Table 2.11 ELECTRICITY DEMAND PROJECTION FOR STUDY AREA AND SOUTH

Peak Demand (MW)

	1982	1991	Annual Av. (growth rate)
PHUNPIN (SURAT)	19.55	52.95	11.7/yr
PHUKET 1, 2	21.10	68.33	13.9/yr
PHANGNGA	3.58	9.15	11.0/yr
KRABI	3.21	9.72	13.1/yr
Subtotal	47.44(22.0%)[1)]	140.15(28.0%)[1)]	12.8%/yr
Region 3	216.10(7.4%)[2)]	499.70(8.0%)[2)]	9.16%/yr
Whole Kingdom	2,891.00	6,217.00	8.9%/yr

Energy Demand (GWh)

	1982	1991	Annual Av. (growth rate)
PHUNPIN	104.48	291.83	12.1%/yr
PHUKET	120.17	410.13	14.6%/yr
PHANGNGA	16.96	46.17	11.8%/yr
KRABI	14.99	49.22	14.1%/yr
Subtotal	256.60(22.1%)[1)]	797.35(28.1%)[1)]	13.4%/yr
Region 3*	1,163.70(6.7%)[2)]	2,836.10(7.7%)[2)]	8.7%/yr
Whole Kingdom*	17,490.00	36,929.00	8.7%/yr

Load Factor*

For SA	62.7 (82)	Region 3	61.5% (82)
	60.9 (91)		64.8% (91)

Notes : * Indicates most current projection of March, 1983 made by EGAT, the rest provided by PEA has been approved and adopted by EGAT

1) A share of SA to Region 3 demand

2) A share of Region 3 to Whole Kingdom demand

Source: PEA and EGAT

2.2 PETROLEUM

In view of projecting petroleum demand pattern by petroleum product, the regression analysis has been carried out. In order to overcome the insufficient data base it was attempted to pool national data and subregional data. The results i.e., demand equations are satisfactory as seen in the following section in conforming the constraint of equational signs of demand function.

In the final part of this section, the readers can find comparison of this study's projection with other forecasting materials. In reaching the final demand projection figure, the demand projected by the regression models has been assessed and evaluated in view of envisaged natural gas use and increasing efficiency in petroleum products use especially in transportation sector. For the projection purpose, the assumptions on the independent variables are described in the main report as the Premises for Projection.

2.2.1 Regression Models for Petroleum Product Demand

Gasoline

$$\ln Gas = -6.946 + 1.291\ \ln Y - 0.375\ \ln P - 1.037\ Dummy$$

t-value: 5.394 (lnY), 2.338 (lnP), 1.216 (Dummy)

$R^2 = 0.999$

Diesel

$$\ln De = -1.893 + .813\ \ln Y$$

t-value: 3.739

$R^2 = 0.972$

Kerosene

$$\ln Kero = -4.183 + .606\ \ln Y + 2.306\ Dummy$$

t-value: 2.031 (lnY), 2.186 (Dummy)

$R^2 = 0.995$

Fuel Oil

$$Kero = -3.471 + 0.001\ Y - .412\ P_{Kero} + 28.105\ Dummy$$

t-value: (0.896) (Y), (-0.001) (P_{Kero}), (0.095) (Dummy)

t-value: 3.969 (Y), 0.021 (P_{Kero}), 0.396 (Dummy)

$R^2 = 0.977$

$$\ln Foil = -5.701 + 1.122\ \ln Y - .325\ P_{Foil} - 0.059\ Dummy$$

t-value: (0.993) (lnY), (-0.043) (P_{Foil}), (-0.015) (Dummy)

t-value: 5.338 (lnY), 2.066 (P_{Foil}), 0.076 (Dummy)

$R^2 = 0.999$

LPG

(1.448) (-0.452)

$\ln LPG = -17.152 + 2.011 \ln Y - 2.217$ Dummy

t-value 14.029 4.377

$R^2 = 0.999$

$\ln LPG = -11.608 + 1.386 \ln Y$

t-value 62.074

$R^2 = 0.997$

Y: GRP (GDP)
P: Petroleum product price
Dummy: Dummy variable for pooling

2.2.2 Existing and Team's Projections Compared

The following charts are prepared for the convenience of comparing relativity of current forecasts available in Thailand and to judge relative position of the demand in Upper South.

The following abbreviation is in use.

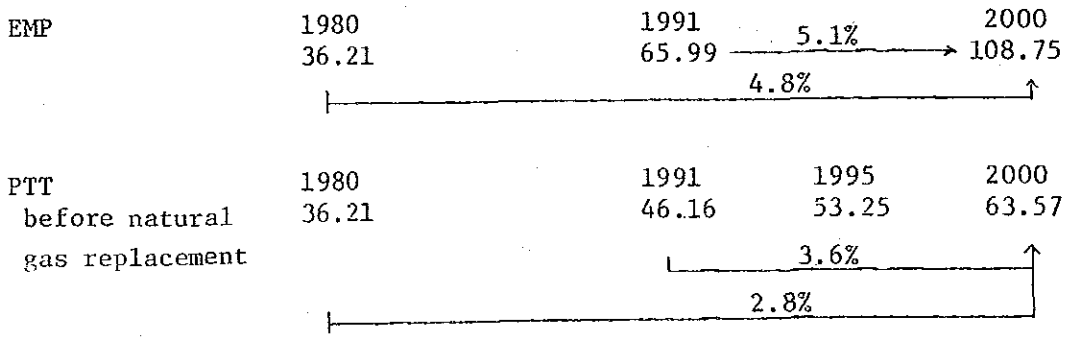
EMP : Energy Master Plan By NEA

PTT : PTT forecast

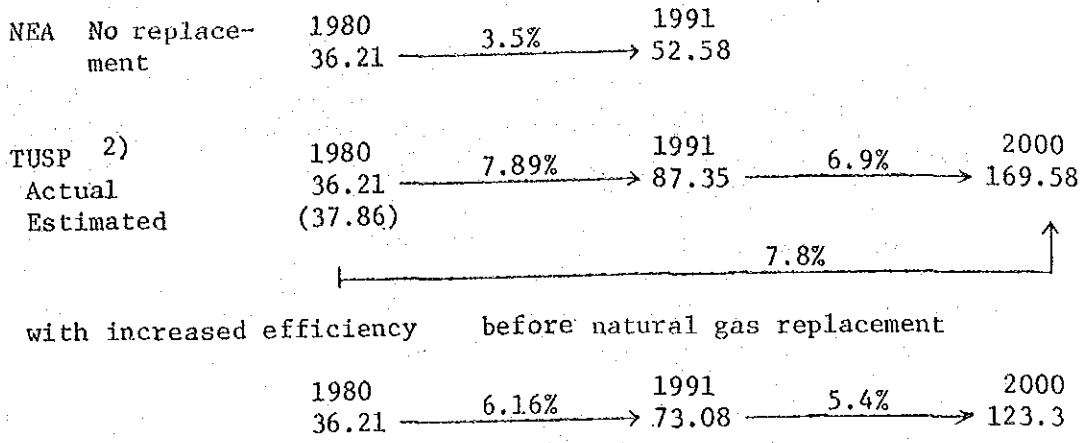
NEA : NEA's own forecast

TUSP : Results of our regression analysis

Gasoline Demand (Unit: KBPD)



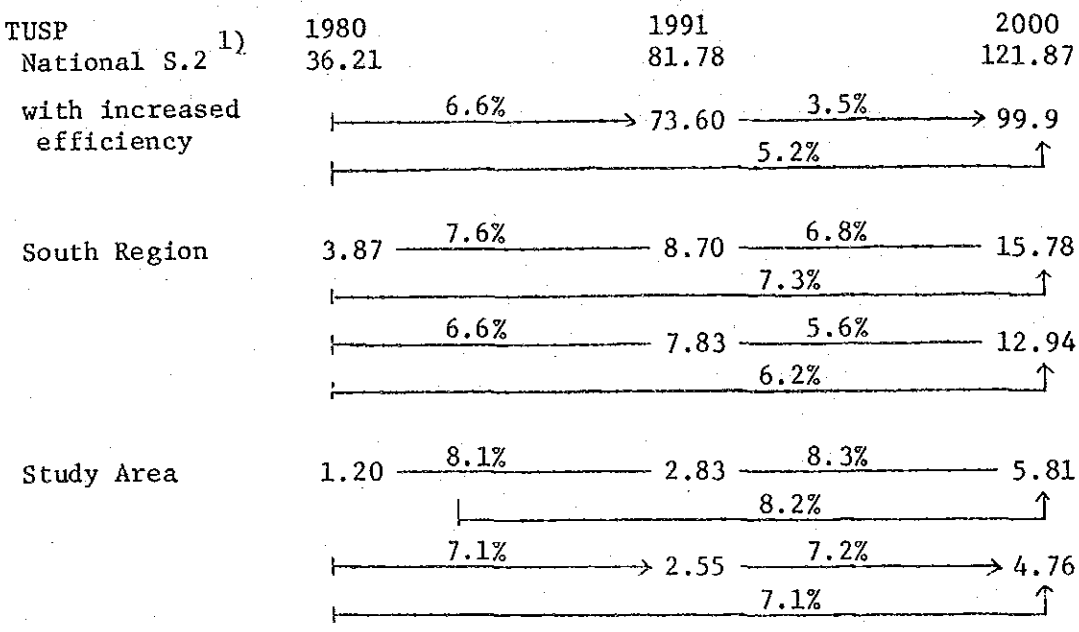
16.4% replacement by LPG (13% growth)



1) Figures in parenthes are those estimated from the model.

2) Assuming annual GDP growth rate of 6.7 percent to the year 2000.

Gasoline Demand (Unit: KBPD)

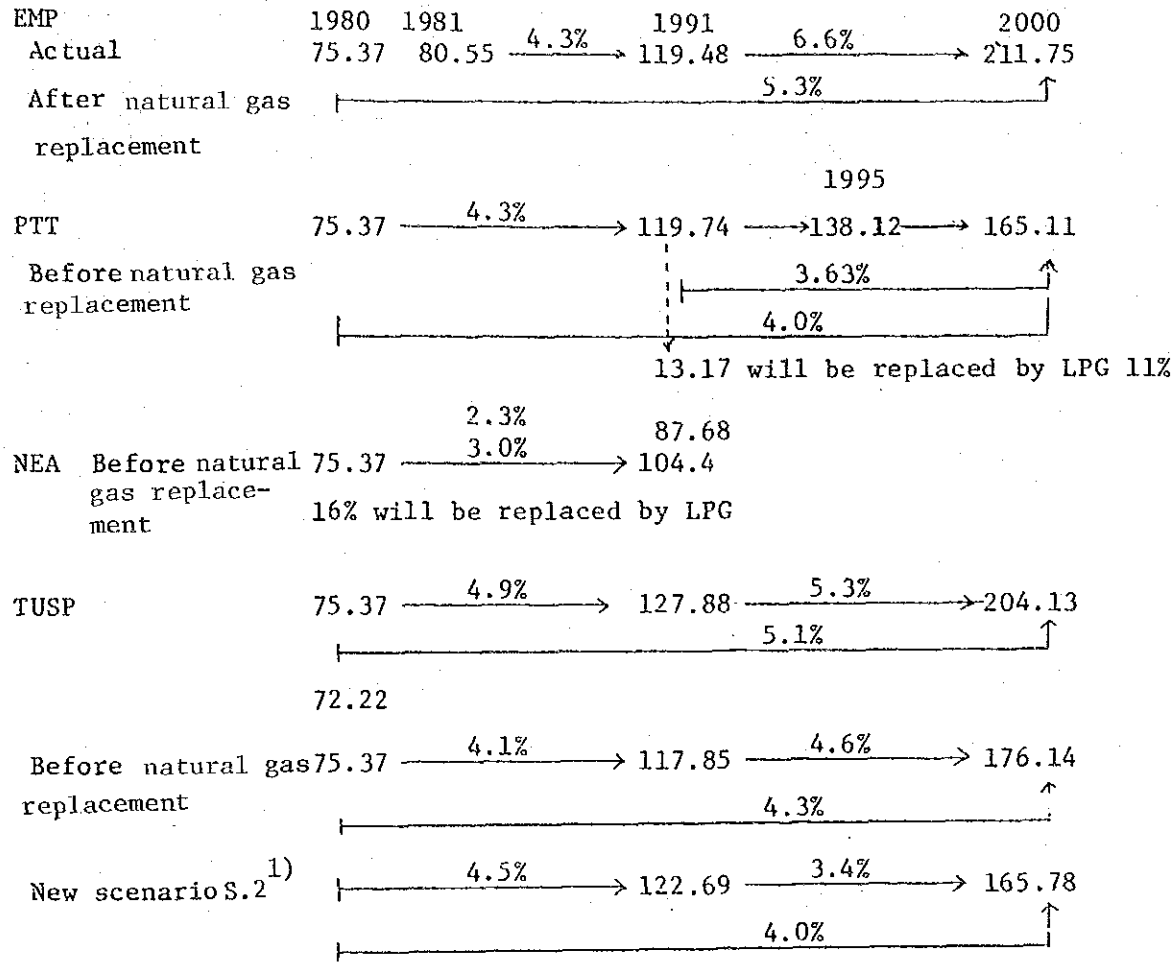


1) Assuming same annual GDP growth rate as SIAM II model.

2) Efficiency of combustion engine is set as 100, 108ans 116 respectively for the year 1980, 1991 and 2000. On average 1.6 % /year improvement is assumed throughout the projection period. For the world average of such indices, OECD/IEA's " World Energy Out-look " assumes 100, 116 and 138 respectively for the year 1980, 1991 and 2000.

Diesel Demand (Unit: KBPD)

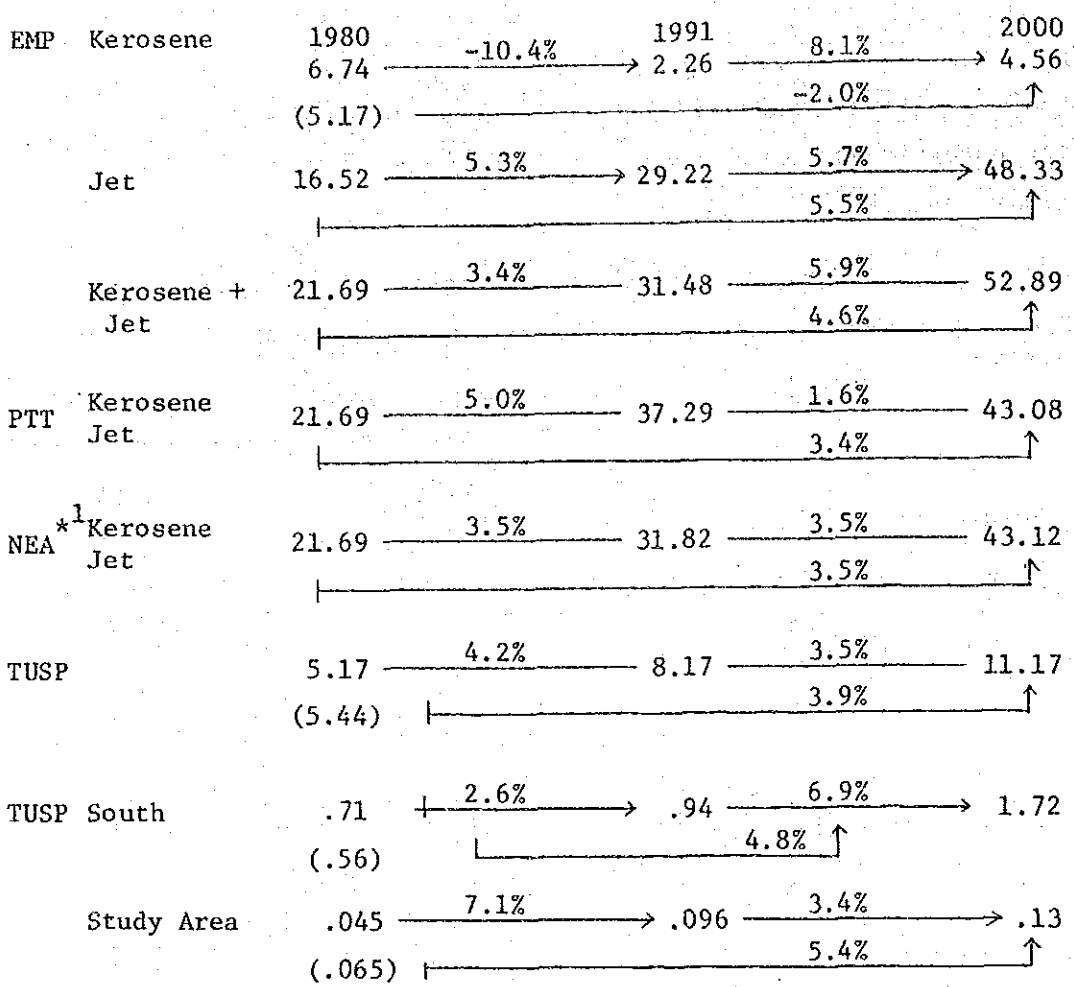
National Level



1) See footnote on the previous page.

Kerosene + Jet (Unit: KBPD)

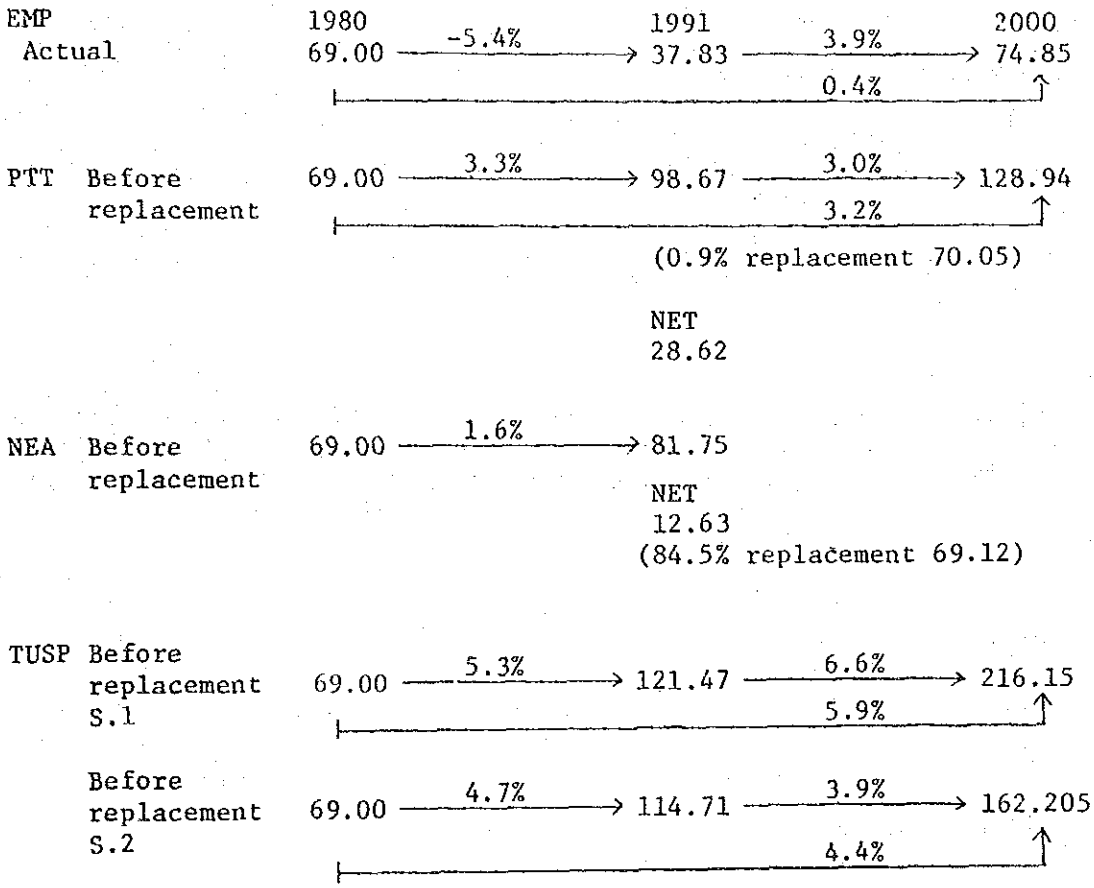
National



Note : Figures in parenthes are those projected from the model.

Fuel Oil (Unit: KBPD)

National



Fuel Oil (Unit: KBPD)

Study Area

TUSP	1980		1991		2000
Study Area	1.11	8.2% →	2.66	7.2% →	4.96
	1.21*[1]	7.8% →			
	(0.13)*[2]				
South Region	1.05*[2]	→	9.29	6.5% →	16.38

Note: *[1] Estimated figure

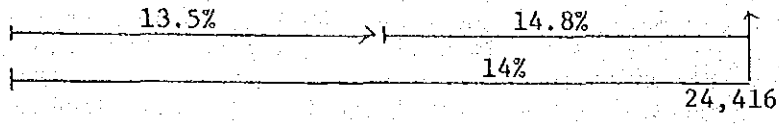
*[2] 1981 figure. For the SA, the sharp drop of fuel oil consumption far apart from historical trend was recorded in 1981 and 1982. The drop of .960 barrel per day (56,000 kl) in Surat Thani was said to be from EGAT's oil fired power plant recession.

Study Area	1980		1991		2000
Study Area	1.11		2.63		5.81
by MFG intensity Analysis		6.1% →	2.13	9.3% →	4.76
		7.6% →			1.13
82% are assumed to be fuel oil			3.23		5.89

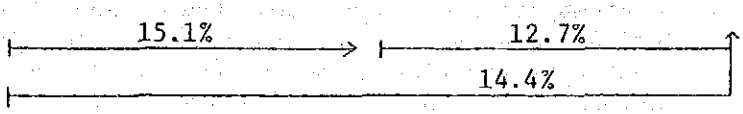
LPG Demand Forecast

SA and South Region

SA	1980	1991		2000
		.42		1.45
10^6 l	5.96	24.098		83.356
10^3 ton	3.4	13.736		47.513



South Thailand	1980	1991		2000
		2.47	13.5	7.74
10^6 l	30,377	143,165		448,990
10^3 ton	17.3	81.6		255.9



2.2.3 LPG

LPG supply program of PTT relies on only gas separation plant with a capacity of 350 MMSCFD, assuming a demand growth rate of 10 percent per year during the period 1991 - 1995. According to this assumption, the national demand for LPG will be 29.73 BPCD or 890,000 tons in 1991, a figure close to the one projected by the World Bank being 800,000 tons. Together with the additional supply from oil refineries, it will still be necessary to import LPG of about 370,000 tons, then.

The price differential between LPG and premium gasoline is 6.91 baht per liter and that between LPG and regular gasoline is 5.41 baht per liter LPG is very cheap fuel for cars though LPG fueled car is a bit inferior to other cars in terms of milage efficiency. For the use of LPG, case costs 120 baht per unit (1981 end) and LPG itself costs 5.7 baht per liter. Its calorific value is 6,357per liter compared to 8,398 per liter of gasoline. Thus LPG's price could be set at 9.1 baht per liter from the viewpoint of keeping its calorific value equal to that of gasoline.

LPG will be compared with other energy sources for home consumption such as charcoal and firewood in view of their rapid price increases. Some consumers make see LPG being cheaper and better if efficiency and easiness in its use are taken into account. In 1982, LPG consumption pattern is as follows, according to PTT data:

Consumption by region:

Bangkok	70%
Central	19%
North	5%
Northeast	3%
South	3%

Consumption by use:

Cooking	65%
Vehicles	21%
Industry	14%

Annual LPG demand growth rate was 16.8 percent (1974 - 81) in the country and 26 percent (1976 - 82). While LPG demand can be estimated by the following Equation 1 in terms of quantitative economics, we adopted the Equation 3 which was derived from the analysis based on the Equation 3, assuming the LPG demand is affected more strongly by income increase.

$$DLPG = f(Y.\ P.) \qquad (1)$$

$$DLPG = f(Y) \qquad (2)$$

$$\ln DLPG = -17.152 + 2.011 \ln Y - 2.217\ D \qquad (3)$$

Where DLPG is LPG demand,

Y is income in terms of GDP or GRP,

P is LPG price and

D is Dummy for pooled data.

At the national level, LPG demand will increase very fast by about 4.3 times during the period 1980 - 1991 and about 13.6 times during the period 1980 - 2000, although PTT's projection is 10 percent higher than that by the World Bank. PTT plans to set up another separation plant with a capacity of 350 MMSCFD. It seems, however, that the plant will actually be constructed after 1992 in view of unsureness in gas supply capacity and demand expansion. On the other hand, the Energy Master Plan (EMP) envisages a maximum utilization and assumes the second separation plant to be completed in 1986. It expects the natural gas production to increase to 994 MMSCFD in 1986. Accordingly EMP forecasts that the LPG demand will increase drastically at an annual rate of 41 percent. Whether this increase will actually take place depends partly on the LPG pricing policy, but the increase seems to be unusually large especially in the transportation sector.

2.3 TRADITIONAL ENERGY

2.3.1 Availability of Firewood

1) Resources

Firewood resources will be supplied from the following forestry group.

(1) Primary forest, including existing and reforested

(2) Secondary forest

(3) Community forest

(4) Mangrove forest

(5) Rubber Plantation

2) Available firewood

(1) Assumption

i Area changed to agricultural land of 366Km^2 was available in 1977. Few area will be converted to agricultural land after 1990.

ii As a by-product of forest maintenance, eight percent of total product will be available for energy source. The proposed primary forest area will be 776Km^2 according to our land use plan.

iii The secondary and the community forest are assumed to be available as follows.

(Unit: Km^2)	Secondary Forest	Community Forest
Tree Crop Area	18% of the area estate type 10% of the area small holder	
Oil Palm Area	582	104.8
Rubber Area	310	31.0
Coconuts and Fruits Area	111	11.1
Paddy Area	112	11.2

iv Mangrove Forest

3m^3/ha/year production

v Area for rubber tree replating is 10,300ha/year after 1991.

vi Land use will be changed as our land use plan recommends.

(2) Assumptions for forestry production and utilization for firewood.

i Maximum matured forest (primary forest) product is considered as $73m^3$/ha.

ii Average annual product of forest in any type is $2m^3$/ha/year.

iii 80% of secondary and community annual forest product is able to be used as firewood.

iv Old rubber trees from replanting holds $70m^3$/ha production.

3) Possible firewood volume to be produced in Upper South.

(1) Primary forest during the period 1986 - 91 :

$(366 \times 100 \times 73) \div 5 = 534,360m^3$/year

In this $534,360m^3$, 30% will be utilized for wood products while 20% will be wasted so that the available volume for fire wood will be :

$534,360 \times 0.5 = 267,180m^3$/year

$267,180m^3$/year is available during 1986 to 1991.

(2) By-products of forestry maintenance

$766Km^2 \times 100 \times 2m^3$/year $\times 0.8 \times 0.1 = 12,256m^3$/year

(3) Secondary and community forest

$(104.8 + 31 + 11.1 + 11.2) \times 100 \times 2m^3$/year $\times 0.8 = 25,296m^3$/year

(4) Old rubber trees from replanting

$10,300ha \times 70m^3$/year $\times 0.4 = 268,400m^3$/year

20% of the total old rubber tree product will be wasted and 30% will be utilized for wood products. According to "Report on the Rubber Wood Crate Industry" 1981, Ministry of Industry, the utilization of rubber wood in 1979 was as follows; for charcoal 12.5% for firewood 54.6%,for wood articles 32.9% . In 1979 the volume of rubber production was reported as $2,505,000m^3$/year in the whole country.

(5) Other tree crops

$(582 + 111 + 112) \times 100 \times 2 \times 0.5 = 80,500m^3$/year

4) Possible charcoal volume to be produced in Upper South

(1) Old rubber tree

40% of rubber tree available for firewood

$164,800 \times 0.4 = 65,920$

(2) Mangrove forest will be maintained in good condition and 25% of annual product of the mangrove forest will be consumed for charcoal

$1,141.3Km^2 \times 100 \times 3m^3$/ha/year $\times 0.6 = 205,434m^3$/year
(Mangrove area) (conversion to ha)

2.3.2 Demand Functions for Household Energy, 1965 -79

1) Disposable income and real cost

$$\log(ELEC) = -4.6429 + \underset{(0.028)}{1.3602}\log(CYD) + \underset{(0.288)}{0.7889}\log(RELEC)$$

$$\log(KERO) = 5.4721 + \underset{(0.3746)}{0.9274}\log(CYD) - \underset{(1.0550)}{2.4436}\log(RKERO)$$

$$\log(LPG) = -4.1638 + \underset{(0.1341)}{1.5034}\log(CYD) - \underset{(0.6331)}{0.1492}\log(RLPG)$$

$$\log(CGAS) = -1.9706 + \underset{(0.0562)}{0.9349}\log(CYD) + \underset{T(0.6199)}{\underset{(0.3386)}{0.2099}}\log(RCGAS)$$

$$\log(COAL) = 20.5838 - \underset{(0.3486)}{3.6095}\log(CYD) + \underset{T(0.2358)}{\underset{(0.3756)}{0.0885}}(RCOAL)$$

$$\log(ETC) = 18.9299 - \underset{(0.1738)}{3.3915}\log(CYD) + \underset{T(0.7257)}{\underset{(0.34164)}{0.2479}}(RETC)$$

2) Disposable income and relative cost of energy ($/Mcal)

$$\log(ELEC) = -4.6944 + \underset{(0.0285)}{1.3601}\log(CYD) + \underset{T(2.7343)}{\underset{(0.28861)}{0.78915}}(CELEC)$$

$$\log(KERO) = 0.0914 + \underset{(0.3740)}{0.9257}\log(CYD) - \underset{T(-2.3254)}{\underset{(1.0496)}{2.4409}}(CKERO)$$

$$\log(LPG) = -4.0320 + \underset{(0.1282)}{1.4579}\log(CYD) - \underset{(0.5279)}{0.3395}(CLPG)$$

$$\log(CGAS) = -1.7606 + \underset{(0.5625)}{0.93492}\log(CYD) + \underset{T(0.6199)}{\underset{(0.14706)}{0.0911}}(CCGAS)$$

$$\log(COAL) = 20.7426 - \underset{(0.3485)}{3.6097}\log(CYD) + \underset{T(0.2350)}{\underset{(0.3757)}{0.0883}}(CCOAL)$$

$$\log(ETC) = 19.1400 - \underset{(0.17392)}{3.3919}\log(CYD) + \underset{T(0.72891)}{\underset{(0.1483)}{0.1081}}(CETC)$$

3) Share and disposable income and total energy consumption

$$\log(SELEC) = -2.3920 + \underset{(0.1898)}{0.9190}\log(CYD) - \underset{(0.3225)}{0.2377}(TOTAL)$$

$$\log(SKERO) = -1.2302 + 3.2774\log(CYD) - 3.6447(TOTAL)$$

$$\log(SLPG) = -1.9819 + 2.0544\log(CYD) - 0.8253(TOTAL)$$

$$\log(SCGAS) = -0.1614 + 0.4447\log(CYD) - 0.1928(TOTAL)$$

$$\log(SCOAL) = 25.9992 - 1.6635\log(CYD) - 4.4129(TOTAL)$$

$$\log(SETC) = 23.5932 - 1.9275\log(CYD) - 3.4978(TOTAL)$$

3. ISSUES TO BE CONSIDERED IN PURSUANCE OF AN OIL REFINERY PROJECT IN KRABI

3.1 REFINERIES IN THE WORLD

The excess capacities in the world refining industry resulted from miscalculation of the growth rate of demand for oil in the mid-1970s. The growth in demand slowed down significantly after the 1973/74 oil price hike, and the absolute level of demand has actually declined since 1980. The excess capacity in refining has created major problems for the industries leading to large-scale closures and scrappings of refineries around the world. This situation is not expected to improve in the near future at least by 1990, coupled with the refinery build up in OPEC nations. In OPEC, the total refinery capacity is expected to increase to 8.5 million bbl/day in 1990 from 4.9 million bbl/day in 1981. The refined oil market is sensitive to OPEC's export policy than the crude market. OPEC's product export policy increases its importance not only on product market but also through direct/indirect effects on the crude market. Careful strategy will be required to benefit all OPEC member countries.

What follows is some observation by F. Fesharaki and D. Isaak "Excess capacity and readjustment pains in the world refining industry" on the OPEC's possible access to the world oil market and its impact in relation to the prevailing segmentation of petroleum market.

(1) Domestic/Domestic Market
Domestic source of crude and a domestic market for the refined product is difficult to invade from outside (19.5 MM bbl/day of which 2.4 MM bbl/day by OPEC).

(2) Import/Domestic Market
There is a domestic refined product market which relies on imported crude. Refineries have firm control over the distribution network given crude oil availability. This market can bar the import of product from OPEC (26.0 MM bbl/day).

(3) Domestic/Export Market
There is a domestic production of crude directed to overseas market without having domestic market (6.7 MM bbl/day of which 2.5 MM bbl/day by OPEC).

(4) Import/Export Market
This relies on crude import without guaranteed access to a domestic market and it is the most unstable segment of the refining industry. Most of the world's excess capacity falls into this category (13.8 MM bbl/day).

According to Peter R. Odell "Outlook for international oil market and options for OPEC", the future oil refining activities will change in the world as follows:

56% of the refinery expansion will be accounted in OPEC. It thus will have a refinery capacity of around 8.5 million bbl/day by 1990 from which about 3.5 million bbl/day will be used for domestic and 5 million bbl/day will be available for export. Since current refined export is less than 2 million bbl/day (despite the production capacity of nearly 2.5 million bbl/day) OPEC with the expansion have to sell 3 million bbl/day in the international market.

Whose market should the OPEC try to capture ? The options are as follows:

NO. 1 Option

Simply adds to world wide supply of refined products, while keeping its crude oil export unaffected.

1 MM bbl/day Refined $4.8/bbl decline Refined

$4.9/bbl decline Crude

NO. 2 Option

Capture some share of "import/export" market cuts back the export of crude oil by the amount that it adds to the export of refined oil, thus keeping the total export of oil constant.

1 MM bbl/day Refined oil export

$0.20/bbl increase in the price of refined oil

+1.8 curtailment of crude export

-1.6 lower demand for crude

$0.40/bbl increase in the price of crude oil.

+3.4 curtailment of crude export

-3.0 lower demand for the crude

Option 2 enables OPEC to extract more monopoly rent through the vertical integration of the petroleum business through attaining the partial control over the refinery market, thereby strengthening the price of crude oil. The stronger crude price will support a higher price for refined oil. The price difference between refined and crude oils will be OPEC's marginal revenue shifting the export-mix from crude to refined oil.

However these gains will be weighted against the processing and transport costs of refined products. According to, F. Fesharaki and D. Isaak, OPEC, the Gulf, and the World Petroleum Market: A Study in Government Policy and Down stream Operations, Westview Press Colorado, 1983, the refining cost is as follows in 1983 prices:

	US$/bbl
Operating cost	1.22
Energy cost	0.17
Capital cost	1.42
Total	2.81
Cost of production transportation	1.73
Cost of crude production	1.50

To recapitulate, Options 1 and 2 are two extreme possibilities for OPEC's involvement in the refined product market. In the first option, OPEC adds to the supply of the refined oil, causing a drastic decline in the price of refined and crude oil. In the second option, OPEC's total export of refined oil will substitute for the export of refined product from other source enabling OPEC to increase its monopoly rent. The gain or loss to OPEC will then depend on which option is pursued. The catch in the study is that the study evaluates alternative product export policies in view of the revenue of OPEC as a whole.

The capture ratio is, of course, an implicit and implied measure, but is a concept used to clarify the discussion. The value of the capture ratio is calculated as follows.

XR = increase in the export of refined product

r = capture ratio

$40rXR - 4.9(1-r)XR = 0$

$4r - 4.9 + 4.9r = 0$

$r = 92.4\%$

The increasing export of refined products will, in general, create a dichotomy of policy views among OPEC member countries. As soon as refined oil export becomes a significant portion of OPEC's oil export, the product-exporting members of the organization will base their views of the desirable price on a dual objective, covering their interests in both crude and product markets.

While the crude exporting countries will be concerned only with the crude market, this will add to the incongruity of members' views on the OPEC price. Saudi, Kuwait/UAE will increase the export of refined products and will introduce another dimension to widen the gap between these countries and other members of OPEC.

In coordinated policy over refined product export, these countries may lead to strong competition among themselves. This will weaken the stability of OPEC, when considering these members have acted as the "shock observers" of OPEC in the past.

Table 3.1 OIL REFINERY CAPACITIES IN OECD COUNTRIES AS OF JAN. 1, 1984

countries	No. Plants	Crude KBPD	Crude 1) Production	Oil 2) Consumption
Australia	12	722.1	373.3	755.0
Austria	1	268.0	25.0	215.0
Belgium	5	694.1		465.0
Denmark	3	174.0	16.0	240.0
Finland	2	299.00		230.0
France	19	2,670.4	34.0	1,935.0
Germany W.	27	2,386.3	86.0	2,360.0
Greece	4	368.7	-	245.0
Iceland	-	-	-	10.0
Ireland	1	56.0	-	95.0
Italy	24	3,050.1	37.0	1,845.0
Luxsemburg	-	-	-	-
Holland	7	1,551.5	27.0	640.0
New Zealand	1	74.0	10.0	
Norway	4	242.7	523.2	160.0
Portugal	2	281.9	-	185.0
Spain	10	1,493.0	24.0	970.0
Switzerland	2	137.0	-	235.0
Turkey	4	472.5	46.0	335.0
UK	16	2,091.5	2,120.4	1,580.0
Canada	28	1,806.6	1,590.2	1,580.0
US	220	15,862.9	10,224.6	14,905.0
Japan	45	5,020.4	7.0	4,380.0
OECD Total		39,722.7	15,143.7	34,075
DC's Total Market		18,835.4	25,219	11,615.0
Market Economy Total		58,588.1	40,363.6	45,69.0
Centrally Planned Economy		16,531.0	14,803.5	12,820.0
World Total		75,089.1	55,167.1	58,510.0

1) Petroleum Economist April, 1982

2) BP Statistical Review of World ENergy 1982

3) "OGJ Report" Oil & Gas Journal Dec . 26, 1983

Table 3.2 OIL REFINERY CAPACITY IN OPEC
AS OF JAN. 1, 1984

Countries	No. Plants	Crude KBPD	Crude Production KBPD
Algeria	12	137.4	691.9
Ecuador	3	83.6	209.0
Gabon	1	20.0	148.0
Indonesia	9	387.0	1,340.3
Iran	4	530.0	1,980.8
Iraq	7	168.5	955.9
Saudi Arabia	4	860.0	6,472.9
Nigeria	3	247.0	1,293.8
Quatar	1	63.2	328.0
UAE	3	185.3	1,217.3
Venezuela	7	1,224.2	1,892.3
Libya	2	125.0	1,136.0
Kuwait	5	622.8	831.8
OPEC Total		4,654.0	18,497.8
Mexico		1,269.0	3,000

3.2 REFINERY PROJECTS ALREADY PLANNED

The following projects have been planned to ease the difficulty of importing middle distillates and to avoid the difficulty of exporting fuel oil. The production ratio of heavy crude oil will increase opposing to declining fuel oil consumption due to energy substitution. Production pattern in Thailand is 32% diesel, 21% gasoline, 30% fuel oil and 10% JET fuel. The ratio between refinery production & consumption of petroleum product in Thailand is as follows: Diesel 0.7, Gasoline 0.87, Fuel oil 0.73.

Military Oil Refinery

Feed Capacity : 65.00 KBPCD

Completion date : early 1984

Products (KBPCD)

LPG	1.5
GASOLINE	13.4
KEROSENE/JP	6.5
DIESEL	18.3
FUEL OIL	22.7 1/
BITUMEN	-
TOTAL	62.4

1/ 22.7 KBPCD of fuel oil is fed to TORC for the use in cracking process.

Esso Standard Thailand

Feed capacity : 62.6 KBPCD

Completion date: 1984/85

Products slate (KBPCD)

LPG	2.7
GASOLINE	11.4
KEROSENE/JP	7.9
DIESEL	19.0
FUEL OIL	18.4 1/
BITUMEN	1.9
TOTAL	61.3

1/ 2.3 KBPCD of fuel oil is fed to TORC for the use in cracking process.

Thai Oil Refinery Company

Phase 1. expansion

Feed capacity : 102.52 KBPCD

Completion date : 80% in 1988
100% in 1989

Products (KBPCD)

LPG	1.7
GASOLINE	22.0
KEROSENE/JR	18.6
DIESEL	41.4
FUEL OIL	14.7
BITUMEN	0.8
TOTAL	99.2

4. FIELD OBSERVATIONS ON TRADITIONAL ENERGY USE

1) A paddy family at Bang Tao Bay, Phuket

This 7-member family engaged in paddy farming consumes about 0.75m^3 of rubber wood per month only for their fuel use. The radius for obtaining firewood ranges within 1 km and the price is ฿70/m^3 with purchase pattern of 1.5m^3 or ฿100 worth at one time.

2) A wood box factory at Srisunthon Road 15 km from Route 402

The factory produces boxes for fish and rubber products. Since the boxes for rubber products have to be precise in handling processes of export the raw materials (old rubber trees) are necessarily required to hold a certain diameter.

The less availability of matured rubber trees in Phuket forces the factory to procure its raw materials from Phangnga in these couple of years.

The operation of the factory requires 7 trips of material procurement per month. Each trip costs ฿3,000/truck, which is ฿130/m^3. 5 years ago, the prices of oil rubber was only ฿70/m^3 (i.e., 6% annum increase).

The left overs during production process are sold to households as firewood at a prices of ฿80/m^3. The factory employs 28-30 laborers at the wage range of 30 to ฿50 /day.

In Phuket there are two wood box factories for rubber products and three factories for fish boxes.

3) A rural type restaurant in Ampoe Sakao

This restaurant uses charcoal and LPG for its operational fuel source. Carcoal use (rubber charcoal) is 100kg/month at ฿2-2.2 / kg, while LPG use is 16.7kg/month or about 50kg cylinder/3 month period at 15 ฿/kg. The total sales ranges from ฿500 to 1,500 /day. This type of restaurant operation seems achieving efficient energy use in terms of scale of economy of cooking.

4) A Pub like restaurant in Ampoe Sakao

This restaurant uses only charcoal for food preparation to sell and consumes about 200kg/month at ฿ 2 to 2.5/kg. On the other hand for domestic use (i.e. household use), it consumes about 15kg per every two month of LPG at ฿ 15/kg.

5) A small family at Ban Pack Men in Krabi

This family holds 5 members and is engaged in fishery and rubber tapping. The main source of fuel is rubber-charcoal with consumption volume of one bag/month (40kg/bay) at a price of ฿70 /day (฿ 1.75/kg).

6) Charcoal factory at Sikao Kantang

This factory produces 20,000kg of mangrove charcoal per month on average with three charcoal producing stores.

The capacity of each stove is 14,000kg and charcoal production process takes about 4 weeks, with processes of one week for preparation one week for burning, and two weeks for cooling and product packaging. The ratio of the feed stock requirement to the finished product is 3 to 1. The product price varies around ฿ 3 to 2.5/kg range due to seasonality of material procurement. In rainy season it gets limited to obtain mangrove from its concession area.

The concession area is 3,000 rais in total and the factory is obliged to replant mangrove after cutting. After 6 to 8 years, the replanted trees at a diameter of 6 to 8 cm are utilized as feed stocks for charcoal according to the owner of this factory. However it seems illegal cutting is in practice.

This factory employs 60 laborers. Wood cutters are 22 to 30 in number and earn ฿150/day/person. For hut work (packaging etc), a man gets ฿ 50 /day, a woman ฿40/day, a child ฿20-35/day.

This factory has been in operation for 40 years. The current competitors are 8 factories in Sikao Districts and 30 factories in Trang in total with 7 to 3 ratio of mangrove to rubber charcoal producers. The owner views that mangrove will have competitive edge over rubber-charcoal. This factory is currently engaged in 20 tons of charcoal shipment to Saudi Arabia as a first trial.

7) A family located near Wiang Sa

This five member family is a small rubber holder making ฿1,500/month from 3 rai rubber plantation. Their energy use depends mainly on rubber charcoal with consumption volume of 40kg/month and expenditure of ฿70/40kg (1 bag = 40kg). The other energy use in this family are a battery, kerosene and firewood. A battery which was initially bought at ฿1,800 /per unit requires 4 times recharging for a month use and each recharging costs ฿ 15. Kerosene use is 3 ℓ/month at ฿ 8/ℓ and that of firewood ฿ 3 to 4/m^3 from nearby forests.

8) A restaurant at the beach park in Songkhla

No. 1 - At this restaurant, charcoal from rubber provides the only fuel with consumption volume of 30kg/month at ฿ 4/kg. The price of rubber-charcoal increased one baht for a single year.

No. 2 - This restaurant uses LPG only for their fuel source and consumes 50kg/month at ฿ 16/kg.

No. 3 - This restaurant uses both LPG and rubber charcoal. Consumption volume are 30kg and 50kg per month respectively. The price for charcoal ranges ฿ 3 to 3.5/kg.

The results of this field observation conform with the analysis of field survey undertaken in Oct. 1983, which required careful interpretation of actual data. Thus the traditional energy use in the Study Area (excluding large scale manufactures such as brick kilins, fish meal factory and rubber smoking) is well understood.

The interviews carried out during the field observation trip endorse the issues and recommendations of this main report.

The current per one baht worth calorific value of firewood charcoal and LPG is as 1,101 kcal, 1,225 kcal and 1,115 kcal respectively. Astonishingly enough the situation where commercial energy is competitive with traditional ones in price , has already been prevailed.

Therefore, with introduction of a better logistic system of LPG and with little income level rise which eases the initial expenditure for LPG use, it is possible to achieve smooth transition opposing to what our traditional energy supply and demand projection illustrates. In recognizing that certain types of food preparation require charcoal use in Thailand, industrial countries also hold potential markets for charcoal use in their certain types of food preparation. In looking the future, the charcoal industry in the Study Area holds potential to grow from domestic oriented to export oriented industry as seen in exports to Saudi Arabia for food preparation and to Malaysia for sponge iron production, if excessive tree cutting is controlled and aforestation is promoted.