of an Energy Conservation Center as a joint venture of Government and private industry to provide technical services for conservation; (iii) monitoring of energy use of large industrial establishments; (iv) provision of incentives for energy conservation in industry; and (v) introduction of an Energy Management Law to better regulate energy-use in the country. While the formulation of the Plan constitutes an important step towards improving the energy conservation performance of the economy, its successful implementation will require experience and capabilities in the field of energy conservation of a level substantially higher than those available in Thailand. Further Bank assistance in this field will be necessary.

F. Energy Pricing Policy

2.15 Until 1978, Thailand's domestic energy price adjustments were restrained in order to encourage economic development. Since then, however, the Government has increased energy prices (by 160-180% between 1978-82) to reflect international price developments. Electricity tariffs have also been raised and broadly reflect the marginal cost of power generation, being set at levels that generate a financial rate of return of about 8% on revalued assets.

2.16 Thailand has established the price levels for its commercial fuel on an individual basis and the pricing system is not fully coordinated across the energy sector. The introduction of natural gas on a large scale, the development of a major lignite mine and changes in petroleum product prices (paras 3.17-3.19 below) are leading to substantial changes in energy consumption and investment patterns. The Government, with the assistance of consultants, has recently completed two closely coordinated energy pricing studies to rationalize the pricing policies across the whole energy sector and to provide for the efficient utilization of the energy resources. The final reports and policy implementation will shortly be reviewed between the Bank and the Government.

G. Institutional Framework

2.17 Overall responsibility for planning and investment decisions in the energy sector is vested in the National Economic and Social Development Board (NESDB) in the Prime Minister's Office. However, specific energy planning and energy policy formulation functions are scattered among several Government ministries and agencies. In addition, several committees and sub-committees deal with energy and petroleum related policies. Given this complex organization, it has not been easy to coordinate energy sector activities and policies in a systematic manner. The Government is aware of this problem and has, as a first step, selected

the National Energy Administration (NEA) in the Ministry of Science, Technology and Energy to undertake, in consultation with other concerned agencies, the responsibility for (a) monitoring energy sector studies and programs, (b) evaluating those which are completed, (c) proposing appropriate measures for implementation, and (d) identifying areas for further investigation. The NEA will complete the initial stock-taking of these studies and prepare a medium-term energy strategy to achieve the plan objectives and targets. Subsequently, this agency for policy coordination will be retained on a continuous basis so that shifts in the energy sector are taken into account in further strategy formulation and implementation.

2.18 The Department of Mineral Resources (DMR) in the Ministry of Industry handles the technical and legal aspects of all mineral activities, including oil and gas exploration and exploitation licensing arrangements, and is also responsible for non-power lignite mining. The Ministry of Industry is responsible for setting ex-refinery prices and taxation policy, and for the ministerial control of the Petroleum Authority of Thailand (PTT). The Ministry of Commerce sets margins between ex-refinery and retail prices and the minimum oil stocks to be maintained. The Ministry of Defense, through its Defense Energy Department (DED), manages small oil fields and operates a pilot refinery at Fang. Prior to the establishment of BCP (Chapter IV), the Bangchak refinery was operated by the Defense Energy Department. The Ministry of Science, Technology and Energy is responsible for NEA and for non-conventional energy. The Prime Minister's Office and the Cabinet take a direct interest in determining retail prices of petroleum products. The Prime Minister's office is also responsible for EGAT, the largest state-owned enterprise. In addition to power generation, EGAT is responsible for exploration and development of lignite for use in power plants. Retail distribution of electricity under the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA) are controlled by the Ministry of Interior. Other institutions involved include the Budget Bureau which controls budgetary aspects of locally funded costs. An organization chart for the energy sector is shown in Annex 2-1.

H. Bank Participation in the Sector

2.19 The Bank has taken an active role in support of the Government's development objectives and policy reform in the energy sector through loans for exploration and development of indigenous energy resources and structural adjustment. The first loan to the oil and gas subsector was made in July 1978 for the preparation and engineering of a gas pipeline project. This was followed by a $107 million loan in December 1979 for the pipeline construction. A subsequent loan of $90 million was approved in June 1982 to help finance the construction of a gas separation plant and associated facilities for the marketing and distribution of LPG. The project also included a large technical assistance component covering training for PTT's staff, strengthening PTT's institutional capabilities, and various studies for PTT's investment programs and energy policy formulation. In addition, a US$33 million loan to PTT for the development,

jointly with Thai Shell, of oil and gas reserves in northern Thailand is in an advanced stage of preparation.

2.20 In the power and lignite subsector, the Bank has made eleven loans to EGAT and its predecessor totalling $542 million to help finance power plants and transmission facilities and three loans totalling $130 million to PEA to finance accelerated rural electrification projects. The first seven EGAT projects have been completed satisfactorily. Good progress is being made with the other EGAT and PEA loans. A further loan was made to EGAT in 1980 for lignite production. The Bank approved in April 1984 a loan of US$59 million for a second lignite project. In relation to policy reform in the energy sector, the Bank has supported various technical assistance programs including an extensive energy pricing study and energy conservation measures through two structural adjustment loans. In addition, the Bank is working closely with NESDB and NEA on energy pricing and strategy formulation which would form the basis for the energy component of the Sixth Five-Year Plan.

III. PETROLEUM PRODUCTS SUBSECTOR AND ISSUES

A. Consumption and Supply of Petroleum Products

3.01 As noted earlier, petroleum products consumption grew at a rapid pace in the 1970s as a result of increased industrial activity, fast growth in the service sectors and higher private use of automobiles, air conditioners, lighting and home appliances. Consumption increased at an average annual rate of 11% over the period 1970-75 and 8% over 1975-80, as shown in the following page. Consumption of gasoline increased at a high rate of 13% p.a. during 1970-75 as a result of the rapid expansion of the country's road network and insufficient price adjustments (para 2.02). With the price corrections and conservation measures introduced since 1978, the increase in gasoline consumption has slowed down to 6% p.a. Consumption of diesel oil, on the other hand, increased at an average rate of 6% p.a. during 1970-75 and 9% p.a. during 1975-80. This growth pattern reflects the increase in farm mechanization as well as higher diesel oil use for mass transportation and power generation during the period. Diesel oil also continued to dominate the petroleum fuels consumption profile with about 36% share by 1980. Fuel oil consumption grew at 13% p.a. during 1970-75 and 10% during 1975-80, but with its substitution by natural gas it registered a drop of 6% p.a. during 1980-83.

3.02 The shifts in the consumption profile reflect the changes that have occurred in the sectoral use of petroleum. The sectoral consumption of petroleum products in 1981 is shown on page 13 of this Report. In 1981, the transportation sector accounted for 42% of total petroleum fuels consumption, followed by the industrial sector with 31% (18% from direct use and 13% indirectly through power use). Consumption in the transport sector increased at an average annual rate of 7% during the 1970s. Since

Thailand - Historical Consumption of Petroleum Products, 1970-83
(in million tons)

	1970	%	1975	%	1980	%	1983	%	Average Annual Growth Rate, % 1970-75	1975-80
Gasoline	0.8	18.2	1.5	20.6	2.0	18.5	1.9	17.1	13.4	5.9
Jet Fuel	0.3	6.8	0.7	9.6	0.8	7.4	1.1	10.0	18.5	2.7
LPG	0.1	2.3	0.2	2.7	0.3	2.8	0.8	7.2	14.9	8.4
Kerosene	0.1	2.3	0.2	2.7	0.3	2.8	0.5	4.5	14.9	8.4
Diesel Oil	1.9	43.2	2.5	34.3	3.9	36.1	3.9	35.1	5.6	9.3
Fuel Oil	1.2	27.2	2.2	30.1	3.5	32.4	2.9	26.1	12.9	9.7
Total	4.4	100.0	7.3	100.0	10.8	100.0	11.1	100.0	10.7	8.2

Source: NEA

1979, however, consumption has declined slightly partly in response to the economic slowdown and partly due to gains in fuel efficiency brought about by increased fuel prices, progressive taxation of engine capacity and shift in fleet composition towards fuel-efficient models. Direct petroleum product consumption in the manufacturing sector developed similarly as in the transport sector, increasing at an average annual rate of 4% during the 1970s, then witnessing a slight decline in absolute terms since 1979 as a result of a slowdown in industrial activity and improvements in the sector's energy efficiency. The sector relies most heavily on fuel oil. Future growth in industry will in part draw on domestic gas resources to replace present fuel oil use and to support expansion of industrial development into new areas, especially as feedstock for fertilizer and petrochemicals.

3.03 Substantial reductions in petroleum product consumption have been observed since 1979 in all major sectors of the Thai economy (overall consumption decreased by 4% from 1979 to 1982). The scope for further reductions in consumption across the sectors depends on each sector's capability to (a) substitute natural gas and coal/lignite for oil, especially in industry and power generation, and (b) reduce energy intensity in petroleum fuels used for transportation (gasoline and diesel), agriculture (diesel) and industry (fuel oil).

3.04 Thailand imports almost all of its petroleum requirements. In recent years, the country imported an average of about 10 million tons of crude and oil products per year which, in 1978, cost about US$ 1 billion. By 1980, the oil import bill had almost tripled to US$2.6 billion, primarily as a result of the second oil shock. The volume of petroleum imports (of which 25% was in the form of refined products) grew at an average annual rate of 9% over 1970 to 1980. For the future, however, projections of Thailand's commercial energy balance (para 2.10) indicate that between 1985 and 1990, oil imports would grow at a substantially slower pace of about 2% p.a. In proportion to total commercial energy

Thailand - Consumption of Liquid Petroleum Products by Sector, 1981
(in million tons)

Sector	Gasoline	%	Diesel Oil	%	Fuel Oil	%	Others	%	All Petroleum Fuels	%
Agriculture	-	-	0.9	26	-	-	-	-	0.9	9
Construction	-	-	0.1	3	-	-	-	-	0.1	1
Industry	-	-	0.4	11	1.3	41	0.2	12	1.9	18
Power and Water Supply	-	-	0.2	6	1.8	56	-	-	2.0	19
Transportation	1.8	94	1.8	51	-	-	0.7	41	4.3	42
Commerce, Service & Others	0.1	6	0.1	3	0.1	3	0.8	47	1.1	11
Total	1.9	100	3.5	100	3.2	100	1.7	100	10.3	100

Source: NEA

consumption, petroleum imports will drop from the 1983 level of 75% to 39% by 1995.

3.05 Future consumption of liquid petroleum products is projected as follows:

Thailand - Projected Consumption of Petroleum Products, 1985-95
(in million tons)

	1985	%	1990	%	1995	%	Average Annual Growth Rate, % 1981-85	1985-90	1990-95
LPG	0.5	4.9	1.3	10.9	1.2	9.1	10.7	21.1	-1.6
Gasoline	1.5	14.6	1.9	16.0	2.1	15.9	-4.2	4.8	2.0
Mid-distillates	4.9	47.6	6.4	53.8	7.5	56.8	8.0	5.5	3.2
Fuel Oil	3.2	31.1	2.1	17.6	2.2	16.7	2.3	-8.1	0.9
Others	0.2	1.8	0.2	1.7	0.2	1.5	-31.3	-	-
Total	10.3	100.0	11.9	100.0	13.2	100.0	2.1	2.9	2.1

Source: NEA, PTT, NESDB and staff estimates.

3.06 As noted, future consumption of petroleum products is projected to increase at a slower pace as a result of more extensive substitution of natural gas and lignite mainly for fuel oil in industry and power generation, and higher efficiency in energy use across the sectors. Total consumption is projected to increase at average annual rates of 3% during 1985-90 and 2% during 1990-95. The growth rates registered in the past

were 11% (1970-75) and 8% (1975-80). Gasoline consumption is projected to decline at a rate of about 4% p.a. up to 1985 as the trend for substituting gasoline with LPG in motor cars continues and additional energy efficiency measures in the transport sector are implemented. Mid-distillates consumption, on the other hand, is expected to maintain its rapid growth at a rate of about 8% p.a. up to 1985 then level off at an average annual growth of 4% up to 1995. By 1990, about 0.6 million tons per year of diesel oil used by EGAT for power generation is expected to be replaced with natural gas, and another 0.2 million tons per year by LPG in the transport sector. As for fuel oil, its consumption is projected to decline sharply at a rate of about 8% p.a. during 1985-90 due to increased substitution by natural gas. By 1990, nearly 5 million tons per year of natural gas would replace energy that would have otherwise been provided by fuel oil.

B. Projected Petroleum Products Balance

3.07 Total production from Thailand's four refineries (TORC, Esso, Bangchak and Fang) currently amounts to about 8 million tons per year (tpy). By 1988, even after completion of TORC's hydrocracking facilities, the rehabilitation of Bangchak and the expansion of Esso (paras 3.14 and 3.15 below), substantial product imbalances are still expected to occur, as shown below:

Thailand - Projected Petroleum Products Balance, 1987-95
(in million tons)

		1987		1990		1995	
	Production	Demand	Surplus/ (Deficit)	Demand	Surplus/ (Deficit)	Demand	Surplus/ (Deficit)
Gasoline	2.2	1.7	0.5	1.9	0.3	2.1	0.1
Kerosene/Jet Fuel and Diesel/Gas Oil	5.6	5.8	(0.2)	6.4	(0.8)	7.5	(1.9)
Fuel Oil	3.6	2.9	0.7	2.1	1.5	2.2	1.4

3.08 The above projections indicate that late in the 1980s, large imbalances between supply and demand will develop, with substantial deficits in mid-distillate products and surpluses of fuel oil. The above production is projected on the basis of light Saudi Arabia crude oil; should crudes get heavier, as generally expected in the 1990s onwards, the net yield of mid-distillates will decline with corresponding increase in fuel oil, thus exacerbating the projected imbalances. The Government, therefore, needs to analyze in detail possible options to minimize economically the above imbalances. The main options available to Thailand to balance demand and supply in the long run are to: (a) increase crude distillation capacity; (b) install secondary conversion facilities to convert the surplus low-value fuel oil into premium value mid-distillates; or (c) import deficit products and export surplus fuel oil. The proposed Project will provide financing to help the Government evaluate these options and determine the one most economically advantageous to Thailand (para 5.09).

C. Petroleum Subsector Organization

3.09 Overall responsibility for planning and investment decisions in the petroleum refining sector is vested in the National Petroleum Policy Committee (NPPC) which was appointed by the Cabinet in March 1981. The NPPC, which is chaired by the Prime Minister, sets policies and targets for the development of the petroleum industry and the pricing of petroleum products. It appoints sub-committees as needed for performing assigned functions. Currently, there are two sub-committees: (i) sub-committee on procurement planning, pricing and compensation of petroleum products; and the sub-committee on refinery expansion.

1. Exploration and Production

3.10 The exploration and production of petroleum in Thailand is undertaken by both the Government and the private sector. Exploration, both inland and offshore, is done primarily by private concessionaires. Exploration activities are monitored by the Department of Mineral Resources in the Ministry of Industry. The Ministry of Defense currently produces crude oil at a rate of 150-400 barrels per day from 17 wells at Amphur Fang in Chiang Mai Province.

2. Refining

3.11 Thailand has a total refining capacity of 9.8 million tpy which is distributed among four refining companies as follows:

Thailand - Total Refining Capacity[a]/
(in million tons per year)

Refinery	Capacity	% of Total
Bangchak Petroleum Co., Ltd (BCP)	3.25	33.2
Thai Oil Refinery Co., Ltd (TORC)	3.25	33.2
Esso Standard Thailand, Ltd	3.25	33.2
Fang Refinery	0.05	0.4
Total	9.80	100.0

a/ Nameplate capacity.

3.12 TORC is a joint venture between PTT and the private sector each of which owns 49% of TORC's equity; the Crown Property Bureau holds the remaining 2%. The main private shareholders are Shell Company of Thailand Ltd. and Caltex Oil (Thailand) Ltd. which are the local subsidiaries of the respective international oil companies. TORC is operated under an operating and service contract with Shell. The Esso refinery is fully

owned by Esso Eastern, Inc., a subsidiary of Exxon (US), while the Fang refinery, which is operated by DED primarily as a pilot plant, is owned by RTG. The recent operating performance of the three major refineries is shown in Annex 3-1 and summarized on the following page.

3.13 Over the last two years, the Bangchak refinery has operated below its rated capacity. Bangchak's capacity utilization during this period averaged 78% while TORC and Esso averaged 99% and 108%, respectively. TORC and Esso have consistently followed a satisfactory repair and maintenance program. In addition, they have supplied a wide range of technical and training services to their refineries and staff. Bangchak, in contrast, has made inadequate repair and maintenance of its processing facilities resulting in a reduction in crude throughput from 65,000 barrels per calendar day (bpcd) to 45,000 bpcd. Furthermore, Bangchak's general operations have weakened with the departure in 1981 of Summit management personnel (para 4.01 below). With regard to the refineries' product yield, Bangchak accounted for about 46% of the total fuel oil produced in the two-year period, while TORC and Esso accounted for only 23% and 31%, respectively. The low fuel oil production in TORC is primarily due to the existence of secondary conversion facilities, including a 6,500 bpcd fluid catalytic cracker (FCC) and a 12,000 bpcd visbreaker. The FCC unit allows further production of about 4,000 bpcd of high quality liquid distillates and 600 bpcd of LPG, while the visbreaker yields about 1,500 bpcd of blendable distillate products. Bangchak and Esso, on the other hand, are simple in configuration and have no secondary processing facilities for conversion of fuel oil to middle distillates.

3. Refinery Expansion Plans

3.14 In 1980, the Government, through PTT, requested Bank assistance to review the proposal by TORC to expand capacity and install an additional FCC unit at the TORC refinery. The Bank subsequently financed a Refinery Study to establish the optimal configuration that TORC should have to help balance the national demand and supply for petroleum products in the long run. The study was carried out by Lummus (US), a major petroleum refinery consultant and engineering firm. It was then reviewed extensively by the Government, as well as the Bank in view of the refinery's interrelationship with sectors in which the Bank is actively involved. The consultant developed a linear programming model to determine the optimal product mix and additional processing capacity at the Bangchak, TORC and Esso refineries under various supply scenarios. The economic rentability of the TORC proposal was then calculated over the project's 15-year life. At the request of the Government, Bank staff calculated economic rates of return and net present values at 10% and 20% discount rates for several selected scenarios.

3.15 The above review established significant economic advantage in installing a hydrocracker at TORC, rather than the originally proposed FCC or other secondary conversion alternatives. Following detailed discussions, TORC decided in favor of a hydrocracker and designed the conversion project along the lines recommended. The project now includes a high vacuum unit and a hydrocracker to increase production of distillate

Thailand - Recent Operating Performance of Refineries

	1981 a/		1982		1983	
	Million Tons	%	Million Tons	%	Million Tons	%
Crude Throughput						
Bangchak	1.9	31	2.5	32	2.6	30
TORC	2.4	40	3.0	39	3.4	40
Esso	1.8	29	2.3	29	2.6	30
Total	6.1	100	7.8	100	8.6	100
Capacity Utilized (%):						
Bangchak		77		77		80
TORC		101		93		105
Esso		104		103		116
Total Industry		93		89		99
Net Product Yield (%):						
Bangchak		94		95		96
TORC		94		96		94
Esso		98		98		97
Total Industry		95		96		98

a/ From April when Bangchak started operation under the Ministry of Defense.

products by about 1.0 million tpy. Foster Wheeler (US), the managing contractor selected for the project, is currently doing the necessary front-end engineering. The hydrocracker is expected to be on stream by the end of 1988. A further project component proposed by TORC, which consisted of the installation of a 3.25 million tpy crude distillation unit has been shelved due to financing constraints. Esso, on the other hand, recently completed an expansion project which increased its crude distillation capacity from 2.25 million to 3.25 million tpy. Esso's project does not include any secondary conversion installations.

4. Marketing and Distribution

3.16 Marketing and distribution of petroleum fuels are handled by Shell, Esso, Caltex, and PTT. Approximately 10 million tons of petroleum fuels per year are marketed in Thailand, as shown on the following page. The four companies plus Mobil, which distributes only kerosene in southern Thailand, together operate through about 2,500 dealer outlets. Shell has 700 outlets (28%); Esso, 625 (25%); Caltex, 375 (15%); PTT 575, (23%); and Mobil, 225 (9%). The Bangkok metropolitan area consumes about 33% of the total petroleum fuels distributed in Thailand. The central region consumes 30%, the north 10%, northeast 12% and the south 15%. Transportation of petroleum fuels is done mainly by sea and rail. There are no product pipelines except for a 5 km pipeline from the Bangchak refinery to EGAT. The existing distribution network is adequate.

Thailand - Petroleum Fuels Distributed and Distributors' Market Shares, September 1984

	Petroleum Fuels Distributed		Distributors' Market Shares, %				
	Million tons	%	Shell	Esso	Caltex	PTT	Total
Gasoline	1.5	14	33	24	22	21	100
Diesel Oil	4.2	40	27	26	21	26	100
Kerosene a/	0.6	6	25	35	15	21	96
Jet Fuel	0.8	8	35	29	28	8	100
Fuel Oil	3.2	30	15	22	6	57	100
LPG b/	0.3	2	23	15	7	12	57
Total c/	10.6	100	25	25	16	30	96

a/ Mobil distributes only kerosene in southern Thailand. Its market share of this product is 2%. Independent distributors' share is also 2%.
b/ About 43% of LPG are distributed by independent distributors.
c/ Mobil and independent distributors' combined total share is 4%.

D. Petroleum Product Pricing

3.17 Petroleum product prices are fixed by the Government at the ex-refinery level through the Ministry of Industry, and at the retail level through the National Petroleum Policy Committee. Ex-refinery prices are set on the basis of Singapore posted prices. Singapore prices are converted into Baht using the floating exchange rate and are reviewed monthly. Excise and municipal taxes are levied on petroleum products; taxes on gasoline currently amount to about 42% of the retail price and 15% on diesel and kerosene. The Oil Stabilization Fund, established by the Government in 1974 as a price stabilization mechanism, collects contributions from refineries for petroleum product sales. Presently, net compensation is paid to refineries for kerosene and fuel oil sales. The current structure of petroleum product prices is shown below.

Thailand - Structure of Petroleum Product Prices a/
(in US$/gallon; 27 Baht: US$)

	Ex-Refinery Price	Excise and Municipal Taxes	Contrib. to/ (Compen. from) Oil Stab. Fund	Marketing Margin	Retail Price
Premium Gasoline	0.86	0.70	-	0.08	1.64
Regular Gasoline	0.79	0.64	0.01	0.07	1.51
Kerosene	0.84	0.13	(0.17)	0.06	0.86
High Speed Diesel	0.81	0.14	(0.07)	0.06	0.94
Fuel Oil	0.68	-	(0.13)	0.02	0.57

a/ Effective November 1984.

3.18 Retail petroleum product prices in Thailand generally compare well with prices elsewhere in the region, as shown below. Most petroleum product prices are significantly higher compared to CIF prices.

Comparative Retail Prices of Petroleum Products
(in US$/gallon)

	Thailand (Dec. '84)	Philippines (June '84)	Korea (March '84)	Singapore (March '84)	CIF Import Prices (Dec. '84)
Regular Gasoline	1.51	1.69	3.15	0.95	0.79
Kerosene	0.86	1.30	1.39	0.96	0.84
Diesel Oil	0.94	1.30	1.32	0.90	0.80
Fuel Oil	0.57	0.98	0.91	0.62	0.67

While domestic retail prices of both gasoline and diesel oil are substantially higher than international prices, significant distortions nevertheless exist in the relative price structure of these two products. The domestic price ratio for regular gasoline and diesel is 1.6 while the international price ratio is about 1.0. Relative price distortions may, over time, encourage uneconomic decisions for energy investments and inter-fuel substitution. Under Sal I and II, petroleum product prices were reviewed and adjustments were recommended to reflect more accurately the structure of international prices and domestic refining costs. Discussions with the Government on this issue are continuing and are likely to result in steps being taken during 1985 to reduce or remove remaining price distortions and subsidies.

3.19 As to the ex-refinery price structure, the Lummus study (para 3.15) established that financial incentives exist for the refiners to minimize fuel oil production and invest in secondary conversion facilities in Thailand. The present ex-refinery diesel oil price is about US$5.46/bbl higher than the fuel oil price; such price difference, however, is still about 40% below that generally available to refiners elsewhere in the region who have similar conditions of surplus fuel oil supply and increasing middle distillate demand. The present price structure is not likely to materially affect the viability of the Project and the refinery, but inter-product price relationships need to be examined closely if refineries are to shift production in line with projected energy demand. Such an analysis is also covered by the energy pricing studies mentioned in para 3.18 above. In connection with this Project, agreement has been reached with the Government that it will continue to set ex-refinery prices which would (a) allow the refineries, operating efficiently, to meet their expenses, service their debts, and earn a reasonable rate of return on capital employed; and (b) be reasonably competitive internationally.

F. Government Policies in the Subsector

3.20 In recent years, RTG has been paying increasing attention to the development of the energy sector, and of the refineries subsector in particular, pursuant to the objectives and strategy of the Fifth National Development Plan (para 1.01). RTG intends to promote and introduce measures, including price adjustments and modifications in refinery configuration, to correct supply/demand imbalances for petroleum products in the long run. The private sector refineries are expected to continue to play a major role in the subsector including the Bangchak refinery (para 4.05 below).

IV. PROJECT SPONSOR

A. The Bangchak Petroleum Company, Ltd. (BCP)

1. Background

4.01 The Bangchak refinery was constructed in 1964 with an initial capacity of 5,000 bpcd. After incurring losses during the refinery's early months of operation, the Ministry of Defense, which then operated the refinery for the Government, transferred the management and operation of BOR to Summit Industrial Corporation (Panama), a private sector company, through a 15-year lease contract awarded in 1965. Controversies during the latter years of the lease arrangement led to the deterioration of relations between Summit, its workers and the Government. The lease expired in March 1981 and the Ministry of Defense assumed management and operation of the refinery. In addition, PTT was made responsible for crude procurement, distribution of finished products, and financing of all operating and administrative requirements of the refinery including crude, salaries and wages, taxes, financial expenses, equipment and spares, etc.

4.02 The above arrangement, which completely divided financial from operating responsibilities within the Bangchak refinery, did not prove beneficial either to Bangchak or to PTT. There was no evidence of efficient resource management or a program to develop new and better sources of funds. During BOR's first full year of operations under DED, total operating and administrative expenses (excluding cost of crude and interest charges) increased from US$10.22/ton in the first quarter to US$13.14/ton in the last quarter. The total refinery costs, including interest expenses, increased from US$28.47/ton to US$40.15/ton (summary financial statements for BOR for 1981-83 are shown in Annexes 4-1 and 4-2). The above increases were in part due to the decline in quantity of crude processed from 0.66 million tons in the first quarter to 0.55 million tons in the last quarter owing to mechanical problems. The heavy interest charges were the inevitable consequence of operations based totally on short-term borrowings, and the wide gap between credit terms for crude purchases (29 days) and refined product sales (at least 57 days) which had to be financed at market rates. In its three-and-a-half years of operations under the DED/PTT arrangement, the refinery accumulated losses of more than

US$120 million. At the same time, the carrying of short-term liabilities amounting to at least US$200 million in its books for BOR had weakened PTT's liquidity position, and has contributed to slowing down efforts assisted by the Bank to transform PTT into a financially viable entity.

2. Corporate Restructuring

4.03 Upon the Government's request, the Bank prepared an extensive analysis (Project File E) of the institutional problems of the Bangchak refinery and the corporate and financial framework on the basis of which operations of the refinery should be carried out in the future. The analysis identified three major problems resulting from the joint PTT/DED management arrangements: (i) refinery operations did not have managerial and legal autonomy nor commercial orientation, and therefore failed to provide sufficient inducement for higher efficiency; (ii) direct financial accountability was diffused between Bangchak and PTT, and financial planning, management and control for the refinery were lacking; and (iii) the refinery had a very precarious financial situation since no funds have been provided permanently to support operations. The analysis then developed alternative arrangements aimed at solving these problems and ensuring that sound financial planning, management and control are carried out.

4.04 Four alternative institutional set-ups were identified for the refinery: (i) consistent with the provisions of the revised PTT Act, transfer the refinery to PTT as a division and have PTT fully responsible for its operations; (ii) organize a state enterprise to manage and operate the refinery; and (iii) establish a commercial company with (a) total or majority private ownership or (b) majority Government shareholding. The transfer of the refinery to PTT was considered a sub-optimal solution because of PTT's already highly diversified operations (natural gas, crude oil procurement, petroleum product marketing and soon, petrochemicals) and thinning management capabilities. Organizing a state enterprise to manage the refinery was not considered favorable since the provisions of the current law for state enterprises, which entail many bureaucratic processes, would limit the enterprise's commercial and corporate flexibility.

4.05 The establishment of Bangchak as a commercial company with total or majority private ownership was the most desirable option. However, discussions by the Government with private companies have indicated that, given the current poor physical state of the refinery, the private sector will not be interested in participating at this time. After the refinery has been rehabilitated and made financially viable under this Project, it is expected that the private sector will be prepared to participate in the subsequent larger project which would involve the installation of secondary conversion facilities. (This conversion project will be studied under the proposed Project, but preliminary calculations suggest that it will be sufficiently attractive to encourage participation by the private sector.) The Bank believed that the establishment of a new company to be operated under the provisions of Thailand's Civil and Commercial Code and with

shares held by the Government, PTT and local banks was the optimal solution at this stage. Such a set-up would ensure autonomy of operations and commercial orientation, as well as facilitate effective operating and financial planning, management and control. Such a solution will also permit the transfer of shares held by the Government and local banks to the private sector whenever feasible.

4.06 A detailed analysis was also prepared to establish the initial balance sheet of the new company. This analysis included projections of the likely financial position of the refinery as of a cut-off date, estimates of the refinery's permanent working capital requirements, and development of schemes for working capital financing and disposition of the refinery's debts and accumulated losses. The operating relationship of the new company with PTT was also analyzed. PTT should continue to procure crude oil for the new company until such time as the new company has developed its own expertise in crude procurement. With regard to product marketing, PTT already has a full staff, the infrastructure and a well-developed network for efficient product distribution. PTT, therefore, should continue product marketing for the new company.

4.07 The Government concurred with the above basic recommendations and a high-level committee was created by the Cabinet to review the proposals and recommend the appropriate institutional, legal and operating set-up for the refinery. This committee proposed a corporate and financial restructuring package along the lines recommended by the Bank, including the establishment of an autonomous commercial company to run and manage the refinery and implement the Project. Upon inception, however, the company would be owned fully by the Government, PTT and Krung Thai Bank, a Government-owned commercial bank, in view of the private sector's deferment in participation given the refinery's current state (para 4.05). The company's incorporation statutes allow private sector participation in the future. Measures, such as appointment of a strong commercially-oriented board of directors, were developed to safeguard the company's autonomy and commercial viability given the company's proposed initial ownership.

4.08 The restructuring package was approved by the National Petroleum Policy Committee in May 1984 and by the Cabinet in June 1984. In November 1984, The Bangchak Petroleum Company, Ltd. (BCP) was incorporated as a limited company under the Civil and Commercial Code. A strong commercially-oriented board of directors, as well as a managing director, was also appointed by the Cabinet. BCP now has full responsibility and accountability for all aspects of refining activities, including crude oil procurement and refined product sale to marketing companies (PTT). It is completely autonomous, having its own system and procedures for all aspects of its operations, including procurement and staff hiring and compensation. BCP will receive policy guidance from the National Petroleum Policy Committee and, although fully Government-owned, is exempted from orders, rules, regulations and Cabinet resolutions governing state enterprises. The transfer of the refinery staff and assets to BCP was completed in early April 1985. Agreements covering crude procurement and refined product sales (para 4.09) were signed between PTT and BCP also in April 1985. To

facilitate the Bank's continuation of its assistance in strengthening the refinery's corporate and financial framework, BCP will inform the Bank of changes in its statutes which may impair the company's operations or financial viability.

3. Financial Restructuring

4.09 Based on the current level of operations, the permanent working capital requirements of the the refinery, from which the financial structuring of BCP was developed, was estimated at US$111.1 million (Annex 4-3). The crude and refined product inventories include buffer quantities and legal requirements. The prevailing credit terms for product sales and crude purchases are 57 and 29 days, respectively. PTT has committed to reduce its payment period to BCP from 57 days to about 45 days to eliminate the heavy financing burden to BCP. It is necessary, however, to further reduce such payment period to about 30 days. To achieve such a reduction, agreement was reached that the Government will submit to the Bank by November 1, 1985 proposals to improve the payment practices of state agencies and enterprises (which are PTT's main customers) for petroleum product purchases. Thereafter, the Government will implement such proposals taking into account the Bank's comments. Such proposals would include interest penalties on delayed payment in order to allow the refinery to service the short-term borrowings needed to finance the extra level of receivables.

4.10 BCP has structured its initial financial position to fully meet its permanent working capital requirements on one hand, and allow adequate liquidity and leverage positions on the other. Of the US$111.1 million permanent working capital required, US$51 million was provided through equity contributions from PTT (US$36 million), the Ministry of Finance (US$7.5 million) and Krung Thai Bank (US$7.5 million). The balance of US$60.1 million was provided through a US$120 million revolving credit facility obtained by BCP for working capital purposes. BCP has undertaken an initial level of current liabilities that provides a security margin of 50%, i.e. a current ratio of 1.5:1. On this basis, in addition to US$38 million of trade payables, BCP can carry as much as US$60.1 million in short-term borrowings and still maintain a current ratio of 1.5:1. In addition, PTT has issued 20-year floating rate notes of up to US$145 million, guaranteed by the Government, to refinance the refinery's past accumulated losses. The notes will be serviced fully by the Government. The sources and uses of funds for the restructuring of BCP, including financial and physical rehabilitation, are shown on the following page.

4.11 The financial restructuring, along with the physical rehabilitation under the Project, will have a significant positive impact on the financial position of the refinery. The financial restructuring will refinance the refinery's permanent working capital with equity funds, thereby reducing significantly the company's financing expenses. Through the physical rehabilitation program, the Project will reduce operating costs, achieve energy savings, and increase capacity utilization. When the Project is completed, net sales are expected to increase from US$511

million in 1985 to US$951 million in 1989. Net profit after tax, which has been negative in the last three years, is expected to become positive and reach US$12 million by 1990. Beyond 1990, when interest charges on long-term borrowings begin to decline, net profit after tax is expected to rise faster, reaching US$33 million by 1995. With improved profitability, the refinery will be able to attract private capital to facilitate the financing of a possible secondary conversion project to be executed later on. The financial projections of BCP are given in Chapter VII.

Sources and Uses of Funds
for BOR Restructuring Program
(in US$ million)

	Financial Restructuring	Physical Rehabilitation	Total Flow of Funds
Sources of Funds			
Short-Term Loans	60.1	-	60.1
Long-Term Loan from IBRD	-	85.0	85.0
Long-Term Loan from Suppliers	-	30.8	30.8
Long-Term Loan from Commercial Banks	-	13.0	13.0
Equity Contribution from Ministry of Finance	82.5[a/]	7.5	90.0
Equity Contribution from Petroleum Authority of Thailand	36.0	-	36.0
Equity Contribution from Krung Thai Bank	7.5	7.5	15.0
Total Sources of Funds	186.1	143.8	329.9
Uses of Funds			
Permanent Working Capital	111.1	-	111.1
Fixed Assets	75.0	143.8	218.8
Total Uses of Funds	186.1	143.8	329.9

a/ US$75 million in the form of refinery assets, and US$7.5 million in cash for working capital.

4. Operations and Management

4.12 Efficient operation and management of the refinery are central to the financial viability of BCP under its new corporate structure. To support its Board of Directors and Managing Director, BCP has appointed a

management and operations team from Caltex Petroleum Corporation (US) for line functions in the refinery. The Caltex team of nine is composed of the Refinery Manager, the Operations, Maintenance, Engineering and Technical Services Managers, the Process, Purchasing and Maintenance Planning Superintendents, and Refinery Special Projects Coordinator. The team's scope of work (detailed terms of reference are shown in Annex 5-1) includes provision of direct operating and management services, continuing technical back-up services, and material and procurement services. The management and operations team will also prepare a detailed training program for refinery personnel for review and approval by the Bank, and provide the services of a Training Manager to implement and monitor such training program. Under the program, it is intended for up to 25 senior technical and managerial staff to be sent abroad to attend seminars/courses (over six-month periods) and visit foreign refineries to improve their knowledge techniques of refinery operations and management. A training center will be established and formal classroom instructions provided for the junior staff. The formal instruction for both senior and junior staff will be combined with on-the-job training to be provided by the technical assistance personnel.

V. THE PROJECT

A. Project Objectives and Scope

5.01 The main objectives of the Project are to assist the Government in improving the operations of the Bangchak refinery through a program of physical, legal, organization, managerial and financial restructuring; reducing the cost of meeting the petroleum requirements of Thailand in the short- to medium-term; and determining the modifications and/or expansion required in Thailand's refinery subsector to balance national demand and supply for petroleum products in the long run. These objectives will be achieved through the following Project components: (i) physical rehabilitation of the Bangchak refinery to increase capacity utilization to design levels and improve its operations; (ii) implementation of energy conservation measures to optimize process unit operations; (iii) improvement of the refinery infrastructure including provision for flood protection; (iv) project engineering, supervision and management assistance to help BCP in the implementation of the rehabilitation, energy conservation and infrastructure upgrading programs, and training to improve the technical and managerial capabilities of the refinery staff; and (v) carrying out of a techno-economic study to determine further modifications required to ensure that the yield pattern of refineries in Thailand will be in balance with the demand profile for petroleum products in the country.

B. Rationale for Bank Participation in the Project

5.02 The Project is an important element of the Bank's assistance in the development of Thailand's energy sector. Through extensive preparation work for the Project, the Bank has been instrumental in assisting RTG in

formulating and implementing an appropriate institutional, legal, management and financial framework for the Bangchak refinery. The Bank's participation has ensured that refinery operations are carried out on an autonomous and commercial basis and that specific operating and financial accountabilities are established within the company. These institutional improvements, as well as the higher operating and financial efficiency to be achieved under the Project, would make the refinery attractive for private investment in the future. With improved management and operations, the refinery should be able to fulfill its share of the responsibility for the development of the refining subsector in Thailand. The Government also regards the restructuring of the Bangchak refinery into an autonomous commercial company as a model for future restructuring of other state economic enterprises in Thailand. Participation in this Project will, moreover, put the Bank in an excellent position to be intimately involved with RTG in rationalizing the demand for and supply of petroleum products in Thailand. From the viewpoint of financial management, the Bank can play an important role in turning the Bangchak refinery into a financially viable enterprise. Furthermore, the Bank is in a good position to advise BCP in acquiring suitable modern technology which the refinery needs badly. Finally, the Bank can ensure, through an appropriate technical assistance and training package included in the Project, that the local staff would be in a better position to operate and manage the refinery.

C. Project Description

1. Refinery Rehabilitation

5.03 This component will support investments to increase operating efficiency and improve product yield. Worn-out equipment will be repaired or replaced and additional equipment will be installed to improve operating efficiency and reliability. Among the equipment to be repaired or replaced are rotating equipment, pumps, compressors, pressure vessels, heat exchangers, fractionation trays, and cooling towers. In addition, the thermal cracker and visbreaker units, which were converted to crude distillation service in the early 1970s, will be restored to their original design basis to increase production of mid-distillates. These investments are consistent with those envisioned for secondary conversion facilities, should the studies included in this Project (para 5.09) determine them to be economic. Tank instrumentation will be upgraded while storage tanks will be repaired and painted for weather protection. The generation and supply of utilities will undergo extensive rehabilitation under the Project to balance steam and electricity generation and consumption, and capture about 27 tons per hour of low pressure steam (valued at about US$5.0 million per year) which are currently vented. Steam turbines that could be driven with high and medium pressure steam from waste-heat boilers will also be installed to eliminate 1.5 megawatts of purchased electricity. Treatment of cooling water will be incorporated to ensure that the water is of acceptable quality and would not cause fouling and plugging of heat exchanger tubes.

2. Energy Conservation

5.04 Energy consumption and processing losses in the refinery have ranged from 5 to 6 volume percent of crude oil processed, as compared to about 3.5 to 4.0 percent norm for a similar but energy-efficient refinery. This is due to the low efficiency of process heaters, poor recovery of heat from process streams, and utility losses such as steam leaks and flaring of hydrocarbon gases. Most of the equipment were designed and built prior to 1973 when minimization of capital costs at the expense of higher energy consumption was the prevailing engineering design philosophy. The current average efficiency for the process heaters at the refinery is about 65% compared to about 90% which is the current industry norm for similar equipment. The refinery has no heat recovery equipment such as air preheaters and waste-heat boilers; these will be provided under the Project to monitor gas flow in flare lines, and by proper maintenance of safety relief valves. In addition, steamlines insulation will be replaced, saving about 25% of the steam consumed.

5.05 Operations of other process units will also be improved with considerable economic benefits to the refinery. These improvements include optimization of the hydro-desulphurization (HDS) unit and of the naphtha reformer, as well as increased recovery of LPG. The design capacity of the HDS unit is 0.8 million tpy. If the refinery is operated at the proposed debottlenecked capacity of 3.0 million tpy, the required capacity of the HDS unit will be 1.0 million tpy. Currently, naphtha, kerosene and diesel oil are hydro-desulphurized. The throughput to the HDS unit, which is a high energy consumer, will be reduced by treating kerosene in a Merox unit which will be installed under the Project. The Merox unit, which consumes very little energy, will reduce the refinery's hydrogen requirement and consumption of utilities. The naphtha reformer currently operates at a pressure of 450 psig. A more reactive catalyst can be used at lower operating pressure (about 250 psig) to increase hydrogen production. The required catalysts and instrumentation are included in the Project. The gas concentration plant loses considerable quantities of LPG to the fuel gas system due to inadequate ancillary equipment. The operating temperatures and pressures of the de-ethanizer and absorber are too high while the operating pressures are too low. Under the Project, repair and replacement of equipment as well as installation of additional coolers and pumps will be provided to reduce LPG losses.

3. Infrastructure Improvement

5.06 The refinery infrastructure includes in-plant roads, drainage and sewer facilities, and staff accommodation, besides port and associated pipeline facilities, and utilities supply networks. The refinery is adjacent to the Chao Phya River and is surrounded by a canal. An internal system of drains and floodgates control river water from inundating the refinery during high tide. A floodgate at the outlet of the canal together with a timber barrier and pumps help to eliminate accumulated water. The refinery location is virtually an island plateau surrounded by a network of connected water courses. This, combined with the low permeability of the

soil, necessitates almost the entirety of the rain water falling within the refinery catchment area to be lifted out. In addition, the current location of the staff housing facilities inside the refinery perimeter fence is inappropriate, posing security and safety hazards to both the refinery and the residents. A program to improve the refinery infrastructure is included in the Project. This includes: (i) land drainage, sewer rehabilitation, and floodwater control; (ii) rehabilitation of in-plant roads and street lighting; and (iii) relocation of the staff housing facilities into an area owned by BCP located south of the battery limits.

4. Project Engineering, Supervision and Management

5.07 As mentioned (para 4.02), a management and operations team from Caltex has been appointed under the Project for line functions in the refinery. This team will also assist BCP in selecting a Consulting Engineering Firm (CEF) (Annex 5-2) to provide the design and engineering required for the refinery rehabilitation and energy conservation components, as well as the design basis for all civil works and equipment and materials to be purchased. In addition, the CEF will prepare the terms of reference for the general contractor (GC) for the installation of equipment and start-up of installed equipment or facilities, assist BCP in the selection of and contract negotiations with GC, and supervise the work of the GC. The CEF will also assist BCP in the procurement of equipment and materials and provide on-the-job training to local personnel. About 670 man-months of CEF services will be required. The appointment of the CEF, under terms and conditions satisfactory to the Bank, will be a condition of loan effectiveness.

5. Staff Training

5.08 Within the first four months of its assignment, the management and operations team will prepare a training program, and provide the services of a Training Manager. This program will comprise both formal and informal instruction. The formal instruction for both senior and junior staff will be combined with on-the-job training to be provided by the technical assistance personnel; it is therefore expected that the majority of the instructors will be from the management and operations team and CEF staff who will perform the training function as part of their regular schedule. A training center will be established and formal classroom instructions provided for the junior staff. The training program will be submitted to the Bank for review and approval by December 31, 1985.

6. Feasibility Study

5.09 This component will determine the modifications in configuration and/or expansion required in the refinery subsector to balance national demand and supply for petroleum products in the future. The feasibility study will be carried out in two phases: Phase I will review the current and projected demand for oil products, the installed and planned refining facilities, the utilization of natural gas and other indigenous energy sources and the extent to which these will affect future demand for liquid

petroleum fuels, and the availability of crude oils to Thailand. Phase I will also include process design configuration for likely secondary conversion options, cost estimates, and financial and economic evaluations of these options. Phase II of the study will commence only if Phase I identifies a process configuration which will be economically justified and provided that Phase I establishes that the necessary conversion facilities should be located at the Bangchak refinery. Phase II will carry out further work on the selected secondary conversion option including basic engineering, more detailed capital and operating cost estimates, complete financial and economic evaluation, and preparation of bidding documents. The feasibility study would be carried out in accordance with the terms of reference (Annex 5-3) agreed with the Bank. The National Petroleum Policy Committee will establish a panel composed of relevant Government departments, agencies and enterprises to review Phase I of the study. By December 31, 1986, BCP will submit Phase I of the study to the Bank for its review along with the comments of the panel. The total study will require about 245 man-months of technical assistance. The consultants will be in place by June 30, 1986.

D. Environmental Considerations

5.10 While the refinery does not appear to be discharging any liquid or solid wastes harmful to the environment, oil sludge, some of which contain lead from the gasoline tanks, is nevertheless being dumped into ponds within the refinery battery limits. The existing sulphur plant has not been operational for several years and is beyond rehabilitation. Gases containing hydrogen sulphide are therefore incinerated and, in the process, discharge substantial quantities of sulphur oxides into the atmosphere. In addition, hydrogeneration and desulphurization facilities are not available for treating heavy oils in which a substantial portion of sulphur in the crude ultimately ends up and gets dispersed throughout the country. The Project will improve the environmental safeguards of the refinery through the installation of a new sulphur plant and the ponds within the refinery battery limits will be cleaned as part of the infrastructure improvement program. The refinery modification feasibility study will also identify additional measures required to ensure that the refinery conforms to acceptable environmental protection standards (i.e. the Bank's environmental guidelines for petroleum refining and sulphur dioxide emissions) and further improve the quality of gaseous and other effluents.

E. Project Organization and Implementation Arrangements

1. Responsibilities for Project Implementation

5.11 The implementation of the Project will be the responsibility of BCP. The management and operations team (para 4.12) will provide operations and management services, as well as training of refinery staff. It will also assist BCP in the selection of the Consultant Engineering Firm and the consultants for the secondary conversion feasibility study. The Consulting Engineering Firm (para 5.07) will provide engineering services for the rehabilitation and energy conservation components, as well as

supervision of the physical implementation of the Project. It will also assist BCP in the selection of the general contractor and the procurement of all equipment and materials required under the Project.

2. Organizational Structure and Staffing

5.12 The BCP organization chart is shown in Chart 1. The key staff needed to work with the Caltex team for continuing refinery operations are already in position. However, two issues will require proper resolution: (i) specific allocation of in-line and advisory positions in the new organizational structure, covering both BCP and technical assistance personnel; and (ii) readjustment/reduction of the current number of personnel (570) in the refinery, to a level compatible with operational requirements (about 350). Agreement has been reached that by September 30, 1985, detailed proposals for (i) and (ii) will be submitted by BCP to the Bank for review and comment, and that such proposals thereafter be implemented taking into account the Bank's comments.

3. Implementation Schedule

5.13 The physical rehabilitation covered by the Project will be implemented over a period of four years. The Project Implementation Schedule agreed upon with BCP is shown in Chart 2. The management and operations team from Caltex will be in place by June 1985. BCP is currently reviewing proposals for the engineering services required for the rehabilitation, energy conservation and infrastructure improvement components of the Project. The Consultant Engineering firm is planned to be appointed in August 1985. The general and civil works contractors will be appointed within the next six months following the appointment of the Consultant Engineering Firm. Civil works, construction and erection for the above Project components will require 17-22 months. As for the refinery modification feasibility study, Phase I will be completed in about 6 months, while Phase II will require 9 months.

F. Monitoring and Reporting

5.14 BCP will be required to submit to the Bank quarterly Project progress and procurement status reports within 30 days of the end of each quarter. In addition, within six months after the closing date of the Project, the company will prepare and furnish to the Bank a completion report on the Project, dealing with its implementation, initial operation, and the costs and benefits derived and expected to be derived therefrom.

VI. CAPITAL COST, FINANCING PLAN AND PROCUREMENT

A. Capital Cost Estimate

6.01 The total financing requirements of the Project, including physical contingencies, price escalation and interest during construction

are estimated at US$143.8 million equivalent, of which US$127.2 million is in foreign exchange, as shown below. Costs include identified import duties and applicable local taxes of about US$8 million.

Summary of Capital Cost [a/]
(for physical rehabilitation)

	--- million Baht ---			---- million US$ ----		
	Foreign	Local	Total	Foreign	Local	Total
Refinery Rehabilitation	1,298.7	205.2	1,503.9	48.1	7.6	55.7
Energy Conservation	180.9	16.2	197.1	6.7	0.6	7.3
Infrastructure Improvement	159.3	70.2	229.5	5.9	2.6	8.5
Training	35.1	5.4	40.5	1.3	0.2	1.5
Project Engineering and Management	337.5	-	337.5	12.5	-	12.5
Operations and Management Assistance	113.4	24.3	137.7	4.2	0.9	5.1
Refinery Feasibility Study	43.2	5.4	48.6	1.6	0.2	1.8
Base Cost Estimate (BCE)	2,168.1	326.7	2,494.8	80.3	12.1	92.4
Physical Contingencies	216.0	32.4	248.4	8.0	1.2	9.2
Price Contingencies	472.5	56.7	529.2	17.5	2.1	19.6
Total Installed Cost	2,856.6	415.8	3,272.4	105.8	15.4	121.2
Interest During Construction						
- Bank-financed	270.0	-	270.0	10.0	-	10.0
- Other	307.8	32.4	340.2	11.4	1.2	12.6
Total Financing Required	3,434.4	448.2	3,882.6	127.2	16.6	143.8

a/ Exchange rate: 27 Baht = US$ 1.00. Costs include identified import duties, applicable local taxes of about US$8 million (Baht 216 million) which have been included in the local cost component.

6.02 Base cost estimates are expressed in December 1984 prices and were developed based on (i) the BOR Refinery Rehabilitation Study undertaken in 1982 by Bangchak along with Lummus Operating Associates (US); (ii) the evaluation prepared by Chiyoda Chemical Engineering and Construction Co. Ltd. in December 1982 based on the refinery inspection conducted in November 1982; (iii) the review of (ii) by Mitsubishi Oil Co. of Japan in September 1984; and (iv) the study conducted in December 1982 by Bank consultant on BOR's infrastructure requirements. Estimates include contingencies amounting to US$28.8 million, or 31% of the base cost. Physical contingencies were calculated at 10% of the base cost. Price contingencies are based on projected international and local price increases for (i) foreign costs of 8% in 1985, 9% in 1986, 1987 and 1988,

7.5% in 1989 and 6% thereafter; and (ii) local cost of 8% in 1985 and 7% thereafter. Project engineering, supervision and management will require about 1,275 man-months of consultant services; this will comprise: (i) 670 man-months of engineering services (para 5.07); (ii) 360 man-months of management and operations services (para 4.12); and (iii) 245 man-months for the feasibility study (para 5.09). Interest during construction includes a 10% guarantee fee over the standard Bank lending rate.

B. Financing Plan

6.03 The overall financing plan for the Project, including the financial restructuring of BOR (para 4.10), is as follows:

Financing Plan
for BOR Restructuring Program
(in US$ million)

	Financial Restructuring a/		Physical Rehabilitation (Project)		Total Restructuring Program	
		%		%		%
Long-Term Debt:						
IBRD	-	-	85.0	59.1	85.0	25.8
Suppliers' Credit	-	-	30.8	21.4	30.8	9.3
Commercial Banks	-	-	13.0	9.1	13.0	3.9
Total	-	-	128.8	89.6	128.8	39.0
Short-Term Debt:						
Commercial Banks	60.1	32.3	-	-	60.1	18.2
Equity Contributions:						
Ministry of Finance	82.5	44.3	7.5	5.2	90.0	27.3
Petroleum Authority of Thailand	36.0	19.3	-	-	36.0	10.9
Krung Thai Bank	7.5	4.1	7.5	5.2	15.0	4.6
Total	126.0	67.7	15.0	10.4	141.0	42.8
Total Financing	186.1	100.0	143.8	100.0	329.9	100.0

a/ Primarily for permanent working capital.

6.04 The proposed Bank loan of US$85 million will cover about 59% of total financing requirements and 67% of the foreign exchange costs of the Project. The items to be financed under the proposed Bank loan are shown

on page 35 of this Report. Bank financing of interest during construction in relation to the Bank loan, amounting to US$10 million, is proposed. BCP will borrow an additional US$30.8 million in the form of suppliers' credits and US$11.4 million in term loans from commercial banks to finance the rest of the foreign costs. The local costs would be financed through equity funds from the Government (US$7.5 million)and Krung Thai Bank, a Government-owned commercial bank (US$7.5 million), and term loans from commercial banks (US$1.6 million). The proposed Bank loan will be extended to BCP for 15 years including 5 years of grace at the standard Bank interest rate. BCP will pay the Government a guarantee fee of 10% and will bear the foreign exchange risk. The suppliers' credits are expected to be for 10 years at 8% interest per annum, with principal repayment to begin six months after Project completion. To ensure the availability of necessary resources to complete the Project in a timely manner, agreement has been reached with the Government that it will meet any cost overrun or shortfall in funds needed to finance the Project.

C. Procurement

6.05 Procurement arrangements are summarized in the table below:

(US$ millions)

Project Element	Procurement Method ICB	LCB	Other	Total Cost
Equipment, Materials and Spare Parts	48.8 (18.0)	- -	2.0 (1.9)	50.8 (19.9)
Works	33.1 (20.8)	9.9 (8.8)	- -	43.0 (29.6)
Operations and Management Assistance	5.5 (5.5)	- -	1.2 -	6.7 (5.5)
Project Engineering and Management	16.2 (16.2)	0.2 -	- -	16.4 (16.2)
Training	1.6 (1.6)	0.4 -	- -	2.0 (1.6)
Feasibility Study	2.2 (2.2)	0.1 -	- -	2.3 (2.2)
TOTAL	107.4 (64.3)	10.6 (8.8)	3.2 (1.9)	121.2 (75.0)

Note: Figures in parentheses are the respective amounts financed by the Bank.

6.06 All equipment and materials contracts to be financed by the Bank will be procured in accordance with Bank procurement guidelines. International competitive bidding (ICB) will be used for procurement of individual items costing over $200,000. This will represent about 70% of the total contracts for equipment and materials. Equipment proprietary to the process design, estimated to cost US$1.9 million (about 2% of the Bank loan), will be procured on the basis of prices negotiated with original equipment suppliers; small items costing less than US$200,000 up to an aggregate amount of US$3.2 million, will be procured through limited international tendering (LIT) after solicitation of quotations from qualified suppliers from at least three Bank-eligible countries. To the maximum extent possible, identical or similar items shall be grouped together for the purpose of bidding and procurement. For purposes of evaluation and comparison of bids for the supply of goods under ICB, qualified domestic suppliers will be allowed a preference of 15% of the CIF price or the applicable import duty, whichever is lower.

6.07 Civil works contracts for construction of training facilities, offices, workshops, maintenance and laboratory buildings, and infrastructure improvement totalling US$9.9 million and representing about 23% of works contracts, will be awarded after local competitive bidding. None of these civil work contracts will exceed US$2.0 million and are not likely to attract interest from foreign bidders. The Bank will finance the design and supervision of civil works, which amounts to about US$2.0 million, or 5% of the total contracts. Bidding packages for these works, as well as for goods over US$300,000 will be subject to the Bank's prior review of procurement documentation. Arrangements for local contracting are satisfactory and contractors' capabilities are considered appropriate for the timely and efficient completion of these works. Local competitive procedures are satisfactory. Consulting services (engineering, management and studies) will be awarded in accordance with bank guidelines on the use of consultants.

D. Disbursements

6.08 An estimated schedule of loan disbursements is given in Annex 6-1. Loan disbursement is expected to be completed by June 30, 1990. The rate of disbursement is based on historical disbursement profiles for industrial projects in the region and in Thailand, as well as on the characteristics and the implementation schedule of each Project component. Disbursements on contracts under categories (a), (b) and (e) costing less than US$100,000 will be made against statement of expenditures. All other disbursements will be fully documented. A special account to assist the company in meeting expenditures in a timely manner will be opened with an initial deposit of US$4.0 million. Retroactive financing of up to US$1 million to cover mobilization and other payments after January 1, 1985 to the Caltex management and operation team is proposed. The proceeds of the Bank loan will cover, net of taxes and duties, the following components.

Category	US$ Million	Eligible Expenditures
(a) Equipment, Materials and Spare Parts a/	38.1	100% of foreign expenditures, 100% of local expenditures (ex-factory), and 65% of local expenditures for other items procured locally
(b) Works	7.6	100% of foreign expenditures and 65% of local expenditures
(c) Operations and Management Assistance	5.2	100%
(d) Project Engineering and Management	15.5	100%
(e) Overseas Training	1.5	100%
(f) Feasibility Study	2.1	100%
(g) Interest During Construction	10.0	100%
(h) Unallocated	5.0	
Total Loan	85.0	

a/ Including equipment installation amounting to US$19.8 million, which may be reallocated to works if equipment contracts do not provide for installation.

VII. FINANCIAL ANALYSIS

A. Basis of Financial Projections

7.01 The detailed assumptions used in the financial analysis are shown in Annex 7-1. Proforma financial statements were prepared in current US$ assuming that the difference between the international and domestic inflation rates will be accounted for in the foreign exchange rate adjustments undertaken by the Government periodically.

1. Production

7.02 With the rehabilitation investments included in the Project, the utilization of the refinery's crude distillation capacity is expected to increase from 70% to 90% by 1990, and 95% by 1992 and the succeeding

years. The restoration of the thermocracker and the visbreaker will enable the processing of the entire Phet crude production which is estimated to be sustained at 20,000 bpd. In addition, substantial improvements in product yield are expected to result from the energy conservation investments such as the incorporation of heaters, pumps, overhead condensers, as well as the processing of a higher quantity of the lighter Phet crude. The comparative product yield and net production with and without the Project are shown below:

Comparative Product Yield and Net Production
With and Without the Project

	Product Yield a/ (in volume %)		Net Production (in mmbbls)	
	With	Without	With	Without
Crude Throughput	-	-	22.5	16.6
LPG	3.0	3.0	0.7	0.5
Regular Gasoline	12.8	14.5	2.9	2.4
Premium Gasoline	7.6	7.2	1.7	1.2
Kerosene	14.2	13.4	3.2	2.2
Diesel Oil	29.8	23.5	6.7	3.9
Fuel Oil	28.6	32.4	6.4	5.4
Total	96.0	94.0	21.6	15.6

a/ Crude mix: 38% Arab light, 27% Arab medium and heavy, 35% Phet and condensates.

7.03 With the Project, the refinery net product yield is expected to increase from 94 volume % to 96%. Furthermore, the restoration of the visbreaker is expected to enable the conversion of about 2,300 bpcd of fuel oil into middle distillate products which are increasing in demand. In addition, about 30,000 tpy of sulfur is expected to be recovered through the upgrading of the refinery's desulphurization facilities. Sulfur is a basic raw material in the manufacture of compound fertilizers. The Government is currently reviewing the feasibility of a fertilizer complex in the Eastern Seaboard industrial estate in the south for which sulfur imports from Saudi Arabia are planned. If not consumed domestically, the sulfur that could be recovered by the refinery has a wide export market, e.g., India, and could yield a netback value of about US$3.6 million per year in real terms.

2. Crude and Product Prices

7.04 The cost of crude used in the analysis was based on the weighted average price currently paid by Thailand of about US$28.3/bbl. This price was assumed to decline in real terms by 6.8% in 1986, and increase by 0.9%

p.a. during 1986-90 and 4.9% p.a. during 1990-95, in accordance with Bank projections. As mentioned earlier, ex-refinery prices are set by the Government on the basis of Singapore posted prices. These prices are then converted into Baht at the floating exchange rate. The Government uses this pricing mechanism to encourage refineries in Thailand to operate as efficiently as those in Singapore. Given the close association of local and Singapore prices, the ex-refinery prices used in the financial analysis were calculated on the basis of the product/crude ratios projected for Singapore/Bahrain. These ratios are discussed in Chapter VIII.

3. Processing and Fixed Costs

7.05 The processing costs per barrel of crude are based on the current level of expenses, as follows: chemicals, US$0.08; power, US$0.06; lead, US$0.14; and transhipment, US$0.23. Labor cost amounts to about US$3.5 million per year. This was assumed to increase by 20-30% in real terms and be in line with the pay scales in the industry in Thailand. Repairs and maintenance costs on new equipment were calculated at 1.5% of project cost; those on existing equipment were estimated at US$2.7 million per year. Depreciation was calculated on straight line basis over 15 years.

B. Financial Projections

7.06 The profitability of the refinery is expected to improve substantially with the implementation of the Project. The Project is, in fact, expected to turn around the refinery into a financially viable enterprise capable of yielding increasing profits. Details of the financial projections for the BCP with the Project are given in Annex 7-2 and summarized on the following page.

7.07 The Project will have a significant positive impact on the financial position of BCP. In 1990, the first year when full benefits from the Project will be earned, net sales are expected to reach US$1,119 million. The increase in net income over the years up to about 1990, when interest payments on the Bank loan and suppliers' credits are most onerous, will be modest but steady. Coverage of annual debt service requirements will be sufficient. With improved operations, the fund generation capability of BCP will be significantly enhanced. The liquidity and leverage position of BCP will also continue to be strong with the Project. To safeguard BCP's financial position, agreement was reached with BCP that it will: (i) maintain a current ratio of no less than 1.1 until December 31, 1988, and 1.2 thereafter; (ii) not incur any long-term debt if, after incurring such debt, the debt/equity ratio of BCP will exceed 60/40; (iii) not incur additional debt if, by so doing, the projected debt service coverage will fall below 1.2 times until December 31, 1988, and 1.3 thereafter; and (iv) not make any repayment in advance of maturity in respect of any of its outstanding debt which would materially and adversely affect its ability to meet its financial obligations. In addition, agreement was reached with BCP that it will not make, during the implementation of the Project, any investment in fixed assets (other than

the implementation of the Project, the ongoing and already approved projects and for maintenance purposes) in excess of US$5 million in any year without prior Bank approval.

Summary of Financial Projections for BCP
(in current US$ million)

	1985	1987	1989	1991	1993
Income and Cash Flow					
Net Sales	510.8	671.2	951.2	1,234.8	1,587.6
Net Operating Profit	7.6	11.1	20.7	31.6	47.4
Net Profit After Tax	0.2	2.4	5.6	11.7	22.8
Funds Generated from Operations	5.5	7.6	10.9	28.9	40.1
Balance Sheet					
Current Assets	149.1	195.4	275.4	354.0	436.2
Net Fixed Assets	84.5	147.0	192.4	163.8	129.3
Total Assets	233.6	342.4	467.8	517.8	565.5
Current Liabilities	92.5	124.5	191.5	246.3	281.1
Long-Term Debt	13.3	78.8	120.4	92.1	63.7
Stockholders' Equity	127.8	139.2	155.8	179.4	220.7
Financial Ratios					
Current Ratio	1.6	1.6	1.4	1.4	1.6
Debt/Equity Ratio	9/91	36/64	44/56	34/66	22/78
Debt Service Coverage (times)	1.8	2.1	2.0	1.6	2.0

D. Financial Rate of Return

7.08 The cost and benefit streams for the incremental financial rate of return calculation are expressed in real terms as shown in Annex 7-3. The after-tax return is satisfactory at 21%. Results of sensitivity tests are shown below:

Sensitivity Tests on Financial Rate of Return, %

1.	Base Case	21
2.	Capital Costs up to 20%	17
3.	Capacity Utilization down 20%	16
4.	Two-Year Project Delay	15
5.	Combination of (2) and (3)	14

7.09 The above sensitivity tests indicate that variations in capital costs, capacity utilization and implementation period will not significantly affect the financial return of the Project. Even under the

worst case of 20% increase in capital costs combined with attainment of 20% less capacity utilization than assumed, the Project financial rate of return is still satisfactory at 14%. The financial rate of return is about 7 percentage points lower than the economic rate of return, which is calculated at 28% in Chapter VIII. The difference lies primarily in the additional expenditures in import duties and taxes that BCP would have to pay to the Government for the importation of goods required for the Project. In any case, the financial return from the Project will lead to adequate cash flow for BCP in order to meet its financial obligations and maintain a healthy financial position.

E. Risks

7.10 The Project does not face any significant risks that would impede its efficient implementation. The technologies that will be used are commercially proven and will be supported by qualified and experienced firms. Comprehensive repair and maintenance and staff training programs are provided for in the Project to ensure that the refinery is operated satisfactorily in the future. Marketing and distribution systems in Thailand are well coordinated. The corporate and financial structure of BCP is sound, and adequate measures are included in the Project to maintain such soundness.

F. Financial Reporting Requirements

7.11 BCP will be required to submit to the Bank annual financial statements and reports examined by independent auditors acceptable to the Bank within six months of the end of the accounting year. BCP will give prompt attention to audit exceptions and recommendations. The company will also be required to submit quarterly financial statements within 60 days after the end of each quarter.

VIII. ECONOMIC ANALYSIS

A. Economic Costs and Benefits

8.01 The costs and benefits used in the economic analysis are in March 1985 US dollars. The economic capital cost of the Project was derived from the financial capital cost, excluding interest during construction, after deducting import duties and local taxes on imported equipment and other items. The profile of expenditures was assumed at 10% in 1985, 22% in 1986, 29% in 1987, 24% in 1988, and 15% in 1989. The economic cost of crude was based on the weighted average CIF price currently paid by Thailand which amounts to US$28.1/bbl. The crude mix planned for 1985-95 is comprised of Arabian light (38%), medium (13%) and heavy (13%), Phet crude (29%) and condensates (7%). Economic processing costs were estimated at US$0.42/bbl. Incremental savings from lower fuel and losses (para 7.02) were calculated at 2.0 volume % and valued at fuel oil equivalent.

8.02 The annual economic benefits that will be derived from the Project will come mainly from increased production of refined products resulting from higher capacity utilization and improved product yields, and savings from lower energy consumption. The rehabilitation and debottlenecking component will help arrest further mechanical deterioration of the two crude distillation units. It will also increase to and stabilize capacity utilization at 95%. Without the Project, capacity utilization is expected to drop from 70% to about 60% by 1989 and 55% by 1991. The incremental throughput and production resulting from the rehabilitation and debottlenecking component are shown in Annex 8-1 and summarized below for 1989, 1991 and 1992:

Incremental Throughput and Production
(Volume im mmbbls; value in March 1985 US$ million)

	Throughput		Production a/	
	Volume	Value	Volume	Value
1989	5.9	159.6	5.9	175.2
1991	8.3	236.7	8.2	261.0
1992	9.5	283.6	9.4	272.1

a/ Excluding sulphur.

8.03 Thailand will continue to import premium-value mid-distillate products even after the TORC conversion project (para 3.14) comes on stream in 1989. Surplus fuel oil, on the other hand, will continue to be exported at depressed prices. To help minimize the net cost of procuring the oil requirements of the country, BOR's yield of mid-distillate products could be optimized with the refinery's existing configuration either by processing lighter crude oils or by spiking--where refined products are added to crude oil to increase the total yield of mid-distillate products and reduce residual fuel oil--or a combination of both. Processing the optimum crude mix is an on-going refinery task. Given the types of crude oil currently processed by BOR and the rehabilitated refinery facilities, it is estimated that spiking up to 10% of crude feed could also be achieved. Spiking would result in savings estimated at about US$5 million per year up to 1990 in real terms. These savings would come from reductions in costly mid-distillate imports and low-netback fuel oil exports.

8.04 Since Thailand is expected to continue to be a net importer of refined products, the economic values assigned to the incremental production were based on projected Singapore FOB product prices. These product prices were calculated from the product to crude price ratios projected by Bank staff. The projected ratios are substantially lower than those which prevailed in the past. For instance, price ratios between

regular gasoline and crude during the last 10 years averaged 1.45, fluctuating from a high of 1.82 in 1979 to a low of 1.21 in 1984. The ratios forecasted for 1990 and 1995 are 1.22 and 1.30, respectively. The historical and projected price ratios, as well as the projected FOB and CIF product prices used in the analysis are shown in Annex 8-2.

B. Economic Rate of Return (ERR)

8.05 The economic rates of return for the Project were calculated in March 1985 US dollars as shown in Annex 8-2. The Project has a satisfactory ERR of 28%. Upon completion of the Project, the refinery as a whole is estimated to yield an ERR of 23% when compared to the alternative of importing the refined products. Results of sensitivity tests are summarized as follows:

Sensitivity Analysis on Economic Rate of Return

		%
1.	Base Case	28
2.	Capital Costs up by 20%	25
3.	Capacity Utilization down 20%	24
4.	Delay of two years in Project implementation	22
5.	Combination of (2) and (3)	21
6.	Combination of (2), (3) and (4)	16

8.06 Variations in capital costs, capacity utilization and implementation period will not materially affect the Project's economic rate of return. A 20% increase in capital cost or a 20% fall in maximum capacity utilized reduces the rate of return to a still favorable 24-25%. Indeed, a two-year delay in Project implementation combined with a 20% increase in capital costs and attainment of 20% less capacity than expected still results in a good 16% rate of return. A sensitivity analysis on the ERRs using the depressed product prices now prevailing in Western Europe was also carried out. Under this scenario, the Project and the refinery yield satisfactory ERRs of 22% and 16%, respectively.

C. Foreign Exchange Savings

8.07 By 1990, the Project is expected to allow additional production of 7 million bbls of refined products with an estimated annual gross import value of US$214 million in real terms. Net of crude, imported chemicals and foreign debt service, the Project will generate over its 15-year economic life net foreign exchange savings of about US$480 million in March 1985 prices (or about US$30 million per year). Details of estimated foreign exchange savings during 1990-2000 are shown in Annex 8-3.

IX. AGREEMENTS

9.01 The following agreements have been reached:

A. With BCP that

(a) it will submit to the Bank by December 31, 1985, a refinery training program and thereafter implement such program taking into account the Bank's comments (para 5.08);

(b) the refinery modification feasibility study would be carried out in accordance with the terms of reference agreed with the Bank, and by December 31, 1986, Phase I of the study would be provided to the Bank for review and comment. Thereafter, Phase II of the study would be carried out only under arrangements acceptable to the Bank (para 5.09);

(c) it will submit to the bank by September 30, 1985, detailed proposals for the specific allocation of in-line and advisory positions in BCP and the reduction of the current number of staff to a level compatible with operational requirements (para 5.12);

(d) it will follow prudent financial practices and maintain a satisfactory financial position as described in para 7.07; and

(e) it will submit to the Bank project reports and financial statements as described in paras 5.14 and 7.11.

B. With the Government that it will

(a) ensure the availability of necessary resources to complete the Project and meet any cost overrun or shortfall in funds needed to finance the Project (para 6.04);

(b) continue to set ex-refinery prices of petroleum products which would (i) allow refineries, operating efficiently, to meet their expenses, service their debts, and earn a reasonable rate of return on capital employed, and (ii) be reasonably competitive internationally (para 3.19); and

(c) submit to the Bank, by November 1, 1985, proposals to improve the payment practices for petroleum product purchases of state agencies and enterprises, and implement such proposals taking into account the Bank's comments (para 4.09).

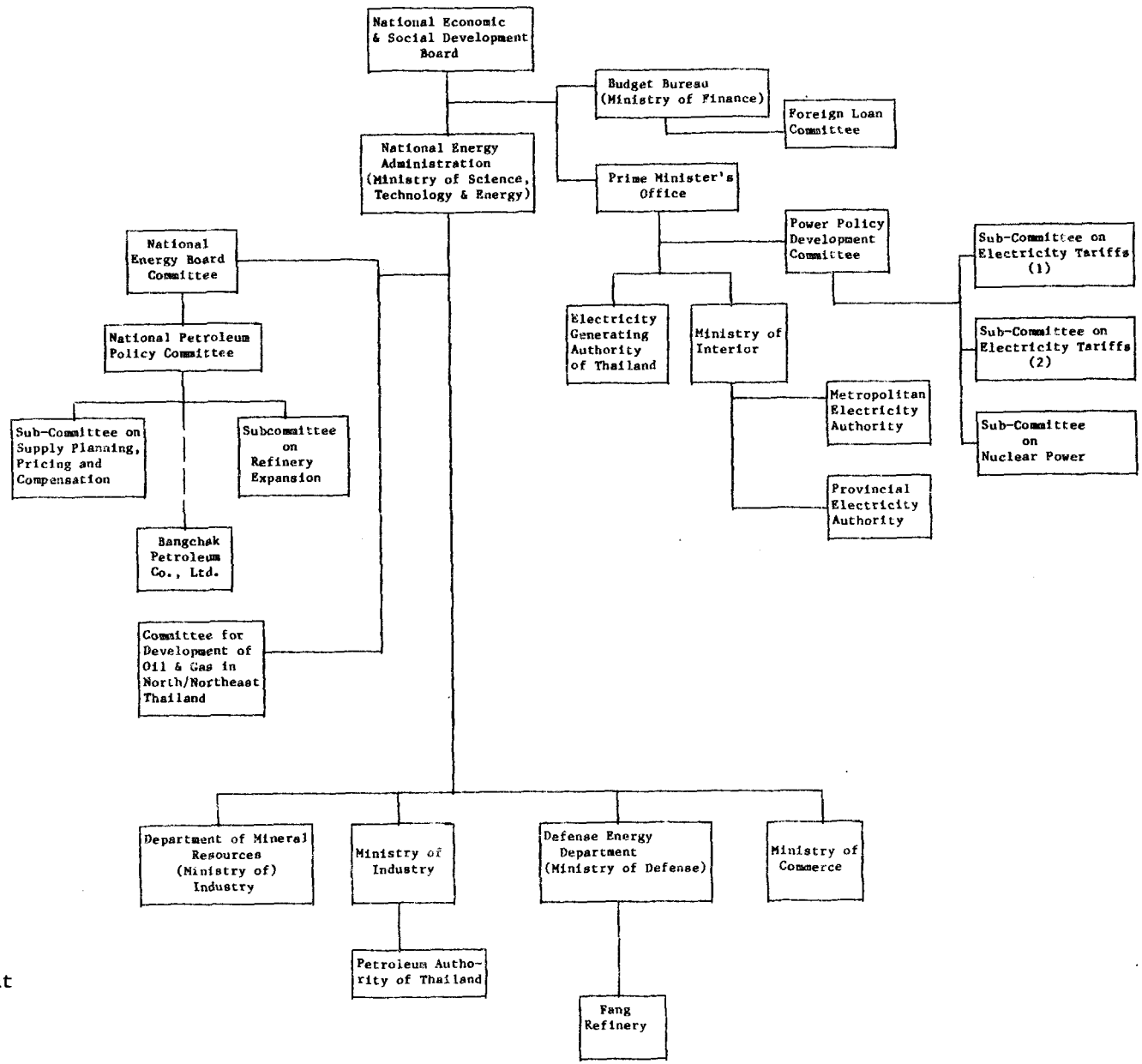
9.02 The appointment of the Consultant Engineering Firm under terms and conditions satisfactory to the Bank (para 5.07) will be a condition of effectiveness of the Bank loan.

9.03 Subject to the above agreements and conditions, the proposed Project is suitable for a Bank loan of US$85.0 million. The loan will be extended to BCP for 15 years including 5 years of grace at the Bank's standard variable interest rate. BCP will pay the Government a guarantee fee equal to 10% of the Bank's standard variable interest rate.

Industry Department
April 1985

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

Energy Sector Organization



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April 1985

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

Bangchak - Production Performance
(in thousand barrels)

	Apr.-Dec. 1981	1982	1983
Total Crude Throughput	13,876	17,940	19,294
Average Throughput per Calendar Day	50	49	53
Average Capacity Utilized (%)	77	76	81
Refined Products:			
LPG	300	282	552
Gasoline	2,505	3,277	4,067
Jet fuel	347	428	808
Kerosene	660	586	1,024
High Speed Diesel	3,614	5,090	5,078
Fuel Oil	5,653	7,309	7,109
Total	13,080	16,972	18,638
Refined Product Yields (in volume %)			
LPG	2.2	1.6	2.9
Gasoline	18.1	18.3	21.1
Jet Fuel	2.5	2.4	4.2
Kerosene	4.8	3.3	5.3
High Speed Diesel	26.0	28.4	26.3
Fuel Oil	40.7	40.7	36.8
Total	94.3	94.7	96.6

Design Capacity: 65,000 bpcd

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

TORC - Production Performance
(in thousand barrels)

	Apr.-Dec. 1981	1982	1983
Total Crude Throughput	18,009	22,350	25,010
Average Throughput per Calendar Day	65	61	68
Average Capacity Utilization (%)	100	94	105
Refined Products:			
LPG	386	454	431
Gasoline	4,394	6,074	6,803
Jet fuel	2,400	3,400	4,463
Kerosene	909	1,236	896
High Speed Diesel	5,629	6,783	8,273
Fuel Oil	3,166	3,321	3,069
Asphalt	81	150	-
Total	16,965	21,418	23,935
Refined Product Yields (in volume %)			
LPG	2.1	2.0	1.7
Gasoline	24.4	27.2	27.2
Jet Fuel	13.3	15.2	17.8
Kerosene	5.0	5.5	3.6
High Speed Diesel	31.3	30.3	33.1
Fuel Oil	17.6	14.9	12.3
Asphalt	0.4	0.7	-
Total	94.1	95.8	95.7

Design Capacity: 65,000 bpcd

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

ESSO - Production Performance
(in thousand barrels)

	Apr.-Dec. 1981	1982	1983
Total Crude Throughput	12,928	16,389	19,257
Average Throughput per Calendar Day	47	45	53
Average Capacity Utilized (%)	104	100	117
Refined Products:			
LPG	478	475	440
Gasoline	2,173	3,090	3,851
Jet fuel	1,392	1,832	2,256
Kerosene	222	492	1,192
High Speed Diesel	3,954	5,564	6,982
Fuel oil	3,879	3,942	4,074
Asphalt	544	595	-
Total	12,642	15,990	18,795
Refined Product Yields (in volume %):			
LPG	3.7	2.9	2.3
Gasoline	16.8	18.9	20.0
Jet Fuel	10.8	11.2	11.7
Kerosene	1.7	3.0	6.2
High Speed Diesel	30.6	33.9	36.3
Fuel Oil	30.0	24.1	21.2
Asphalt	4.2	3.6	-
Total	97.8	97.6	97.7

Design Capacity: 45,000 bpcd

Industry Department
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ANNEX 4-1

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

BANGCHAK OIL REFINERY

SUMMARY INCOME STATEMENTS
(In million Baht)

	Sept. 30, 1981 (6 months)	Sept. 30, 1982 (12 months)	Sept. 30, 1983 (12 months)	Sept. 30, 1984 (12 months)
Gross Sales	9,140.2	17,527.0	18,114.8	
Less: Excise Tax	1,398.7	2,997.5	3,040.6	
Contributions to Oil Fund	42.4	439.6	1,117.8	
Net Sales	7,699.1	14,089.9	13,956.4	10,718
Less: Cost of Goods Sold	6,970.3	14,108.1	13,507.9	
Gross Profit (Loss)	728.8	(18.2)	448.5	743
Less: Operating Expenses	11.1	48.0	637.1	
Operating Profit (Loss)	717.7	(66.2)	(188.6)	179
Less: Net Interest Expense	438.2	1,109.7	529.0	674
Loss on Foreign Exchange	598.5	-	-	
Other Expenses	58.7 a/	7.1	-	
Add: Other Income	42.8 b/	17.0	11.5	
Net Profit (Loss)	(334.9)	(1,166.0)	(706.1)	(495)
Ratios (%)				
Gross Profit Rate	9.5	(0.1)	3.2	6.9
Operating Profit Rate	9.3	(0.5)	(1.4)	1.7
Net Profit (Loss) Rate	(4.4)	(8.3)	(5.1)	(4.6)
Net Interest Expense/Net Sales	5.7	7.9	3.8	(6.3)
Times Interest Earned	0.2x	(0.1x)	(.3x)	(.3x)

a/ Largely for fine for delayed payment of excise tax.
b/ Largely from crude oil overcharge, blending fee and CO_2 sales.

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ANNEX 4-2

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

BANGCHAK OIL REFINERY

SUMMARY BALANCE SHEETS
(In million Baht)

	as of			
	Sept. 30, 1981	Sept. 30 1982	Nov. 30, 1983	Sept. 30, 1984
ASSETS				
Current Assets:				
Cash	0.4	1.1		
Accounts Receivable	1.1	25.3 a/		
Inventories	4,056.0 b/	2,482.3 b/		
Prepayments	15.5	26.1		
Total Current Assets	4,073.0	2,534.8	2,051.6	1,829
Gross Fixed Assets	482.5	486.6		
Less: Accumulated Depreciation	27.0	81.3		
Net Fixed Assets	455.5	405.3	365.7	304
Deferred Charges	-	11.5	13.8	
Total Assets	4,528.5	2,951.6	2,431.1	2,133
LIABILITIES AND EQUITY				
Current Liabilities: c/				
Accounts Payable	11.3	23.6		
Payable to PTT	4,216.7	2,608.0		
Other Payables	154.8	1,340.3		
Total Current Liabilities	4,382.8	3,971.9	4,006.6	4,142
Equity:				
Retained Earnings	145.7 d/	(1,020.3)	(1,575.5)	(2,009)
Total Liabilities and Equity	4,528.5	2,951.6	2,431.1	2,133
Ratios:				
Current Ratio	0.93:1	0.64:1	0.51:1	
Quick Ratio	nil	0.01:1	-	
Total Debt/Equity	97/3	135/(35)	165/(65)	

a/ Mostly for compensation from Oil Stabilization Fund. Receivables from PTT for refined products transferred are offset with 'Payable to PTT' account.

b/ As of September 30, 1982, about Baht 1,538 million (62%) in crude oil, Baht 865 million (35%) in refined products and Baht 79 million (3%) in supplies.

c/ Current liabilities are grouped into accounts payable, payable to PTT and other payables for cost accounting purposes. All current liabilities are essentially payable to PTT.

d/ Net income reported for six months ended September 30, 1981 was 145.7 million Baht. Included in this income was a book credit for Baht 480.6 million to establish the Fixed Assets account.

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April 1985

ANNEX 4-3

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

Bangchak Petroleum Co. Ltd. (BCP)
Permanent Working Capital [a/]
(1985 US$ million)

1.	Accounts Receivable (45 days of credit sales)	63.0
2.	Crude Inventory (54 days of throughput)	70.7
3.	Chemicals (60 days of throughput requirement)	0.5
4.	Materials and Spares	4.3
5.	Finished Goods (7 days of cost of production)	9.6
6.	Operating Cash (30 days of cash expenditures)	1.0
	Total	149.1
7.	Accounts Payable (29 days of credit purchases)	38.0
	Permanent Working Capital	111.1

a/ Based on current level of refinery operations of 45,500 bpcd, or 70% of rated capacity.

Industry Department
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THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

TERMS OF REFERENCE FOR THE MANAGEMENT AND OPERATIONS TEAM

I. Background

1. Thailand has a total oil refining capacity of 195,000 bpcd distributed among three major refineries as follows: Bangchak Petroleum Co., Ltd. (BCP), 65,000 bpcd; Thai Oil Refinery Co. Ltd (TORC), 65,000 bpcd; and Esso Standard Thailand Ltd., 65,000 bpcd. TORC is a joint venture between the Petroleum Authority of Thailand and the private sector while Esso is fully owned by Esso Eastern, Inc. BCP is fully Government-owned.

2. Actual production from the three refineries amounts to about 158,000 bpcd. By 1989, when TORC's 17,000-bpcd hydrocracker goes on stream, total production is estimated at 233,000 bpcd. Even with increased production, however, substantial deficits in mid-distillates are still expected to occur. Fuel oil production, on the other hand, will continue to be in excess of demand. Balancing national supply and demand could be achieved largely through rationalization of the country's refining capacity to which BCP could contribute significantly. However, the current state of BCP's facilities and the limited technical capabilities of the staff preclude the refinery from efficiently performing its role in the rationalization program. BCP has, therefore, launched a rehabilitation/ rationalization project aimed at improving the overall performance of the refinery. The project, which will be implemented with technical and financial assistance from the World Bank, consists of five components: (1) rehabilitation of the Bangchak refinery to restore its mechanical integrity, increase capacity utilization to design levels and improve its operations; (ii) implementation of energy conservation measures to optimize process unit operations; (iii) improvement of the refinery infrastructure including safeguards to plant and equipment against flooding; (iv) training to improve the technical and managerial capabilities of the refinery staff; and (v) techno-economic study to determine further modifications required to ensure that the refineries' yield pattern will be in balance with the projected demand profile for petroleum fuels in the country. BCP wishes to engage the services of an experienced operating firm for the overall management and operations of the Bangchak refinery and to implement component (iv) above.

II. Objectives

3. The operating firm will provide a management and operations team to:

(a) Bring current refinery operations to international levels;

(b) Provide continuing technical back-up support;

(c) Upgrade refinery management, operating and technical skills;

(d) Assist BCP to review the rehabilitation project; and

(e) Provide material and procurement services.

III. Scope of Work

4. The management and operations team will, inter alia:

(a) Review the operations of all departments of the refinery, including general management, finance and accounting, personnel administration, and operating and support services; as well as the organizational structure of the company, current staffing structure, experience and qualification of staff, reassignment of personnel, and training needs. A team of the operating firm's specialists in refinery management, finance and accounting, personnel administration and manpower planning, operations, engineering, maintenance and inspection, and training will be required to spend a period of about two weeks to undertake the review;

(b) Upon completion of the review mentioned in (i) above, submit to BCP a preliminary report covering the organization and plan of work to meet the objectives given above, and implement the recommended plan;

(c) Provide and establish technical reference libraries including design guide, manuals, codes, basic practices, safety practices, etc;

(d) Recommend appropriate computer facilities and establish an adequate technical information and data management system;

(e) Make available crude oil assay data from parent company and develop/institute a LP model to optimize crude oil selection and refinery production;

(f) Provide an annual refinery performance audit by a selected team of specialist drawn from the parent company's staff;

(g) Provide, through senior management and technical personnel seconded to BCP, advisory and direct operating services to administer and establish efficient and modern refinery management and operating practices;

(h) Assist BCP in the selection and appointment of management and technical personnel, including the development of personnel administration system and procedures;

(i) Develop and implement a training program for senior and middle management and technical personnel. The training program will need to be developed within four (4) months together with an implementaion schedule;

(j) Review the refinery rationalization, energy conservation and rehabilitation programs; and

(k) Provide, from the operating company's head office and through the placement of a specialist at the Bangchak Refinery, procurement services for materials and spares.

5. The management and operations team will comprise of an appropriate number of specialists to act in executive positions, including a Manufacturing Manager. The Manufacturing Manager will be responsible for refinery operations for a period of two years. The option to retain the Manufacturing Manager for another two years should be available to BCP. The Manufacturing Manager, in consultation with the company senior management, will determine how the specialists will be deployed, the schedule for training of BCP personnel, and the personnel to succeed those specialists who will be occupying in-line positions including the Manufacturing Manager.

6. The management and operations team will be required to within: (i) four months, provide all necessary operating manuals and systems; and (ii) eighteen months of mobilization, to have in place BCP staff in all key in-line positions and demonstrate that refinery operations can be carried out efficiently essentially by BCP personnel.

7. If the management and technical assistance company fulfills the stated objectives of the management and technical assistance program, BCP will enter into an annually renewable technical back-up service contract.

Industry Department
April 1985

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

TERMS OF REFERENCE FOR THE CONSULTANT ENGINEERING FIRM

I. Background

1. Thailand has a total oil refining capacity of 195,000 bpcd distributed among three major refineries as follows: Bangchak Petroleum Co., Ltd. (BCP), 65,000 bpcd; Thai Oil Refinery Co. Ltd (TORC), 65,000 bpcd; and Esso Standard Thailand Ltd, 65,000 bpcd. TORC is a joint venture between the Petroleum Authority of Thailand and the private sector while Esso is fully owned by Esso Eastern, Inc. BCP is fully Government-owned.

2. Actual production from the three refineries amounts to about 158,000 bpcd. By 1989, when TORC's 17,000-bpcd hydrocracker goes on stream, total production is estimated at 233,000 bpcd. Even with increased production, however, substantial deficits in mid-distillates are still expected to occur. Fuel oil production, on the other hand, will continue to be in excess of demand. Balancing national supply and demand could be achieved largely through rationalization of the country's refining capacity to which BCP could contribute significantly. However, the current state of BCP's facilities and the limited technical capabilities of its staff preclude the refinery from efficiently performing its role in the rationalization program. BCP has, therefore, launched a rehabilitation/ rationalization project aimed at improving the overall performance of the refinery. The project consists of five components: (i) rehabilitation of the Bangchak refinery to restore its mechanical integrity, increase capacity utilization to design levels and improve its operations; (ii) implementation of energy conservation measures to optimize process unit operations; (iii) improvement of the refinery infrastructure including safeguards to plant and equipment from flooding; (iv) training to improve the technical and managerial capabilities of the refinery staff; and (v) techno-economic study to determine further modifications required to ensure that the refineries' yield pattern will be in balance with the projected demand profile for petroleum fuels in the country. The Project will be implemented by BCP with financial and technical assistance from the World Bank. BCP wishes to engage the services of a Consultant Engineering Firm to assist in the implementation of the above rehabilitation/rationalization project.

II. Objectives

3. The Consultant Engineering Firm will be engaged to:

(a) provide design and engineering services for the refinery facilities rationalization, rehabilitation and energy conservation components;

(b) assist BCP in the procurement of all equipment and materials required for the project except those to be procured by the General Contractor;

(c) assist BCP in the selection of a General Contractor who will be engaged for the installation, erection and start-up of major facilities such as process heaters or new process units (viz. sulfur plant, merox unit), and for all civil works which cannot be performed by the refinery; and

(d) provide on-the-job training to local personnel in project management and implementation in the course of execution of this project.

4. Ultimately, the Consultant Engineering Firm will ensure that:

(a) the rehabilitation plan is properly executed;

(b) all components and sub-components of the project, new facilities, equipment and process plant operate as envisaged in the rehabilitation plan;

(c) the two rehabilitated crude units and their associated equipment and ancillary units operate satisfactorily and, over a test-run period of 24 hours continuous operation, meet the envisaged increased feed throughput rates and product specifications;

(d) the heaters reach their specified efficiencies; and

(e) the refinery's total losses and own consumption does not exceed 4.0 volume percent when operated at the conditions stipulated for the rehabilitated plant.

III. Scope of Work

5. Except for the refinery infrastructure improvement, housing sub-component and minor works, the Consultant Engineering Firm will:

With respect to design and engineering:

(a) review the refinery inspection reports and rehabilitation and energy conservation program and propose changes, replacements or deletions of equipment and facilities where necessary;

(b) revise and update piping and instrument diagrams of all process facilities;

(c) review the proposed rehabilitation program vis-a-vis the objectives for each piece of equipment, each facility and,

ultimately, each process unit and prepare revised process flow diagrams indicating process conditions and flow-rates for each process unit;

(d) establish specifications for each item of equipment including metallurgy, design and operating conditions, and process stream characteristics;

(e) evaluate how proposed equipment would operate when incorporated into existing plant and any modifications required; and

(f) establish, where applicable, process and mechanical guarantee requirements and penalties for non-performance.

With respect to procurement:

(g) review and prepare lists of vendors and suppliers for equipment, bulk materials including piping, instruments and consumables for approval by BCP for all items whether to be implemented by the refinery or the General Contractor;

(h) prepare procurement documents, including tender forms, equipment specifications and commercial terms of tender for items to be implemented by refinery staff, and schedule and evaluate offers and recommend to BCP the one most competitive and technically sound taking into account capital and operating costs;

(i) assist BCP, if required, in negotiating for suppliers/export or other forms of commercial credit; and

(j) prepare purchase orders and monitor and supervise procurement;

With respect to the General Contractor:

(k) assist BCP in the selection of the General Contractor to supply all necessary equipment, material and labor and install, erect and start-up new process units, and the rehabilitation of existing major equipment such as process heaters;

(l) review and finalize the items of work that the General Contractor is expected to perform for BCP;

(m) describe in detail the scope and responsibilities of the General Contractor, including each item of work to be done and the time frame over which these are to be accomplished;

(n) propose a list of bidders who are qualified to under take the work;

(o) prepare detailed tender documents and assist BCP to obtain bids for execution of work to be performed. Bids should include costs of all materials, equipment, labor, installation and construction supervision and start-up of equipment and facilities to be supplied on a fixed-fee basis;

(p) evaluate offers and recommend to BCP the one most competitive taking into account expertise, capabilities and workload of bidders; and

(q) prepare contract documents.

With respect to the supervision of the General Contractor

(r) supervise field activities, submit periodic progress reports, arrange and attend meetings with BCP and General Contractor to discuss work programs and plan;

(s) supervise start-up and operation of new equipment and facilities ensuring that any deficiencies are corrected; and

(t) evaluate work performed and review bills submitted to BCP for payment including certifying that bills represent a fair price of work performed;

6. For the refinery infrastructure improvements including the housing sub-component and minor works, the Consultant Engineering Firm will:

(a) review the consultant's report on infrastructure improvement and finalize the program;

(b) define the housing requirements of the company with respect to number, design per requirements of the Thailand Housing Authority, and minor civil works in the refinery such as extension of laboratory, workshops and internal roads, flood protection and drainage requirements;

(b) prepare bid documents incorporating design requirements and plans, bills of quantities, material requirements prepared by the Housing Authority of Thailand;

(d) prepare a short list of bidders drawn worldwide;

(e) call for competitive offers, schedule offers, evaluate and rank technically acceptable offers in order of competitiveness;

(f) prepare contract documents for award of contract to successful bidder;

(g) prepare work schedule to monitor project progress; and

(h) supervise field construction to ensure that work is carried out per the design specifications and construction plans and submit monthly progress reports.

Industry Department
April 1985

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

TERMS OF REFERENCE FOR THE REFINERY MODIFICATION STUDY

A. Background

1. Thailand has a total oil refining capacity of 195,000 bpcd distributed among three major refineries as follows: Bangchak Petroleum Co. Ltd. (BCP), 65,000 bpcd; Thai Oil Refinery Co. Ltd. (TORC), 65,000 bpcd; and Esso Standard Thailand Ltd., 65,000 bpcd. TORC is a joint venture between the Petroleum Authority of Thailand and the private sector while Esso is fully owned by Esso Eastern, Inc. BCP is a commercial limited company owned by the Government and the Petroleum Authority of Thailand.

2. Actual production from the three refineries amounts to about 158,000 bpcd. By 1989, when TORC's 17,000-bpcd hydrocracker goes on-stream and Esso's distillation capacity is increased to 65,000 bpcd, total production is estimated at 233,000 bpcd. Even with increased production, however, substantial deficits in mid-distillates are still expected to occur. Fuel oil production, on the other hand, will continue to be in excess of demand. Balancing national supply and demand could be achieved largely through rationalization of the country's refining capacity to which BOR could contribute significantly. However, the current state of BOR's facilities and the limited technical experience of the staff preclude the refinery from efficiently performing its role in the rationalization program. BCP has, therefore, launched a rehabilitation/rationalization project aimed at improving the overall performance of the refinery. The project, which was identified by BCP with the assistance of technical consultants, will be implemented by BCP with technical and financial assistance from the World Bank, consisting of five components: (i) rehabilitation of the BOR refinery to restore its mechanical integrity, increase capacity utilization to design levels and improve its operations; (ii) implementation of energy conservation measures to optimize process unit operations; (iii) improvement of the refinery infrastructure including safeguards to plant and equipment against flooding; (iv) training to improve the technical and managerial capabilities of the refinery staff; and (v) techno-economic study to determine further modifications required to ensure that the refineries yield pattern will be in balance with the projected demand profile for petroleum fuels in the country. BCP wishes to engage the services of engineering consultants to carry out the techno-economic study in (v) and assist the company in implementing the resulting recommendations.

B. Objectives

3. The Refinery Secondary Conversion study will:

(a) Review the demand for and supply of petroleum fuels in Thailand up to 1995, taking into account the availability of

indigenous natural gas, coal and hydropower, and the Government's energy conservation program;

(b) Identify and evaluate the options available to Thailand to balance petroleum product supply and demand in the future, including import/export of deficit/surplus products and installation of conversion facilities such as hydrocracker, fluid cracker or thermal cracker in the various refineries in the country;

(c) Determine the option which gives Thailand the most economic benefit;

(d) Prepare a comprehensive and documented compilation of data regarding the recommended option for the BOR refinery; if recommended option is installation of conversion facilities, data would include technical descriptions of conversion scheme, implications on offsites and utilities, cost estimates with reliability of ± 15% including the basis of such estimates, and possible sources and terms of financing, including suppliers' credits;

(e) Prepare detailed plans for engineering, design and implementation, including project management, procurement, construction and supervision, cost control, project scheduling, plant start-up, etc., and prepare bid documents for the selection of the Engineering Contractors; and

(f) Provide technical advisory services during project implementation.

C. Scope of Work

4. The proposed study will be carried out in two phases:

Phase I shall comprise, inter alia:

A. Petroleum product demand and supply:

(1) Review of available information on energy consumption in Thailand with particular emphasis on extent of demand served by petroleum fuels; review of past trends and extent to which these trends were influenced by crude oil prices, interfuel substitution programs, natural gas substitution, level and structure of taxation (customs duties, sales and excise taxes) including individual product pricing and cross-subsidization policies, and general economic conditions in the country; and

(2) Review of available energy demand projections (NEA, PTT, NESDB) and extent to which development of indigenous energy would effect future demand for petroleum fuels, particularly in the industrial sector and develop demand projections for petroleum products up to the year 1995.

B. Marketing and distribution of petroleum products:

(1) Analysis of existing institutional framework for marketing and distribution of petroleum products in Thailand (companies involved, ownership, size, geographical/product coverage, etc.); and

(2) Review of physical facilities used for different transport modes, size and locations of storage facilities, recommendations on changes to improve the system.

C. Existing BCP refinery;

Evaluation of BCP refinery and its role in the rationalization of the refining sector;

D. Least Cost Analysis

(1) Review of existing product specifications with respect to distillation range, flash and smoke points, cetane and research octane numbers, and sulphur content; examination of extent to which these specifications could be changed without harmful effects on user equipment life, cost of operation and the environment;

(2) Evaluation of options available to the country's various refineries, particularly the BCP refinery, to meet the country's petroleum fuel requirements up to year 2000. Assumptions and any new facilities/units associated with each option should be clearly identified. The options considered shall include, but not be limited to:

(a) Operation of BCP refinery with its existing configuration. Evaluation of this option shall include detailed review of existing configuration and evaluation of extent to which the refinery could meet future demand by processing other types of crude oils likely to prove economically beneficial, and identification of any bottlenecks that could prevent the

processing of such optimum blends of crude oils not excluding refined products if this be considered necessary to meet future needs;

(b) Evaluation of alternative processing configurations such as hydrocracking, fluid catalytic cracking and thermal cracking for integration into the existing refinery; and

(c) Possible modification in the other refineries in the country.

(3) Detailed description of each configuration considered for the BOR refinery, including technical flexibility of each unit in the configuration, efficiency, and product quality and yields compared to those of recent units elsewhere;

(4) Capital and operating cost estimates (in adequate detail and broken down into local and foreign exchange costs) based on preliminary engineering design for each option; the estimate should include any additional utilities, ancillary facilities and infrastructure required to ensure efficient operations of each option considered;

(5) Preparation of implementation schedule and estimates of annual disbursements for each option; and

(6) Economic analysis of options considered and ranking of options in terms of economic benefits to Thailand. Assumptions used in analysis should be included.

Phase II will be carried out only if Phase I concludes that modification of the refinery configuration at BCP would result in substantial economic benefit to Thailand. Phase II shall be limited to the BCP refinery and shall include, inter alia:

A. Project and engineering design package:

(1) Detailed description of the scope and configuration of the option approved by BCP including rationale for its selection, size of facilities, process/technology/licenses to be used, and how new facilities will be integrated into existing facilities;

(2) Detailed process design of the option selected, including optimum process configuration and capacity to meet projected market demand for a period of at least 15 years from plant start-up;

(3) Source and type of feedstock to be utilized;

(4) Utility facilities (water, power, air, steam, etc.) to be provided or expanded under the project including their size, input requirements, energy source, and reliability of external supply;

(5) Offsites and infrastructure facilities required by the project;

(6) Analysis of environmental impact of the project, such as hydrogen sulphide, sulphur oxide and nitrogen oxide emissions, and devices and controls that will ensure that the project will be constructed and operated in accordance with international and local environmental standards;

(7) Infrastructure needs of the project, such as access roads, bridges at maximum loads, and port facilities from Siracha to Bangchak; and

(8) Development of all required engineering design data to enable the General Contractor to proceed with the detailed engineering and execution of the project. Data in the process design engineering package should include material and energy balances, estimate of utilities, process flow diagrams showing major process lines, equipment and material balances, piping and instrument diagrams showing process piping, line sizes, vessel sizes, skirt heights and instrumentation, reference drawings for each process unit with applicable standard drawings for individual process units, design specification for each piece of equipment (supported with dimensioned drawings where applicable) giving operating and design conditions, materials of construction and process conditions, plot plan layout, detailed specification of all offsites facilities including storage tanks and utility system, and process start-up and operating instructions in sufficient detail for the general contractor to prepare operating manuals.

B. Project implementation arrangements and schedule

(1) Design of organizational and administrative arrangements for the efficient management and supervision of project construction and operations, including a detailed assessment of needs of foreign staff and consultants by categories and by duration;

(2) Estimate of total additional staffing requirements for the new facilities including possible sources, and provision of a training program to improve staff capabilities and total operating efficiency;

(3) Development of a refinery operations management agreement incorporating operating management requirements of the proposed modifications, existing facilities and available personnel;

(4) Development of a practical economic and expedient plan for the implementation of the project, including realistic and detailed time schedule for project implementation; and

(5) Preparation of Invitation to Bid (ITB) documents.

C. Capital and operating cost estimate

(1) Detailed revised estimates of the project capital cost broken down into foreign exchange and local costs and further into the following categories: equipment, utilities, infrastructure, offsites, freight, engineering, erection, construction, pre-operating costs, customs duties, physical and price contingencies, interest during construction and permanent working capital;

(2) Expenditure/disbursement schedule; and

(3) Detailed estimate of operating cost broken down into local and foreign exchange costs, and showing specific consumption of all inputs and utilities; assumptions used for the estimates should be included.

D. Financing

(1) Develop possible sources of financing for the project, including internal cash generation, additional equity, loans and suppliers' credits and the terms and conditions under which each source of financing could be secured; and

(2) Preparation of a financing plan for the project based on the source and contributions established in (1) above.

E. Financial and economic analysis

(1) Evaluation of financial viability of the overall project on the basis of discounted cash flow projections and

internal financial rate of return calculations. The assumptions used in the financial evaluation should be fully explained. The computation should include a risk analysis to evaluate the sensitivity of the project to critical factors;

(2) Evaluation of indirect benefits by natural gas substitution and foreign exchange savings;

(3) Evaluation of economic viability of the overall project on the basis of net present value and economic rate of return. For this purpose, all inputs and outputs should be evaluated at their economic opportunity cost, rather than at domestic prices which may reflect market imperfections. For internationally tradeable goods and services, c.i.f. international prices can be used as representative of opportunity costs. Appropriate risk analyses should also be made; the assumptions used in the evaluation should be fully explained;

(4) Estimate of net foreign exchange savings of Thailand due to the project;

(5) Projected financial statements (balance sheet, income statements and cash flows) for 15 years, in current prices; and

(6) Evaluation of impact of the project on the region of the country in which the project is located and identification of direct and indirect social and economic benefits. Possible changes in some of the parameters of the project and its infrastructure that could have favorable impact on the region should be considered, including analysis of the social and economic benefits and cost of these changes in order to permit a decision on the desirability of executing them.

Industry Department
April 1985

ANNEX 6-1

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

ESTIMATED SCHEDULE OF DISBURSEMENT
(US$ thousand)

Bank Fiscal Year and Quarter	Estimated Disbursements		Annual Disb. as % of Total Loan
	By end of Quarter	Cumulative	
1986			
September 30, 1985	6,340	6,340	
December 31, 1985	2,433	8,773	
March 31, 1986	3,600	12,373	
June 30, 1986	2,600	14,973	17.6
1987			
September 30, 1986	5,800	20,773	
December 31, 1986	6,933	27,706	
March 31, 1987	2,215	29,921	
June 30, 1987	9,000	38,921	28.2
1988			
September 30, 1987	5,320	44,241	
December 31, 1987	4,647	51,977	
March 31, 1988	4,895	56,872	
June 30, 1988	3,895	60,767	25.7
1989			
September 30, 1988	3,590	64,357	
December 31, 1988	4,647	69,004	
March 31, 1989	3,800	72,804	
June 30, 1989	3,840	76,644	18.7
1990			
September 30, 1989	3,000	79,644	
December 31, 1989	2,356	82,000	
March 31, 1990	1,500	83,500	
June 30, 1990	1,500	85,000	9.8

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THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

ASSUMPTIONS FOR FINANCIAL ANALYSIS

A. Production

1. Capacity utilization of the crude distillation units is expected to increase from the current 70% to 95% by 1992 and the succeeding years. In addition, refined products yield is expected to improve from 94 volume % to 96%. The comparative volume of net production and product yield with (1992) and without (1985) the Project are shown in Chapter VIII. The crude mix and the financial cost per barrel of crude used in the analysis are as follows:

	Volume %	March 1985 Actual Financial Cost US$/bbl
Arabian Light	37.8	29.82
Arabian Medium	13.3	28.23
Arabian Heavy	13.3	26.83
Condensates	6.7	27.49
Phet Crude	28.9	27.19
	100.0	28.29 a/

a/ Weighted average at 60°F.

2. The processing costs per barrel of crude used in the analysis were based on the current level of expenses, as follows: chemicals, US$0.08; power, US$0.06; lead, US$0.14; and transhipment, US$0.23. Labor cost amounts to about US$3.5 million per year. This was assumed to increase by 20-30% in real terms and be in line with the pay scales in the industry in Thailand. Repairs and maintenance costs on new equipment were calculated at 1.5% of project cost; those on existing equipment were estimated at US$2.7 million per year. Depreciation was calculated on straight line basis over 15 years.

B. Sales

3. The ex-refinery product prices used in the analysis were the March 1985 levels, as follows:

	US$/bbl
LPG	30.64
Premium Gasoline	36.88
Regular Gasoline	33.76
Kerosene/Jet Fuel	35.68
Diesel Oil	34.42
Fuel Oil	28.65

These prices were assumed to decline in real terms by 6.8% in 1986, and increase by 0.9% p.a. during 1986-90 and 4.9% p.a. during 1990-95, in accordance with Bank projections.

C. Financial Costs

4. Interest on the Bank loan was calculated at 9.3% plus 10% guarantee fee. Interest on export credits and commercial borrowings were calculated at 8% and 14%, respectively.

Industry Department
April 1985

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

BANGCHAK PETROLEUM COMPANY LTD.

PROJECTED BALANCE SHEET

(IN MILLION US DOLLARS)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
ASSETS											
CURRENT ASSETS:											
CASH	1.00	1.15	1.29	1.52	1.77	2.02	2.23	2.56	2.71	2.87	3.04
ACCOUNTS RECEIVABLE	62.96	73.51	82.77	99.40	117.25	137.94	152.24	177.37	188.01	199.29	211.25
INVENTORIES											
CRUDE OIL	70.71	82.58	92.98	111.62	131.69	152.61	168.44	196.20	207.97	220.45	233.68
FINISHED GOODS	9.57	11.17	12.58	15.07	17.75	20.80	23.14	26.87	28.48	30.19	32.00
OTHERS	4.83	5.30	5.79	6.39	6.95	7.46	7.96	8.56	9.07	9.61	10.19
TOTAL INVENTORIES	85.11	99.05	111.35	133.08	156.39	180.87	199.54	231.63	245.52	260.25	275.87
TOTAL CURRENT ASSETS	149.07	173.71	195.41	234.00	275.41	320.83	354.01	411.56	436.24	462.41	490.16
GROSS FIXED ASSETS	89.79	121.78	162.90	196.85	218.80	218.80	218.80	218.80	218.80	218.80	218.80
ACCUMULATED DEPRECIATION	5.29	10.58	15.87	21.16	26.45	37.73	55.00	72.27	89.54	106.81	124.08
NET FIXED ASSETS	84.50	111.20	147.03	175.69	192.35	181.07	163.80	146.53	129.26	111.99	94.72
TOTAL ASSETS	233.57	284.91	342.44	409.69	467.76	501.90	517.81	558.09	565.50	574.40	584.88
LIABILITIES & STOCKHOLDERS EQUITY											
CURRENT LIABILITIES:											
ACCOUNTS PAYABLE	37.98	44.35	49.93	59.94	70.72	81.96	90.46	105.37	111.69	118.39	125.49
SHORT-TERM LOANS	54.55	66.07	74.55	92.64	112.40	131.75	141.68	162.79	155.22	143.77	125.59
CURRENT PORTION OF LONG-TERM DEBT	-	-	-	-	8.39	14.18	14.18	14.18	14.18	11.58	11.58
TOTAL CURRENT LIABILITIES	92.53	110.42	124.48	152.58	191.51	227.89	246.32	282.34	281.09	273.74	262.66
LONG-TERM DEBT:											
PAYABLE TO IBRD	8.77	27.70	51.97	72.00	80.75	72.25	63.75	55.25	46.75	38.25	29.75
PAYABLE TO EXPORT CREDITORS	3.18	10.04	18.83	26.09	29.26	26.19	23.10	20.02	16.94	13.86	10.78
PAYABLE TO COMMERCIAL BANKS	1.34	4.24	7.95	11.01	10.40	7.80	5.20	2.60	-	-	-
TOTAL LONG-TERM DEBT	13.29	41.98	78.75	109.10	120.41	106.23	92.05	77.87	63.69	52.11	40.53
STOCKHOLDERS EQUITY:											
CAPITAL STOCK	127.50	130.80	135.15	138.75	141.00	141.00	141.00	141.00	141.00	141.00	141.00
RETAINED EARNINGS	0.25	1.71	4.06	9.26	14.84	26.78	38.44	56.88	79.72	107.55	140.69
TOTAL STOCKHOLDERS EQUITY	127.75	132.51	139.21	148.01	155.84	167.78	179.44	197.88	220.72	248.55	281.69
TOTAL LIABILITIES AND RETAINED EARNINGS	233.57	284.91	342.44	409.69	467.76	501.90	517.81	558.09	565.50	574.40	584.88
CURRENT RATIO	1.61	1.57	1.57	1.53	1.44	1.41	1.44	1.46	1.55	1.69	1.87
DEBT/EQUITY RATIO:											
DEBT	0.09	0.24	0.36	0.42	0.44	0.39	0.34	0.28	0.22	0.17	0.13
EQUITY	0.91	0.76	0.64	0.58	0.56	0.61	0.66	0.72	0.78	0.83	0.87

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

BANGCHAK PETROLEUM COMPANY LTD.

PROJECTED INCOME STATEMENT

(IN CURRENT MILLION US DOLLARS)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
CRUDE RUN (MMBBLS)	16.61	17.79	17.79	18.98	20.17	21.35	21.35	22.54	22.54	22.54	22.54
AVE. VALUE OF PRODS. (US$/BBL CRUDE)	30.75	33.51	37.73	42.48	47.16	52.40	57.83	63.83	70.44	77.75	85.84
CRUDE COST (US$/BBL)	28.78	31.37	35.32	39.75	44.14	48.31	53.32	58.84	64.94	71.68	79.13
GROSS REFINING MARGIN	1.97	2.14	2.41	2.73	3.02	4.09	4.51	4.99	5.50	6.07	6.71
NET SALES	510.78	596.07	671.16	806.19	951.23	1,118.66	1,234.75	1,438.65	1,587.64	1,752.58	1,934.73
COST OF GOODS SOLD											
VARIABLE COSTS:											
CRUDE OIL	478.04	558.07	628.34	754.46	890.30	1,031.42	1,138.38	1,326.25	1,463.75	1,615.67	1,783.59
CHEMICALS	3.72	4.34	4.89	5.87	6.92	8.02	8.85	10.31	11.38	12.56	13.87
UTILITIES	1.01	1.18	1.33	1.60	1.89	2.19	2.41	2.81	3.10	3.43	3.78
TRANSHIPMENT	3.89	4.54	5.11	6.13	7.24	8.39	9.26	10.78	11.90	13.14	14.50
TOTAL VARIABLE COSTS	486.66	568.13	639.67	768.06	906.35	1,050.02	1,158.90	1,350.15	1,490.13	1,644.80	1,815.74
FIXED COSTS:											
LABOR	3.54	4.63	5.64	6.35	7.05	7.72	8.52	9.40	10.38	11.45	12.64
REPAIRS & MAINTENANCE	2.94	3.20	3.51	4.06	4.51	8.71	9.61	10.61	11.71	12.92	14.27
REFINERY LAND LEASE	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.09
DEPRECIATION	5.29	5.29	5.29	5.29	5.29	11.28	17.27	17.27	17.27	17.27	17.27
TOTAL FIXED COSTS	11.81	13.17	14.59	15.76	16.91	27.77	35.47	37.35	39.44	41.72	44.27
COST OF GOODS SOLD	498.47	581.30	654.26	783.82	923.26	1,077.79	1,194.37	1,387.50	1,529.57	1,686.52	1,860.01
GROSS PROFIT ON SALES	12.31	14.77	16.90	22.37	27.97	40.87	40.38	51.15	58.07	66.06	74.72
OPERATING & ADMIN. EXPENSES	4.74	5.17	5.82	6.55	7.27	7.96	8.78	9.69	10.70	11.81	13.03
NET OPERATING PROFIT	7.57	9.60	11.08	15.82	20.70	32.91	31.60	41.46	47.37	54.25	61.69
INTEREST EXPENSE	7.16	7.16	7.16	7.16	11.40	13.01	12.16	10.73	9.31	7.87	6.45
NET PROFIT BEFORE TAX	0.41	2.44	3.92	8.66	9.30	19.90	19.44	30.73	38.06	46.38	55.24
INCOME TAXES	0.16	0.98	1.57	3.46	3.72	7.96	7.78	12.29	15.22	18.55	22.10
NET PROFIT AFTER TAX	0.25	1.46	2.35	5.20	5.58	11.94	11.66	18.44	22.84	27.83	33.14

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

BANGCHAK PETROLEUM COMPANY, LTD.

PROJECTED CASH FLOW STATEMENT

(IN MILLION US DOLLARS)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
SOURCES OF CASH											
OPERATIONS:											
NET INCOME	0.25	1.46	2.35	5.20	5.58	11.94	11.66	18.44	22.84	27.83	33.14
DEPRECIATION	5.29	5.29	5.29	5.29	5.29	11.28	17.27	17.27	17.27	17.27	17.27
TOTAL CASH FROM OPERATIONS	5.54	6.75	7.64	10.49	10.87	23.22	28.93	35.71	40.11	45.10	50.41
LONG-TERM BORROWINGS:											
IBRD	8.77	18.93	24.27	20.03	13.00	-	-	-	-	-	-
EXPORT CREDITS	3.18	6.86	8.79	7.26	4.71	-	-	-	-	-	-
COMMERCIAL BANKS	1.34	2.90	3.71	3.06	1.99	-	-	-	-	-	-
TOTAL LONG-TERM BORROWINGS	13.29	28.69	36.77	30.35	19.70	-	-	-	-	-	-
EQUITY INVESTMENTS	1.50	3.30	4.35	3.60	2.25	-	-	-	-	-	-
SHORT-TERM LOANS	-	11.52	8.48	18.09	11.37	13.56	9.93	21.11	-	-	-
TOTAL SOURCES OF CASH	20.33	50.26	57.24	62.53	44.19	36.78	38.86	56.82	40.11	45.10	50.41
USES OF CASH											
REPAYMENT OF LONG-TERM LOANS:											
IBRD	-	-	-	-	-	4.25	8.50	8.50	8.50	8.50	8.50
EXPORTS CREDITORS	-	-	-	-	-	1.54	3.08	3.08	3.08	3.08	3.08
COMMERCIAL BANKS	-	-	-	-	-	2.60	2.60	2.60	2.60	2.60	-
TOTAL REPAYMENT	-	-	-	-	-	8.39	14.18	14.18	14.18	14.18	11.58
INVESTMENTS IN FIXED ASSETS	14.79	31.99	41.12	33.95	21.95	-	-	-	-	-	-
INCREASE IN WORKING CAPITAL	5.54	18.27	16.12	28.58	22.24	28.39	24.68	42.64	18.36	27.04	32.10
TOTAL USES OF CASH	20.33	50.26	57.24	62.53	44.19	36.78	38.86	56.82	32.54	41.22	43.68
ANNUAL SURPLUS CASH	-	-	-	-	-	-	-	-	7.57	3.88	6.73
ACCUMULATED SURPLUS CASH	-	-	-	-	-	-	-	-	7.57	11.45	18.18

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ANNEX 7-3

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

COST AND BENEFIT STREAMS FOR FINANCIAL RATE OF RETURN a/ CALCULATION
(in March 1985 US$)

	Capital Costs	Benefits: Refined Products	Benefits: Sulphur	Costs: Crude Oil b/	Costs: Processing Costs	Costs: Other Costs	Net Stream
1985	10.2	-	-	-	-	-	(10.2)
1986	22.4	33.4	-	31.4	0.6	0.1	(21.1)
1987	29.5	69.4	-	65.2	1.1	0.1	(26.5)
1988	24.4	108.1	-	101.2	1.8	1.1	(20.4)
1989	15.2	186.5	-	174.2	3.2	0.2	(6.3)
1990	-	241.2	4.0	215.6	4.0	1.3	24.3
1991	-	291.1	4.0	262.0	4.7	-	28.4
1992	-	345.7	4.1	311.9	5.6	1.9	30.4
1993	-	359.9	4.1	324.8	5.9	3.0	30.3
1994	-	374.8	4.2	338.3	6.1	4.1	30.5
1995	-	390.3	4.2	352.3	6.3	5.3	30.6
1996	-	406.3	4.3	366.7	6.6	5.5	31.8
1997	-	423.0	4.3	381.8	6.8	5.7	33.0
1998	-	440.3	4.4	397.4	7.1	6.0	34.2
1999	-	458.4	4.4	413.7	7.4	6.2	35.5
2000	-	477.2	4.5	430.7	7.7	6.5	36.8
2001	-	496.7	4.6	448.4	8.0	6.7	38.2

Net Present Value: US$31.1 million
Financial Rate of Return: 20.8%

a/ After tax.
b/ Including refinery fuel and losses.

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THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

ASSUMPTIONS USED IN ECONOMIC ANALYSIS

A. General

1. The economic rates of return for the Project are calculated in March 1985 US$. Project life was assumed at 15 years with a terminal-value credit of 10%.

B. Benefits

2. The annual economic benefits that will be derived from the Project will come principally from: (a) increased production of refined products resulting from higher capacity utilization; and (b) savings from lower energy consumption. The Project will increase to and stabilize capacity utilization of the crude distillation units at about 95%. The incremental throughput and production after completion of the project are as follows:

Comparative Crude and Product Slate--Before and After Project, 1990
(mmbbls)

	Before Project	After Project	Increment
Crude Throughput	14.24	21.35	7.11
Capacity Utilized a/	60%	90%	30%
Refined Products:			
LPG	0.43	0.62	0.19
Premium Gasoline	1.03	1.63	0.60
Regular Gasoline	2.06	2.74	0.68
Kerosene/Jet	1.91	3.03	1.12
Diesel Oil	3.35	6.37	3.02
Fuel Oil	4.61	6.11	1.50
	13.39	20.50	7.11
Net Product Yield	94%	96%	

a/ Based on design capacity of 23.725 mmbbls/year.

3. The economic value assigned to the incremental production and fuel savings were based on the Singapore/Bahrain product to crude price ratios projected by the Bank and shown in Annex 8-2. The full benefits from the incremental production and full savings are expected to

be earned by 1990. In addition to production of higher volume of refined products, about 30,000 tpy of sulphur is expected to be recovered through upgrading of the desulphurization facilities. The netback value to Thailand of sulphur exports is estimated at US$120/ton in March 1985 terms.

C. Operating Costs

4. The economic cost of crude was based on the weighted average CIF price currently paid by Thailand and amounts to about US$28.1/bbl. The cost of crude was assumed to decline in real terms by 6.8% in 1986, and increase by 0.9% p.a. during 1986-90 and 4.1% during 1990-95, in accordance with Bank projections. Other operating costs considered in the economic analysis of the Project include chemicals and utilities and repairs and maintenance incremental to the Project.

D. Capital Costs

5. The economic capital cost of the Project was derived from the financial capital cost, excluding interest during construction, after deducting import duties and local taxes on imported equipment and other items. The phase of expenditures was assumed at 10% in 1985, 22% in 1986, 29% in 1987, 24% in 1988, and 15% in 1989.

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THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

INCREMENTAL ECONOMIC COSTS AND BENEFITS
(in March 1985 US$ million)

	Costs			Benefits	
	Capital Costs	Crude Oil	Processing Costs	Refined Products	Net (Cost)/ Benefit
1985	9.1	-	-	-	(9.1)
1986	20.0	31.2	0.4	33.8	(17.8)
1987	26.4	62.9	0.9	68.5	(21.6)
1988	21.8	95.0	1.3	105.3	(12.6)
1989	13.6	159.6	2.2	175.2	(0.2)
1990		193.3	2.6	217.4	21.5
1991		236.7	3.2	264.6	24.7
1992		283.6	3.9	316.8	29.4
1993		297.4	4.1	335.0	33.5
1994		312.0	4.3	354.5	38.2
1995		327.3	4.5	374.9	43.1
1996		343.4	4.6	393.2	45.2
1997		360.1	4.8	412.5	47.5
1998		377.8	5.0	432.7	49.9
1999		396.3	5.3	453.9	52.3
2000		415.8	5.6	476.2	54.8
2001		436.2	5.9	499.5	57.5
2002		457.5	6.2	524.0	60.3
2003		479.9	6.5	549.6	63.2
2004		503.4	6.7	576.6	75.5

Net Present Value: US$80 million
Economic Rate of Return: 28.4%

THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

Product/Crude Price Ratios - Singapore
(weight basis)

	Historical						Projected					
	PRE	REG	KER	DO	FO		LPG	PRE	REG	KER	DO	FO
1975	1.88	1.54	1.52	1.27	0.85	1985	1.25	1.21	1.13	1.23	1.13	0.83
1976	1.82	1.50	1.50	1.31	0.75	1986	1.26	1.22	1.15	1.23	1.14	0.82
1977	1.82	1.52	1.49	1.30	0.81	1987	1.26	1.23	1.16	1.23	1.15	0.81
1978	1.75	1.46	1.51	1.29	0.80	1988	1.27	1.25	1.18	1.23	1.16	0.80
1979	2.10	1.82	1.81	1.67	0.95	1989	1.28	1.26	1.20	1.23	1.17	0.79
1980	1.70	1.43	1.70	1.41	0.67	1990	1.28	1.27	1.22	1.24	1.18	0.78
1981	1.68	1.46	1.68	1.48	0.83	1991	1.30	1.29	1.24	1.26	1.19	0.78
1982	1.47	1.26	1.51	1.32	0.70	1992	1.31	1.30	1.25	1.28	1.20	0.78
1983	1.58	1.31	1.39	1.24	0.82	1993	1.32	1.32	1.27	1.29	1.21	0.78
1984	1.46	1.21	1.25	1.16	0.84	1994	1.34	1.33	1.29	1.31	1.22	0.78
						1995	1.35	1.35	1.30	1.33	1.23	0.78

Crude and Product Prices

	Crude Price FOB-SNG	Product Prices, FOB-SNG (US$/bbl)						Crude Price CIF-BKK	Product Prices, CIF-BKK (US$/bbl)					
Year	(US$/ton)	LPG	PRE	REG	KER	DO	FO	(US$/bbl)	LPG	PRE	REG	KER	DO	FO
1985	208.80	24.86	29.72	29.49	32.93	31.05	25.87	28.10	25.34	30.31	30.12	33.57	31.71	26.62
1986	194.60	23.35	27.93	27.97	30.69	29.19	23.82	26.19	23.79	28.48	28.55	31.29	29.80	24.52
1987	196.33	23.56	28.41	28.47	30.96	29.71	23.74	26.43	24.01	28.96	29.06	31.56	30.33	24.44
1988	198.12	23.96	29.14	29.22	31.24	30.24	23.66	26.67	24.41	29.70	29.81	31.85	30.86	24.37
1989	199.90	24.37	29.63	29.99	31.52	30.77	23.57	26.91	24.83	30.19	30.59	32.13	31.40	24.28
1990	201.70	24.59	30.14	30.76	32.07	31.32	23.48	27.15	25.05	30.71	31.36	32.69	31.95	24.20
1991	211.58	26.20	32.11	32.79	34.18	33.13	24.63	28.48	26.68	32.71	33.42	34.83	33.80	25.39
1992	221.95	27.69	33.95	34.68	36.42	35.04	25.84	29.88	28.20	34.57	35.34	37.10	35.74	26.63
1993	232.83	29.27	36.16	36.96	38.51	37.07	27.11	31.34	29.80	36.82	37.66	39.22	37.80	27.94
1994	244.24	31.17	38.22	39.38	41.02	39.21	28.43	32.88	31.73	38.91	40.11	41.77	39.98	29.30
1995	256.21	32.94	40.69	41.63	43.69	41.47	29.83	34.49	33.52	41.41	42.40	44.48	42.28	30.74

Prices in March 1984 US$

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THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

Production Data

With Project

Year	Cap. %	Feed (mm-bbls)	Product Yield (Vol. %)						Production (mmbbls)						
			LPG	PRE	REG	KER	DO	FO	LPG	PRE	REG	KER	DO	FO	Total
1985	0.70	16.61	3.00	7.20	14.50	13.40	23.50	32.40	0.50	1.20	2.41	2.23	3.90	5.38	15.62
1986	0.75	17.80	3.00	7.28	14.50	13.56	24.65	31.41	0.53	1.30	2.58	2.41	4.39	5.59	16.80
1987	0.75	17.80	3.00	7.37	14.50	13.72	25.86	30.32	0.53	1.31	2.58	2.44	4.60	5.40	16.86
1988	0.80	18.98	3.00	7.46	14.50	13.88	27.12	29.19	0.57	1.42	2.75	2.63	5.15	5.54	18.06
1989	0.85	20.17	3.00	7.55	14.50	14.05	28.45	27.98	0.61	1.52	2.92	2.83	5.74	5.64	19.26
1990	0.90	21.36	2.88	7.63	12.84	14.20	29.83	28.62	0.62	1.63	2.74	3.03	6.37	6.11	20.50
1991	0.90	21.36	2.88	7.63	12.84	14.20	29.83	28.62	0.62	1.63	2.74	3.03	6.37	6.11	20.50
1992	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
1993	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
1994	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
1995	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
1996	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
1997	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
1998	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
1999	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
2000	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63
2001	0.95	22.54	2.88	7.63	12.84	14.20	29.83	28.62	0.65	1.72	2.89	3.20	6.72	6.45	21.63

Without Project

	Cap. %	Feed (mm-bbls)	Product Yield (Vol. %)						Production (mmbbls)						
			LPG	PRE	REG	KER	DO	FO	LPG	PRE	REG	KER	DO	FO	Total
1985	0.70	16.61	3.00	7.20	14.50	13.40	23.50	32.40	0.50	1.20	2.41	2.23	3.90	5.38	15.62
1986	0.70	16.61	3.00	7.20	14.50	13.40	23.50	32.40	0.50	1.20	2.41	2.23	3.90	5.38	15.62
1987	0.65	15.42	3.00	7.20	14.50	13.40	23.50	32.40	0.46	1.11	2.24	2.07	3.62	5.00	14.50
1988	0.65	15.42	3.00	7.20	14.50	13.40	23.50	32.40	0.46	1.11	2.24	2.07	3.62	5.00	14.50
1989	0.60	14.24	3.00	7.20	14.50	13.40	23.50	32.40	0.43	1.03	2.06	1.91	3.35	4.61	13.39
1990	0.60	14.24	3.00	7.20	14.50	13.40	23.50	32.40	0.43	1.03	2.06	1.91	3.35	4.61	13.39
1991	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1992	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1993	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1994	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1995	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1996	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1997	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1998	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
1999	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
2000	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
2001	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
2002	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
2003	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27
2004	0.55	13.05	3.00	7.20	14.50	13.40	23.50	32.40	0.39	0.94	1.89	1.75	3.07	4.23	12.27

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THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

ESTIMATED FOREIGN EXCHANGE SAVINGS
(March 1985 US$ millions)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Gross Foreign Exchange Savings:											
Import Value of Production:											
With Project	602	637	711	751	795	840	881	925	970	1,017	1,067
Without Project	388	376	398	420	444	470	493	517	542	569	597
Increment	214	261	313	331	351	370	388	408	428	448	470
Less: Foreign Exchange Expenses:											
Crude Imports:											
With Project	580	608	674	706	741	777	816	855	897	941	987
Without Project	387	372	390	409	429	450	472	495	520	545	572
Increment	193	236	284	297	312	327	344	360	377	396	415
Principal Repayment of Foreign Debt	8	14	14	14	14	12	12	12	12	12	6
Interest on Foreign Debt	12	11	11	9	8	6	5	4	3	2	1
Net Foreign Exchange Savings											
Annual	1	-	4	11	17	25	27	32	36	38	48
Accumulated	1	1	5	16	33	58	85	117	153	191	239

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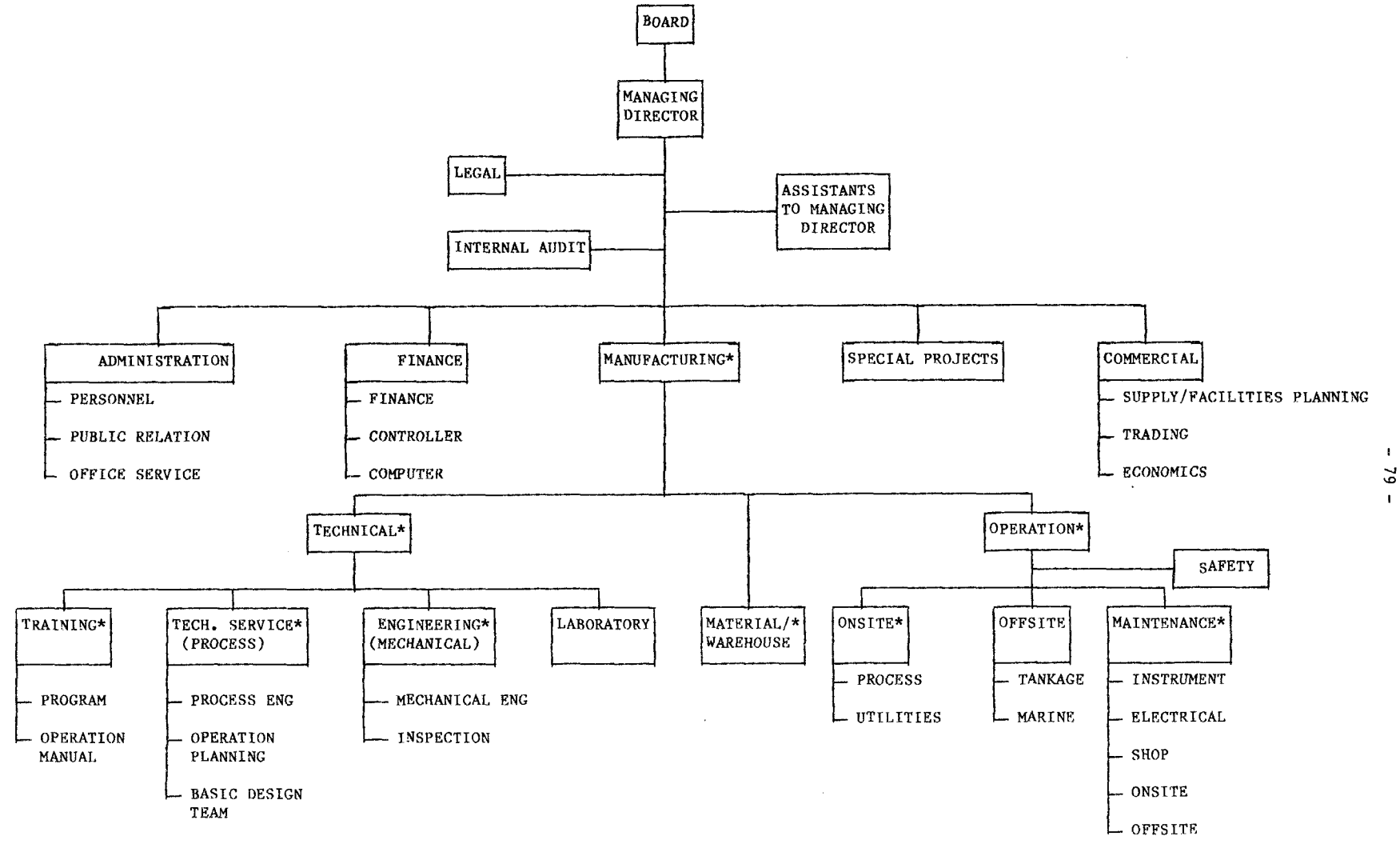
THAILAND - BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

BCP ORGANIZATION



* Denotes positions occupied by Caltex management and operations team.

CHART 1

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THAILAND -- BANGCHAK OIL REFINERY RESTRUCTURING PROJECT

IMPLEMENTATION SCHEDULE

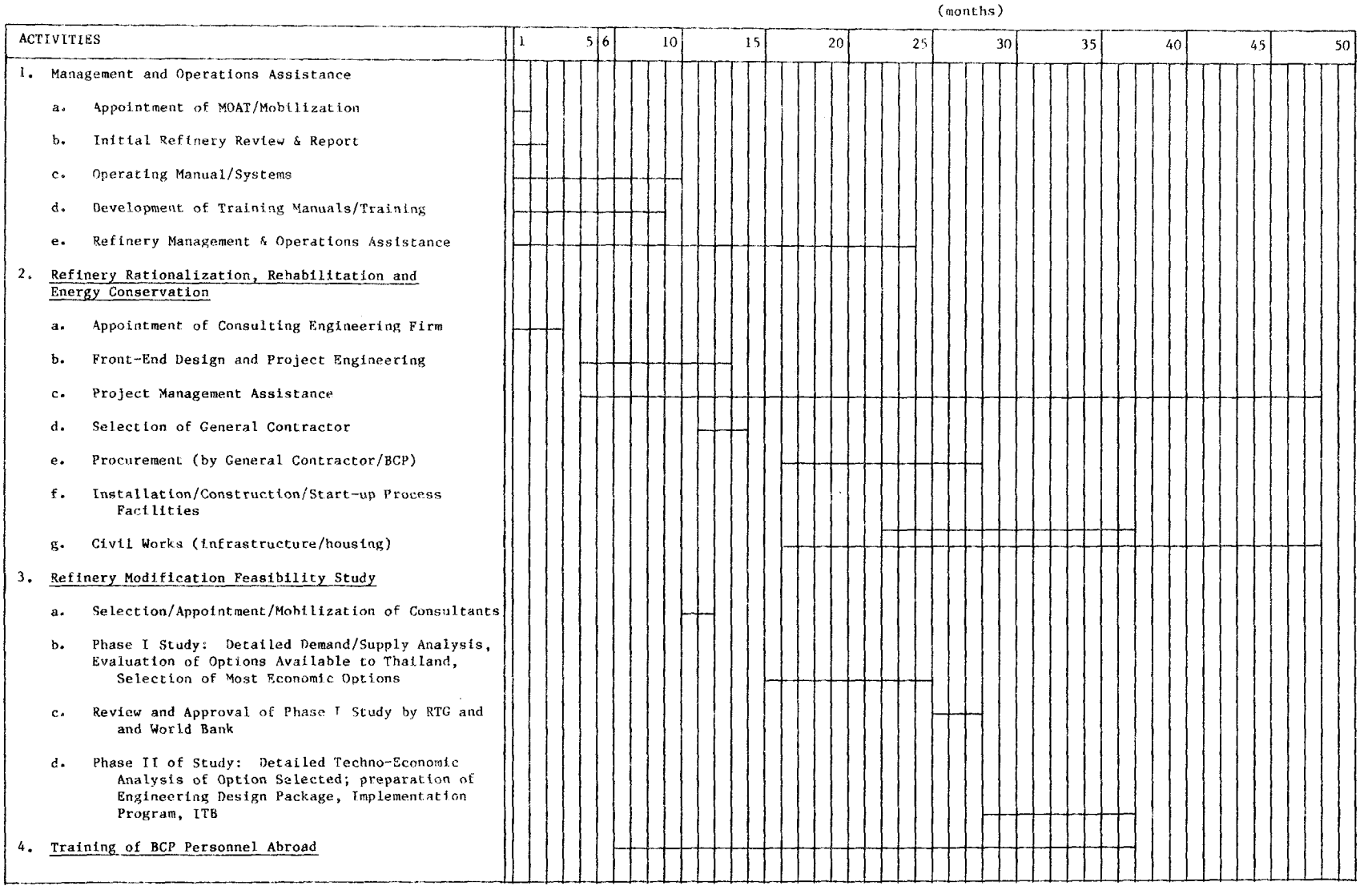

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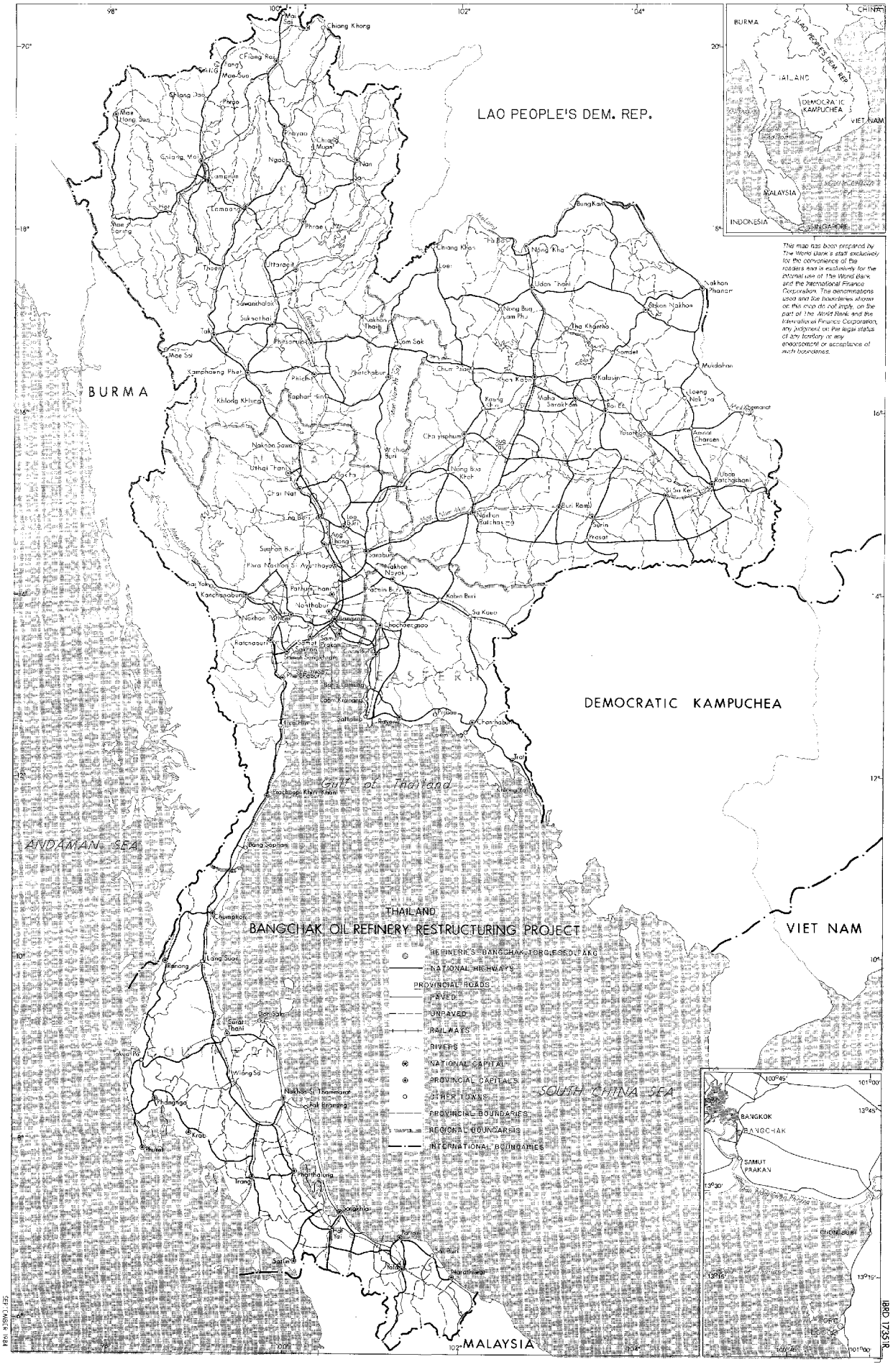
CHART 2



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