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THAILAND ENERGY SITUATION

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Abbreviation

AIT - Asian Institute of Technology

DMR - Department of Mineral Resource

EGAT - Electricity Generating Authority of Thailand

JICA - Japan International Corporation Agency

MEA - Metropolitan Electricity Authority

NEA - National Energy Administration

NESDB - National Economic and Social Development Board

PEA - Provincial Electricity Authority

TAET - Training in Alternative Energy Technologies Program

TTA - Thailand Telephone Authority

UNDP - United Nations Development Programme

Introduction

General

Thailand, with a land area of 198,456 square miles and a population of 50 million in 1984, is the second largest Southeast Asian country. It is bordered on the northeast and east by Laos, on the southeast by Cambodia and the gulf of Siam, on the south by Malaysia, and on the west and northwest by Burma.

The capital and the largest city, Bangkok has about 5.5 million people, is the center of government office, education system, trade, transportation and communication.

Economy and Energy

Thailand is one of the few rapidly growing developing countries. In 1982, current GDP was about $37.24 billion ($16.22 billion at 1972 price, Table 1, 4) and current GDP per capita was about $768.5 ($332.1 at 1972 price, Table 2). Its average GDP growth rate in the past decade was about 7% per year. Total energy consumption in 1982 was about 682.64 x 10^{15} Joules (energy consumption per capita was about 14.28 x 10^{9} Joules, Table 1, 2.) Its energy consumption growth rate was about 6.8% per year in past decade. Total electricity consumption in 1982 was about 62.82 x 10^{15} Joules (15,047 megawatt hour). Electricity consumption per capita was about 12.86 x 10^{9} Joules, Table 1, 2, and its electricity consumption growth rate was about 10% per year in the past decade.

Thailand's economy was fairly stable but in 1973 and 1980 the increase in world petroleum price seriously threatened its economy. In the fourth quarter of 1981, natural gas from the Gulf of Thailand was initally substituted fuel oil in generating electricity. Imported energy was reduced from more than eighty percent in 1973-1978 to about sixty-two percent in 1982 (Table 3, Fig. 5) and will be reduced to 46% in 1986 (Table 21, Fig. 8, 10) by substitution of indigenous resources such as: natural gas, lignite, indigenous petroleum and renewable energy.

Thailand Economic Summary

GDP at current price	1982 - $37.25 billion
GDP growth rate	1982 - 4.5% 1983 - 5.5-6%
Inflation rate	1982 - 5.2% 1983 - 4%
Export	1982 - $6.78 billion
Import	1982 - $8.55 billion
Trade deficit	1982 - $1.77 billion
International reserve	1982 - $7.55 million
Foreign borrowing	1982 Public Sector $7 billion
	1982 Private Sector $4 billion
Government revenue	1982 - $4.9 billion
Government expenditure	1982 - $6.2 billion

Major Commodities Export: Rice, Tapioca Products, Sugar, Tin, Maize Rubber, Shrimps, Integrated Circuit.

Major Commodities Import: Petroleum Products, Fertizler, Machinery, Chemical, Dispensary, Crude Materials.

Mineral Resources: Tin, Tungsten, Lead, Antimomy, Manganese Iron, Zinc, Gypsum, Lignite, Florite, Marl.

Energy Resources, Production and Consumption

In 1982 Energy Consumption in Thailand was about 697.4 x 10^{15} Joules and was imported about 61.13% of total energy consumption (Table 3, Fig. 5). The net imported energy was about 425.3 x 10^{15} Joules and cost about $2,553.5 million (30% of total commodities import or 38% total commodities export, Table 4).

Figure 2, 3, 4 and 5, 6 showed Energy Flow Chart, Energy Supply by type and Energy Demand by Economic Sector in 1982.

In 1982, Thailand energy consumption by fuel type:

	Consumption	% of Total
Petroleum Products	418.44×10^{15} Joules	58.27
Paddy Husk	23.98×10^{15} Joules	3.31
Bagasse	47.78×10^{15} Joules	6.59
Fuel Wood	24.89×10^{15} Joules	3.43
Charcoal	74.42×10^{15} Joules	10.41
Coal and Lignite	29.49×10^{15} Joules	4.17
Hydro	50.05×10^{15} Joules	6.91
Natural Gas	50.06×10^{15} Joules	6.91
Total	724.69×10^{15} Joules	100.00

In 1982, Thailand Energy Consumption by economic sectors:

	Consumption	% Share of Total
Transportation	191.4×10^{15} Joules	33.44
Industrial	168.0×10^{15} Joules	29.35
Residential Commercial Service and Other	153.5×10^{15} Joules	27.24
Construction	5.0×10^{15} Joules	0.88
Agriculture	52.0×10^{15} Joules	9.09
Total	569.9×10^{15} Joules	100.00

Figure 1 Energy Map of Thailand showed the location of the energy resource both existing and future projects. Fig. 6 and Table 11,12,13 showed the petroleum exploration activities both offshore and onshore of Thailand. Table 10 showed energy resource production in 1982. Table 7 Balance sheet of petroleum product showed inland production sources, indigenous source total supply, total import and total consumption of petroleum products from 1973-1982. Table 8 showed the average imported price of crude oil, kerosine, diesel

oil, jet fuel, fuel oil and coal from 1973 to 1982.

Table 9 showed the comparison of energy product in retailed price, heat content and energy price in 1982 and Fig. 7 showed the maximum retail price of petroleum in Bangkok.

Electricity Generating and Consumption

Table 14 Electricity summary in Thailand 1973-1982 showed installed capacity, total generation, annual generation per capita, thermal efficiency and peak generation. Table 15 showed existing system generating capacity in 1982, included type of power plant, type of fuel, installed capacity, and commissioning date. Table 16, 17 showed the trend of sales of electricity. Table 18 showed electricity consumption by economic sector in 1982. Table 19 showed basic electric tariff effective in April, 1982 both in Metropolitan area and provincial area.

Energy Supply and Demand in the Future

The fifth National Economic and Social Development Plan from 1982 to 1986 was intensive to reduce the percentage of imported energy from 62% in 1982 to 46% in 1986 and to control energy consumption growth rate not more than 4.8% per year by increase in utilizing indigenous energy source; natural gas, lignite inland oil, and renewable energy, by energy conservation regulatory, no television broadcasting in the peak period 6:30-8:00 pm, energy saving campaign.

Table 20, 21 and Figure 8, 9, 10 showed forecast Thailand energy demand by type of fuel; Commercial Energy: petroleum products are the major percent of energy consumption but are reduced in percent from 61.04% in 1983 to 48.69% in 1986, and to 37.99 in 1991 (437.2 x 10^{15} Joules in 1983, 41.8 x 10^{15} Joules in 1986 and 411.9 x 10^{15} Joules in 1991). Hydro Electric is increased from 4.29% in 1983 to 6.52% in 1986 and 7.51% in 1991 (34.28 x 10^{15} Joules in 1983 to 55.18 x 10^{15} Joules in 1986 and to 81.47 x 10^{15} Joules in 1991). Coal and Lignite are increased from 4.29% in 1983 to

7.93% in 1986 and 12.11% in 1991 (30.73 x 10^{15} Joules in 1983 to 67.05 x 10^{15} Joules in 1986 and to 131.34 x 10^{15} Joules in 1991). Most of Lignite that increased four times in ten years is used in electricity generation. Natural gas which was first utilized in the forth quarter of 1981 will be the important indigenous fuel in next ten years. It is increased from 8.60% in 1983 to 16.69% in 1986 and 24.34 in 1991. (61.62 x 10^{15} Joules in 1983 to 141.50 x 10^{15} Joules in 1986 and to 263.93 in 1991). For the petroleum exploration activities both onshore and offshore, it may discover the new petroleum sources. In January 1983 Thai Shell Exploration and Production Co. Ltd. started to produce the crude oil 5000 barrel per day and will be increased to 17,000 barrel per day in 1985. Esso Exploration and Production Khorat Inc. discovered the natural gas in Khon Kaen Province and the reserve are being carried out.

Bagasse is the by product of sugar industries and is used in steam and electricity production in sugar mill. It is slightly increased in amount of energy demand and is less in percent of energy demand from 6.38% in 1983 to 5.80% in 1986 and to 5.31% in 1991. Fuel wood, charcoal and paddy husk which is the traditional fuel, is slightly increased in amount of energy demand.

Mini hydro is increased from 0.266 x 10^{15} Joules in 1983 to 1.79 x 10^{15} Joules in 1986 and 5.43 x 10^{15} Joules in 1991. Table 15 showed the future mini hydro electric power project in a five year plan. Biogas is increased from 85 x 10^{12} Joules to 300 x 10^{12} Joules in 1986 and to 356 x 10^{12} Joules in 1991. Oil shale may be developed by co-generation with cement industries or by fluidized bed combustion technology and may be utilized 1.028 x 10^{15} Joules in 1991. Alcohol may be produced from sugarcane or mollasse or cassava or other crops. In the forecast alcohol production for fuel will be increased form 1.355 x 10^{15} Joules in 1984 to 5.419 x 10^{15} Joules in 1989. Fast growth plantation may be developed in 1985 and increased

from 2.48 x 10^{15} Joules in 1985 to 4.249 x 10^{15} Joules in 1991. Solar energy will be increased from 92 x 10^{12} Joules in 1983 to 377 x 10^{12} Joules in 1986 and to 1770 x 10^{12} Joules in 1991. Wind energy will be increased 4 x 10^{12} Joules in 1983 to 38 x 10^{12} Joules in 1986 and to 80 x 10^{12} Joules in 1991. Geothermal may be developed in 1985 and will be increased from 192 x 10^{12} Joules in 1985 to 384 x 10^{12} Joules in 1988.

Figure 9 showed Thailand energy demand forecast from 1982 to 1986 both before energy conservation and after energy substitution and conservation measures. Total energy demand forecast will be increased from 716.3 x 10^{15} Joules to 845.8 x 10^{15} Joules in 1986 and is 1084.4 x 10^{15} Joules in 1991. Table 22 showed type of energy demand for electricity generation and other uses in 1986 and 1991. Table 23 showed petroleum products consumption with 10 years forecast from 1983-1992. Table 24 showed forecast of electricity demand by economic sector from 1982 to 1992. Table 26 showed power development projects under construction or consderation 1982.

Assessment and Utilization of Renewable Energy in Thailand

Solar Energy

- Photovoltaic

EGAT, NEA, PEA, TTA and other government offices have installed photovoltaic system in the purpose of warning light, rural communication, power supply for seismograph, lighting in survey camp, repeater substation communication, portable radio. NEA will install photovoltaic for water pumping demonstration in northeastern rural area of Thailand. Ministry of Industries plan to install photovoltaic for lighting in five rural villages. EGAT plan to install photovoltaic in new repeater substation. TTA get the loan from World Bank to install photovoltaic in telecommunication substation. PEA is granted from Japan to install photovoltaic in some rural villages. Installation, operation, and maintenance the photovoltaic systems is simple and satisfactory

- Solar Water Heater

There are a lot of solar water heater systems installed in he hotels, hospitals in Bangkok but there is no need to use the hot water in the rural area. The system can be fabricated, operated and maintained by local technician. Solar water heater is hardly an appropriate technology in Thailand rural area.

-Solar Dryer

There are few solar dryers in Thailand. AIT researched to develop the tabacco solar dryer include other crops dryer. The problem is the taste of the dried products from solar dryer is usually different from that obtained by traditional techniques. There is a lot of unexploited potential to use solar dryer to dry crops such as rice, maize, tabacco, bean etc. Other solar energy applications is under research and development.

-Wind Energy

NEA and EGAT installed a few wind turbine both for generating electricity and pumping water. There is a well known wind turbine industry in Thailand that manufactures and installs the wind turbine for water pumping. In tradition use of wind turbine is for pumping water in the salt mills and rice field. The average wind speed in Thailand is slightly low except in the west of the southern part of Thailand and in some islands.

Mini hydroelectric

Thailand has unexploited hydro potential and plan to use these resources Table 25 showed the future minihydro power projects in a five year plan which total investment cost about $97.72 million (1982 price) and generate electricity 194.3 gegawatt-hour per year. Thailand has also the large scale inland hydro electric plan and considers these projects as the commercial energy. Thailand tries to promote the international hydro electric projects; Mekhong river between Thailand, Burma, Laos, Salween river between Thailand and Burma but there are a lot of problems.

There are many constraints in developing mini hydro projects such as: the high investment cost (US $1500-6300 /Kw installed), low demand in rural area initially, unreliable and lack of information about the projects, and the variation of flow rate from the seasonal effect. The PEA has set up a minihydro generation program which is integrated with the Accelerated Rural Electricification. These programs are co-operated among the various government departments i.e. Irrigation, Forestry, Agriculture Environment, NEA, EGAT, PEA and NESDB.

Geothermal

With more than 50 hot springs in various parts of Thailand, the working group from EGAT, DMR and Chiang Mai University has studied to determine the possibility in utilization geothermal energy. Japan International Corporation Agency grant some equipment and send some expert to work with Thai scientists and engineers. After study in geophysic, geochemical and shallow hole drilling, in mid 1984 the deep hole 1500-2000 m will be drilled in Sankampaeng Area, Chiang Mai Province. If the reserve is proven the working group will develop for domestic energy resource. There are other potential area in the northern part of Thailand such as, Fang, Pa Pae, Mae Chan, and Mae Cham.

Biomass

-Bagasse

From Table 5, sugar industries supply 47.78 x 10^{15} Joules and use 44.60 x 10^{15} Joules. The bagasse utilization is only for generate steam and electricity in sugar mills. It is possible to use the excess bagasse for co-generation of electricity, source of fuel in other industries & raw material in paper industries.

-Paddy Husk

From Table 5 the rice production supplies 23.98 x 10^{15} Joules but presently consumption is only 5.48 x 10^{15} Joules. The problem in utilization of paddy husk is its low bulk density, silica in ash, transportation and storage cost. The Thailand Institute of Scientific and Technology Research has constructed the prototype of rice husk pyrolysis and briquetting machine. It is highly

potential to use excess paddy husk if the government promotes this program such as rice mill cogeneration to produce electricity, special design stove for rice husk, developing commercial scale of paddy husk pyrolysis and briquetting machine. This program should include incentive and subsidary in financial, technical, marketing.

-Fuel Wood

From Table 5 and Table 20, fuel wood utilization is slightly increasesd from 24.88 x 10^{15} Joules in 1982 to 26.0 x 10^{15} in 1986 and to 27.66 x 10^{15} Joules in 1991. This figure may be changed because of the deforest problem and high cost of fuel wood. Thai government has set the program to promote the village forest for fuel wood utilized in the village.

-Charcoal

From Table 5 and Table 10 charcoal production is slightly up from 75.45 x 10^{15} Joules in 1982 to 76.49 x 10^{15} Joules in 1986 and 80.23 x 10^{15} Joules in 1991. Most of wood for charcoal production is supplied from private forest and the rubber plantation. The market of charcoal is limited in the urban area because it is replaced by electricity and LPG in cooking. But it is necessary for the rural area and the poor to use charcoal in cooking.

-Alcohol

There are a lot of kinds of crops in Thailand which can produce alcohol such as: sugar and molasse, rice, cassava and corn etc. There are a lot of factories that produce alcohol for whiskey, beer and one produces alcohol for export. The technique in producing alcohol is reliable and available in Thailand. The problem is the policy of government about excise tax, and the price of both alcohol and petroleum products. To produce alcohol, it should be carefully evaluate all the cost and benefit. The cost of producing alcohol is the opportunity cost in use land, manpower and investment includes the export opportunity. The benefit is the value of alcohol including the import reduction.

-Fast Growth Plantation

Thailand is in the tropical rain area and is suitable for fast growth plantation. In Table 20, NEA forcast the energy from fast growth plantation about 2.55×10^{15} Joules in 1985 and up to 4.06×10^{15} Joules in 1987. Forestry department has grown the demonstration fast growth wood plantations in some areas in Thailand such as Ipil-Ipil, ecualyptus. Sweden and Finland Company have proposed the dentrothermal power plant program to Thailand government but it is not approved now. It should be carefully studies and planned for fast growth plantation in large scale: seedlings, nursery, plantation, fertilizing, cutting program, transportation, storage. It should be considered on the economical, financial and marketing aspects by compared with the process of wood utilization such as: direct combustion, gasification, pyrolysis, wood for construction.

Biogas

Thailand has a population of about 50 million poultry, 17 million water buffalo and cattle, 5 million swine and a lot of kinds of crops which bio-gas energy can be produced from these wastes. Agricultural Economic Department, Ministry of Health, The Applied Scientific Research Corporation and Kastsart University, with subsidies from government for the gas holders, have promoted the biogas plants. Plans call for building 50 digesters every year. The present emphasis of biogas plant is on waste treatment rather than on eneryg production. The government should promote the farm, agro industries, food and beverage industries to construct the biogas plants for waste treatment and energy production.

Water hyacinths grow heavily and spread to the unwanted areas, cause many problems such as waste water, shallow canal and river, inconvenient water transportation and unwanted odor. The government should control the growth of aquatic plants and study to bring these plants for use in waste treatment system and biogas energy production.

The problem of biogas utilization is the value of the people and the lack of knowledge. The government should inform the rural people about the process, and the benefit of biogas.

Conclusion

The trend of indigenous energy resource will increase in next decade. Although the amount of imported petroleum will be constant but the price may be increased and may cause the Thailand economy. Thailand has a lot of resources of renewable energy which can be developed to use in order to reach the National Goal in the forthcoming fifth National Economic and Social Development Plan. These goals are: (1) Reduction the imported energy from 62% in 1982 to 46% in 1986 (2) Control the growth rate of energy consumption not more than 4.8% per year (3) Accelerated rural electrification.

Thailand is granted from other countries in energy developing program:

1. Eneryg conservation in Thailand Project from Japan Government
2. Renewable Nonconventional Energy Project from USA Government
3. Industrial Energy Audit and Conservation Development Project form ADB
4. Irrigation water Pumping Projects from Japan Government
5. Management and Utilization of Food Water Materials Project from Australia government
6. Minihydro Development Project from UNDP and JICA

The government and energy authorities should under take the plan to satisfy the forecast energy demand both by the public sector and the private sector. The public sector can promote these program by paper, model demonstration, pilot plant, and commercial scale. The private sector by subsideries from government with technical information and financial support in term of tax credit or financial aid can construct the renewable energy plant and use.

The government should promote and subsidy all universities and institutes in research and development energy programs.

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TABLE 1 GROSS DOMESTIC PRODUCT, TOTAL ENERGY CONSUMPTION AND ELECTRICITY GENERATION

YEAR	Gross Domestic Product at 1972 Price			Total Energy Consumption			Electricity Consumption		
	10^6 $	Growth rate %	Index (1965 = 100)	10^{15} Joules	Growth rate %	Index (1965 = 100)	10^{15} Joules	Growth rate %	Index (1965 = 100)
1973	9,0073	9.56	180.97	377.82	12.94	307.10	25.117	18.03	521.28
1974	9,497.5	5.44	190.82	384.80	1.85	312.77	28.070	6.44	554.84
1975	10,175.7	7.14	204.45	408.43	6.14	331.98	31.902	13.65	630.56
1976	11,061.2	8.70	222.24	465.836	14.05	378.63	37.044	16.12	732.22
1977	11,858.7	7.21	238.26	503.806	8.17	409.56	42.065	13.56	831.49
1978	13,054.9	10.09	262.29	530.140	5.21	430.90	47.508	12.94	939.11
1979	13.845.4	6.06	278.18	610.227	15.11	496.00	50.615	6.54	1,000.49
1980	14,642.6	5.76	294.19	653.183	7.04	530.91	54.376	7.43	1,074.85
1981	15,729.1	7.42	316.02	696.716	6.60	556.30	58.048	6.75	1,147.39
1982	16,222.9	3.14	325.94 *	682.640	(2.03)	554.86	628.20	8.22	1,241.70

NOTE: GDP 1965 = 99544 - 100
Total Energy Consumption 1965 = 29,390.9 = 100
Electricity Generation 1965 = 1208.60 = 100

THAILAND ENERGY SITUATION 1982

GROSS DOMESTIC PRODUCT AND ENERGY

Table 2 GDP PER CAPITA AND TOTAL ENERGY CONSUMPTION PER CAPITA

Unit: 10^9 JOULES

YEAR	Population (1,000)	GDP at 1972 Price $	Growth rate %	Total Energy Consumption	Growth rate %	Petroleum Products	Growth rate %	Hydroelectric	Growth rate %	Coal & Lignite	Growth rate %	Fuel Wood	Growth rate %	Charcoal	Growth rate %	Paddy Husk	Growth rate %	Bagasse	Growth rate %	Natural Gas	Growth rate %
1973	39,946	225.5	5.3	9.464	8.5	8.121	8.6	0.635	3.8	0.142	(5.1)	0.050	(18.8)	0.038	(23.0)	0.042	22.2	0.435	29.9	-	-
1974	41,339	229.7	1.9	9.310	(1.6)	7.644	(5.9)	0.785	23.6	0.219	54.1	0.042	(15.4)	0.023	(40.0)	0.035	(18.2)	0.562	29.2	-	-
1975	42,391	240.5	4.5	9.634	3.5	7.698	0.8	1.043	32.8	0.216	(1.8)	0.038	(9.1)	0.014	(50.0)	0.042	22.2	0.581	3.4	-	-
1976	43,214	255.9	6.6	10.784	12.0	8.533	5.8	1.093	4.8	0.246	14.3	0.038	-	0.023	100.0	0.038	(9.1)	0.812	39.7	-	-
1977	44,273	267.8	4.7	11.381	5.5	9.318	9.2	0.966	(11.6)	0.216	(12.5)	0.042	10.0	0.019	(16.7)	0.035	(10.0)	0.785	3.3	-	-
1978	45,222	288.7	7.8	11.726	3.0	9.818	5.4	0.643	(33.5)	0.273	26.8	0.031	(27.3)	0.154	(20.0)	0.038	11.1	0.904	15.2	-	-
1979	46,114	300.3	4.0	13.913	18.7	10.180	3.7	0.958	49.1	0.366	33.8	0.366	1,087.5	1.050	6,750.0	0.042	10.0	0.947	4.7	-	-
1980	46,961	311.8	3.9	13.724	(1.4)	10.419	2.3	0.473	(50.6)	0.380	5.3	0.500	36.8	1.324	25.5	0.042	-	0.581	(38.6)	-	-
1981	47,875	328.5	5.4	14.109	2.8	9.684	(7.1)	0.846	78.9	0.404	5.0	0.535	6.9	1.538	15.7	0.084	100.0	0.843	45.0	0.204	-
1982	48,847	332.1	1.1	14.275	1.0	8.567	(11.5)	1.024	20.9	0.604	49.5	0.208	(5.0)	1.524	(12.07)	0.112	31.8	0.912	8.2	1.024	401.9

TABLE 3 GROSS ENERGY BALANCE SHEET

UNIT: 10^{15} JOULES

YEAR	SUPPLY					Exports & Re-Exports	Net Imports	Total Consumption	Statistical Difference	Percent Share of Net Import Total Consumption
	Inland Production Sources		Sub Total	Imports	Total Supply					
	Indigenous	Foreign								
1973	52.119	305.357	357.476	45.198	402.675	24.793	325.762	377.881	-	-
1974	67.069	281.134	348.203	43.611	391.814	6.952	317.793	384.862	-	82.57
1975	80.439	297.829	378.268	34.404	410.672	4.178	328.055	408.494	-	80.31
1976	95.734	320.269	416.003	50.980	466.983	1.079	370.170	465.904	-	79.45
1977	89.,808	344.852	434.861	70.218	504.879	0.914	414.157	503.965	-	82.18
1978	83.765	343.781	427.548	103.595	531.134	0.917	446.460	530.229		84.20
1979	162.722	372.646	535.363	108.347	643.710	0.785	480.202	641.487	2.039	74.84
1980	145.131	327.561	472.692	168.378	641.071	0.482	495.455	641.775	(3.490)	76.87
1981	204.770	332.272	537.042	137.402	674.444	1.335	468.338	675.498	1.010	69.33
1982	298.341	323.633	621.974	102.720	724.694	1.056	425.297	697.433	26.215	61.13

TABLE 4 COMPARISON OF OIL IMPORTED AND EXPORTED WITH GDP AND COMMODITIES

UNIT 10^6 Dollars

Items	1978	1979	1980	1981	1982
(1) Imports:					
Crude oil	798.518	1166.518	1,9232.191	2,050.156	1,951.102
Petroleum Products	245.616	383.590	895.323	676.094	574.095
Lubricants	19.175	18.679	14.218	14.807	27.819
Bitumen	0.548	0.911	1.455	0.935	1.294
Total:	1063.858	1,569.699	2834.187	2741.932	2554.310
(2) Exports:					
Petroleum Products	-	-	-	-	-
Lubricants	0.767	0.027	0.063	0.137	0.047
Bitumen	0.664	0.341	0.443	0.198	0.778
Total:	0.741	0.368	0.506	0.335	0.825
(3) Net Imports	1,080.838	1,569.330	2833.681	2,741.658	2553.484
(4) Total Commodities Import	6,330.978	7,147.251	9,403.510	9,460.312	8,554.008
(5) Total Commodities Export	4,088.852	5,289.925	6,469.022	6,642.711	6,779.566
(6) GDP (at Current Prices)	20,586.709	24,221.858	29,793.921	31,258.264	37239.479
(7) Ratio: Net Oil Imports/Total Commodities Imports (3):(4)	19.84	21.96	30.12	28.98	29.85
Net Oil Imports/Total Commodities Exports (3):(5)	26.02	29.67	43.97	41.27	37.55
Total Commodities Imports/ GDP (4):(6)	26.04	29.51	31.56	30.26	22.97
NOTE: Exchange Rate $ 1: B	20.315	20.45	20.59	23.05	23.05

TABLE 5 BALANCE SHEET OF ENERGY CONSUMPTION IN THAILAND YEAR 1982

UNIT: 10^{15} JOULES

TYPES OF Energy	SUPPLY					Exports & Re-Exports	Total Consumption	Statistical Difference
	Inland Production Sources		Sub Total	Imports	Total Supply			
	Indigenous	Foreign						
1. Hydroelectric	41.842	-	41.842	8.205	50.047	-	50.047	-
2. Coal & Lignite	25.841	-	25.841	4.382	30.223	0.031	29.492	0.699
3. Fuel Wood	24.876	-	24.876	.001	24.876	.000	24.876	-
4.Charcoal	75.448	-	75.448	-	75.448	1.025	74.423	-
5. Paddy husk	23.981	-	23.981	-	23.981	-	5.484	18.496
6. Bagasse	47.784	-	47.784	-	47.784	-	44.598	3.186
7. Petroleum Products	8.512	323.633	332.145	40.133	422.278	-	418.441	3.834
-Premium Gasoline	2.891	24.125	26.999	0.561	27.560	-	24.431	3.920
-Regular Gasoline	2.110	40.578	42.689	0.136	42.825	-	46.510	(3.685)
-Kerosene	-	14.007	14.007	2.619	16.626	-	15.062	1.563
-High Speed Diesel	1.407	107.342	108.731	45.736	154.437	-	152.217	2.220
-Low Speed Diesel	-	2.885	2.885	-	2.885	-	2.008	0.877
-Fuel Oil	0.745	96.699	97.744	20.996	123.439	-	123.277	0.162
-Jet Fuel	1.049	33.190	34.239	3.788	38.026	-	39.032	(1.006)
-L.P.G.	0.309	4.842	5.152	11.327	16.478	-	15.992	0.486
8. Natural Gas	50.058	-	50.058	-	50.058	-	50.058	-
TOTAL	298.341	323.633	621.974	102.718	724.694	1.056	697.422	26.215

TABLE 6 GROSS ENERGY CONSUMPTION

UNIT: 10^{15} JOULES

YEAR	TOTAL	PETROLEUM PRODUCTS	HYDROELECTRIC	COAL & LIGNITE	FUEL WOOD	CHARCOAL	PADDY HUSH	BAGGASSE	NATURAL GAS
1973	377.881	324.161	26.770	5.745	1.979	1.511	1.629	17.458	-
1974	384.462	315.925	32.465	9.156	1.727	0.898	1.507	23.299	-
1975	408.494	326.538	44.260	9.079	1.626	0.545	1.830	24.616	-
1976	465.904	368.731	47.232	10.643	1.631	1.028	1.588	35.051	-
1977	503.965	412.620	42.863	9.522	1.796	0.799	1.616	34.761	-
1978	630.229	444.065	28.994	12.336	1.413	0.755	1.765	40.895	-
1979	641.487	469.284	44.185	16.948	16.905	48.676	1.964	43.709	-
1980	641.775	489.319	22.243	18.047	23.546	62.257	1.917	27.231	-
1981	675.498	462.558	40.508	19.383	25.578	73.312	4.110	40.270	9.776
1982	697.433	418.444	50.047	29.492	24.876	74.423	5.485	44.598	50.058

TABLE 7 BALANCE SHEET OF PETROLEUM PRODUCTS

UNIT: 10^{15} JOULES

YEAR	SUPPLY					Exports & Re-Exports	Net Imports	Total Consumption	Statistical Difference	Percent Share of Net Import Total Consumption	Percent Share of Inland Production in Total
	Inland Production Sources		Sub Total	Imports	Total Supply						
	Indigenous	Foreign									
1973	0.258	305.357	305.615	42.678	348.294	24.133	323.902	324.161	-	99.92	0.08
1974	0.184	281.134	281.318	40.564	321.882	5.957	315.741	315.925	-	99.94	0.06
1975	0.530	297.829	298.359	31.462	329.821	3.283	326.007	326.538	-	99.84	0.16
1976	0.471	320.269	320.740	47.991	368.731	-	368.260	368.731	-	99.87	0.13
1977	0.658	344.852	345.511	67.109	412.620	-	411.962	412.620	-	99.84	0.16
1978	0.673	343.781	344.453	99.612	444.066	-	443.393	444.068	-	99.85	0.15
1979	0.423	372.640	373.066	97.473	470.539	-	470.113	469.285	1.253	100.18	0.09
1980	0.522	327.561	328.083	157.261	485.347	-	483.786	489.319	(3.972)	99.08	0.11
1981	0.659	232.272	332.931	127.240	460.172	-	459.413	462.559	2.387	99.34	0.14
1982	8.512	323.623	332.145	90.133	422.278	-	413.766	418.444	3.834	98.88	2.03

TABLE 8 AVERAGE COMPARATIVE IMPORT PRICES OF SELECTED FUELS

UNITS: Dollar / 10^9 Joules

YEAR	Crude Oil	Gasoline	Kerosene	Diesel Oil	Jet Fuel	Fuel Oil	Coal	B/$
1973	0.525	0.961	1.802	0.876	0.817		3.018	20.00
1974	1.710	3.036	2.094	2.026	2.552		4.182	20.00
1975	1.861	3.544	2.494	2.225	2.783	1.616	4.552	20.355
1976	2.006	3.358	2.731	2.365	2.894	1.817	4.691	20.375
1977	2.158	3.569	2.810	2.564	3.063	1.992	5.034	20.375
1978	2.175	3.238	2.727	2.672	3.242	1.854	4.948	20.315
1979	2.948	4.308	3.749	4.003	4.435	3.685	5.257	20.45
1980	5.066	7.745	6.759	6.793	7.747	4.396	7.076	20.59
1981	5.585	7.688	7.292	6.788	7.718	4.977	6.260	23.05
1982	5.934	11.957	7.556	7.173	8.096	4.530	5.874	23.05

TABLE 9 ENERGY RETAILED PRICE IN THAILAND

Energy Product	Retailed Price	Heat Content	Eneryg Price
Petroleum	$/Gallon	10^9J Gallon	$/$10^9$J
-Premium Gasoline	2.069	133.06	15.5
-Regular Gasoline	1.823	133.06	13.7
-Kerosene	1.005	147.03	6.83
-High Speed Disel	1.148	148.47	7.73
-Low Speed Disel	1.103	148.47	7.43
-Fuel Oil (600)	0.709	148.47	4.78
-Fuel Oil (1200)	0.685	148.47	4.61
-Fuel Oil (1500)	0.672	155.68	4.32
-Fuel Oil (2800)	0.655	155.68	4.21
LPG 15kg	0.433/kg	46.69/kg	9.27
LPG 50kg	0.410/kg	46.89/kg	8.78
-Lignite Mae Moh	21.69/Ton	10.46/kg	2.07
-Lignite Kra bi	21.69/Ton	10.88/kg	1.99
-Lignite Li	12.00/Ton	18.84/kg	0.64
Imported Coal	86.96/Ton	23.02/kg	4.15
Natural Gas-off Shore	-	-	3.94
Natural Gas-on Shore	-	-	1.33

TABLE 10 THAILAND ENERGY RESOURCES AND PRODUCTION YEAR 1982

Types of Fuel	Potential Reserve	Total Economically Recoverable	Production in 1982
Lignite (10^6 tons)			
-Mae Moh Lignite Mine	678-1317	450	1.2
-Krabi Lignite Mine	7	7	0.3
-Li Lignite Mine	20	15	0.1
-Other	12.2	N.A.	0.04
Hydro Potential (MW)			
-In-Country Projects	10,120	1,519	3,825.9 (10^6kWh)
-International Projects	14,045	-	-
-Total	24,165	1,519	3,825.9 (10^6kWh)
Natural Gas (10^{12} cf)			
-On Shore	N.A.	N.A.	-
-Off Shore	25.1	16.2	
Oil Shale (10^6 tons)			
-Tak Province Deposits	18,500	-	-
Petroleum Crude (10^6 Barrels)			
- Pong Nok		Under exploration	N.A.
- Lan Krabue	200	30	-

TABLE 11 OFFSHORE PETROLEUM EXPLORATION BLOCKS IN THE GULF OF THAILAND

Operators	Converturers	Offshore Block No.	Approximate Area (Sq Km)	Awarded in	Compulsory Relinquishment 50% of Orginal Acreage (another 25%)
1 Amoco Thailand Petroleum Company	Amoco Thailand Petroleum Co. 50% Idemitsu Exploration Co. (Thailand) Co. 50%	5-6	25.857	April 68	April 75 Holding only over-lapping area
2 Texas Pacific Thailand Inc.	Texas Pacific Thailand Inc. 93% Canadian Superior Oil Ltd. 5% Highland Thailand, Inc. 2%	3-4,16-17	45,578	March 68	March 76 March 79 Block 3-4 Valuntary relinquishment
3 Union Oil Company of Thailand	Union Oil Company of Thailand 60% Mitsui Oil Exploration Co., Ltd. 40%	10-11	21,802	April 68	April 75 (April 78)
4 Texas Pacific Thailand Inc.	Texas Pacific Thailand Inc. 75.745% Canadian Superior Ltd. 19.755% Highland Thailand, Inc. 4.500%	1-2,14-15	38,609	April 68	April 75 (April 78) Block 1-2 Voluntary relinquishment
5 Thailand Sun Oil Co.	Thailand Sun Oil Co. 50% Gulf Oil Corp. 33 1/3% Petroleum Resources (Thailand) Pty. Limited 16 2/3%	7-8-9	35,909	March 68	March 76 Holding only over-lapping area
6 Union Oil Co. of Thailand	Union Oil Co.Of Thailand 80% Seapec (South East Asia) Petroleum Exploration 20%	12-13	18,697	April 68	April 75 (April 78)
7 Triton Oil Co. of Thailand	Triton Oil Co. of Thailand 58.92857% Anschuts Oversea Corp. of Thailand 28.57143% Inlet Petroleum (Thailand) Corp. 12.5%	18-19	15,900	Oct. 72	Oct. 77 (Jan. 79) Block 19 voluntary relinguishment relinquishment Holding only 2819 Sq. Km of Block 18
8 Union Oil Company of Thailand	Union Oil of Thailand 100%	23	16,639	June 79	June 84
9 Pecten Thailand Company	Pecten Thailand Company 100%	1,2,3,	26,700	June 81	June 86

Source: Petroleum Activites in Thailand, Report No. 7 Minerial Fuels Division Department of Mineral Resources

TABLE 12 OFFSHORE PETROLEUM EXPLORATION BLOCKS IN THAILAND

Operators	Converturers		Offshore Block No.	Approximate Area (Sq Km)	Awarded in	Compulsory Relinquishment 50% of Orginal Acreage
1. Thai Shell Exploration and Production CO. Ltd.	Tai Shell Exploration and Production Co. Ltd.	100%	S1,S2	20,000	March 79	March 1984
2. Esso Exploration and Production Khorat Inc.	Esso Exploration and Production Khorat Inc.	100%	E1,E2, E3,E4,E5	50,000	March 79	March 1984
3. Esso Udon Inc.	Esso Udon Inc.	100%	EU1,EU2	20,000	June 81	June 1986
4. Phillips Petroleum International Corp.	Phillips Petroleum International Corp.	100%	P1,P2,P3	25,638.30	June 81	June 1986
5. Terra Marine International, Inc.	Terra Marine International, Inc.	100%	T1	8,473.16	June 81	June 1986

Source: Department of Mineral Resources.

TABLE 13 EXPLORATORY WELLS DRILLED IN ONSHORE AREAS

YEARS	Well No.	Company	Concession Block	Well Name	Location Lat/Long	Spudded | Completed	Total Depth in Feet	Status
1971	1	Union	Korat-Plateau	Kuchinarai-1	16°42'25"N 104°04'12"E	Nov.13,71 Apr.14,72	11,010 ft. 3,357M	Abandoned Dry Hole
1974	2	Gulf Oil	Bangkok	Wat-Sala Daeng-IX	13°44'28"N 100°22'27"E	Feb.16,74 Mar.19,74	6,099	Abandoned Dry Hole
1981	3	Esso	E5	Namphong-1 Kudnamsai	16°40'22"N 102°46'05"E	Mar.16,81		Rig skidded to Namphong-1(2) (40 Ft. away) because of technical Problem
				Namphong-1(2) (Carker 200)	16°40'35"N 102°46'22"E	Apr.12,81 Feb.15,82	13,471 ft. 4,107M	Abandoned Gas
	4	shell	S1	Pratu Tao-1 Sedco 91	16°52'42"N 99°58'59.6"E	Jun.4,81 Sep.4,81	11,840 (3,609 M)	Abandoned Sub-Commercial (Oil gas)
	5	Shell	S1	Lan Krabue A-1 Sedco 91	16°39'24.9"N 99°51'04.8"E	Sep.11,81 Dec.1,81	6,420 ft. (1,957 M)	Abandoned (Oil gas)
	6	Shell	S1	Lan krabue A-2 Sedco 91	16°39'24.9"N 99°51'04.8"	Dec.2,81 Feb.20,82	3,077 M 53.52 M	Oil & Gas
1982	7	Shell	S1	Lan krabue B1 Sedco 91	16°40'29.8"N 99°51'45.8"E	Feb.24,82 May 11,82	2,625 M	Abandoned Oil
	8	Esso	E2	Chonnabot-1	15°52'49"N 102°26'35"E	Feb.21,82 Sep.23,82	3,601 M	Abandoned Gas
	9	Shell	S1	Lan krabue D-1	16°37'38.85"N 99°51'34.18"E	Apr.12,82 Jun.19,82	2,622 M	Abandoned Oil
	10	Shell	S1	Lan krabue C-1	16°38'33.9"N 99°52'01.16"E	Jun.4,82 Jul.24,82	2,851 M	Abandoned Oil
	11	Shell	S1	Lan krabue J-01	16°33'59.6"N 99°51'12"E	Jul.11,82 Aug.17,82	2,326 M	Abandoned Dry-Hole

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TABLE 13 EXPLORATORY WELLS DRILLED IN ONSHORE AREAS

YEARS	Well No.	Company	Concession Block	Well Name	Location Lat/Long	Spudded Completed	Total Depth in Feet	Status
1982	12	Shell	S1	Nong-Bua-1	16°7'35.69"N 100°11'0.94"E	Aug.3,82 Nov.11,82	3,443 M	Abandoned Dry-Hole
	13	Esso	E3	Kaset-Somboon-1	16°12'30"N 101°55'43"E	Oct.14,82 Dec.11,82	7,704 ft. (23,345M)	Abandoned Dry-Hole
	14	Shell	S1	Pratu-Tao-A2	16°52'42.83"N 99°58'59.82"E	Nov.18,82 Jan.15,83	2,937	Abandoned Dry-Hole
	15	Shell	S1	Lan Krabue F-1	7°38'47.6"N 59°07'8"E	Dec.17,82 Mar.18,83	2,810M (9,219.61ft	Abandoned Oil

Source: Department of Mineral Resources

CAPACITY AND PRODUCTION

TABLE 14 ELECTRICITIES SUMMARY IN THAILAND 1975-1982

YEAR	1975	1976	1977	1978	1979	1980	1981	1982
Installed Capacity by Electric Utilities (MW)	2,543	2,543	2,832	2,902	2,964	3,448	4,008	4,403
Total Installed Capacity Including Privately owned (MW)	2,755	2,775	3,088	3,331	3,471	4,010	4,602	5,057
Annual Generation by Electric Utilities (GWH)	8,493.702	9,826.220	11,175.171	12,636.619	13,442.969	14,425.996	15,377.347	16,619.904
Total Generation Including Privately owned (GWH)	8,865.802	10,294.930	11,690.752	13,203.758	14,066.822	15,112.234	16,132.209	17,450.252
Population (10^6 Person)	42,391	43,214	44,273	45,222	46,114	46,961	47,848	48,847
Annual Generation Per Capita (kWh Per capita)	199.090	277.390	252.420	279.440	291.520	307.190	321.380	340.240
Average Thermal Efficiency at Sending End (%)	27.920	32.170	32.290	32.650	30.800	31.380	32.170	35.070
Transmission and Distribution Loss (%)	9.670	10.250	8.700	7.650	9.610	9.830	10.760	9.900
Peak Generation (MW)	1,483.000	1,763.000	1,953.000	2,175.000	2,201.000	2,379.000	2,561.000	3,234.000

Source EGAT NEA POF, Privately Owned

TABLE 15 EXISTING SYSTEM GENERATING CAPACITY IN 1982

Name of Power Plant	Types	Types of Fuel	Installed Generating (MW)	commissioning date	
Bhumibol	Hydro	Hydro	70.0	May	1964
			70.0	June	1964
			70.0	May	1967
			70.0	August	1967
			70.0	October	1968
			70.0	August	1969
			133.0	October	1981
Sub Total			553.0		
Sirikit	Hydro	Hydro	125.0	January	1974
			125.0	March	1974
			125.0	July	1974
Sub Total			375.0		
Ubol-Ratana	Hydro	Hydro	8.33	March	1966
			8.33	March	1966
			8.33	June	1968
Sub Total			24.99		
Sirindhorn	Hydro	Hydro	12.0	November	1971
			12.0	October	1971
Sub Total			24.0		
Chulabhorn	Hydro	Hydro	20.0	October	1972
			20.0	November	1972
Sub Total			40.0		
Kang Krachan	Hydro	Hydro	19.0	August	1974
Sub Total			19.0		
Nam Pung	Hydro	Hydro	3.0	October	1965
			3.0	October	1965
Sub Total			6.0		
Mae Hong Son	Hydro	Hydro	0.83	January	1972
Sub Total			0.83		
Srinagaring	Hydro	Hydro	120	February	1980
			120	February	1980
			120	March	1980
Sub Total			360		
Bang Lang	Hydro	Hydro	24.0	July	1981
			24.0	August	1981
			24.0	October	1981
Sub Total			72.0		
Tha Thang Na	Hydro	Hydro	19.0	December	1981
			19.0	February	1981
Sub Total			38.0		

(CONTINUED)

(CONTINUED TABLE 15.1)

TABLE 15 EXISTING SYSTEM GENERATING CAPACITY IN 1982

Name of Power Plant	Types	Types of Fuel	Installed Generating (MW)	commissioning date	
Mae Kum Luang	Hydro	Hydro	1.600	March	1981
			1.60	March	1981
Sub Total			3.20		
Huai Kum	Hydro	Hydro	1.3	February	1982
Sub Total			1.3		
Ban Santi	Hydro	Hydro	1.3	October	1982
Sub Total			1.3		
Ban Yang	Hydro	Hydro	.056	May	1979
			.056	May	1979
			.0125	May	1979
Sub Total			.01245		
North Bangkok	Thermal	Heavy Oil	75.0	March	1961
			75.0	June	1963
			87.5	December	1968
Sub Total			237.5		
South Bangkok	Thermal	Heavy Oil	200.0	December	1970
			200.0	November	1971
			300.0	June	1974
			300.0	September	1975
			300.0	Novermber	1977
Sub Total			1,300.00		

TABLE 15.2

TABLE 15 EXISTING SYSTEM GENERATING CAPACITY IN 1982

Name of Power Plants	Types	Types of Fuel	Unit Capacity MW	Commissioning Date
Krabi	Thermal	Lignite	20.0	June 1964
			20.0	June 1964
			20.0	June 1964
Sub Total			60.0	
Surat Thani	Thermal	Heavy Oil	30.0	February 1973
Sub Total			30.0	
Mae Moh	Thermal	Lignite	75.0	March 1978
			75.0	December 1978
			75.0	February 1981
Sub Total			225.0	
Khanom	Thermal	Heavy Oil	75.0	February 1981
Sub Total			75.0	
Udon Thani	Gas Turbine	Diesel	15.0	June 1969
Sub Total			15.0	
Nakhon Ratchasima	Gas Turbine	Diesel	15.0	June 1968
Sub Total			15.0	
Hat Yai	Gas Turbine	Diesel	15.0	August 1971
			15.0	June 1976
			15.0	May 1977
Sub Total			45.0	
Surat Thani	Gas Turbine	Disel	15.0	November 1977
			15.0	December 1977
			15.0	June 1978
			15.0	October 1979
			15.0	March 1980
Sub Total			75.0	
Bang Pa Kong	Gas Turbine	Diesel	60.0	December 1980
			60.0	October 1980
			60.0	January 1981
			60.0	July 1981
			60.0	September1981
			60.0	October 1981
			60.0	January 1981
			60.0	March 1981
Sub Total			480.0	
South Bangkok	Gas Turbine	Diesel	25.0	April 1981
			25.0	March 1981
			25.0	March 1981
			25.0	March 1981
Sub Total			100.0	

(CONTINUED)

(CONTINUED TABLE 15.3

TABLE 15 EXISTING SYSTEM GENERATING CAPACITY IN 1982

Name of Power Plants	Types	Types of Fuel	Unit Capacity MW	Commissioning Date
Nakhon	Diesel	Diesel	1.0	February 1974
Thammarat			1.0	February 1974
Sub Total			2.0	
Phuket	Diesel	Diesel	2.65	November 1967
			2.65	November 1967
			2.65	January 1968
			2.65	January 1968
Sub Total			10.60	
Chiang Mai	Diesel	Diesel	1.0	July 1968
			1.0	September1968
			1.0	January 1972
Sub Total			3.0	
Mae Mohani	Diesel	Diesel	1.0	June 1972
			1.0	May 1972
			1.0	May 1972
			1.0	June 1972
			1.0	October 1972
			1.0	October 1972
			1.0	September1972
			1.0	December 1972
Sub Total			8.0	
Bang Lang	Diesel	Disel	1.0	August 1978
			1.0	August 1978
			1.0	August 1978
			1.0	August 1978
			1.0	August 1978
Sub Total			5.0	
Bang Pa Kong	Combined Cycle	Natural Gas	120	December 1982
Sub Total			120	
Grand Total			4,325.01	

TABLE 16 TREND OF SALES OF ELECTRICITY (ELECTRIC UTILITY INDUSTRY)

YEAR	(10^6 kWh)			Annual Increase (%)		
	Lighting	Power	Total	Lighting	Power	Total
1978	4,256.761	7,091.780	11,348.541	15.56	28.39	23.54
1979	4,679.713	7,739.502	12,419.215	9.94	9.13	9.42
1980	4,786.235	8,349.983	13,136.218	2.28	7.89	5.77
1981	4,851.599	8,966.072	13,819.671	1.37	7.40	5.20
1982	5,536.982	9,480.835	15,017.817	14.13	5.72	8.67

Sources: EGAT,MEA,PEA

TABLE 17 TREND OF TOTAL REVENUE AND AVERAGE REVENUE/kWh SOLD

YEAR	Total Revenues from Sales of Electricity (10^6 $)			Average Revenue/kWh Sold (¢ 1kwh)			Exchange Rate
	Lighting	Power	Total	Lighting	Power	Total	¢/$
1978	293.95	252.45	546.39	6.89	3.54	4.82.	20.31
1979	212.39	282.92	495.31	4.55	3.6[illegible]	4.01	20.45
1980	363.23	619.49	982.72	7.58	7.43	7.48	20.59
1981	369.13	654.23	1023.361	7.59	7.29	7.42	23.05
1982	429.77	745.10	4 1174.86	7.77	7.85	7.81	23.05

Sources: EGAT,MEA,PEA,POF

TABLE 18 ELECTRICITY CONSUMPTION BY ECONOMIC SECTORS (FISCAL YEAR 1982)

Economic Sectors	Electricity Consumption (10^6 kWh)
1. Agriculture	129.830
2. Mining and Quarrying	132.474
3. Manufacturing	6,385.229
3.1 Food	1,322.457
3.2 Beverage	92.676
3.3 Tobacco	31.079
3.4 Textile	1,587.798
3.5 Wearing Apparel	24.690
3.6 Wood and Wood Product	97.296
3.7 Furniture	6.475
3.8 Paper and Paper Product	302.476
3.9 Printing and Publishing	45.228
3.10 Leather	19.101
3.11 Rubber and Rubber Product	208.820
3.12 Chemicals	317.438
3.13 Petroleum Products	18.811
3.14 Non-Metallic Product	871.743
3.15 Iron and Steel	466.812
3.16 Metals	165.814
3.17 Machinery	26.162
3.18 Electrical Equipment	133.305
3.19 Transportation and Equipment	91.425
3.20 Others	575.622
4. Construction	36.608
5. Electricity and Water Supply	322.742
6. Transportation and communication	101.320
7. Wholesale and retail trade	1,971.934
8. Banking, insurance and real estate	190.464
9. Residential	3,683.010
10. Public Administrative and Defence	582.061
11. Services	1,038.266
12. Others	162.028
Total	14,735.966

Sources: EGAT, MEA, PEA

TABLE 19 BASIC ELECTRICITY TARIFF EFFECTIVE APRIL 1982.

A. METROPLOITAN ELECTRICITY AUTHORITY (MEA)

1. Residential Service			
Energy Charge:	First	5 kWh or less	$ 0.21
	Next	10 kWh	3.04 ¢/kWh
	Next	10 kWh	3.90
	Next	10 kWh	5.08
	Next	65 kWh	7.25
	Next	50 kWh	7.68
	Next	150 kWh	8.03
	Next	100 kWh	8.94
	Over	400 kWh	9.24
	Minimum Charge: $0.21 per month		
2. Small Business (Under 30 kW)			
Energy Charge:	First	40 kWh or less	$ 3.92
	Next	260 kWh	7.94 ¢/kWh
	Next	700 kWh	8.42
	Next	2,000 kWh	8.94
	Over	3,000 kWh	9.67
	Minimum Charge: $3.92 per month		
3. Large Business (Over 30 kW)			
Demand Charge:			$4.25
Energy Charge:			6.68 ¢/kWh
4. Small Industrial (30-499 kW)			
Demand Charge:			$ 4.25
Energy Charge:	First	50 kWh/kW	6.42 ¢/kWh
	Next	150 kWh/kW	6.38
	Next	200 kWh/kW	6.33
	Over	400 kWh/kW	6.29
5. Large Industrial (Over 500 kW)			
Demand Charge:			$ 3.9
Energy Charge:	First	200 kWh/kW	6.33 ¢/kWh
	Next	280 kWh/kW	6.29
	Over	480 kWh/kW	6.20
6. Large Industrial (OFF-PEAK)			
OFF-PEAK Demand Charge:			$ 2.82
Energy Charge:			6.16 ¢/kWh
ON-PEAK Demand Charge:			$ 4.99
Energy Charge:			6.16 ¢/kWh
7. Temporary			
Demand Charge:			$ 1.30
8. Special Rate			
Demand Charge:			$ 3.77
Energy Charge:			4.06 ¢/kWh

TABLE 19 (CONTINUED)

B. PROVINCIAL ELECTRICITY AUTHORITY (PEA)

1. Residential Service			
Energy Charge:	First	5 kWh or less	$ 0.21
	Next	10 kWh	3.04 ¢/kWh
	Next	10 kWh	3.90
	Next	10 kWh	5.08
	Next	65 kWh	7.25
	Next	50 kWh	7.68
	Next	150 kWh	8.03
	Next	100 kWh	8.94
	Over	400 kWh	9.24
	Minimum Charge: $0.21 per month		
2. Small Business (Under 30 kW)			
Energy Charge:	First	50 kWh or less	$ 5.16
	Next	250 kWh	9.02 ¢/kWh
	Next	700 kWh	9.24
	Next	2,000 kWh	9.46
	Over	3,000 kWh	9.67
	Minimum Charge: $5.16 per month		
3. Large Business (Over 30 kW)			
Demand Charge:			$4.12
Energy Charge:			7.25 ¢/kWh
4. Small Industrial (30-499 kW)			
Demand Charge:			$ 3.99
Energy Charge:	First	50 kWh/kW	7.07 ¢/kWh
	Next	150 kWh/kW	6.94
	Next	200 kWh/kW	6.81
	Over	400 kWh/kW	6.68
5. Large Industrial (Over 500 kW)			
Demand Charge:			$ 3.82
Energy Charge:	First	59 kWh/kW	8.94 ¢/kWh
	Next	150 kWh/kW	6.77
	Over	200 kWh/kW	6.59
		400 kWh/kW	6.42
6. Special Rate			
Demand Charge:			$ 3.77
Energy Charge:			6.25 ¢/kWh
7. Water Work and Irrigation			
Energy Charge:	First		$ 5.16
	Over		5.16 ¢/kWh
	Minimum Charge $5.16 per month		
8. Street Lighting			
Energy Charge:			$ 6.90 ¢/kWh
9. Temporary			
Energy Charge:			$16.05 ¢/kWh

Sources: MEA, PEA

Table 20 FORECAST OF ENERGY DEMAND

Unit: 10^{15} Joules

YEAR	Petroleum Products	Hydro Electric	Coal & Lignite	Bagasse	Fuel Wood	Charcoal	Paddy Husk	Natural Gas	Nuclear	Garbage	Mini & Micro Hydro	Biogas	Oil Shale	Alcohol	Fast Growth Plan-tation	Solar Energy	Wind Energy	Geo-thermal	Total
1983	437.258	34.277	30.733	45.670	25.160	75.667	5.496	61.615	-	-	0.265	0.085	-	-	-	0.092	0.004	-	716.300
1984	454.354	37.102	35.201	47.059	25.494	76.876	5.515	67.289	-	-	0.622	0.142	-	1.355	-	0.150	0.012	-	751.212
1985	417.233	47.082	51.354	47.971	25.779	75.486	5.527	114.690	-	-	1.520	0.212	0.443	2.710	2.548	0.242	0.019	0.192	793.010
1986	411.775	55.176	67.046	49.060	26.022	76.491	5.546	141.497	-	2.725	2.790	0.300	0.443	4.064	2.548	0.377	0.038	0.192	845.793
1987	392.677	56.539	83.711	50.261	26.322	75.802	5.561	190.573	-	2.725	3.314	0.312	0.443	4.064	4.249	0.547	0.046	0.384	897.532
1988	419.350	55.846	90.897	51.482	26.688	76.822	5.585	211.488	-	2.725	3.837	0.327	0.443	4.064	4.249	0.758	0.058	0.384	954.987
1989	416.159	66.584	102.592	52.740	26.961	77.850	5.600	234.704	-	2.725	4.361	0.339	1.528	5.419	4.249	1.024	0.069	0.384	1002.962
1990	402.611	74.020	114.040	54.033	27.300	78.947	5.627	276.309	-	2.725	4.884	0.350	1.528	5.419	4.249	1.358	0.081	0.384	1053.866
1991	411.944	81.471	131.340	57.536	27.665	80.232	5.638	263.931	-	5.465	5.427	0.346	1.528	5.419	4.249	1.770	0.080	0.384	1084.422

Table 21 FORECAST OF ENERGY DEMAND (IN PERCENT SHARE OF TOTAL)

YEAR	Petroleum Products	Hydro Electric	Coal & Lignite	Bagasse	Fuel Wood	Charcoal	Paddy Husk	Natural Gas	Nuclear	Garbage	Mini & Micro Hydro	Biogas	Oil Shale	Alcohol	Fast Growth Plan-tation	Solar Energy	Wind Energy	Gas-thermal	Total
1983	61.04	4.79	4.29	6.38	3.50	10.56	0.78	8.60	-	-	0.04	0.01	-	-	-	0.01	0.0005	-	100.00
1984	60.48	4.94	4.69	6.26	3.39	10.23	0.73	8.96	-	-	0.09	0.02	-	0.18	-	0.02	0.0015	-	100.00
1985	52.61	5.94	6.48	6.05	3.25	9.52	0.70	14.46	-	-	0.19	0.03	0.06	0.34	0.32	0.03	0.003	0.02	100.00
1986	48.69	6.52	7.93	5.80	3.08	9.04	0.66	16.69	-	0.32	0.33	0.04	0.05	0.48	0.30	0.04	0.005	0.02	100.00
1987	43.75	6.30	9.33	5.60	2.93	8.45	0.62	21.23	-	0.30	0.37	0.03	0.05	0.45	0.47	0.06	0.01	0.04	100.00
1988	43.92	5.85	9.52	5.39	2.79	8.04	0.58	22.15	-	0.29	0.40	0.03	0.05	0.42	0.44	0.08	0.006	0.04	100.00
1989	41.49	6.64	10.20	5.26	2.69	7.76	0.56	23.40	-	0.27	0.43	0.03	0.15	0.54	0.42	0.10	0.007	0.04	100.00
1990	38.21	7.02	10.82	5.13	2.59	7.49	0.53	26.22	-	0.26	0.46	0.03	0.15	0.51	0.40	0.13	0.008	0.04	100.00
1991	37.99	7.51	12.11	5.31	2.55	7.40	0.52	24.34	-	0.50	0.50	0.03	0.14	0.50	0.39	0.17	0.007	0.04	100.00

Table 22 FORECAST OF ENERGY DEMAND FOR ELECTRICITY GENERATION AND OTHER USES

UNITS: 10^{15} JOULES

Type of Energy	1986		1991	
	10^{15} Joules	%	10^{15} Joules	%
A. Electric Use:-				
Petroleum Products	22.212	8.76	15.674	4.34
Hydroelectric	55.176	21.75	81.471	22.57
Lignite	56.693	22.35	100.333	27.80
Natural Gas	119.602	47.14	163.469	45.29
Total A.	245.986	100.00	360.948	100.00
B. Non-Electric Use:-				
Petroleum Products	389.556	65.79	396.271	54.77
Coal, Lignite	10.353	1.75	31.007	4.29
Natural Gas	21.595	3.65	100.453	13.88
Others	170.606	28.81	195.734	27.06
Total B	592.109	100.00	723.474	100.00
Total	845.793	-	1084.422	-

TABLE 23 PETROLEUM PRODUCT CONSUMPTION WITH 10 YEARS FORCAST

UNITS: 10^6 Gallon

YEARS	Diesel	Gasoline	Fuel Oil	Kerosene	Jet Fuel	LPG	Total
1983	1017	545	1014	116	277	165	3135
1984	1059	544	1066	119	283	203	3274
1985	1116	507	789	122	289	245	3068
1986	1174	498	702	124	294	295	3088
1987	1206	532	564	126	300	345	3073
1988	1243	556	643	128	305	398	3274
1989	1192	586	622	129	311	457	3298
1990	1241	628	337	130	316	310	3163
1991	1302	674	581	130	322	549	3558
1992	1276	723	788	130	327	587	3833

NOTE: 1 litre = 0.26417 gallon

TABLE 24 FORECAST OF ELECTRICITY DEMAND BY ECONOMIC SECTORS

Description	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Residential											
Energy (GWh)	3,462.85	3,797.67	4,240.13	4,782.82	5,423.34	6,176.75	6,980.52	7,878.84	8,949.70	10,290.30	11,714.72
% Increase	-	9.67	11.65	12.80	13.39	13.89	13.01	12.87	13.59	14.98	13.84
Commercial & Industrial											
Energy (Gwh)	11,187.31	12,095.36	13,014.76	14,039.40	15,113.93	16,256.48	17,476.21	18,794.49	20,239.19	21,859.15	23,514.05
% Increase	-	8.12	7.60	7.87	7.65	7.56	7.50	7.54	7.69	8.00	7.57
Street Lighting											
Energy (GWh)	63.60	65.96	68.65	71.56	74.58	77.80	80.99	84.29	87.85	91.84	95.75
% Increase	-	3.71	4.08	4.24	4.22	4.32	4.10	4.07	4.22	4.54	4.26
Other											
Energy (GWh)	50.52	53.60	58.75	64.04	69.41	74.96	80.83	86.85	93.81	102.11	110.28
% Increase	-	6.10	9.61	9.00	8.39	8.00	7.83	7.45	8.01	8.85	8.00
Total											
Energy (GWh)	14,764.28	16,012.59	17,382.29	18,957.82	20,681.26	22,585.99	24,618.55	26,844.47	29,370.55	32,343.40	35,434.80
% Increase	-	8.45	8.55	9.06	9.09	9.21	9.00	9.04	9.41	10.12	9.56

TABLE 25 FUTURE MINI-HYDRO ELECTRIC POWER PROJECTS IN A FIVE-YEAR PLAN

No.	Project	Location	Installed Capacity (kW)	Annual Energy (Gwh)	Estimated Construction Cost (m $)	Remark
1.	Nam Mae Sa Nga	Mae Hong Son	5,040	32.6	10.37	Cost at 1983
2.	Nam Mae Mao	Chiang Mai	4,340	9.2	9.02	Cost at 1983
3.	Nam Mae Tho	Chiang Mai	1,360	5.3	3.86	Cost at 1983
4.	Nam Mae Sap	Chiang Mai	1,360	4.8	3.17	Cost at 1983
5.	Nam Mae Ngat	Chiang Mai	1,340	4.9	3.89	Cost at 1983
6.	Huai Mae Ping	Mae Hong Son	500	2.9	1.52	Cost at 1983
7.	Nam Mae Rim	Chiang Mai	1,540	5.5	3.21	Cost at 1983
8.	Nam Mae'Klang	Chiang Mai	3,000	11.3	3.82	Cost at 1983
9.	Nam Mae Ya	Chiang Mai	1,500	6.2	2.43	Cost at 1983
10.	Nam Mae Wang	Chiang Mai	6,000	27.9	6.46	Cost at 1983
11.	Nam Mae Tun	Chiang Mai	400	1.6	1.08	Cost at 1983
12.	Nam Mae Puai-1	Chiang Mai	2,000	7.4	3.95	Cost at 1983
13.	Nam Mae Puai-2	Chiang Mai	1,420	5.2	2.52	Cost at 1983
14.	Nam Mae Ton	Chiang Mai	870	4.1	3.36	Cost at 1983
15.	Nam Mae Wan	Chiang Mai	930	3.9	3.13	Cost at 1983
16.	Klong La Un	Ranong	500	4.2	1.61	Cost at 1983
17.	Nam Mae Surin	Mae Hong Son	275	1.8	1.00	Cost at 1983
18.	Nam Mae Ob	Chiang Mai	1,970	7.2	5.81	Cost at 1983
19.	Nam Mae Tia	Chiang Mai	1,650	6.1	5.03	Cost at 1983
20.	Nam Mae Suai	Chiang Mai	5,600	16.2	11.41	Cost at 1983
21.	Huai Wang Kian	Kanchanaburi	1,000	6.5	1.74	Cost at 1983
22.	Klong Ra	Phang Nga	1,040	4.4	2.13	Cost at 1983
23.	Klong Ae	Surat Thani	2,700	11.1	4.51	Cost at 1983
24.	Klong Nai	Phang Nga	970	4.1	2.69	Cost at 1983

TABLE 26 POWER DEVELOPMENT PROJECTS UNDER CONSTRUCTION OR CONSIDERATION 1982.

Name and Location of The Project	Generation Station			Transmission System				Estimated Cost (Thousand US.$)			Anticipated Date of Completion
	Number of Generating Units	Unit Capacity (MW)	Total Plant Capacity (MW)	Transmission And Sub-Transmission Lines: Voltage (kV)	Transmission And Sub-Transmission Lines: Route Length (km)	Main Sub-Station: Number of Stations	Main Sub-Station: Aggregate Transformer Capacity (MVA)	Total	Generating Station	Transmission System	
EGAT											
Bang Pakong Combine Cycle (Block 1)	1	120	600	230	-	-	-	60,434	60.434	-	Jan.,1983
Lan Krabue Gas Turbine # 1-2	2	15.25	40	115	48	1	-				Apr.,1983
								4,909	2,358	2,551	Jan.,1983
Lan Krabue Gas Turbine # 3	1	15	55	115	-	-	-				
Bang Pakong Combine Cycle (Block 2)	1	120	720	230	-	-	-	118,265	118,265	-	Jul.,1983
Bang Pakong Thermal # 1	1	550	550	230	110	3	-	307,419	272,018	35,401	Sep.,1983
Sirindhorn # 3	1	12	36	115	-	1	-	6,508	6,508	-	Apr.,1984
Mae Moh #4	1	150	375	230	165	2	300	224,998	180,573	44,425	May, 1984
Bang Pakong Thermal # 2	1	550	1,100	230	42	2	-	215,792	186,725	29,067	Aug.,1984
Mae Moh # 5	1	150	525	230	-	1	-	137,475	136,894	581	Nov.,1984
Khao Laem # 1-3	3	100	300	230	196	3	66.7	390,456	359,957	30,499	Dec.,1984
Mae Moh # 6	1	150	675	230	-	1	-	189,438	188,153	1,285	Sep.,1985

(CONTINUED)

(CONTINUED)

TABLE 26 POWER DEVELOPMENT PROJECTS UNDER CONSTRUCTION OR CONSIDERATION 1982.

Name and Location of The Project	Generation Station			Transmission System				Estimated Cost (Thousand US.$)			Anticipated Date of Completion
	Number of Generating Units	Unit Capacity (MW)	Total Plant Capacity (MW)	Transmission And Sub-Transmission Lines		Main Sub-Station		Total	Generating Station	Transmission System	
				Voltage (kV)	Route Length (km)	Number of Stations	Aggregate Transformer Capacity (MVA)				
NEA											
Huai Mae Phongm-	1	1	1	33	7	-	-	926	757	169	1982
Mae Sarieng	2	64	1.28	22	3	-	-	-	-	-	1984
Mae Sanga	2	2.5	5	22	21	-	-	-	-	-	1985
Huai Saphan Hin	2	6	12	115	23	-	-	-	-	-	1986

a Including Costs of Land, Civil Engineering Works Such as Tunnels, Dams etc., Power House, Switchyard, Electrical and Mechanical Equipment, etc., Pertaining to Generating Station.

b Including Costs of Land, Transmission Lines and Sub-Station, etc., Pertaining to Transmission System.

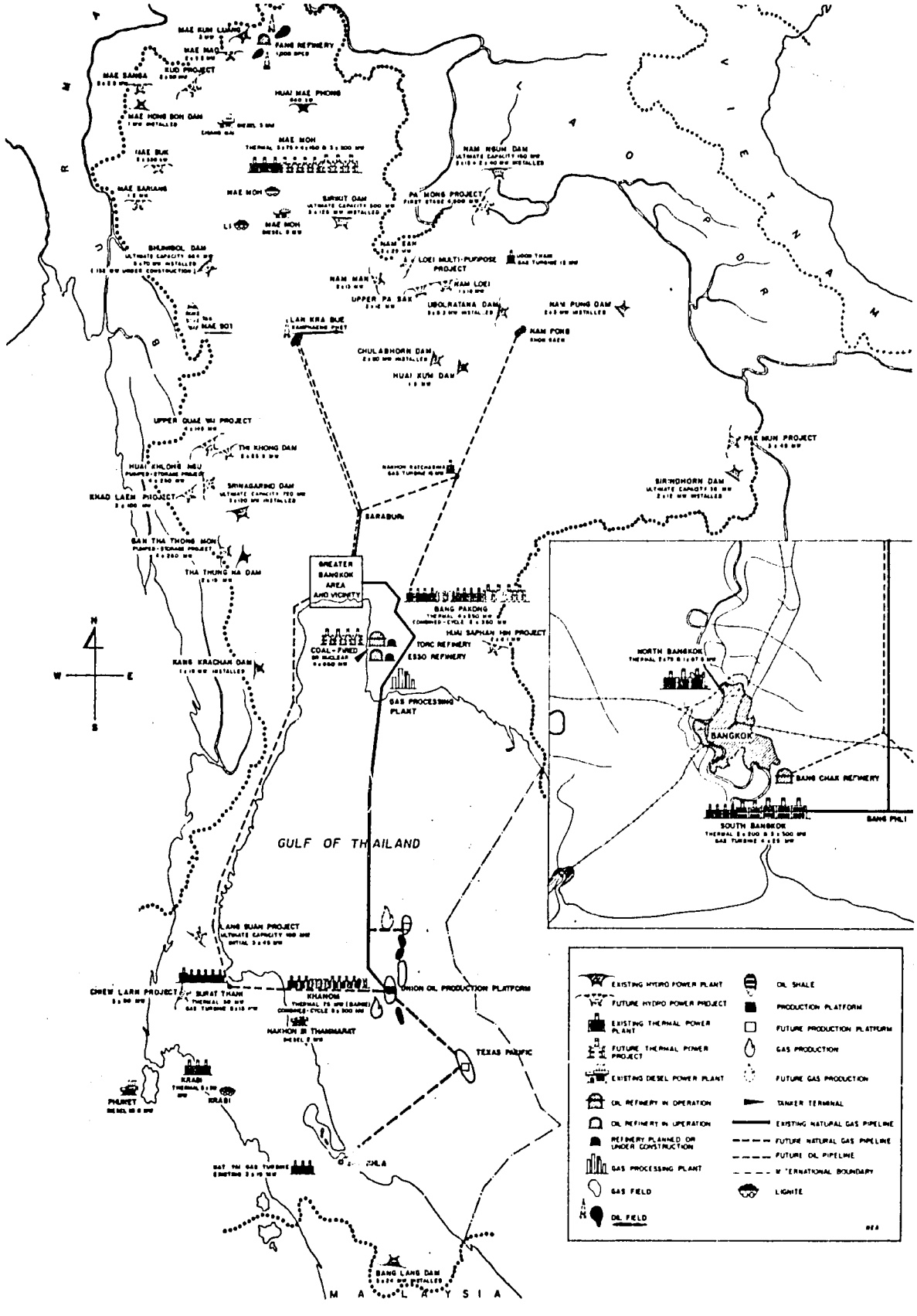


Fig. 1 Energy Map of Thailand

FIGURE 2 ENERGY FLOW CHART (ACTUAL PERFORMANCE IN 1982)

UNIT 10^{15} JOULES

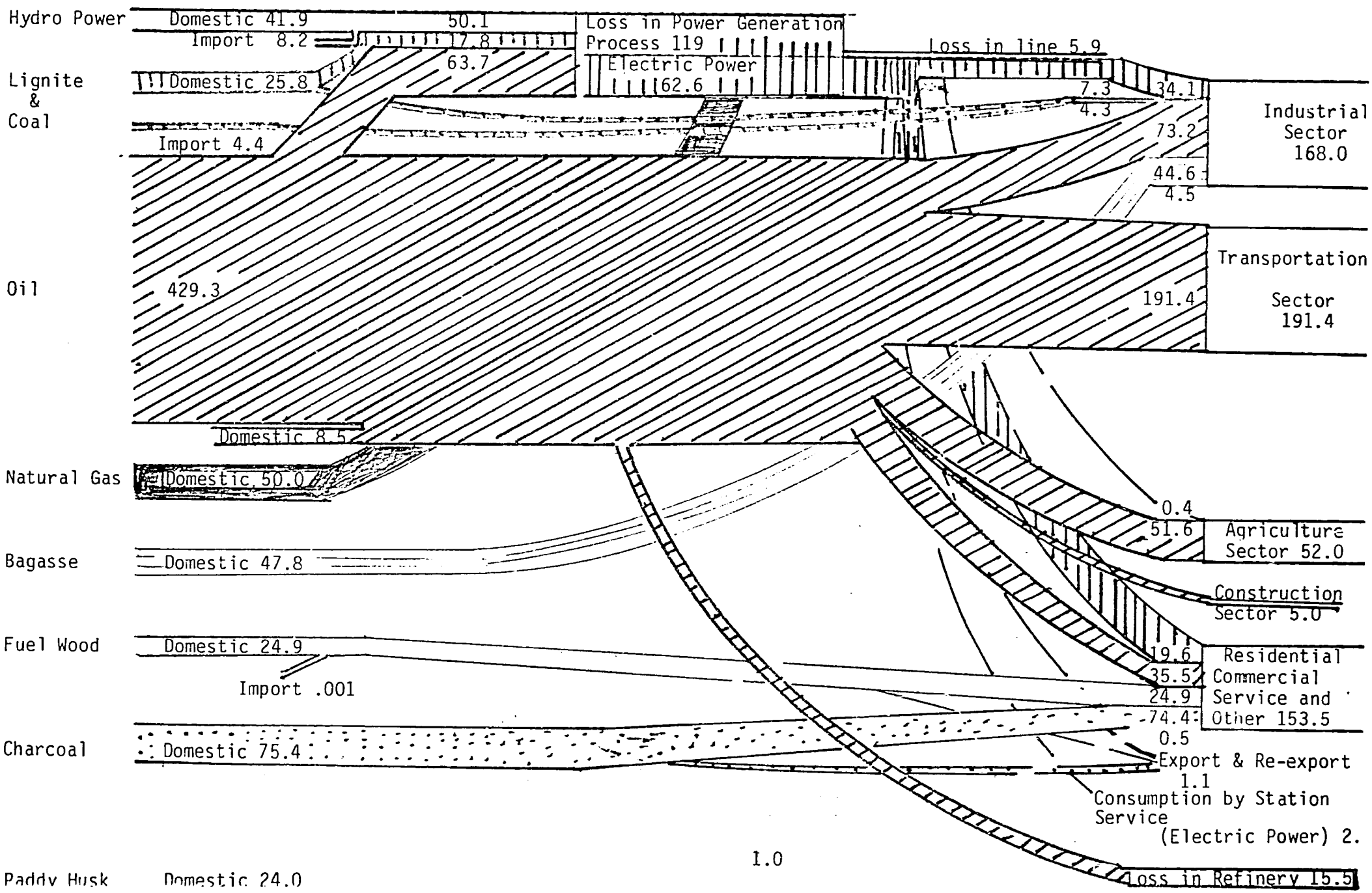
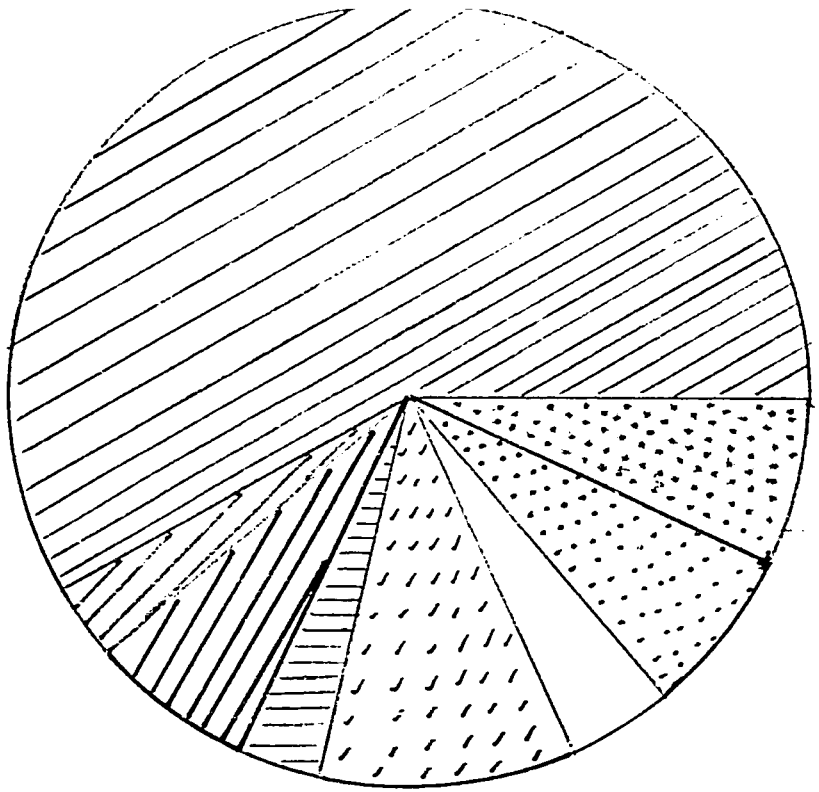


Figure 3 Thailand Energy Supply in 1982



Petroleum Product	58.27 %
Paddy Husk	3.31 %
Bagasse	6.59 %
Fuel Wood	3.43 %
Charcoal	10.41 %
Coal & Lignite	4.17 %
Hydro	6.91 %
Natural Gas	6.91 %

Figure 4 Thailand Energy Demand in 1982

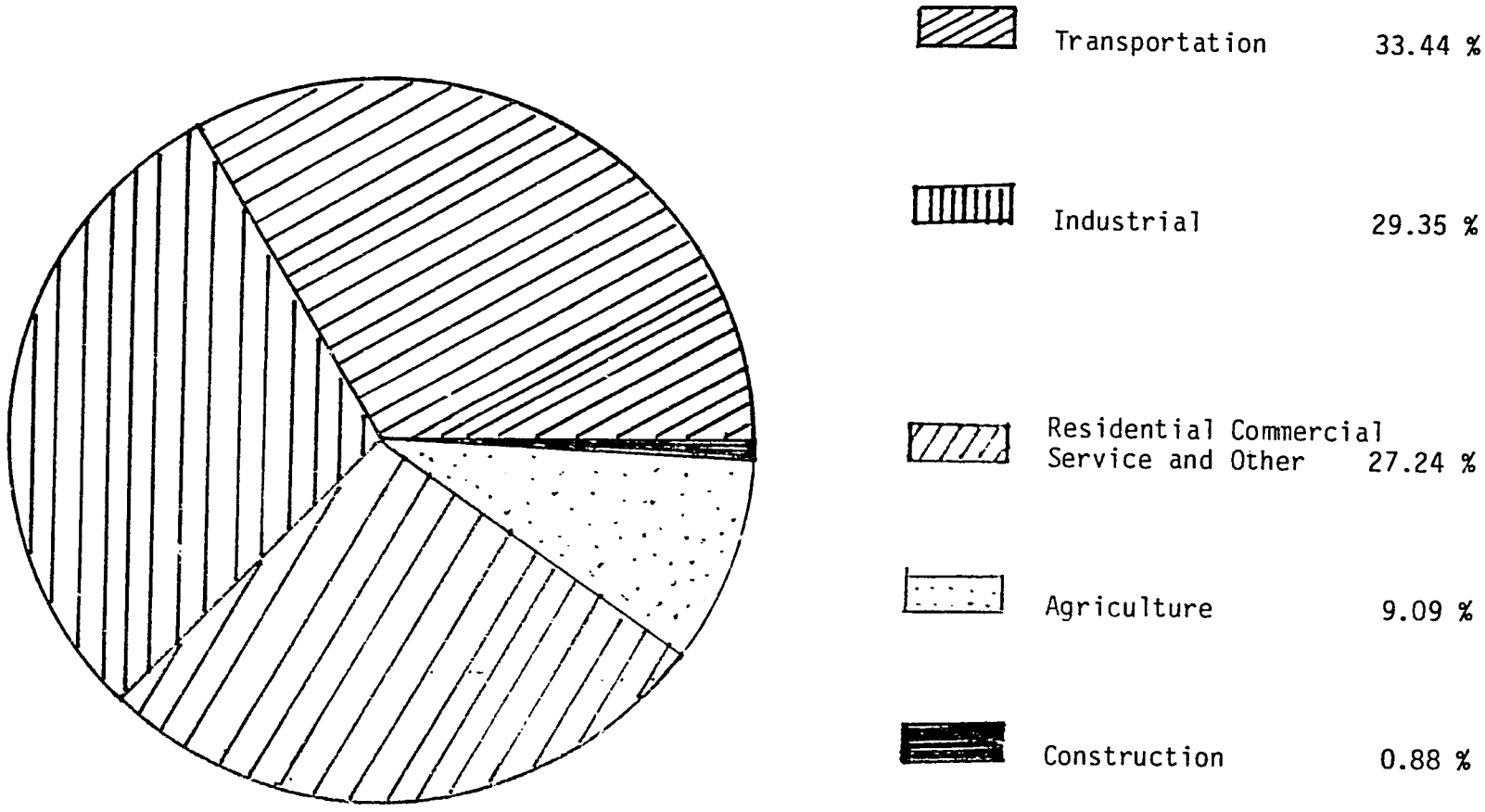


Figure 5 Share of Energy from Indigenous and Foreign Sources in Total Consumption

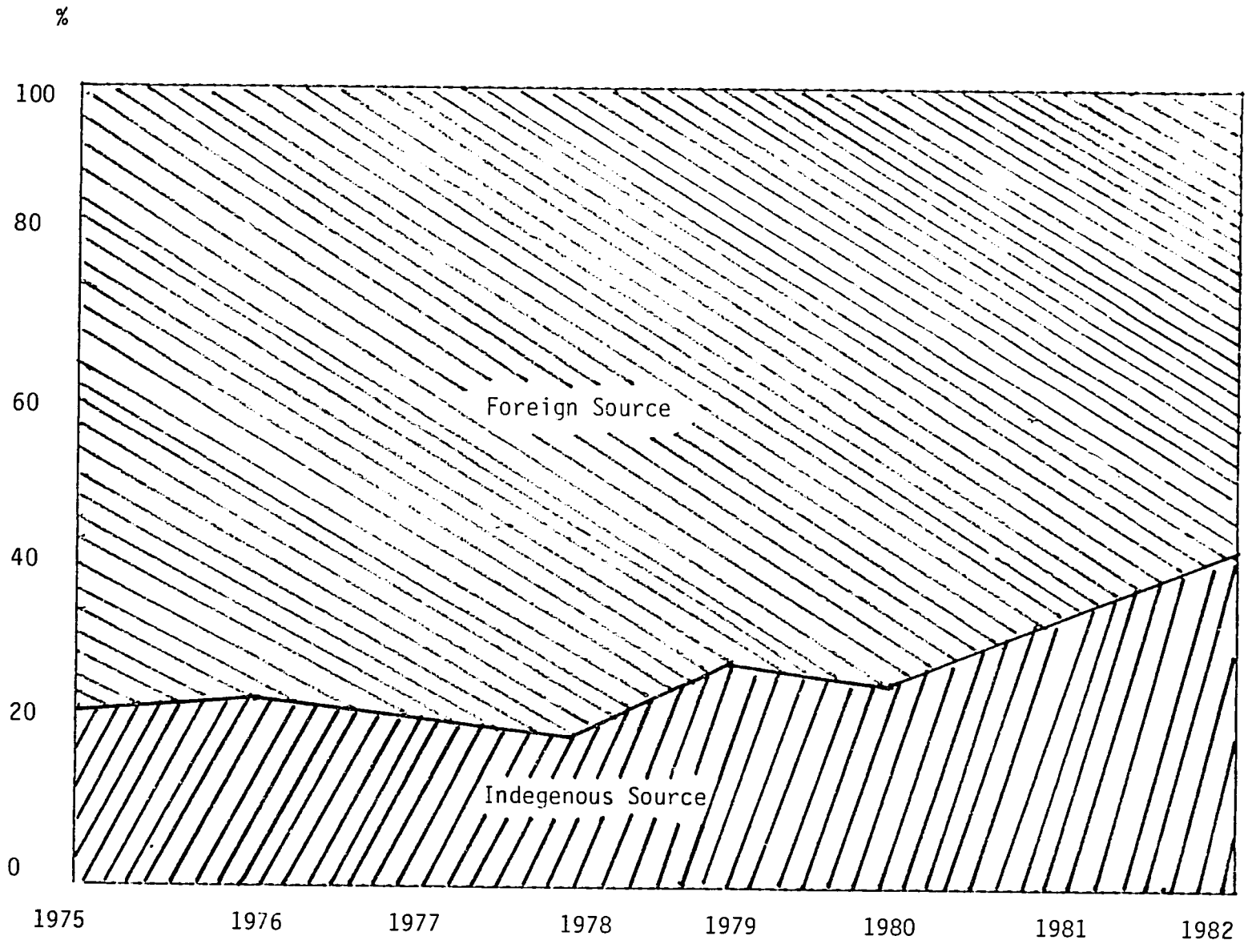


FIGURE 6 MAP SHOWING PETROLEUM EXPLORATION BLOCKS IN THAILAND

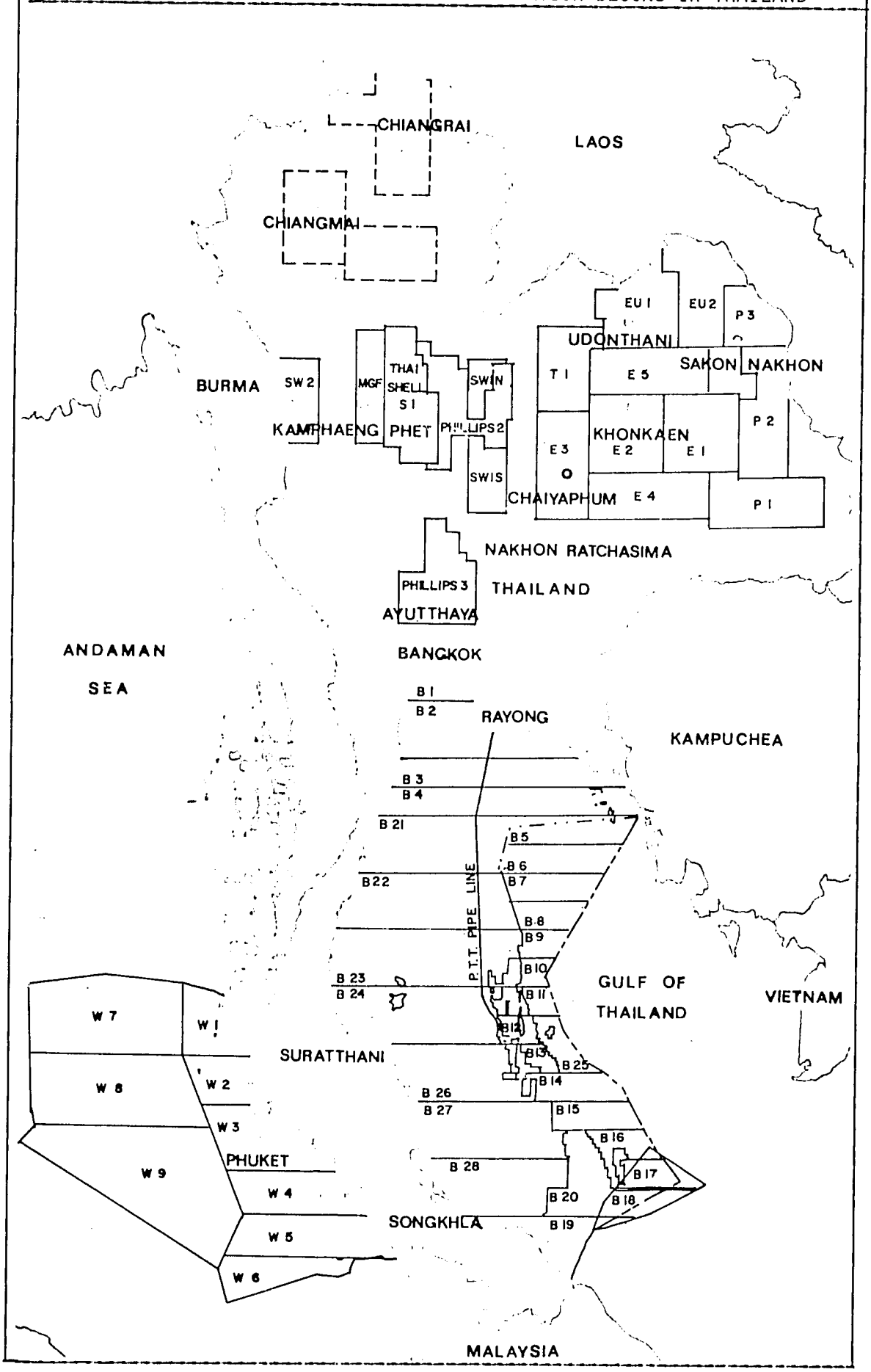


FIGURE 7 MAXIMUM RETAIL PRICES OF PETROLEUM PRODUCTS IN THE MUNICIPALITY OF BANGKOK

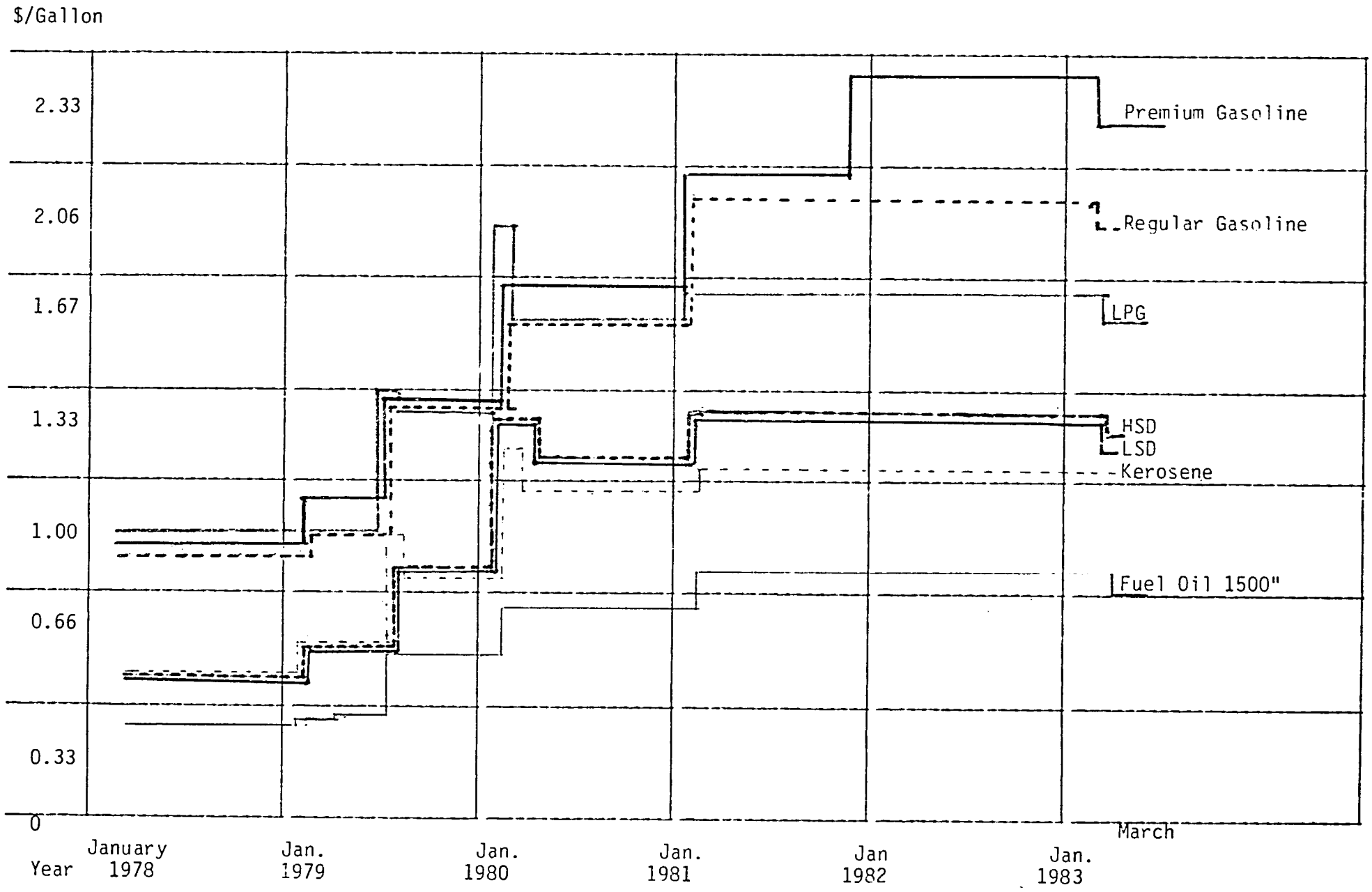


FIGURE 8 FORECAST GROSS ENERGY CONSUMPTION IN THAILAND

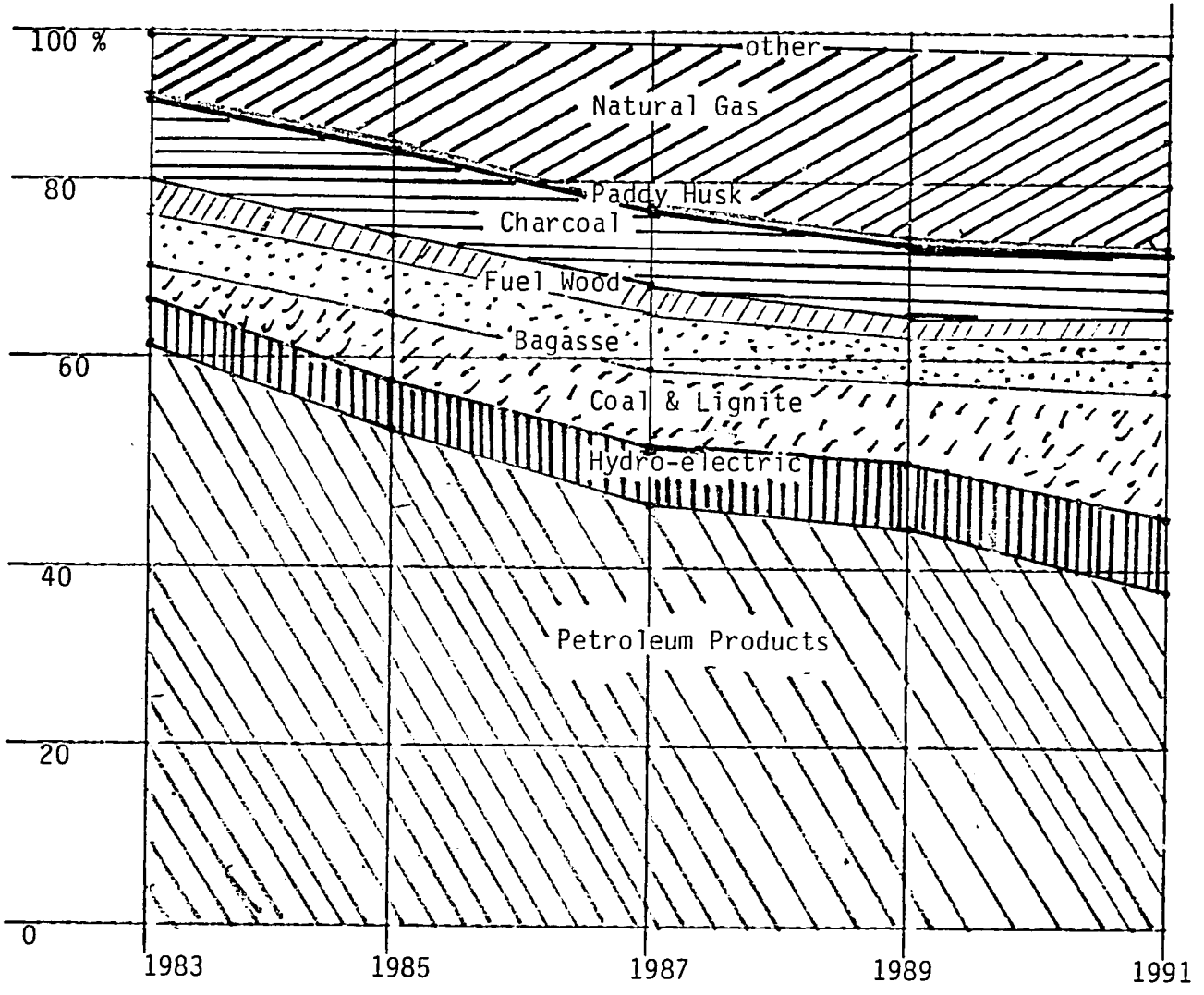


FIGURE 9 THAILAND ENERGY DEMAND FORECAST 1982-1986

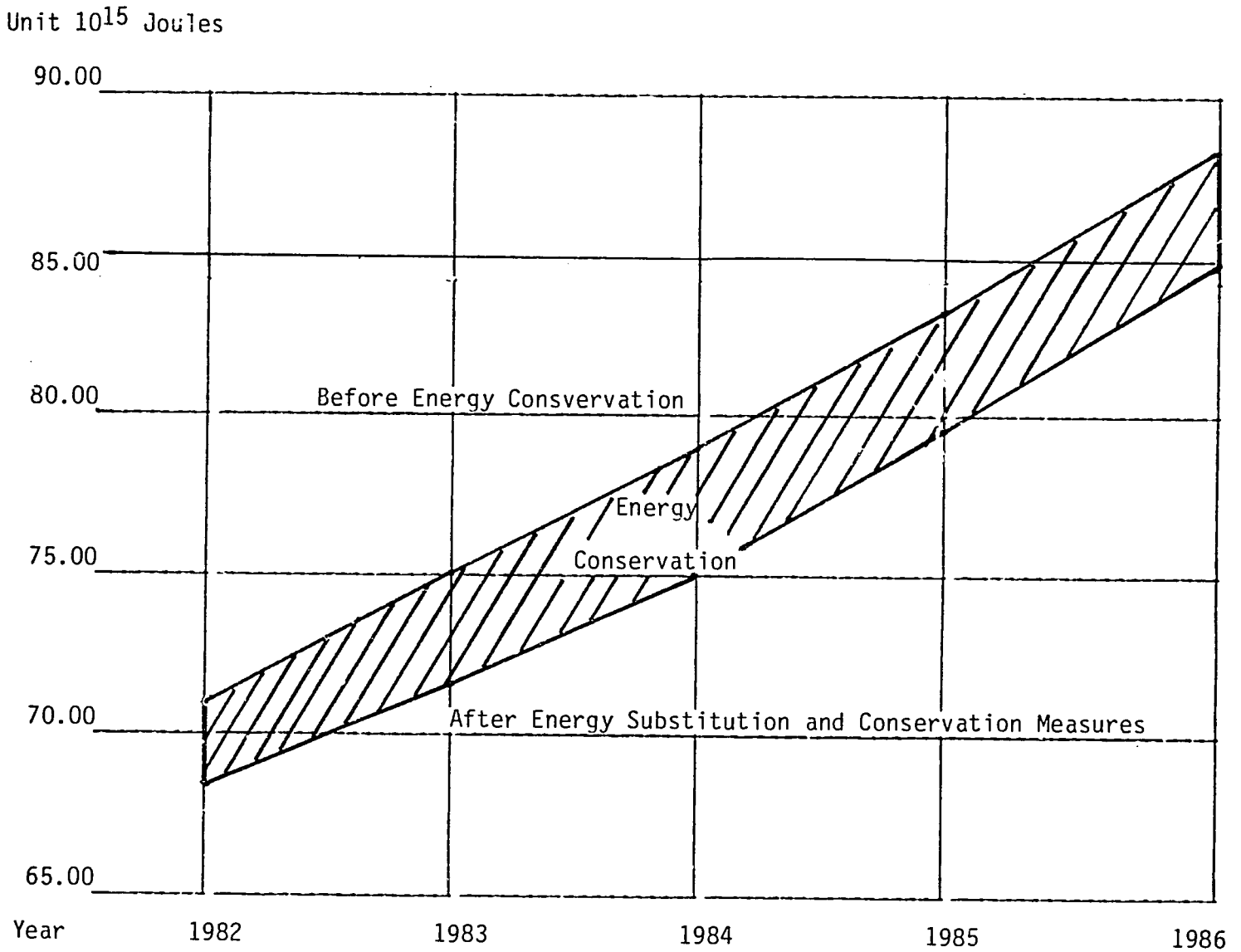
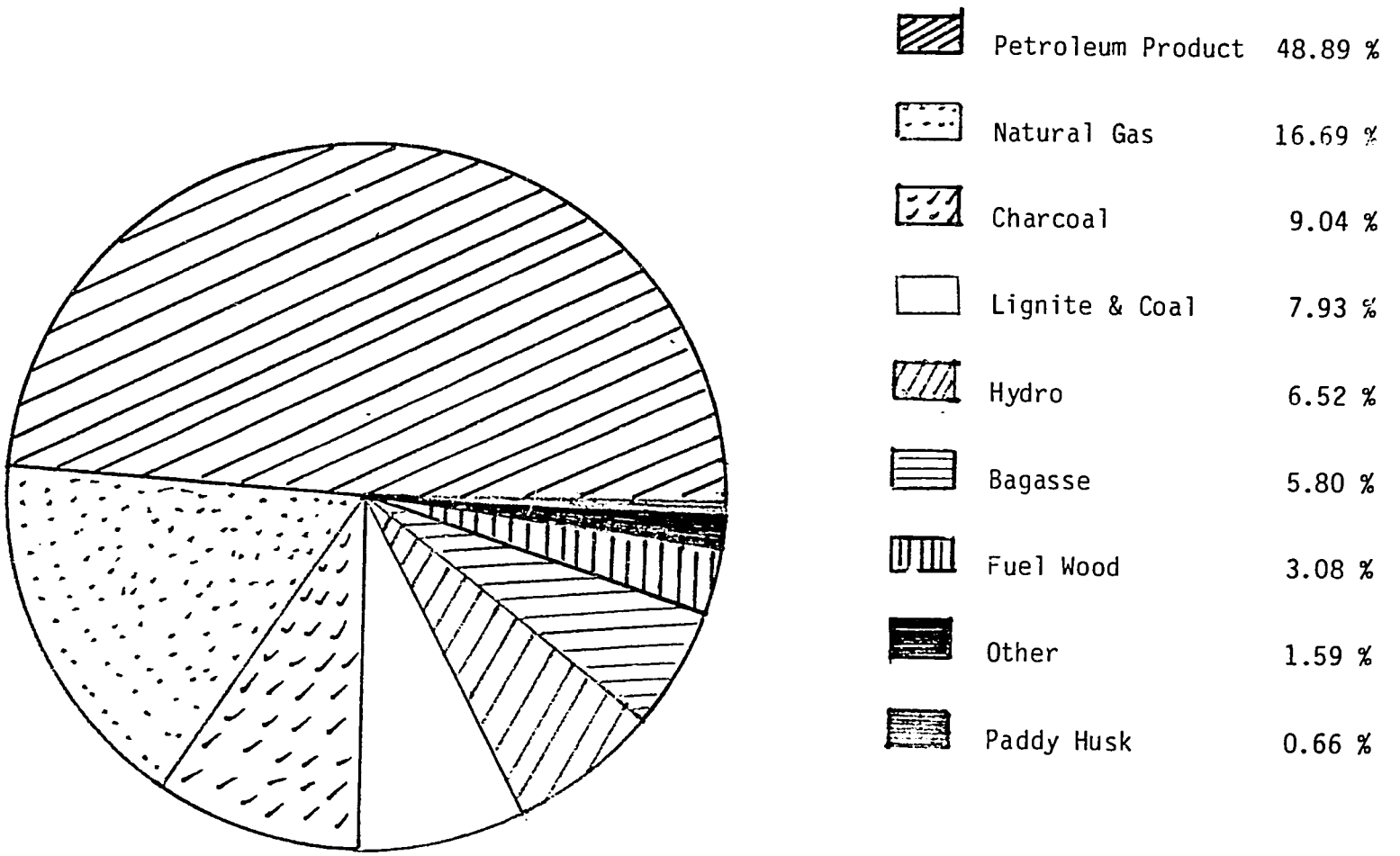



FIGURE 10 FORECAST OF THAILAND ENERGY CONSUMPTION IN 1986