

# Chapter 1

## Introduction

### 1.1 Socio-economic Background

#### ◆ Geography

Thailand is a tropical country located at the heart in the Southeast of Asia. The configuration is likely an axe or tree-shaped and with a total land area of 513,015 km<sup>2</sup>. It is bound in the north by Myanmar (Burma) and Lao people's Democratic Republic (Lao PDR), in the south by Malaysia, in the east by Lao PDR and Cambodia, and in the west by Myanmar. Further north is the Yunnan province of China. These countries, except for Malaysia, form a region known as the Greater Mekong Subregion (GMS).

For country administrative purpose, Thailand is divided into six regions as presented in Table 1-1. The two largest are the northern and northeastern regions. Each comprising around 33% of the total land area. The country is further subdivided into 76 provinces. Nakhon Ratchasima, located in the northeastern region and 256 km (159 miles) from Bangkok, is the largest province with a total land area of 20,494 km<sup>2</sup> (4% of the total area of Thailand). The Bangkok metropolis, or Bangkok, the capital city of Thailand, is located at the southernmost tip of the central region, facing the Gulf of Thailand, but has a total land area of only 1,565 km<sup>2</sup> (0.3% of Thailand's total land area).

<b>Table 1-1 Thailand Land Area by Region</b>			
Region	Number of Province	Land Area	
		km <sup>2</sup>	% of total
Northern	15	169,644	33.07
Central <sup>1/</sup>	13	18,742	3.65
Northeastern	19	168,784	32.90
Eastern	7	37,477	7.31
Western	7	46,087	8.98
Southern	14	70,715	13.78
Bangkok <sup>2/</sup>	1	1,565	0.31
<b>Total</b>	<b>76</b>	<b>513,015</b>	<b>100.00</b>
Note : <sup>1/</sup> Excluding Bangkok			
<sup>2/</sup> Part of central region			

Source : Department of Local Administration, Ministry of Interior

In historic background, Thailand is the only one nation in Southeast of Asia that had never been ruled by a Western power. The Thai people dated their history from B.E. (Buddhist Era) 1781 or A.D. 1238, when the Sukhothai Kingdom was founded in what is now Thailand. For most of its history, the country was called Siam. It officially adopted the name Thailand since 1939. Overview for Socio-economic Background of Thailand such as government, people, economy will be presented below:

#### ◆ Population

In December 31, 2000 total population of Thailand was placed at 62.43 millions (equivalent to 122 persons per km<sup>2</sup>) and the population had been growing at an average annual rate of 1.13% since 1990. It is projected that the total population will reach 64.84 millions by the year 2005 (126 persons per km<sup>2</sup>) and grow at less than 1.0% per year through 2010.

Bangkok, capital city is the most populous and densely populated province in Thailand. By the year 2000 Bangkok residents number 5.7 millions (9.1% of total), equivalent to more than 3,642 persons per km<sup>2</sup>. In contrast, Nakhon Ratchasima, the largest province has a population of less than 3 millions (4.8% of total), or 130 persons per km<sup>2</sup>. Nonthaburi, the second most crowded province located about 20 km north of Bangkok (also in the central region), is estimated to have a density of 1,500 persons per km<sup>2</sup>.

Since the economic boom in the 80s caused a rapid migration of population from those provinces to Bangkok and nearby urban areas where industrial expansion had been taking place. As a consequence, employment in the agriculture sector dropped to 40% (12 millions) of the total employed in 1996, from 68% (18 millions) in 1985. Those employed in the manufacturing sector increased by almost 3 million to 5 millions in 1996 (from 1995 to 1996, from 8% to 13% of the total employed).

In 1998, the second year of the country's economic crisis, the unemployment rate was reversed to worsen 4.4% from 1.5% in 1997. However, the unemployment rate was slightly improving to 4.2% in 1999 and further 3.6% in 2000. For the year 2001 the actual figure still is questionable, but it is predicted at 3.6%.

#### ◆ System of Government and Administration

Executive powers rest with the Cabinet headed by the Prime Minister and consisting of all the ministers (36 members) and deputies of the different functional agencies (or ministries). The Cabinet formulates and co-ordinates the policies of the different ministries.

Legislative powers, however, reside in the National Assembly. The Thai constitution provides for a bicameral legislature consisting of the House of Representatives with 500 elected members, serve four-year terms, and a Senate of 200 members, directly elected by the people and appointed by the King for six-year terms. Since 1975, three parties have dominated the National Assembly-the Social Action, Chart Thai and Democrat Parties. But the latest election in 2001 saw the rise to prominence of only one party-the Thai Rak Thai. In this election, the Thai Rak Thai Party took more parliamentary seats than any other political party-248 seats almost an half of the total. However, for setting up the first cabinet on 16 February 2001 Thai Rak Thai associated with the remaining two parties-New Aspiration and Chart Thai as current government. It should be noted that the head of Thai Rak Thai Party who takes the post of Prime Minister, comes from a business circle. Other members of 35 ministers comprise businessmen and ex-civil service, some militaries and university's professors.

Judicial functions are performed by the Thai court system that consists of three levels. The Courts of First Instance (also called Provincial Courts) are the trial courts at the lowest level. The second level is the Court of Appeals. The third and highest level is the Dika Court (Supreme Court). The Thai legal system is based on the civil law found in Europe. All laws are written and embodied in the Codes or Acts of Parliament (or their equivalent). The decisions of the Supreme Court do not establish binding legal precedents, unlike those in the US.

The Thai government has three levels of administration: the central or national administration, the local administration and the local government. The central administration refers to functional agencies (the ministries and departments) that operate at the national level. The local administration refers to the offices of the functional agencies that operate at the provincial, district or village levels, while the local government refers to the decision making and autonomous ruling body at the provincial level. Local governments have jurisdiction over the local administration.

The primary units of administration, are the provinces ("Changwats") which currently number at 76, including the Bangkok metropolis. This has been the status since 1957. Each province is headed by a governor who is appointed by the King on the recommendation of the Ministry of Interior. The governor reports to the Ministry of Interior with regard to the administration of the province.

The governor is assisted by the Department of Local Administration and presides as the chairman of the board which consists of officials and representatives from the different functional agencies. The governor represents the executive branch of government at the provincial level.

The local government at the provincial level also consists of a legislative branch called the provincial assembly. The provincial assembly normally has 24 elected members who serve a term of five years. The assembly is basically concerned with the provincial budget for financing local government. This budget is approved by the governor who sits as the chairman of the assembly.

To facilitate administration and in order to bring the government closer to the people, provinces are divided into districts ("Amphoe"). But districts are not institutions of autonomous. They are administrative units that provide an important link between the government and the people. Functional agencies, therefore, are represented at the district level in the same way as at the provincial level. They are headed by a district officer appointed by the Ministry of Interior and under the jurisdiction of the governor. The district officer is assisted by the staff of the Local Administration Department, collectively called the Local Administration Section. This section has five subsections: registration, administration, vocational promotion, local development and security (since 1965 in some districts).

Districts are further divided into communes (subdistricts or "Tambons") comprising at least 20 villages. Each village, in turn, has at least five households. A village is led by a headman ("Kamnan"). Village headmen elect among themselves a person to head the commune (headman of the commune). Again, these organizations have evolved to facilitate administration at the provincial level.

#### ◆ Latest Political Situation

Thailand's latest general election was performed on 6 January 2001 in accordance with New Constitution of Thailand 1997. The result was that the Thai Rak Thai Party (TRTP) led by Dr. Taksin Shinnawatra won among the 37 parties. TRTP won 248 seats of total 500 seats in parliament (400 for constituency and 100 for party list). Thai people generally were happy because he committed during election campaign that when he is elected, his government would bring some new projects for the people such as "Thirty Baht for All Disease Treat", "Village Fund" and including economic problem solution which still has to be mended urgently. The new project offering met people's requirements. Dr. Shinnawatra has been appointed to premiership on 9 February 2001 and soon formed a coalition with New Aspiration Party (NAP), Chart Thai Party (CTP), and Sereetham Party (STP) (later on STP was merged with TRTP). The NAP is headed by the former prime minister Gen Chavalit Yongchaiyudth. The CTP is headed by also former prime minister Banharn Silpa-archa. Cabinet comprises of 36 ministers as prescribed by the New Constitution. Majority of the people and political analysts believed that this cabinet will be likely to bring more smoothly management than the previous cabinets because TRTP won supporters in parliament twice the opposition parties and as its policy pleased the people's requirement especially in remote provinces.

Dr. Shinnawatra administrated the country for 3-4 months and then he had to defend the case "hidden wealth" which was accused by National of the Commission Counter Corruption (NCCC) a few weeks before the general election. The final decision was proceeded at National Constitution Commission Court. If he is judged to violate, automatically he will be divested from his position and prohibited in political role for five years. The process of this case took several months which caused political situation instable. In addition many lawyers and political analysts commented that the prime minister is somewhat guilty. However, in early August 2001 he was judged by the Court to be unbiased. Since then Thai political situation has returned to normal condition.

Political analysts believed that if Dr. Shinnawatra's cabinet can implement its committed policy to achieve targets, consequently his administration will be successful. It is, however, Thai economy still depend on exporting to some countries, i.e. U.S.A., Japan, European countries. Export amounts of each year to these countries are more than thousand billions THB. But since this cabinet has managed the country the export is gradually slowdown, because economies in U.S.A. and Japan are also slowdown. These brought to the popularity of political parties somewhat swing, all this economic and political in Thailand has closely relationship.

Some political analysts have given some comments about political stability, the nature of Thai political structure is believed to be relative firm level. It would take sometime to gradually develop itself. Mainly supporting factors of analysts' comment are as follow:

- Too many political parties

In the latest general election (January 6, 2001) there were 37 parties for voters to select.

- Politicians still favor to transfer themselves to new (popular) party when there is a new election.

Latest general election also was a good example, many politicians transferred to the TRTP.

- Politicians likely to be under qualification

Qualified politicians or good politicians cannot win in election-field.

- Thai voters mainly still have different idea

Buying-selling rights for voting in the latest general election still prevail.

These are important factors for stabilizing political development which various groups of Thailand have been responding to nationwide campaign.

It took six months (as of August 2001) since the present cabinet took power, the overall political situation seems normal and has been accepted by general people moderately.

#### ◆ **Economy Situation**

Since Thailand suffered from economic crisis during 1997-1998, after the Prime Minister Mr. Chuan Leekpai took over office on 15 November 1997. The economic situation in Thailand was stabilized when he has committed to restore business and public confidence in the government. He also committed to restore economic order by accepting and implementing prescription by the International Monetary Fund (IMF) and the World Bank. Overall Thai economy was rather healthy, until the end of 1999, which was the last period of his term prior to new general election arrangement on 6 January 2001. After that country administration was taken over by the new Government headed by Dr. Shinnawatra as mentioned before. Economic situation for the year 2001 seems likely to follow prediction of the National Economic and Social Development Board (NESDB).

#### • **First Quarter of 2001**

In the first quarter of 2001, the Thai economy remained in the expansion path, but grew with a slower pace. In the first quarter exports decreased, following the declining trend started at the end of year 2000. Private consumption increased slightly. Private investment continued to expand well in the first quarter; however, there are negative signals of slowdown particularly in machinery and equipment investment. The slowdown in several economic activities was clearer in this quarter because the obstacles to the economic expansion, which had started to show since the second half of last year, became more pronounced. Those discouraging factors are as follows:

- The slowdown in the world economy became clearer because the US economy slowdown became more pronounced and the recovery of the Japanese economy was slower than expected. The slowdown in the world's two major economies inevitably affected the exports of Thailand. The effect of the world economy slowdown on the Thai exports in the first quarter of 2001 was more obvious than at the end of year 2000. It appeared that export value in this quarter in term of dollars decreased by 1.3 percent comparing to rising of 21.8 percent over the first three quarters of last year and 14.4 percent in the final quarter of last year. Exports to the US decreased by 0.5 percent and those to the ASEAN (9) decreased by 0.8 percent. However, exports

to the European Union (15) and Japan increased by 7.6 and 6.2 percent, respectively.

- Non-performing loans (NPLs) in the economy remained high, which was an obstacle for business and financial sector.
- Unemployment rate remained high at approximately 4.25 percent, which was equivalent to 1.41 million unemployed people. This number was close to that of the first quarter of last year. Moreover, there were many underemployed people i.e. who worked less than 35 hours per week, about 1 million.
- A decline in exports became more pronounced and affected negatively to production sector. Its current production level was much lower than the full capacity. Although income from tourism increased continuously and fiscal stimulus program is expected to soon trigger the economic growth, economic indicators in the early 2001 pointed out limited poor economic growth.

- **Economic Projection for 2001**

Economic indicators of production and expenditure in April 2001 showed that economic trend remained somewhat unchanged from the first quarter of this year. Economic indicators of expenditure such as sales of automobiles and sales of soda, soft drinks, and liquor increased from April 2000, but with slower pace than the average of last year.

Economic indicators of private investment for the first quarter of 2001 shown expansion over the same period of previous year. Capital goods import, however, decreased successively in the first quarter of this year due to the slowdown in exports, domestic demand, and low level of production.

Manufacturing Production Index (MPI) in April 2001 increased by 0.7 percent from April 2000 which was lower than 3.1 percent and 1.3 percent of the first quarter (April 2001) this year. Rises of production volumes in several sectors such beverage, construction, iron and products, and automobile and parts corresponded to increase in domestic demand. It should be noted that sales of automobiles and parts were supported by exports as well. However, sales in some sectors such as textile and products, and ornaments decreased. Some exporting goods e.g. electronic products and appliances, integrated circuits, televisions, and canned pineapple were slowed down as *the external demand decreased and international competition was more serious.*

In April 2001 overall capacity utilization rate in manufacturing sector was 50.2 percent, slightly lower than 51.2 percent in last April.

Export value in April and May 2001 decreased 2.4 percent from the same periods of the last year. The monthly average of exports in April and May 2001 was 5,010 million USD, which was lower than the monthly average over the first three months of 5,340 million USD. Exports in almost every category decreased, except frozen shrimps, automobiles and parts, sugar, and cassava products still increased.

Thai export depends on the world market. The economic slowdown in the US and Japan produced spillover effect to other markets. Therefore, it can be seen that Thai exports to major markets such as the US, Japan, EU, and ASEAN decreased.

Decrease in exports and a slowdown in domestic demand caused demand for imported goods to lower. Import value in April and May 2001 increased by 2.3 percent, lower than 11.6 percent of the same period of last year.

Looking into 2001 as a whole, it is anticipated that the slowdown in the Thai economy started in the second half of last year will continue. The US economy in the second half of 2001 seem to expand more than that in the first half of this year and it is more inclined that the US Federal Reserve Bank is likely to cut the Fed Fund Rate even more in the second half of this year. The Japanese economy remained weak and appeared to be stagnant in the first half of this year. The deteriorating external environment will make export recovery in the latter half of this year more challenging, particularly when comparing with high exporting base in the second half of last year.

In the context of slowdown in domestic demand, decrease in exports, low rate of production capacity utilization, high unemployment rate, there are no picked-up signs of business and consumer confidence, and no real signs of recovery in real sector. It is anticipated that in the second half of this year the economy will continue to slow down. Higher gasoline prices, a raise in electricity cost, and an increase in Liquefied Petroleum Gas (LPG) prices together with weakening Baht increase the upward pressure on the inflation, but the weak domestic demand will not make the inflation to increase so much.

Supporting factors that can help boost the economy are the government spending to stimulate domestic demand and stimulus packages to encourage private spending.

Under the circumstance of the world economic slowdown which is an obstacle to Thai exports, it is expected that in 2001 the Thai economy will grow at the annual rate of 2 percent, lower than 4.4 percent of last year (see Table 1-2) according to NESDB.



The projection by sector for 2001 is summarized as follows:

- Private investment expands at the rate of 5.1 percent, lower than 14.2 percent in 2000.
- Government consumption and investment at the constant price expand 5.3 percent and 2.0 percent.
- Private consumption expands at the rate of 3.8 percent, lower than 4.5 percent in 2000.
- Export value is estimated at 66.5 billion USD, which decreases by 2 percent from that of last year, while import value is estimated as 64.4 billion USD, which increases by 3.2 percent.
- Current account surplus is 3.7 percent of GDP, lower than current account surplus of 7.5 percent of GDP last year (2000).
- Inflation rate is 2.2 percent, higher than 1.6 percent in 2000.

If economic packages launched by the government can stimulate the economy as expected, the Thai economy is likely to grow at an annual rate of 3 percent.

Table 1-2 Thailand Economic Outlook 2001

	Actual Preliminary		Estimate (As of 19 March 2001)	Estimate (As of June 2001)
	1999	2000	2001	2001
GDP (Current prices; billion of Baht)	4,615.4	4,900.3	5,179.3	5,081.5
GDP growth rate (1988 price, %)	4.2	4.4	3.5-4.0	2.0-3.0
Investment (1988 price, %)	-4.0	5.4	5.1-5.9	3.7-7.1
♦ Private (1988 price, %)	-5.0	14.6	6.8-8.2	5.1-9.4
♦ Public (1988 price, %)	-2.8	-6.1	2.6	2.0
Consumption (1988 price, %)	3.5	4.9	4.1	3.8
♦ Private (1988 price, %)	4.0	4.6	4.0-4.2	3.5-3.7
♦ Public (1988 price, %)	0.9	6.5	4.8	5.3
Export value (Billions of USD)	56.8	67.9	72.7-74.0	66.5-67.6
♦ Growth rate (%)	7.4	19.6	7.0-9.0	(-2.0) - (-0.5)
Import value (Billions of USD)	47.5	62.4	68.0-70.0	64.4-65.8
♦ Growth rate (%)	16.9	31.3	9.0-12.2	3.2-5.5
Balance of Trade (Billions of USD)	9.3	5.5	4.6	2.1
Current account balance (Billions of USD)	12.5	9.2	6.6	4.2
Current account balance/GDP (%)	10.2	7.5	5.5	3.7
Inflation (%)				
♦ Consumer price index	0.3	1.6	2.2	2.2
♦ GDP Deflator	-4.5	1.7	2.4	1.9

Source : National Economic and Social Development Board, June 2001

- **Economic Policy Management in 2001**

After evaluating economic situation and making forecasts, it can be seen that the Thai economy in 2001 will face limitation reflecting slowdown of the world economy. Therefore, driving force from exports, which helped support the recovery of the economy in the past couple years, will be diminished. Moreover, economic indicators in the first half of this year sent signals about limitation on domestic demand expansion. While the government budget's disbursement is lower than target, economic policies in the second half of this year are acceleration of the government budget's disbursement, and following up and to closely evaluate the effectiveness of measures that the government launched. In addition, increasing the ability to gain income from exports and tourism remains to be an important course to keep the economic potential for recovery.

The stimulus packages prepared in the second half of this year are Village fund, Thailand Asset Management Company (TAMC), credit extension by the government's financial institutions, credit insurance, and acceleration of the budget's disbursement. Two important points to be emphasized are:

- a) based on past experience, functions of the government mechanism remain ineffective;
- b) transparency and monitoring of policy implementation is necessary to prevent more problems or burden generated by current policy implementation.

Beyond the short-term stimulus programs, the long-term measures are required to help build sustainability of the economy. These include, determining the outline for speeding up the economic restructuring both in manufacturing and agricultural sectors, setting up national process to increase production productivity, scientific and technological ability, and information technology because they are key factors to keeping country competitiveness in long term, and reforming educational system and improving the efficiency of various government agencies.

- **Future Economic Prospects**

The Thailand Development Research Institute (TDRI) has given an assumption on future economic prospects for the years up to 2011 as shown in Table 1-3 showing those economic recovery scenery, namely rapid, moderate, slow. It is presented its 8<sup>th</sup> -10<sup>th</sup> five year plans.

The 9<sup>th</sup> Plan (2002-2006) starting on 1 October 2001 (Thai fiscal year) assumes that the average Gross Domestic Product (GDP) growth rates during the period are 6.11%, 4.72% and 3.62% for rapid, moderate and slow respectively. Economists believe that the growth figures of the 9<sup>th</sup> Plan are high considering current economic

situation background. For the 10<sup>th</sup> plan (2007-2011) the annual average growth is assumed to be nearly 5% in overall.

TDRI also has forecasted GDP by sectors as shown in Table 1-4, indicated that by moderate economic recovery of each sector for the 9<sup>th</sup>, 10<sup>th</sup> plans are rather well figures, particularly in industrial sector.

**Table 1-3 Assumption on Economic Conditions**

Fiscal Year	Average GDP Growth Rate		
	Rapid	Moderate	Slow
1999	2.40	0.63	-0.53
2000	5.40	3.67	2.52
2001	6.08	4.42	3.29
2002	6.35	4.80	3.68
2003	6.37	4.90	3.79
2004	6.07	4.68	3.58
2005	5.86	4.56	3.47
2006	5.91	4.62	3.56
2007	6.24	4.86	3.90
2008	6.00	4.74	3.83
2009	5.82	4.73	3.85
2010	5.55	4.63	3.80
2011	5.31	4.55	3.70
<b>Average for the 8<sup>th</sup> Plan (1997 – 2001)</b>	<b>1.60</b>	<b>0.60</b>	<b>-0.10</b>
<b>Average for the 9<sup>th</sup> Plan (2002 – 2006)</b>	<b>6.11</b>	<b>4.72</b>	<b>3.62</b>
<b>Average for the 10<sup>th</sup> Plan (2007 – 2011)</b>	<b>5.78</b>	<b>4.71</b>	<b>3.82</b>

Source : TDRI

**Table 1-4 GDP by Sectors**

	1998	1999	2000	2001	Average Through the Plans		
					8 <sup>th</sup>	9 <sup>th</sup>	10 <sup>th</sup>
<b>Rapid Economic Recovery</b>							
Agriculture	2.3	2.7	3.0	3.0	2.4	3.3	3.6
Industry	-8.5	3.1	7.6	8.5	2.1	8.1	7.0
Service	-4.6	1.9	4.5	5.0	1.1	5.3	5.2
<b>Total (GDP)</b>	<b>-5.5</b>	<b>2.4</b>	<b>5.4</b>	<b>6.1</b>	<b>1.6</b>	<b>6.1</b>	<b>5.8</b>
<b>Moderate Economic Recovery</b>							
Agriculture	2.3	2.0	2.2	2.3	2.0	2.5	2.6
Industry	-8.5	0.3	4.9	6.1	0.6	6.2	6.0
Service	-4.6	0.6	3.2	3.8	0.4	4.2	4.2
<b>Total (GDP)</b>	<b>-5.5</b>	<b>0.6</b>	<b>3.7</b>	<b>4.4</b>	<b>0.6</b>	<b>4.7</b>	<b>4.7</b>
<b>Slow Economic Recovery</b>							
Agriculture	2.3	1.7	2.0	2.0	1.8	2.3	2.5
Industry	-8.5	-1.6	3.0	4.2	-0.5	4.5	4.6
Service	-4.6	-0.3	2.4	3.0	-0.3	3.4	3.6
<b>Total (GDP)</b>	<b>-5.5</b>	<b>-0.5</b>	<b>2.5</b>	<b>3.3</b>	<b>-0.1</b>	<b>3.6</b>	<b>3.8</b>

Source : TDRI

## 1.2 Electricity Sector and Thai Economy

It is needless to say electricity and economy has a close relationship and will move in the same direction. Therefore, if people want to see the growth of economy, they also want to see electricity consumption or vice versa. This relationship can be seen clearly in a few years ago. Looking back to Thailand's electricity and economy situation since 1995 up to 1998 shows what was happened with electricity growth when Thai economy fell during economic crisis in 1997-1998. In Table 1-5 and Fig. 1-1 are illustrated the relationship between electricity and GDP growth rate during 1995-2000 and outlook for 2001.

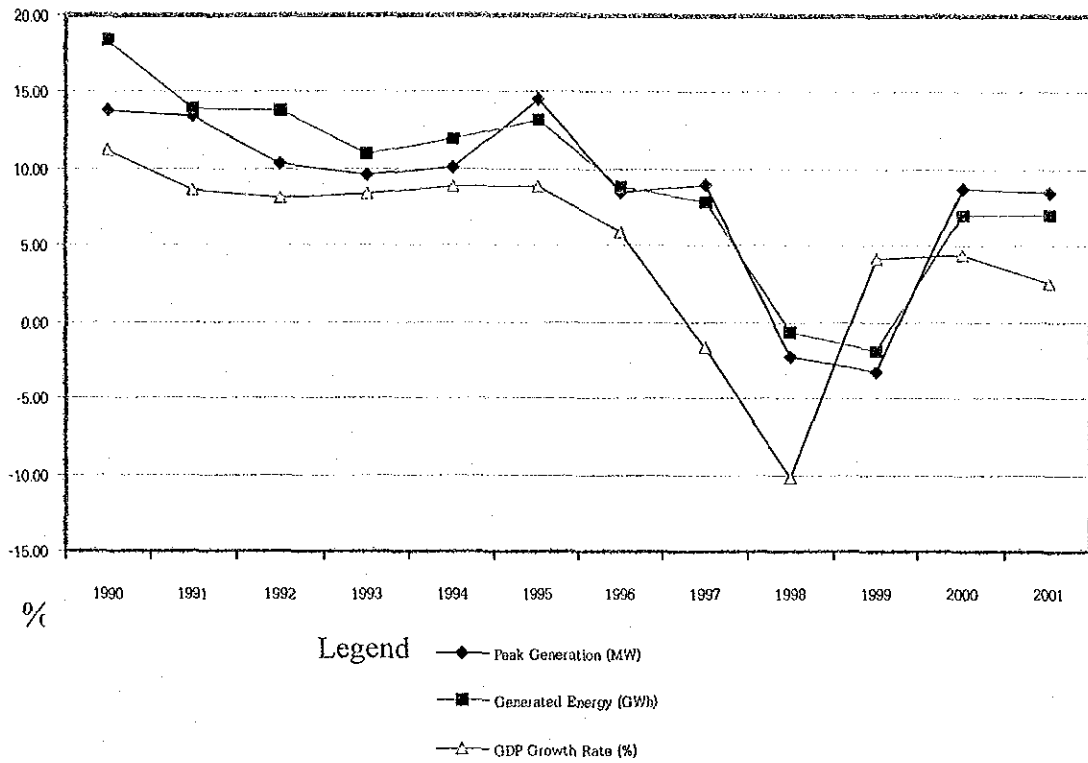
**Table 1-5 The Electricity Generation and Investment of Electricity Generating Authority of Thailand (EGAT)**

Fiscal Year <sup>1/</sup>	Installed Capacity		Peak Generation		Generated Energy		EGAT's Investment		GDP Growth Rate (%)
	MW	Incr. (%)	MW	Incr. (%)	GWh	Incr. (%)	Million Baht	Incr. (%)	
1995	13,427.15	3.64	12,267.90	14.56	78,880	13.25	30,592	10.86	8.90
1996	13,579.30	1.13	13,310.90	8.50	85,924	8.93	28,433	-7.10	5.93
1997	14,686.90	8.16	14,506.30	9.00	92,725	7.92	34,083	19.87	-1.68
1998	15,357.30	4.56	14,179.90	-2.25	92,134	-0.64	44,149	29.53	-10.17
1999	19,110.40	24.44	13,712.40	-3.30	90,413	-1.87	35,728	-19.07	4.16
2000	22,269.00	16.53	14,918.30	8.80	96,781	7.04	22,203	-37.86	4.40
2001	24,321.36	9.22	16,184.00 <sup>2/</sup>	8.48	103,496 <sup>3/</sup>	6.94	30,725	38.38	1.50 <sup>3/</sup>

Note : <sup>1/</sup> Period 1<sup>st</sup> October - 30<sup>th</sup> September  
<sup>2/</sup> Actual (April 23, 2001)  
<sup>3/</sup> Forecast

The years 1995-1997 were the electricity consumption in positive growth, while GDP growth rate was slowed down to -1.68%, could be seen that GDP growth rate seem to be more sensitive than electricity demand (see Fig 1-1).

Fig. 1-1 Electricity and Economy Relationship for Thailand



In Thailand, it is normally that electricity demand will grow faster than economy. For example, in 1995, when GDP was growing at 8.90%, growth electricity consumption 13.25%. When the economy slowed down slightly to -1.68%, but electricity consumption growth still was 7.92%, in positive side.

The electricity consumption slowed down to -0.64% in 1997 and -1.87% in 1998, while the GDP growth rate went down since 1996 or one year before.

It is also observed that, apart from the electricity demand had negative occurred about one year lag to the GDP growth, its percentage also had lesser than those GDP growth rate. Year 1998 is a good example, and its percentage did not occur to be equal GDP growth rate. Once people's living standard has been lifted to higher level, they will try to maintain the same level. Because electric energy is a prime energy for general convenient appliances, therefore, electricity consumption will not drop plummeted like an economic sector. In 1998 the GDP was slowed down elasticity as low -10.17% while electricity consumption was reduction only -0.64%.

## Chapter 2

### Overall Energy Situation

This chapter will present the overview of the energy situation during the 8<sup>th</sup> National Economic and Social Development Plan (NESDP) period (1997-2001), followed by an extensive discussion on the future outlook of the energy supply and demand in Thailand.

Thailand has her own domestic energy resources such as lignite and natural gas which can be used to reduce the dependence on imported energy. The domestic energy resources will be used to supply about half of the total energy need of the country in 2001. In the 9<sup>th</sup> NESDP period, the level of utilization of domestic resources will become a little less than 50 %. In the long run, however, the domestic resources will not be sufficient to meet the increasing demand and the more energy will be imported. At the end of the 10<sup>th</sup> NESDP and 11<sup>th</sup> NESDP periods, the domestic supply will be able to meet only about 30 % and 20 % of the total country demand. The imported energy can be either the primary energy or electricity. Considering the possibility of power development in Thailand neighboring countries, the import of electricity seems to be a favorable option for Thailand.

#### 2.1 Energy Resources and Supply

##### 2.1.1 Natural Gas

The natural gas has been an important source of energy for almost 2 decades since it was discovered in the gulf of Thailand some 20 years ago. At present, the estimated possible reserve is about 12.2 trillion cubic feet which, assuming the current utilization rate, would last for another 17 years.

During the 1997-2000 the production of natural gas increased 11.8 % annually. The main production (28.1 %) came from the Bongkot field in the Gulf of Thailand. For the year 2001, the total supply of natural gas dropped -6.1 % which is mainly due to the impact of the country's economy downturn.

As for the future, it has been projected that the supply of natural gas during the period of the 9<sup>th</sup> NESDP (2002-2006) would increase slightly by 1.0 % annually. For the next 10 years during the 10<sup>th</sup> and 11<sup>th</sup> NESDP, the supply of natural gas is expected to decline. The 10<sup>th</sup> NESDP would see a drop of 4.0 % yearly on the supply and the decreasing trend would continue into the 11<sup>th</sup> NESDP in which the yearly supply would be further reduced by 12.3 % on the average. The decrease in natural gas supply in the long term is attributable to the replacement of electricity production from natural gas by imported coal and the power import from Thailand's neighboring countries. Details of natural gas supply from 2001 up to 2016 are shown in Table 2-1 below.



**Table 2-1 Natural Gas Supply**

Unit : MMSCFD

Fields	2001	2002	2003	2004	2005	2006	2011	2016
<b>Domestic</b>	1,829	1,811	1,959	1,959	1,947	1,920	1,569	813
Sirikit	59	50	50	50	50	50	44	15
Nam Phong	61	63	38	23	24	25	15	
Unocal #1-3	772	847	948	963	950	922	714	
Bongkot	560	506	506	506	506	506	506	507
Pailin	225	218	290	290	290	290	290	291
Benjamas	152	127	127	127	127	127		
<b>Import</b>	620	856	870	1037	1075	1052	964	937
<b>Future Sources</b>					200	200	1,254	3,363
<b>Total</b>	<b>2,449</b>	<b>2,666</b>	<b>2,829</b>	<b>2,996</b>	<b>3,222</b>	<b>3,172</b>	<b>3,787</b>	<b>5,114</b>

Source : Department of Mineral Resources

### 2.1.2 Lignite & Coal

During the first 4 years of the 8<sup>th</sup> NESDP (1997-2001), the supply of lignite decreased continuously at an average rate of 4.5 % per year. EGAT supplies about 75.3 % of the market while other small mining companies such as Prae Lignite, Lanna Lignite and others produced only 10.9 %, 7.2 % and 6.7 %, respectively. The domestic lignite was used mostly for electricity generation which amounted to 80 % of the total production and the remaining 20 % was consumed in the industry sector.

EGAT will remain the major supplier of lignite for the future. However, the production in the long run would be decreased due to lower consumption after power plant retirements at Mae Moh. The imported coal will be used by the domestic Independent Power Producers (IPPs) which will start operation in 2004. However, the commissioning of the coal-fired power plants could be delayed as there has been the strong public opposition.

The remaining reserve of lignite is currently estimated at 1,390 million tons which would last for another 77.7 years.

Details of the supply of lignite and imported coal are given in Table 2-2 below.

**Table 2-2 Supply of Lignite and Coal**

Unit : Thousand Tons

Sources	2001	2002	2003	2004	2005	2006	2011	2016
Domestic Lignite	14,510	14,770	15,179	16,718	16,666	16,666	16,666	11,873
EGAT	11,045	11,535	12,175	13,921	14,066	14,234	16,056	11,263
Private	3,465	3,235	3,004	2,797	2,600	2,432	610	610
Imported Coal	5,166	5,717	6,241	6,953	8,817	12,968	19,732	21,113
Total	19,676	20,487	21,420	23,671	25,483	29,634	36,398	32,986

Source : EGAT

**2.1.3 Domestic Crude Oil and Condensate**

The production of crude oil during 1997-2000 was from three major fields :- Sirikit, Benjamas and Tantawan whose percentage share of production was 41.6 %, 39.3 % and 14.8 %, respectively. The production of condensate during the same period has also been increased steadily in line with the production of natural gas since the condensate was found in the same sites of natural gas. The average rate of increase in the 1997-2000 period was 10.3 % annually.

The current reserve of crude oil is 156.2 million barrels while that of condensate is 212.7 million barrels. The crude oil production is expected to last for 7.4 years and the condensate would be depleted within 11.1 years.

In 2001, the supply of crude oil (including import) will be totaled 811,214 barrels/day, representing an increase of 11.0 % over last year. The growth of crude oil supply would still increase in the 9<sup>th</sup> and 10<sup>th</sup> NESDP with lower figures of 4.7 % and 0.7 %, respectively. During the duration of the 11<sup>th</sup> NESDP, the supply of crude oil is expected to be at zero-growth.

As for the condensate, the domestic production in 2001 will amount to 44,475 barrels/day of which 28,875 barrels/day will be exported. The production of condensate will be in excess of the level of domestic demand and the balance will be exported for the whole period of the 9<sup>th</sup>, 10<sup>th</sup> and 11<sup>th</sup> NESDPs with a declining trend.

Details of the supply of crude oil and condensate can be seen in Table 2-3.

**Table 2-3 Crude Oil and Condensate Supply**

Unit : Barrels/day

Sources	Fiscal Year							
	2001	2002	2003	2004	2005	2006	2011	2016
<b>Crude Oil</b>								
- Domestic	70,989	108,842	112,521	127,050	127,117	115,872	38,691	28,514
Sirikit	24,500	24,000	23,000	24,000	24,000	24,100	7,300	3,000
Phang	740	740	740	740	740	710	549	548
Unocal 1-3	6,200	13,500	14,500	14,200	14,600	13,600	0	16,385
Shefron	39,549	70,602	74,281	88,110	87,777	77,462	30,842	8,581
- Import	740,225	784,588	791,297	763,299	823,719	902,520	1,018,159	1,043,859
<b>Total</b>	<b>811,214</b>	<b>893,430</b>	<b>903,818</b>	<b>890,349</b>	<b>950,836</b>	<b>1,018,392</b>	<b>1,056,850</b>	<b>1,072,373</b>
<b>Condensate</b>								
- Domestic	44,475	43,267	43,470	48,527	47,789	46,974	40,990	20,444
Unocal 1-3	21,093	22,900	23,500	28,584	27,345	26,530	20,546	0
Bongkot	16,475	13,267	10,470	10,527	10,789	10,789	10,789	10,789
Pailin	6,907	7,100	9,500	9,416	9,655	9,655	9,655	9,655
- Export	28,875	27,355	27,240	32,017	30,903	29,919	23,065	1,656
<b>Total</b>	<b>73,350</b>	<b>70,622</b>	<b>70,710</b>	<b>80,544</b>	<b>78,692</b>	<b>76,893</b>	<b>64,055</b>	<b>22,100</b>

Source : Department of Mineral Resources

## 2.1.4 Hydropower

The hydropower potential in Thailand is estimated at 15,155 MW. In the period of 1997-2000, the percentage of capacity of the hydropower with respect to the total installed capacity was 16.9 % in 1997, 16.0 % in 1998, 15.0 % in 1999 and 12.9 % in 2000. The percentage of hydro generation will keep dwindling due to the fact that there will be no more construction of large-scale hydro power plants. In 2001, the capacity share of hydro power plants will be 13.9 % of the total. At the end of the 9<sup>th</sup> NESDP period in 2006, only 12.5 % of capacity will be from hydro power plants. In 2011 and 2016 (the end of the 10<sup>th</sup> and 11<sup>th</sup> NESDP), the generation from hydro power plants will be 9.2 % and 8.4 %, respectively (see Table 2-4). Since the hydro power plants (there is no plan to bring more peaking gas turbines in to operation) will be used to serve the peaking capacity need of the system, there seems to be the possible lack of peaking plants in the long run.

**Table 2-4 Supply of Domestic Hydro Power by EGAT**

Type of Plant	Units	Fiscal Year							
		2001	2002	2003	2004	2005	2006	2011	2016
Hydro power	MW	3,386	3,386	3,386	3,386	3,386	3,386	3,386	4,046
	GWh	5,052	3,552	3,552	4,428	4,512	4,562	4,464	5,573

Source : EGAT

## 2.2 Imported Energy

In the 1997-2000 period, the import of energy was mainly on the crude oil, natural gas and electricity. The import of crude oil increased slightly at the annual rate of 1.5 % over 1996. The import of natural gas from Myanmar started in the year 2000 to be used at the Ratchaburi Power Plant of EGAT. Electricity import as compared to the 1996 level exhibits an increase of 36.9 %. There was also an import of coal in the period which amounted to an annual increase of 2.5 % over 1996.

On an average, the import of energy in the 1997-2000 period decreased slightly from the 1996 figure. In this four year period, the import consisted of 91.6 % of crude oil, 7.0 % of coal, 3.5 % of natural gas, and 0.7 % of electricity. In the same period, there was an export of condensate and petroleum products to the international market.

The long term import of energy is shown in Table 2-5. The net import in 2001 will be 37,264 thousand tons of oil equivalent (ktoe), or 1.2 % increase over the year 2000. This is topped by crude oil and the second highest import will be natural gas from Myanmar which is projected to reach 620 million cubic feet per day in the year 2001. Additional import will be coal and electricity (from Laos). As for the condensate and petroleum products, the domestic consumption will be lower than the domestic production and the remaining will be exported.

In the next 15 years, there will be an increase of the net import of energy in the range of 7-8 % per year, especially on the import of natural gas which will give rise to the annual growth rate of over 10 %. The import of coal will begin in 2005 to be used by IPPs. In terms of the dependency of energy utilization on imported energy, the level in 2001 will be 50 %. The dependency level will remain in the neighborhood of 50 % until 2006, then the dependency will rise to 71 % in 2011. At the end of the 11<sup>th</sup> NESDP period, the imported energy will amount to 81 % of the country's demand for energy.

**Table 2-5 Imported Energy**

Unit : Ktoe

Sources	2001	2002	2003	2004	2005	2006	2011	2016
Domestic Supply	42,728	44,414	46,433	48,410	48,588	48,187	43,141	36,333
Total Import	37,263	40,041	42,124	41,858	48,467	54,655	82,005	115,515
Crude Oil	32,716	39,156	39,491	38,198	41,109	45,042	50,813	52,239
Petroleum Products	-3,150	-9,344	-8,050	-8,795	-8,424	-8,605	-1,564	10,030
Condensate	-1,312	-1,243	-1,237	-1,458	-1,404	-1,359	-1,048	-75
Natural Gas	5,560	7,675	7,800	9,324	11,432	11,226	19,893	38,566
Imported Coal	3,225	3,568	3,895	4,340	5,503	8,095	12,316	13,179
Electricity	224	229	225	249	251	256	1,595	1,576
Demand	73,963	76,936	80,874	84,520	89,548	93,757	116,136	142,112
Dependence on Import	50%	52%	52%	50%	54%	58%	71%	81%

Source : Department of Mineral Resources

## 2.3 Structure of Energy Demand

### 2.3.1 Primary Energy Demand

The primary energy consumption in fiscal year 2001 amounts to 73,963 ktoe, up 3.3 % over fiscal year 2000. The increase is seen in the demand for natural gas and lignite. The use of petroleum products and hydropower (including hydro energy import), however, has been lowered.

In the next five years period (2002-2006), the average annual increase of primary energy consumption is estimated at 4.9 %. In fiscal year 2005, the primary energy demand would be 93,757 ktoe. The growth in consumption of all the primary energy components is expected to increase except for the hydropower whose consumption rate is projected to decrease. In the following 5 years periods of the 10<sup>th</sup> and 11<sup>th</sup> NESDPs, the annual growth rates of primary energy demand averaged at 4.4% and 4.1%, respectively.

The percentage breakdown of primary energy consumption for fiscal year 2001 is as follows:

Petroleum products	38 %
Natural gas	30 %
Renewable energy	20 %
Lignite and coal	11 %
Hydro power	2 %

Details of primary energy demand are shown in Table 2-6a and 2-6b.

**Table 2-6a Primary Energy Demand**

Unit : Ktoe

Energy Sources	Fiscal Year							
	2001	2002	2003	2004	2005	2006	2011	2016
<b>Commercial Energy</b>	59,426	62,013	65,460	68,634	73,199	76,901	96,240	119,046
Petroleum Products	27,789	28,447	30,111	30,765	32,288	33,909	42,983	53,996
Natural Gas	21,965	23,913	25,372	26,944	28,896	28,444	33,964	45,859
Coal and Lignite	8,329	8,637	8,965	9,700	10,765	13,283	16,711	16,385
Hydro power/Import	1,343	1,016	1,012	1,225	1,250	1,265	2,582	2,806
<b>Renewable Energy</b>	14,537	14,922	15,414	15,885	16,350	16,856	19,896	23,065
<b>Total</b>	<b>73,963</b>	<b>76,935</b>	<b>80,874</b>	<b>84,519</b>	<b>89,549</b>	<b>93,757</b>	<b>116,136</b>	<b>142,111</b>

Source : Department of Mineral Resources

**Table 2-6b Composition of Primary Energy Demand**

Unit : %

Energy Sources	Fiscal Year							
	2001	2002	2003	2004	2005	2006	2011	2016
Commercial Energy	80	81	81	81	82	82	83	84
Petroleum Products	38	37	37	36	36	36	37	38
Natural Gas	30	31	31	32	32	30	29	32
Coal and Lignite	11	11	11	11	12	14	14	12
Hydro power/Impor	2	1	1	1	1	1	2	2
Renewable Energy	20	19	19	19	18	18	17	16
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source : Department of Mineral Resources

**2.3.2 Final (Secondary) Energy Demand**

The final energy consumption for fiscal year 2001 is 4.1 % up from fiscal year 2000. The demand for all forms of energy has been increased, especially the demand for natural gas. In the period of 2002-2006 (9<sup>th</sup> NESDP), the demand for the final energy is expected to increase 4.8 % annually followed by the annual rates of increase by 4.9 % and 4.6 % in the 10<sup>th</sup> and 11<sup>th</sup> plan periods, respectively.

In terms of consumption by sectors for fiscal year 2001, the use of the final energy in transportation sector has the highest portion amounting to 38 % followed by the use in the industrial sector at the level of 36 %. In the long run, the consumption of the final energy in the transportation will exhibit a higher trend. At the end of the 11<sup>th</sup> NESDP, the consumption in the transportation sector will be increased to 41 % while the consumption in the industrial sector will be decreased to 35 %.

The consumption of the final energy for fiscal year 2001 is composed of : 54 % petroleum products, 19 % of renewable energy, 7 % of lignite and coal, 16 % of electricity and 4 % of natural gas. At the end of the 11<sup>th</sup> NESDP, the composition of the final energy consumption remains similar to that of fiscal year 2001 with petroleum products as the main source of energy (54 %) followed by electricity, renewable energy, lignite/coal and natural gas, respectively.

Details of the final energy demand are shown in Table 2-7a (breakdown by sectors) and Table 2-7b (breakdown by energy sources), respectively.

**Table 2-7a Breakdown of Final Energy Consumption by Sectors**

Unit : Ktoe

Energy Sources	Fiscal Year							
	2001	2002	2003	2004	2005	2006	2011	2016
Agriculture	2,019	2,033	2,059	2,098	2,203	2,250	2,494	2,783
(%)	4	4	4	4	4	4	3	3
Mining	35	34	34	33	33	32	30	29
(%)	0	0	0	0	0	0	0	0
Industry	17,507	18,228	19,065	20,097	21,129	22,050	27,417	34,000
(%)	35	35	35	35	35	35	35	34
Construction	176	174	175	179	183	188	220	254
(%)	0	0	0	0	0	0	0	0
Residential/Commercial	10,666	11,175	11,753	12,343	12,941	13,579	17,378	21,823
(%)	22	22	22	22	22	22	22	22
Transportation	18,966	19,774	20,789	21,983	23,162	24,428	31,737	40,338
(%)	38	38	39	39	39	39	40	41
<b>Total</b>	<b>49,369</b>	<b>51,418</b>	<b>53,875</b>	<b>56,733</b>	<b>59,651</b>	<b>62,527</b>	<b>79,276</b>	<b>99,227</b>

Source : Department of Mineral Resources



**Table 2-7b Breakdown of Final Energy Consumption by Energy Sources**

Unit : Ktoe

Energy Sources	Fiscal Year							
	2001	2002	2003	2004	2005	2006	2011	2016
Petroleum Products	26,845	27,768	29,005	30,458	31,968	33,580	42,682	53,718
(%)	54	54	54	54	54	54	54	54
Natural Gas	2,181	2,381	2,594	2,948	3,285	3,418	4,416	5,362
(%)	4	5	5	5	6	5	6	5
Coal and Lignite	3,400	3,511	3,629	3,757	3,884	4,019	4,785	5,628
(%)	7	7	7	7	7	6	6	6
Electricity	7,694	8,264	8,838	9,463	10,109	10,785	14,735	19,844
(%)	16	16	16	17	17	17	19	20
Renewable Energy	9,249	9,495	9,807	10,107	10,403	10,725	12,659	14,676
(%)	19	18	18	18	17	17	16	15

Source : Department of Mineral Resources

#### 2.4 Petroleum Products Supply and Consumption

In the 1997-2000 period, the supply of petroleum products increased 2.3 % annually. In the year 2000, the total production of petroleum consisted of diesel oil (39.2 %), benzene (19.7 %), heavy oil (17.2 %), LPG (12.5 %) and airplane fuel/kerosene (11.5 %). The total production of petroleum products in the year 2001 amounted to 710 thousand barrels/day or 0.1 % up from the production of the year 2000. It is expected that the production at the end of the 9<sup>th</sup> NESDP (2006) will be about 968 barrels/day or about 6.4 % increase in terms of the yearly average over the 8<sup>th</sup> NESDP. In the 10<sup>th</sup> NESDP the growth of petroleum products supply will slow down to the rate of 1.3 % yearly. Since there is no expansion of the refinery to be expected in the 11<sup>th</sup> NESDP, the level of supply is expected to be the same as in the 10<sup>th</sup> NESDP.

The demand for petroleum products was up by 3.6 % yearly in the first 4 years of the 8<sup>th</sup> NESDP from the year 1996. The demand structure during these 4 years was made up of 42.4 % of diesel oil, 19.1 % of benzene, 17.5 % of heavy oil, 11.0 % of LPG and 9.9 % of kerosene/airplane fuel. The demand of petroleum products in the year 2001 is 593 thousand barrels/day (down 2.8 % from the year 2000). The use of benzene in the year 2001 dropped by 2.2% due to the higher price of benzene and the slowdown in the country economy caused the consumers to limit the use of vehicles. The use of heavy oil was also decreased since EGAT turned to natural gas for power generation. However, the consumption of LPG was up at a high rate because of the subsidy of LPG price by the government. The rates of increase in petroleum products in the 9<sup>th</sup>, 10<sup>th</sup> and 11<sup>th</sup> national plans will be 4.2 %, 4.9 % and 4.7 % per year, respectively.

Table 2-8 below shows prospects for petroleum products supply and consumption during 2001 through 2016.

**Table 2-8 Petroleum Products Supply and Demand**

Unit : Thousand Barrels/day

Types of Product	Fiscal Year							
	2001	2002	2003	2004	2005	2006	2011	2016
<b>Supply</b>								
LPG	98.0	97.0	95.9	111.9	120.0	123.6	144.7	144.7
Benzene	145.0	184.8	184.8	189.3	194.6	208.6	218.1	218.1
Kerosene/Airplane	79.0	97.3	96.3	89.9	91.5	99.2	98.6	98.6
Diesel	277.0	339.4	347.3	363.8	374.5	390.7	409.6	409.6
Heavy Oil	111.0	135.6	137.2	138.9	144.6	146.1	159.4	159.4
<b>Total</b>	<b>710.0</b>	<b>854.1</b>	<b>861.5</b>	<b>893.8</b>	<b>925.2</b>	<b>968.2</b>	<b>1,030.4</b>	<b>1,030.4</b>
<b>Consumption</b>								
LPG	75.1	79.7	84.2	88.8	93.4	98.3	125.1	156.4
Benzene	113.7	117.2	122.8	130.2	137.7	145.7	193.2	249.4
Kerosene/Airplane	64.0	67.4	71.0	74.7	78.3	81.9	100.9	124.1
Diesel	257.7	267.8	280.5	295.9	311.7	327.7	422.2	533.0
Heavy Oil	82.5	76.7	85.1	71.1	72.6	75.0	83.6	99.5
<b>Total</b>	<b>510.5</b>	<b>532.1</b>	<b>558.5</b>	<b>589.6</b>	<b>621.1</b>	<b>653.6</b>	<b>841.4</b>	<b>1,062.9</b>

Source : Department of Mineral Resources

## 2.5 Energy Development Targets

The Government has a policy to conserve and develop energy as well as promote the efficient use of energy in balance with the country's environment and natural resources. Efforts will be made to reduce dependency on energy sources from foreign countries. Towards this end, the following policies will be pursued:

- (1) Promote the combined use of energy by further developing the use and exploitation of Thailand's natural gas, which is a domestic resource, as the country's major source of energy.
- (2) Promote the efficient procurement and use of alternative energy sources by expediting the survey, development and procurement of alternative energy sources as well as by promoting research and development of innovative energy sources for the purpose of energy conservation.
- (3) Emphasize energy management to increase the competitiveness of Thailand's production sector and to enhance the stability of energy prices through appropriate monetary, fiscal and managerial measures.

In the meantime, the government is drafting a policy paper on energy utilization for the 9<sup>th</sup> NESDP, which is expected to be issued by the beginning of 2002.

### 2.5.1 Domestic Energy Sources

The supply of domestic energy sources for the next 15 years are discussed earlier in section 2.1 of this chapter. The given numbers can be used as the preliminary guideline for the energy development target for Thailand. For convenience of the readers, the supply of domestic energy resources will be recapped in Table 2-9 below:

Table 2-9 Summary of Domestic Energy Supply

Energy Sources	Units	2001	2002	2003	2004	2005	2006	2011	2016
Natural Gas	MMSCFD	1,829	1,811	1,959	1,959	1,947	1,920	1,569	813
Lignite and Coal	10 <sup>3</sup> Tons	14,510	14,770	15,179	16,718	16,666	16,666	16,666	11,873
Crude Oil	Barrels/day	70,989	108,842	112,521	127,050	127,117	115,872	38,691	12,129
Condensate	Barrels/day	44,475	43,267	43,470	48,527	47,789	46,974	40,990	20,444
Hydropower	GWh	5,052	3,552	3,552	4,428	4,512	4,562	4,464	5,573

Source : Department of Mineral Resources

## 2.5.2 Imported Energy Sources

As mentioned above that the dependency on the imported energy for Thailand will range from 50 % to 80 % in the next 15 years. Therefore, the government will have to establish a policy that will allow import of energy to meet this level. Otherwise there will be an energy shortage which is not a favorable situation. The major imported energy will be natural gas for power generation in the combined cycle power plants because it is the most efficient mean of power generation and the import of electricity directly from Thailand's neighbors.

### ◆ Natural Gas

The import of natural gas from Myanmar is from the two fields – Yadana (with a reserve of 10 trillion cubicfeet) and Yetagun (with a reserve of 1.2 trillion cubicfeet) to be used at the Ratchaburi Power Plants and Tri Energy Power Plant. The pipe line connecting the western pipe line system to eastern system was already completed and some of the Myanmar gas has been used at Wang Noi Combined Cycle Power Plant of EGAT. Since the heating values of the Myanmar gas and the gas from the Gulf of Thailand are different, the interchangeable use of gases from the two sources is not possible at the moment. Furthermore, the heating values of the gas from the two Myanmar fields are also different. The gross saturated heating value of the Yadana gas is 712 –720 Btu/ft<sup>3</sup> while that of the Yetagun gas is 1,040 Btu/ft<sup>3</sup>. The modification of the nozzles for the Ratchaburi combined cycle plants is, therefore, necessary for flexible operation of the Ratchaburi combined cycle power plant.

The delivery of natural gas from the Yadana gas field was scheduled to begin in August 1998 with the starting daily contract quantity (DCQ) of 65 million cubic feet/day (MMSCFD) which would be increased to 325 MMSCFD by December 1998. The full delivery was agreed at 525 MMSCFD through the contract life of 20 years. The import of natural gas from the Yetagun gas field began in the year 2000 at the DCQ of 50 MMSCFD. The DCQ will be 200 MMSCFD in 2001 and 2002. For the years 2003 and 2004 the DCQ will be increased to 260 and 330 MMSCFD. From 2004 onwards, the DCQ will be 400 MMSCFD until the end of the contract life of 20 years.

### ◆ Power

The government of Thailand has already signed Memorandum of Understandings (MOUs) for power cooperation with the governments of Lao PDR, Myanmar and China for a combined power import into Thailand of 7,500 MW (3,000 MW from Lao PDR, 1,500 MW from Myanmar and another 3,000 MW from China).

The governments of Thailand and Lao PDR signed the first MOU on June 4, 1993 for a power export to Thailand of 1,500 MW. The second MOU was signed on June 19, 1996 to increase the power purchase by Thailand to 3,000 MW. At present, there are 2 projects, namely, the Theun-Hinbun (187 MW) and the Huai Ho (126 MW) which were already put into commercial operation in March 31, 1998 and September 3, 1999, respectively. The third project – the Nam Theun 2 (920 MW) – is under the stage of negotiation of power purchase agreement (PPA), as of October 2001.

The Laos government has proposed two groups of projects whose power will be exported to Thailand in the future. The first group consists of Nam Theun 2, Nam Ngum 3 and Nam Ngum 2 for a combined capacity at the border point of 1,903 MW, to be commissioned by September 2007. The second group comprises Hong Sa Lignite, Xekaman 1 and Xepien-Xenamnoi with a total capacity at the metering point of 1,380 MW, to be on line by 2008.

According to the current plan, the import of power from other neighboring countries (apart from Lao PDR) will commence in the fiscal year 2009 at the earliest.

Table 2-10 shows the amount of electricity produced from the imported natural gas and imported electricity from Lao PDR as well as the future import.

**Table 2-10 Natural Gas and Imported Electricity from Lao PDR**

Energy Sources	Units	2001	2002	2003	2004	2005	2006	2011	2016
Natural Gas	GWh	22,643	36,224	38,094	42,461	43,533	43,011	38,364	30,072
- Ratchaburi		7,343	18,119	21,184	22,021	23,133	22,681	18,419	16,632
- Tri Energy		4,420	4,880	4,460	5,270	5,270	5,230	5,000	2,000
- Wang Noi		10,880	13,225	12,450	15,170	15,130	15,100	14,945	11,440
Electricity	GWh	2,631	2,690	2,640	2,921	2,918	2,875	39,464	144,432
- Lao PDR		2,631	2,690	2,640	2,921	2,918	2,875	18,722	18,499
- Other countries/IPPs		0	0	0	0	0	0	20,742	125,933
<b>Total</b>	<b>GWh</b>	<b>25,274</b>	<b>38,914</b>	<b>40,734</b>	<b>45,382</b>	<b>46,451</b>	<b>45,886</b>	<b>77,828</b>	<b>174,504</b>

Source : EGAT

## Chapter 3

### Electricity Supply and Demand

#### 3.1 Introduction

The planning for the national economic and social development in Thailand has been done to cover a timeframe of five years at a time. The government of Thailand has launched the first "National Economic and Social Development Plan (NESDP)" since 1962. The eighth NESDP (1997-2001) is currently undertaken. In each NESDP, the framework for the development of energy sector, including electricity generation, has been established. This is to ensure that there will be sufficient power supply to meet the demand of all the customers. The demand for power in Thailand has been growing continuously until 1997 when the country was hit by the economic crisis. However, the demand has picked up again in 2000 after only two years of negative growth in 1998 and 1999. This year, the peak demand of 16,126.4 megawatts was registered on April 23, 2001 representing an increase of 8.48% over that in the previous year.

#### 3.2 Evolution of Electricity Demand

Since the government of Thailand has a policy to accelerate the economic development of the country, the demand for electricity has been increasing at a rapid pace. During the early 1990's, the growth rate for both peak and energy was over 10% annually. The peak demand for 1995, in particular, was up by 14.5% which was the highest growth for the past 10 year. The average growth rate of peak demand for the period of 1991-2000 was 7.72%. The energy demand for the same period increased at 8.40%. The load factor for the Thailand electricity system was 69.50% in 1990. At present, the annual load factor is about 73-74%. The historical peak and energy demand during the period of 1990-2000 is shown in Table 3-1.

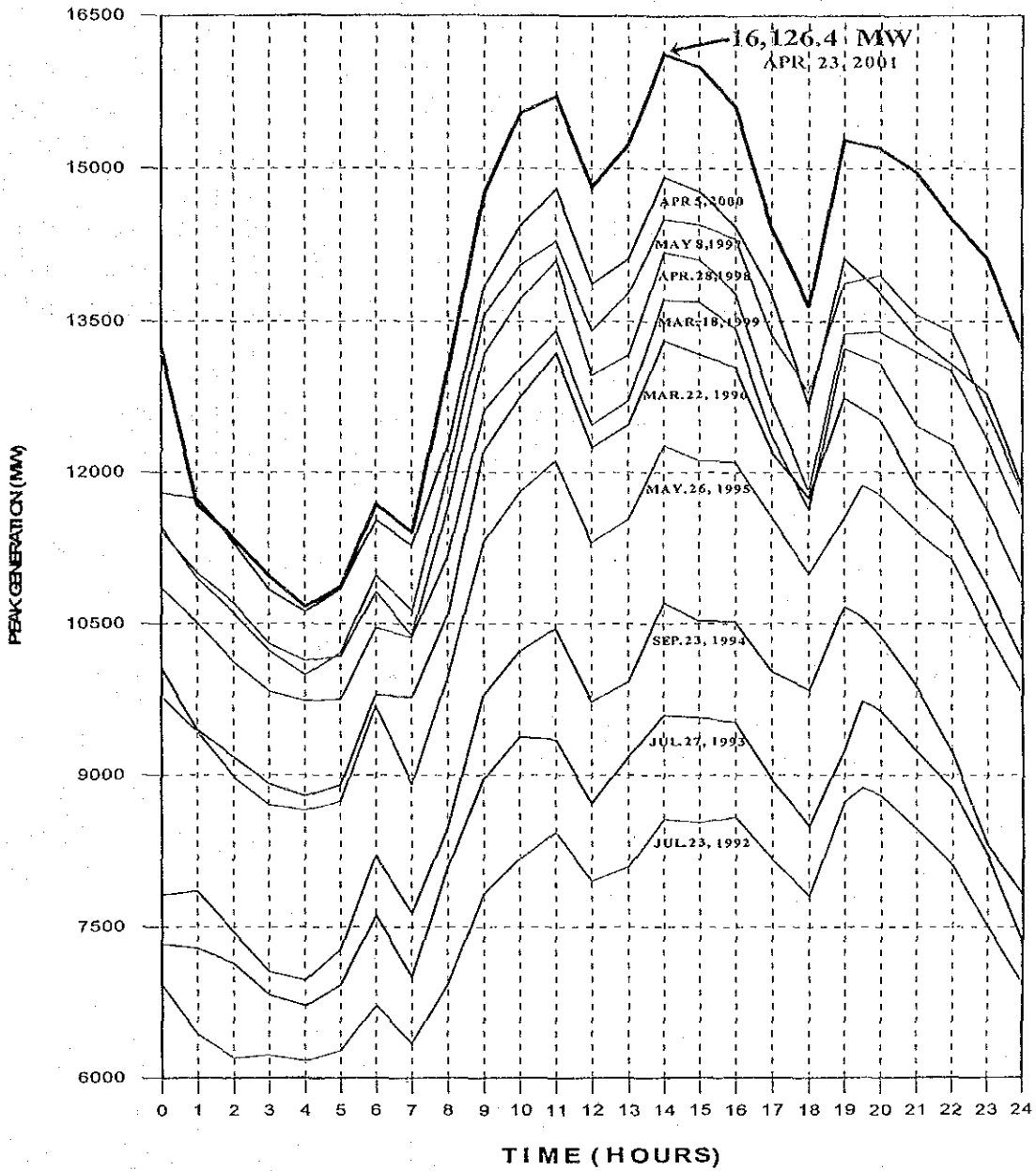
The daily power consumption of Thailand used to peak at night sometime around 7:30 pm. The night peak was common when the country's power consumption was dominated by the residential sector. As the country becomes more and more industrialized, the power demand of the day has shifted to a day-time peak. Beginning in 1994, the maximum daily demand occurred at around 2:00 pm. In addition, the daily demand exhibits a flatter pattern with a higher load factor, typically characterized by three peaks occurring in the morning, afternoon and evening, respectively, Figure 3-1 depicts the daily load curves of the Thailand's system since 1992.

**Table 3-1 Historical Records of Peak and Energy Generation Requirement**

Fiscal Year	Peak Generation			Energy Generation			Load Factor %
	MW	Increase		GWh	Increase		
		MW	%		GWh	%	
1990	7,093.70	861.00	13.81	43,188.79	6,731.70	18.46	69.50
1991	8,045.00	951.30	13.41	49,225.03	6,036.24	13.98	69.85
1992	8,876.90	831.90	10.34	56,006.44	6,781.41	13.78	72.02
1993	9,730.00	853.10	9.61	62,179.73	6,173.29	11.02	72.95
1994	10,708.80	978.80	10.06	69,651.14	7,471.41	12.02	74.25
1995	12,267.90	1,559.10	14.56	78,880.37	9,229.23	13.25	73.40
1996	13,310.90	1,043.00	8.50	85,924.14	7,043.77	8.93	73.69
1997	14,506.30	1,195.40	8.98	92,724.66	6,800.52	7.91	72.97
1998	14,179.90	-326.40	-2.25	92,134.44	-590.22	-0.64	74.17
1999	13,712.40	-467.50	-3.30	90,413.99	-1,720.45	-1.87	75.27
2000	14,918.30	1,205.90	8.79	96,780.72	6,366.73	7.04	74.06
<b>Average Growth</b> 1990-2000		782.50	7.72		5,359.20	8.40	

Source : EGAT

Figure 3-1 Typical Daily Load Curves of Thailand Power System

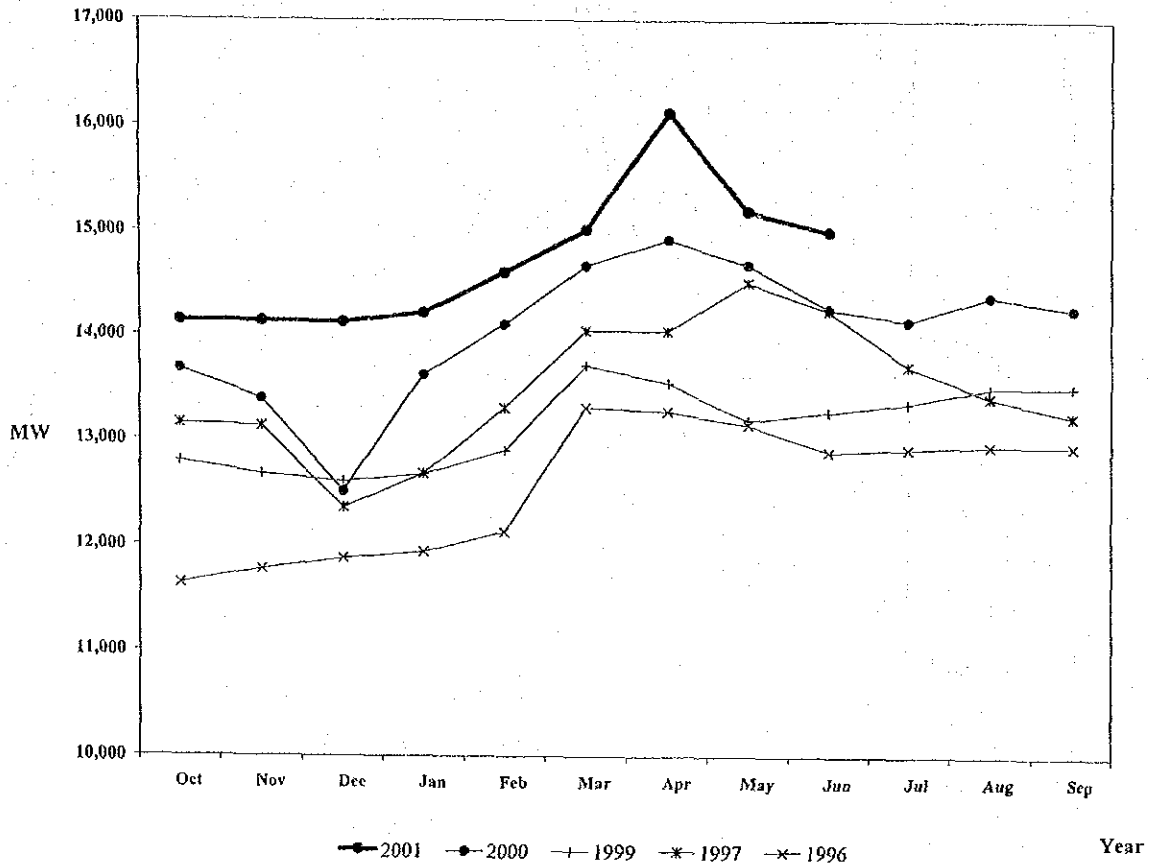


Source : EGAT



In terms of seasonal variation, there is no significant change in the hourly characteristics of the power demand. However, the maximum demand of a day is very much dependent on the temperature. A dip of 1 degree Celsius will lower the maximum demand by as much as 300-400 MW. Figure 3-2 illustrates the monthly peak demand for the fiscal years FY 1996, 1997, 1999, 2000 and 2001 (fiscal year begins in October of the previous year and ends in September of the current year). It is clearly seen that the monthly variation of the demand follows the temperature pattern. The peak demand of the year occurs always in the summer months, around March or April or May. A good example of temperature dependent nature of the power demand can be observed in the month of December 2000. The temperature for December 2000 was the lowest in the past 20 years and, as a consequence, the corresponding peak demand dropped significantly.

**Figure 3-2 Monthly Peak Demand of the Thailand System**



Source : EGAT

### 3.3 Evolution of Electricity Supply

#### 3.3.1 Installed Capacity

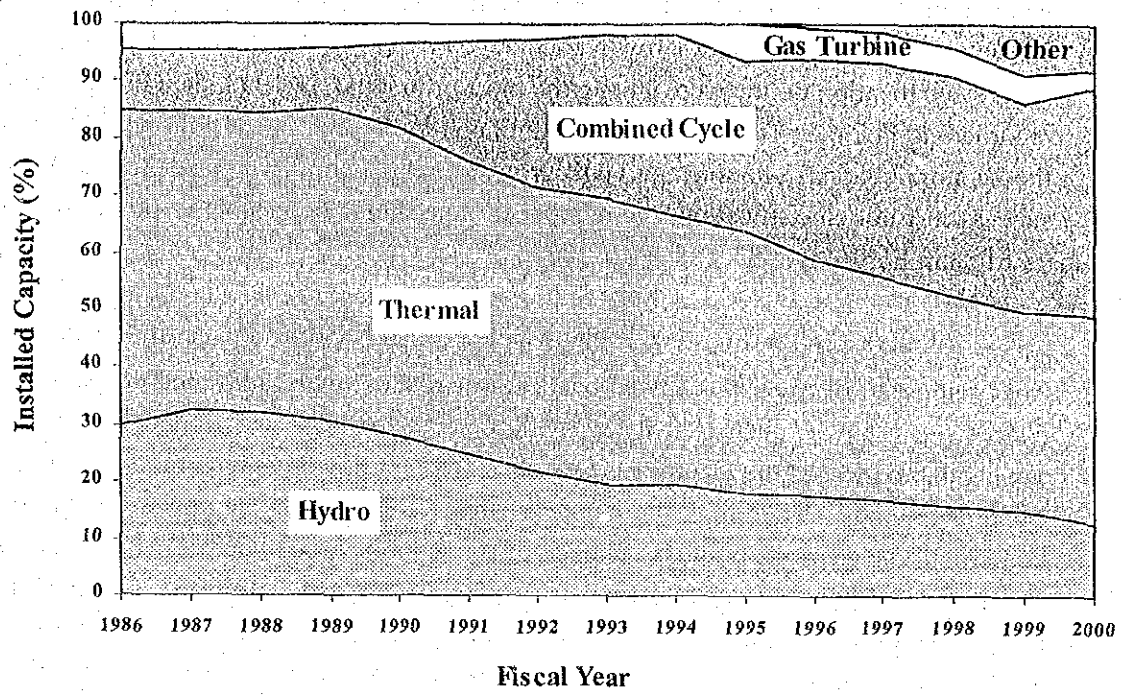
In the last decade, the total installed capacity of the country has increased from approximately 8,000 MW in FY 1990 to about 21,073.7 MW in FY 2000. This capacity addition represents an increase more than 2.5 times or roughly 1,400 MW yearly. There were a number of factors that contributed to this fast growing requirement of new capacity. The high economic growth encouraged by the government of Thailand and the rural electrification policy were among the most influential. In 1990, the GDP growth was recorded at 11.2 %. The GDP growth continued to be high in the following years until the economic crisis. The average GDP growth of this period was over 8.0 %. With the success in rural electrification, the number of households accessible to power rose from 73.61 % in FY 1990 to 82.0 % in FY 2000.

As illustrated in Figure 3-3, the installed capacity of the system in the early years was made up of mostly conventional power plants with additional capacity from hydroelectric power plants. In later years, more natural gas was found in the Gulf of Thailand and most of the natural gas was developed for power generation in the combined cycle technology. Therefore, the market share of combined cycle power plants became larger with the decrease in the percentage of conventional and hydroelectric power plants. The import of power from Lao PDR took place in FY 1998 from the Theun Hinboun Project. The power import from the project was part of the 3,000 MW agreement under the Memorandum of Understanding (MOU) between the governments of Lao PDR and Thailand.

The main categories of power plants during FY 1990 – 2000 were hydroelectric, thermal plants, combined cycle power plants, peaking gas turbines & diesel power plants and purchases from SPPs, Laos, Malaysia as well as from mini hydro projects operated by the Department of Energy Development and Promotion. In FY 1990, the total installed capacity consisted of 28 % of hydropower, 53.8 % of convention thermal, 3.3 % of peaking plants and 0.2 % of power purchases. In FY 2000, more power was generated from combined cycle power plants operated on natural gas from the Gulf of Thailand. The proportion of generating capacity in FY 2000 became 13.7 % of hydro power, 35 % of conventional thermal, 39.8 % of combined cycle power plants, 3.1 % of peaking capacity and 8.4 % of purchase power.

The installed capacity of the EGAT's system during FY 1990 – 2000 are shown in Table 3-2.

Figure 3-3 Evolution of Installed Capacity of Major Power Plant Groups



Source : EGAT

**Table 3-2 Evolution of Installed Capacity During 1990 - 2000**

Types of Power Plants	Unit	Fiscal Year												
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000		
Hydro Power Plants - EGAT	MW	2,236.5	2,416.5	2,416.5	2,422.8	2,565.1	2,690.1	2,861.1	2,873.7	2,873.7	2,873.7	2,880.0		
	%	28.0	25.1	21.9	19.9	19.7	18.3	17.7	16.9	15.8	15.0	13.7		
Thermal Plants	Heavy Oil - EGAT	MW	267.5	267.5	267.5	262.5	262.5	262.5	262.5	262.5	262.5	262.5	237.5	
		%	3.3	2.8	2.4	2.2	2.0	1.8	1.6	1.5	1.4	1.4	1.1	
	Heavy Oil or Natural Gas - EGAT	MW	2,580.0	2,580.0	3,180.0	3,780.0	3,780.0	3,780.0	3,630.0	3,630.0	3,630.0	3,630.0	4,365.0	
		%	32.3	26.8	28.8	31.0	29.1	25.8	22.5	21.4	20.0	19.0	20.7	
		- EGCO	MW	-	-	-	-	-	-	150.0	150.0	150.0	150.0	150.0
		%	-	-	-	-	-	-	0.9	0.9	0.8	0.8	0.7	
	Lignite - EGAT	MW	1,459.0	2,059.0	2,059.0	2,059.0	2,059.0	2,659.0	2,625.0	2,625.0	2,625.0	2,625.0	2,625.0	
		%	18.2	21.4	18.6	16.9	15.8	18.1	15.3	15.5	14.4	13.7	12.5	
	Sub-total	MW	4,306.5	4,906.5	5,506.5	6,101.5	6,101.5	6,701.5	6,667.5	6,667.5	6,667.5	6,667.5	7,377.5	
	%	53.8	50.9	49.8	50.0	46.9	45.7	41.3	39.3	36.7	34.9	35.0		
Combined Cycle Plants - EGAT	MW	1,176.6	2,036.6	2,859.6	3,423.6	4,099.6	3,093.6	3,715.6	4,392.6	5,073.6	5,074.6	5,074.6		
	%	14.7	21.1	25.9	28.1	31.5	21.1	23.0	25.9	27.9	26.6	24.1		
	- EGCO	MW	-	-	-	-	-	1,232.0	1,906.0	1,906.0	1,906.0	1,906.0	1,906.0	
		%	-	-	-	-	-	8.4	11.8	11.2	10.5	10.0	9.0	
	- IPPs	MW	-	-	-	-	-	-	-	-	-	-	1,400.0	
		%	-	-	-	-	-	-	-	-	-	-	6.6	
Sub-total	MW	1,176.6	2,036.6	2,859.6	3,423.6	4,099.6	4,325.6	5,621.6	6,298.6	6,979.6	6,980.6	8,380.6		
%	14.7	21.1	25.9	28.1	31.5	29.5	34.8	37.1	38.4	36.5	39.8			
Gas Turbine & Diesel - EGAT	MW	266.6	266.6	261.6	237.6	223.6	941.6	888.6	902.6	892.0	892.0	662.0		
	%	3.3	2.8	2.4	1.9	1.7	6.4	5.5	5.3	4.9	4.7	3.1		
Purchase (Exclusive of IPPs)	- Domestic	MW	12.7	12.7	12.7	12.7	12.7	12.7	102.7	236.7	579.7	1,366.1	1,433.4	
		%	0.2	0.1	0.1	0.1	0.1	0.1	0.6	1.4	3.2	7.1	6.8	
	- Import	MW	-	-	-	-	-	-	-	-	187.0	340.0	340.0	
		%	-	-	-	-	-	-	-	-	1.0	1.8	1.6	
	Sub-total	MW	12.7	12.7	12.7	12.7	12.7	12.7	102.7	236.7	766.7	1,696.1	1,773.4	
		%	0.2	0.1	0.1	0.1	0.1	0.1	0.6	1.4	4.2	8.9	8.4	
Total	MW	7,998.9	9,638.9	11,056.9	12,198.2	13,002.5	14,671.5	16,141.5	16,979.1	18,179.5	19,109.9	21,073.7		
	%	100.0	100.0	100.0	100.0	100.3	100.0	100.0	100.0	100.0	100.0	100.0		

Source : EGAT

However, the economic downturn which started in 1997 has slowed down the power demand to the extent that the growth rates of FY 1998 and 1999 were negative which was unprecedented in the history of power demand in Thailand. Contrary to this fact, the capacity additions in FY 1998 and 1999 were still developed due to the committed capacity. The committed projects added 7.0 %, 5.1 % and 10.3 % of capacity to the system in FY 1998, 1999 and 2000, respectively. In FY 2001, it is expected that there will be some 870.8 MW of new capacity or 4.13 % increase over FY 2000. At the end of August 2001, the total installed capacity of the system was 21,939 MW which comprised 2,886.264 MW of hydropower, 7,875 MW of conventional thermal power plants, 8,380.6 MW of combined cycle power plants, 340 MW of power purchase from Laos, and 2,457.4 MW of SPPs and peaking capacity. Details of the installed capacity as of August 2001 is shown in Table 3-3.

**Table 3-3 Installed Capacity in Thailand at the End of August 2001**

<b>Power Plants</b>	<b>Fuel Types</b>	<b>Total Capacity (MW)</b>
<b>Hydroelectric</b>	-	<b>2,886.264</b>
<b>Conventional Thermal Plants</b>		<b>7,875.0</b>
◆ South Bangkok	Heavy Oil/Natural Gas	1,330.0
◆ Mae Moh	Lignite	2,625.0
◆ Bang Pakong	Heavy Oil/Natural Gas	2,300.0
◆ Ratchaburi	Natural Gas	1,470.0
◆ Khanom	Heavy Oil/Natural Gas	150.0
<b>Combined Cycle</b>		<b>8,380.6</b>
◆ Nam Phong	Natural Gas	710.0
◆ South Bangkok	Natural Gas	959.0
◆ Bang Pakong	Natural Gas	1,374.6
◆ Wang Noi	Natural Gas	2,031.0
◆ Rayong	Natural Gas	1,232.0
◆ Khanom	Natural Gas	674.0
◆ IPPs	Natural Gas	1,400.0
<b>External Purchase</b>		<b>340.0</b>
◆ Laos	-	340.0
<b>Others</b>		<b>2,457.4</b>
◆ SPPs	-	1,673.4
◆ Gas Turbines	Diesel/Natural Gas	778.0
◆ Diesel Power Plants	Diesel Oil	6.0
<b>Total Capacity</b>		<b>21,939.264</b>

Source : EGAT

### **3.3.2 Energy Generation**

The energy generation from FY 1990 to FY 2000 is shown in Figure 3-4 and Table 3-4. For the past ten years, the generation of electricity has been mainly dependent on domestic fuels. The peak generation is served by hydro power plants, the intermediate generation is from combined cycle power plants operated on natural gas and the base load generation is supplied by thermal plants running on lignite, natural gas and heavy oil. Only the heavy oil is the imported fuel.

In FY 1990, the energy generation was from hydro power (11.2 %), power purchase from Laos (1.6 %), natural gas (41.8 %), heavy oil (21 %), diesel oil (0.6 %), lignite (23.7 %) and SPPs & others (0.1 %).

By the end of the last decade, the generation share of various fuels was totally different from that in FY 1990. The use of heavy oil was reduced while the consumption of natural gas was constantly increased. This is because the generation from heavy oil is more expensive than the production of the combined cycle power plants. Furthermore, it has been the national policy to diversify fuel resources for power generation. This has been achieved by not heavily relying on any particular type of fuel. Under this policy, the utilization of natural gas and lignite has been increased in parallel to maintain an appropriate mix of fuels for electricity generation. After the development of lignite power plants has reached its limit, imported coal will be used to serve the diversification of fuel resources.

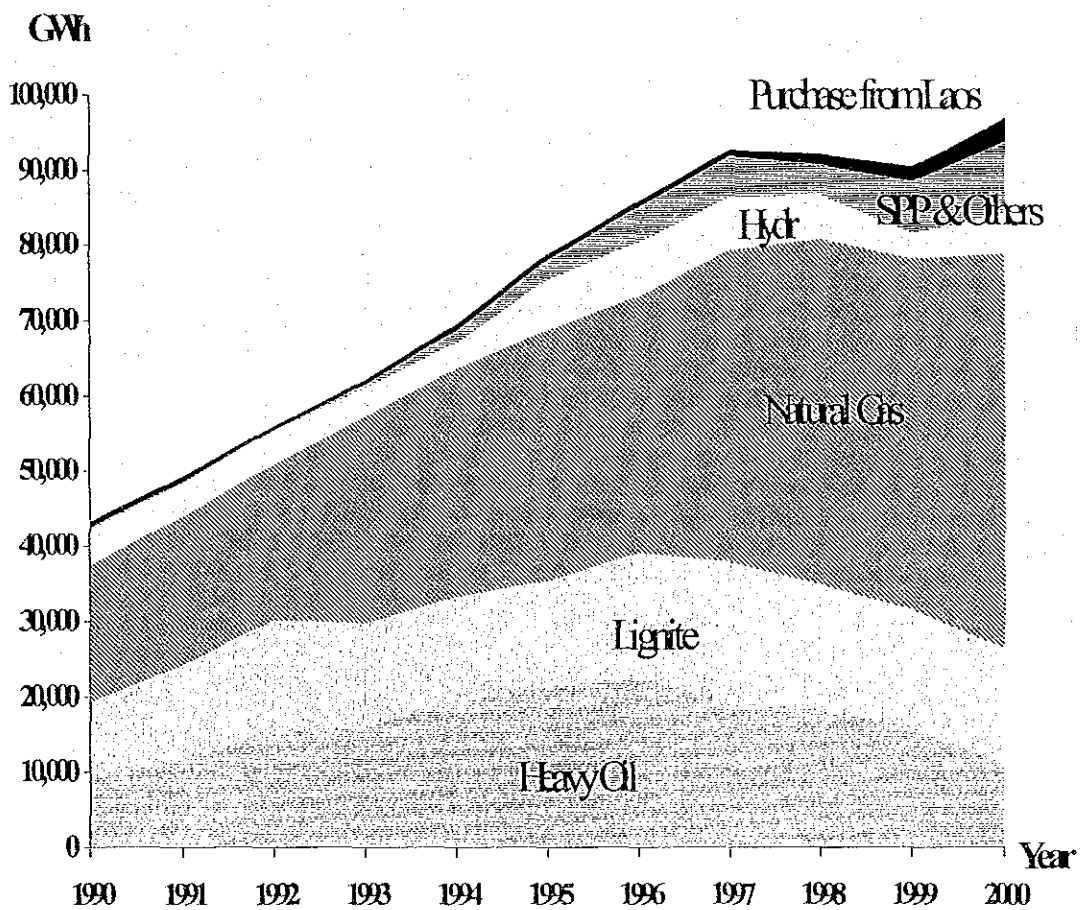
In FY 2000, the generation composition was 5.5 % hydropower, 3.1 % power purchase from Laos, 54.2 % natural gas, 11.3 % heavy oil, 0.2 % diesel oil, 16.0 % lignite and 9.7 % SPP & others.

### **3.4 Fuel Consumption for Power Generation**

Table 3.4 depicts the amount of various fuels used for power generation during the FY 1990 – FY 2000. In this period, the consumption of natural gas was continuously increased from 468 MMSCFD in FY 1990 to 1,202 MMSCDF in FY 2000 which represented an increase of almost 3 times over 10 years. The utilization of natural gas was in line with the policy on energy security and resources diversification which discouraged the dependency on only imported fuels. Consumption of lignite -another domestic fuel which was available in bulk supply - was also increased from 8.890 million tons in FY 1990 to 13.970 million tons in FY 2000 under the same policy.

Since the energy requirement rose at the rate of 8.4 % yearly during this period, the use of heavy oil was also on the upward trend despite the higher consumption of domestic fuels. The consumption of heavy oil increased from 2,318 million liters in FY 1990 to the highest amount of 5,432 million liters in FY 1996. After FY 1996, the use of heavy oil gradually dropped and in FY 2000 the heavy oil consumption was at 2,818 million liters.

Figure 3-4 Historical Records of Energy Generation by Fuel Types



Source : EGAT



**Table 3-4 Historical Records of Energy Generation  
Classified by Fuel Types and Sources**

Types of Fuels	Units	Fiscal Year										
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Hydroelectricity	GWh	4,858	4,413	4,506	3,827	3,431	6,685	7,234	7,055	5,882	3,433	5,296
	(%)	11.2	9.0	8.0	6.2	4.9	8.5	8.4	7.6	6.4	3.8	5.5
Purchase from Laos	GWh	691	630	485	543	801	742	721	803	1,401	1,904	2,991
	(%)	1.6	1.3	0.9	0.9	1.2	0.9	0.8	0.9	1.5	2.1	3.1
Natural Gas	GWh	18,057	19,752	20,663	27,573	30,391	33,446	34,053	41,485	45,929	46,705	52,500
	(%)	41.8	40.1	36.9	44.3	43.6	42.4	39.6	44.7	49.9	51.7	54.2
	MMCFD.	468	625	612	717	842	845	974	1,137	1,190	1,155	1,202
Heavy Oil	GWh	9,067	11,676	15,139	15,925	19,294	21,367	22,511	19,094	18,171	15,945	10,950
	(%)	21.0	23.7	27.0	25.6	27.7	27.1	26.2	20.6	19.7	17.6	11.3
	10 <sup>6</sup> Litres	2,318	2,928	3,772	3,955	4,711	5,169	5,432	4,623	4,477	3,831	2,818
Diesel	GWh	260	217	105	457	1,628	2,434	3,773	3,472	1,216	719	156
	(%)	0.6	0.4	0.2	0.7	2.3	3.1	4.4	3.7	1.3	0.8	0.2
	10 <sup>6</sup> Litres	123	103	53	171	495	671	1,070	1,009	349	214	47
Lignite	GWh	10,230	12,514	15,081	13,826	14,061	14,046	16,670	18,809	16,693	15,588	15,450
	(%)	23.7	25.4	26.9	22.2	20.2	17.8	19.4	20.3	18.1	17.2	16.0
	10 <sup>6</sup> Tons	8,890	11,581	12,554	11,832	12,288	12,791	15,655	19,004	15,900	14,013	13,970
SPP & Others	GWh	27	24	28	29	45	160	962	2,007	2,842	6,120	9,438
	(%)	0.1	0.1	0.1	0.1	0.1	0.2	1.2	2.2	3.1	6.8	9.7
<b>Total Energy Generation</b>	<b>GWh</b>	<b>43,190</b>	<b>49,226</b>	<b>56,007</b>	<b>62,180</b>	<b>69,651</b>	<b>78,880</b>	<b>85,924</b>	<b>92,725</b>	<b>92,134</b>	<b>90,414</b>	<b>96,781</b>

Source : EGAT

### **3.5 Transmission and Distribution System**

The functions of transmission and distribution are assigned to three state enterprises - EGAT, MEA and PEA. EGAT is in charge of power generation and transmission while PEA and MEA take the role of distributing the power received from EGAT to their respective customers. Details of these two functions are given in the following sections.

#### **3.5.1 Transmission System**

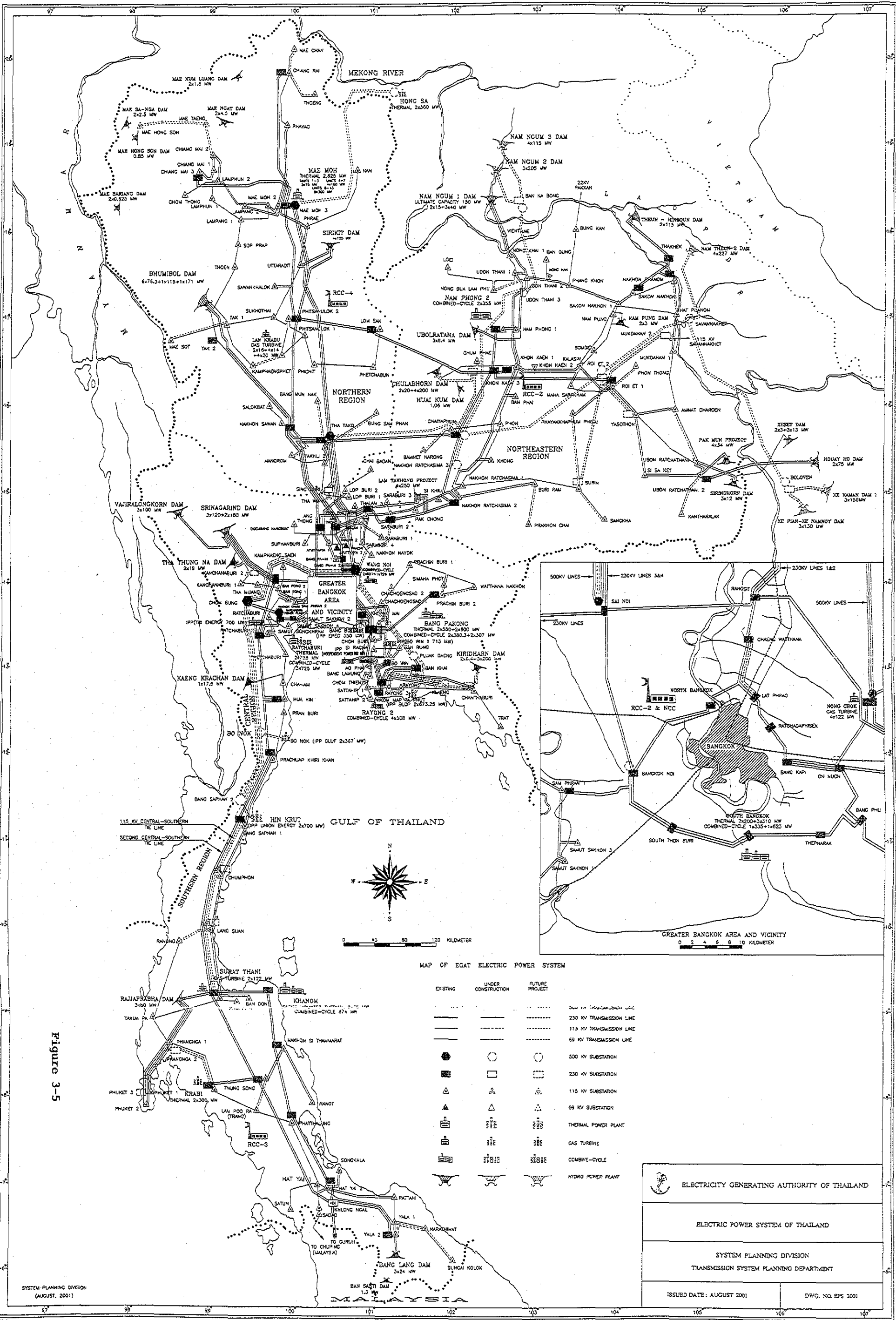
The planning, development, maintenance and operation of the transmission network in Thailand is under the responsibility of EGAT. The standard transmission voltages consist of the 500 kV, 230 kV, 132 kV, 115 kV and 69 kV. The system frequency is 50 Hz throughout the kingdom. As of April 2001, the transmission lines for the whole country extend 26,904 circuit-kilometers (cct-km), connecting all the corners of the country. There are a total of 194 high-voltage substations with transformer capacity amounting to 57,109 MVA. Although, there are 5 levels of transmission voltage in operation, the 132 kV and 69 kV systems will be gradually removed and, currently, there are only 60 circuit-kilometers left in the system for these two voltages. The main trunk is made of the 230 kV system with 10,774 circuit-kilometers at present. The 500 kV system will become more widely used in the future. All of the links to Lao PDR and to IPPs, for example, will be totally at 500 kV. The existing 500 kV transmission lines connect the Mae Moh Power Plant in the North to the load center in Bangkok. More information on the transmission system is given in Table 3-5.

The transmission network is divided into 5 sub-systems in accordance with the EGAT's service areas, known as regions. The 5 regions are -- the North, the Northeast, the South, the Central and the Metropolitan area which is presented in Figure 3-5: Electric Power System of Thailand.

Table 3-5 Description of Existing Transmission System (as of April 2001)

Voltage Levels (kV)	Station		Transmission Line Length (Circuit-kilometers)
	Number	Transformer Capacity (MVA)	
<b>Metropolitan</b>			
500	2	3,450	349
230	12	13,333	788
<b>Sub-total</b>	14	16,783	1,137
<b>Central Region</b>			
500	3	3,000	640
230	19	10,793	32,921
115	44	5,300	2,965
69	2	108	52
<b>Sub-total</b>	68	19,201	6,949
<b>Northeastern Region</b>			
230	9	3,800	1,571
115	37	3,645	5,181
69	-	7	-
<b>Sub-total</b>	46	7,452	6,752
<b>Southern Region</b>			
230	7	3,100	1,828
132	1	133	9
115	19	2,069	3,052
<b>Sub-total</b>	27	5,302	4,889
<b>Northern Region</b>			
500	2	2,400	1,143
230	7	3,200	3,295
115	30	2,771	2,739
<b>Sub-total</b>	39	8,371	7,177
<b>Whole Country</b>			
500	7	8,850	2,132
230	54	34,226	10,774
132	1	133	9
115	130	13,785	13,937
69	2	115	52
<b>Total</b>	<b>194</b>	<b>57,109</b>	<b>26,904</b>

Source : EGAT



3-15

Figure 3-5

SYSTEM PLANNING DIVISION  
(AUGUST, 2001)

### 3.5.2 Distribution System

The distribution of electric power in Thailand is carried out by two state enterprises – the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA). As the names imply, the MEA serves customers in the Bangkok area and other two adjoining provinces, i.e., Nonthaburi and Samutprakarn while PEA distributes electricity to the remaining areas of the country.

The service area of PEA covers approximately 510,000 km<sup>2</sup> or 99 % of the country. Similar to EGAT, the PEA's service area is split into 4 regions, namely, the North, the Northeast, the Central and the South. Each region is further broken down into 3 sub-areas. In addition to distribution function, PEA also operates some small generating units especially in the locations isolated from the main network, such as islands or remote areas. As of March 2001, PEA supplement about 6.24 MW of its own generation to the customers. In FY 2000, PEA's self generation amounted to 21 MW. Details of the PEA's distribution network as of December 31, 2000 are given in Table 3-6. The development of PEA's distribution network since 1982 is also shown in Table 3-7.

The PEA service area is divided into the North, the Northeast, the Central and the South systems. Each system is further divided into three sub-systems. For example, the North system is composed of the North 1, the North 2 and the North 3 sub-systems, respectively. The distribution voltages of PEA area are 115 kV, 69 kV, 33 kV, 22 kV, 19 kV 3.5 kV and the low voltage of 380 volts and 220 volts. As of December 2000, the combined length of the 115/69 kV systems was 3,809.48 circuit-kms. The total length of the remaining high voltage systems was 243,824.03 circuit-kms. The low voltage system covered the highest length totaling 338,493.75 circuit-kms.

Table 3-8 contains the information on the historical development of the distribution system of the MEA from 1981 to 2000. The distribution system of MEA is divided into three groups, i.e., the subtransmission system consisting of the 69 kV, 115 kV and 230 kV, the primary system consisting of the 12 kV and the 24 kV, and the secondary system consisting of the 380/220 V system. As of the end of FY 2000, the length of these three systems were as follows: subtransmission system was 1,160.6 cct-kms, the primary system was 13,303.5 cct-kms and the secondary system was 23,356. 2 cct-kms, respectively.

**Table 3-6 Existing Distribution Facilities of PEA  
(As of December 31, 2000)**

Unit : Circuit-km.

Region	115/69 kV	High Voltage					Low Voltage 380/220
		33 kV	22 kV	19 kV	3.5 kV	Total	
North 1	257.20	4,373.77	11,379.69	1,178.23	-	16,931.69	25,484.11
North 2	285.57	-	20,795.24	-	-	20,795.24	27,618.27
North 3	80.76	-	18,318.98	-	-	18,318.98	22,678.47
<b>Sub-total</b>	<b>623.53</b>	<b>4,373.77</b>	<b>50,493.91</b>	<b>1,178.23</b>	<b>-</b>	<b>56,045.91</b>	<b>75,780.85</b>
Northeast 1	315.45	-	24,354.63	-	-	24,354.63	29,116.13
Northeast 2	56.95	-	26,750.16	-	-	26,750.16	32,250.32
Northeast 3	250.22	-	26,984.72	-	-	26,984.72	37,783.70
<b>Sub-total</b>	<b>622.62</b>	<b>-</b>	<b>78,089.51</b>	<b>-</b>	<b>-</b>	<b>78,089.51</b>	<b>99,150.15</b>
Central 1	885.68	-	15,742.69	-	-	15,742.69	22,501.76
Central 2	820.73	-	22,829.88	-	-	22,829.88	35,075.21
Central 3	507.51	-	16,397.98	-	-	16,397.98	24,723.35
<b>Sub-total</b>	<b>2,213.92</b>	<b>-</b>	<b>54,970.55</b>	<b>-</b>	<b>-</b>	<b>54,970.55</b>	<b>82,300.32</b>
South 1	110.00	862.50	14,355.72	-	-	15,218.22	24,529.19
South 2	175.58	18,800.17	-	7,233.78	29.24	26,063.19	38,885.60
South 3	63.83	7,099.88	-	6,336.77	-	13,436.65	17,847.64
<b>Sub-total</b>	<b>349.41</b>	<b>26,762.55</b>	<b>14,355.72</b>	<b>13,570.55</b>	<b>29.24</b>	<b>54,718.06</b>	<b>81,262.43</b>
<b>Total</b>	<b>3,809.48</b>	<b>31,136.32</b>	<b>197,909.69</b>	<b>14,748.78</b>	<b>29.24</b>	<b>243,824.03</b>	<b>338,493.75</b>

Source : PEA

**Table 3-7 Records of Distribution System of PEA**

Fiscal Year	115/69 kV		33/22/11/3.5 kV		380/220 volt	
	Length (circuit-km)	% Increase	Length (circuit-km)	% Increase	Length (circuit-km)	% Increase
1982	2	-	61,422	28.8	63,286	20.3
1983	13	550.0	70,889	15.4	74,464	17.7
1984	133	-	80,784	14.0	83,859	12.6
1985	53	307.7	89,316	10.6	97,366	16.1
1986	53	-	101,008	13.1	113,537	16.6
1987	56	5.7	113,027	11.9	130,274	14.7
1988	58	3.6	126,216	11.7	152,390	17.0
1989	67	15.5	137,934	9.3	171,103	12.3
1990	92	37.3	152,515	10.6	191,937	12.2
1991	160	73.9	160,264	5.1	203,973	6.3
1992	336	110.0	172,073	7.4	218,705	7.2
1993	547	62.8	178,779	3.9	232,317	6.2
1994	616	12.6	187,189	4.7	243,628	4.9
1995	769	24.8	192,377	2.8	254,559	4.5
1996	1,103	43.4	202,156	5.1	266,849	4.8
1997	1,450	31.5	214,632	6.2	290,890	9.0
1998	1,996	37.7	224,243	4.5	310,595	6.8
1999	2,893	44.9	238,990	6.6	352,227	13.4
2000	3,809	31.7	243,824	2.0	338,494	3.9

Source : PEA

Table 3-8 Length of Subtransmission, Primary and Secondary Lines

Fiscal Year 1981-2000

Unit : cct-km

Fiscal Year	Subtransmission Lines				Primary Lines			Secondary Lines
	69 kV	115 kV	230 kV	Total	12 kV	24 kV	Total	380/220 V
1981	474.9922	26.8042	15.0062	516.8026	3,655.871	1,631.659	5,287.530	11,111.769
1982	441.6296	90.1779	15.0062	546.8137	3,754.253	1,730.532	5,484.785	11,552.195
1983	444.7424	89.8699	15.0062	549.6185	3,908.832	1,749.457	5,658.289	11,964.791
1984	474.0926	87.6454	15.0062	576.7442	4,040.505	1,759.154	5,799.659	12,345.807
1985	484.204	84.754	15.0062	583.9642	4,207.612	1,825.663	6,033.275	12,729.465
1986	516.031	118.0815	15.0062	649.1187	4,379.667	1,948.521	6,328.188	13,120.381
1987	518.523	118.0815	15.0062	651.6107	4,527.581	2,034.893	6,562.474	13,545.084
1988	519.8482	118.0815	15.0062	652.9359	4,610.818	2,545.965	7,156.783	14,043.559
1989	528.8184	130.4968	15.0062	674.3214	4,933.177	2,743.325	7,676.502	14,660.176
1990	536.1814	151.4186	15.0062	702.6062	5,184.837	2,971.200	8,156.037	15,249.977
1991	574.0812	168.9539	15.0062	758.0413	5,290.095	3,192.870	8,482.965	15,928.655
1992	584.4971	176.1194	15.0062	775.6227	5,549.686	3,537.871	9,087.557	16,812.472
1993	609.5528	192.116	15.0062	816.675	5,746.422	3,874.889	9,621.311	17,598.174
1994	652.0797	208.3138	15.0062	875.3997	5,805.383	4,395.228	10,200.611	18,462.406
1995	668.6184	229.9412	15.0062	913.5658	5,981.525	4,835.776	10,817.301	19,558.927
1996	699.5622	245.9518	15.0062	960.5202	6,259.341	5,345.178	11,604.519	20,824.219
1997	721.2621	266.2634	15.0062	1,002.5317	6,550.559	5,713.545	12,264.104	21,789.026
1998	738.84	312.202	15.0062	1,066.0482	6,707.779	5,963.717	12,671.496	22,479.340
1999	745.0472	364.5962	15.0062	1,124.6496	6,837.013	6,166.907	13,003.920	22,915.321
2000	768.0127	377.5824	15.0062	1,160.6013	6,945.496	6,357.955	13,303.451	23,356.230

Source : MEA



## Chapter 4

### Structure and Regulation of the Power Sector

#### 4.1 Introduction

Three state-owned electric utilities are responsible for electricity supply in Thailand. The Electricity Generating Authority of Thailand (EGAT) is responsible for generation and transmission while the function of distribution is shared by the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA). MEA serves metropolitan Bangkok and the two adjacent provinces of Nonthaburi and Samut Prakan. PEA provides electricity to all the other provinces in Thailand.

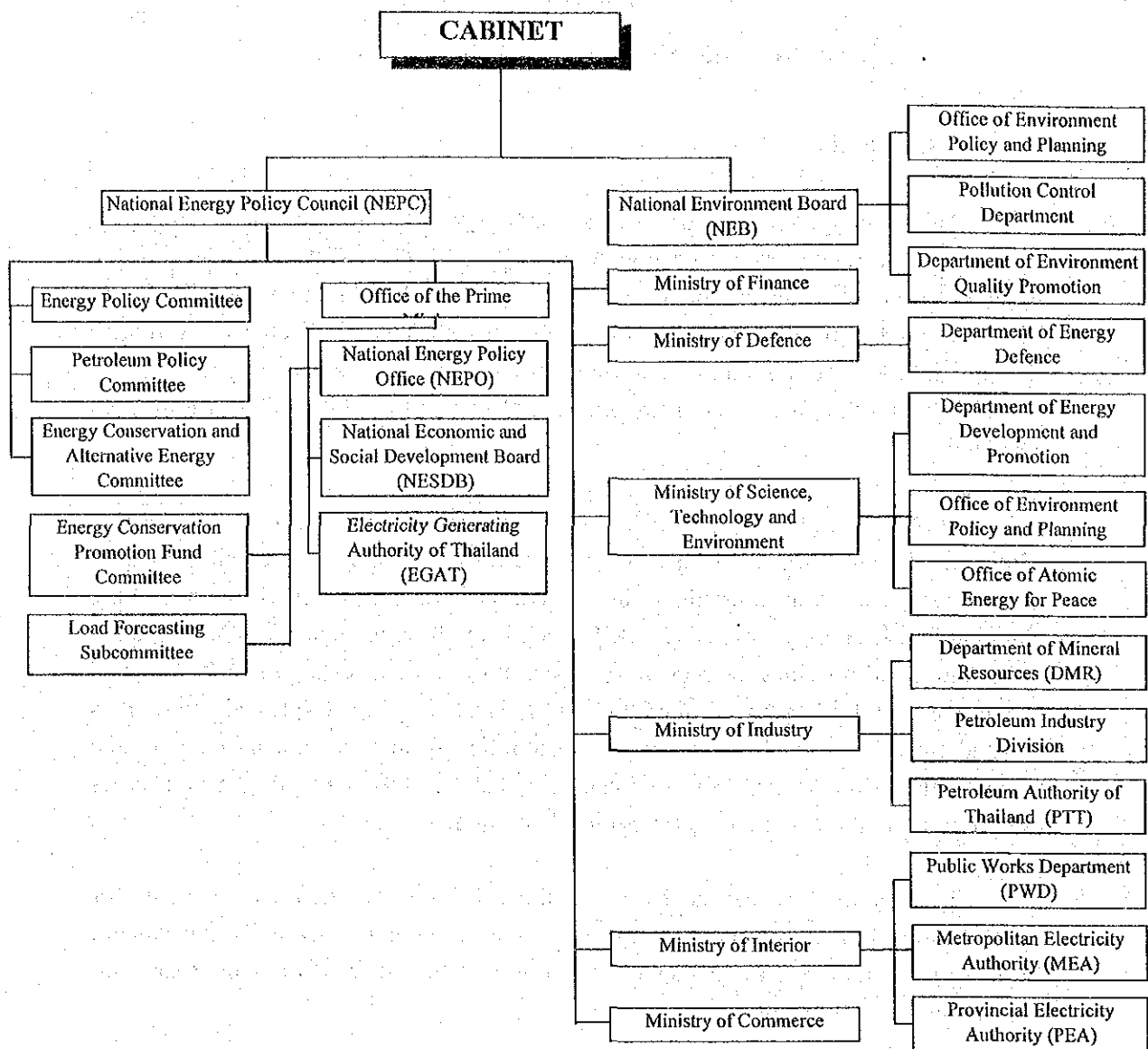
EGAT is under the administrative supervision of the Office of the Prime Minister, while MEA and PEA are under the Ministry of Interior. Overall regulation of the energy sector, from pricing to investment decisions, however, is the task of the National Energy Policy Council (NEPC) which is the topmost body for energy policy formulation and provides the regulatory guidelines to all parties/organizations related to the energy affairs of the country. NEPC is headed by the Prime Minister. It is assisted by the National Energy Policy Committee headed by the minister of the Office of the Prime Minister and National Energy Policy Office (NEPO) which serves as secretariat to the National Energy Policy Committee.

The electricity sector also has strong links with other government agencies, for example, the Ministry of Finance, Ministry of Science, Technology and Environment, Ministry of Commerce, the National Economic and Social Development Board and the National Environment Board.

Institutional structure for regulating the power sector in Thailand is illustrated in Figure 4-1. The structural institution for regulating power sector is divided into 2 main parts, namely NEPC and National Environment Board (NEB).

The NEPC is the central authoritative body in establishment of the national policy. It has relationship with 9 government institutions and 6 ministries. EGAT, MEA, PEA which are responsible for electricity supply are included in this part.

The NEB has relationship with power sector in term of environmental matters. It oversees environmental policy, planning, pollution control and environmental quality as well as environmental promotion.



Source : NEPO

**Figure 4-1 Institutional Structure for Regulating the Power Sector in Thailand**