

## **5.4 The Transmission System Expansion Plans**

As indicated in the PDP2002, the transmission system expansion will be carried out in three major categories:

- 1) Transmission System Development Program to link new generation projects to the main grid, including the construction of additional substations and transmission lines, in various regions of the country to extend services to new customers
- 2) Transmission System Expansion for IPPs Projects and for Power Import.
- 3) Transmission System Package to develop a combination of several minor transmission systems to serve customers in some specific areas, usually with urgent need.

### **5.4.1 Transmission System Development Program**

The long term transmission expansion program will be implemented to increase the capability of the transmission system and to maintain the quality and reliability of the services. The plan has been designed to cover the development of transmission systems throughout the country. The major activities include:

- Upgrading and expansion of the 230 kV transmission system in the Metropolitan area to support the growing demand by the customers connected to the MEA network. Most of the works are under construction and expected to be completed by 2002.
- Development of the transmission system in the central region under the "Transmission System Expansion Package – Phase 9". There is also some development associated with the power purchase from the IPPs.
- Transmission system expansion to receive power from IPPs in the eastern and western areas.
- Development of transmission in the Northeastern area for the Lam Takhong Pumped Storage Project (under construction) and the development of 230 kV to receive power from Lao PDR.
- Transmission system development in the Southern region associated with the future projects in the South, such as the Krabi Thermal Power as well as the network reinforcement to serve the increasing demand.
- Transmission system development in the Northern area to support the tourist industry in Chiang Mai, Mae Hongson and Chiang Rai.

#### **5.4.2 Transmission System Expansion for IPP Projects and for Receiving Power from Lao PDR**

The government of Thailand and Laos have agreed in the form of an MOU for Thailand to import 3,000 MW of power. EGAT has, therefore, planned for the construction of the 500 kV system to the Thai-Lao border to receive the power to the load center in Bangkok and the central area.

#### **5.4.3 Transmission System Expansion Projects (T.S.)**

In addition to the development of the transmission projects associated with the generation projects and the development of the major transmission system facilities, EGAT also implement a combination of several transmission projects known as "Transmission System Expansion Package" or T.S. Each T.S. has been designed to be suitable for financing arrangement. EGAT has successfully implemented 8 T.S, i.e. T.S. 1 to T.S. 8. The T.S. 9 is currently in progress.

The transmission system development as outlined in the PDP2002 consists of the 500 kV, 230 kV and 115 kV systems. For the 500 kV system, some of the projects will be developed to increase the power transfer to the Southern system, some will be for the power import from Lao PDR and some will be for the connection of IPPs to the main grid.

##### **The 500 kV System**

- **Projects to increase power transfer to the South**

The Bangsapan2-Chombung which consists of 4 circuits of 500 kV transmission lines will be implemented in 2 stages. The first stage is scheduled for operation in 2004 and the second stage will be completed in 2010. When they are in operation, these Bangsapan 2 – Chombung lines will help eliminate the problem of power oscillation and will increase the stability limit in the current Southern-Central tie lines.

- **Projects for power import from Laos**

The transmission system extension to the Thai-Laos border consists of three separate line routes, i.e., from Mukdahan, Nongkai and Nan provinces to the Thai-Laos border. All these lines are planned to be completed in 2007 to receive the power from the future projects beyond Nam Theun 2 in Laos under the agreement in the existing MOU.

- **Projects associated with IPPs**

The transmission projects to link the IPPs to the main grid cover only a short distance. The transmission system development under this scheme will be for the Gulf Electric, Union Energy and the BLCP power plants and will be completed by 2004, 2005 and 2006, respectively. The total distance is 2x65.2 circuit-kms.

**The 230 kV and the 115 kV Transmission Systems**

The 230 kV and 115 kV transmission lines are planned to provide services for the demand increase as well as to strengthen the existing lines which are carrying power close to their stability limits. There are specifically two line routes associated with the IPPs, i.e. the Bo Win 2 and the Bang Bo power plants, which are the 230 kv system (other links to IPPs are 500 kV system). The two line sections will be completed in 2002.

Details of the transmission system expansion program are shown in Table 5-7. Some of the transmission system expansion projects as well as their locations are shown in Figure 3-5 of Chapter 3.

**Table 5-7 Transmission System Development Plan**

<b>Projects</b>	<b>Distance (circuit-km)</b>	<b>Commissioning Date</b>
<b>500 kV</b>		
Chombung-Wangnoi	2x198	2002
Pluakdaeng-Nongchok Junction Circuit no. 1&2	2x118	2002
Bonok Power Plant-Bonok	2x7.2	2004
Bangsapan 2-Chombung Circuit no. 1&2	2x270	2004
Hinkud Power Plant-Bangsapan 2	2x11.0	2005
BLCP-Pluakdaeng	2x47.0	2006
Border (Mukdahan Province)-Roiet 2	2x160	2007
Border (Nongkai Province)-Udonthani 3	2x97	2007
Udonthani 3-Chaiyapoom 2	2x200	2007
Chaiyapoom 2-Tatoko	2x222	2007
Border (Nan Province)-Mae Moh 3	2x245	2007
Roiet 2-Chaiyapoom 2	2x180	2007
Bangsapan 2-Chombung Circuit no. 3&4	2x278	2010
Pluakdaeng-Nongchok Junction Circuit no. 3&4	2x154	2010
<b>230 kV</b>		
Krabi-Tungsong	2x79.0	2001
Klong Ngae-Yala 2	2x122.4	2001
Pung Nga-Phuket Junction	2x76	2001
Krabi-Pung Nga 2	2x98.5	2002
Bangkoknoi-North Bangkok	2x18.4	2002
Chaengwattana-North Bangkok Junction	2x7.1	2002
North Bangkok-North Bangkok Junction	2x4.4	2002
North Bangkok Junction-Latprao	4x2.6	2002
Bo Win 2 Power Plant-Bo Win	2x1.9	2002
Bang Bo Power Plant-Klongmai	2x22.0	2002
Banpong 2-Sainoi	2x53.6	2004
Kirithan 2-Chanthaburi	2x33.0	2014
Chanthaburi-Rayong 2	2x114.0	2014
<b>115 kV</b>		
Prachinburi 2-Wattananakorn	1x67.0	2001
Yala 2-Yala 1	2x2.4	2001
Phuket 2-Phuket Junction	1x6.0	2001
Yala 2-Narathiwat	1x63.4	2001
Udonthani 2-Nongbualumpoo	1x61.0	2002
Lan Krabue-Kampaengpet	2x47	2003
Chiangmai 2-Maetaeng	1x42	2004
Talan 3-Saraburi 1	2x15.0	2004

Source : EGAT

## **5.5 The Investment Plan of EGAT**

This section presents the investment requirements for the projects to be implemented by EGAT including the power plant development as well as transmission system expansion during the period of 2002-2011. The detailed expenditures for these projects are given in Table 5-8:

There are 11 transmission projects, 1 hydroelectric project and 3 thermal power plant projects which require a total investment of 225,055.1 million Baht in the 2002-2011 period.

Shown in Table 5-8 are the capital requirements and the associated expenditures for all the projects whose construction periods are within 2002-2011. The total investment for the 11 transmission projects amount to 169,955.1 million Baht, equivalent to more than 75 % of the total planned investment. The hydro renovation project will require an investment of 2,471.2 million Baht. The remaining expenditure will go to the repowering project for which EGAT will have to invest 52,626.8 million Baht.

Table 5-8 Investment Plan of EGAT

Unit : Million Baht

Project	Fiscal Year								2010	2011	Total
	2002	2003	2004	2005	2006	2007	2008	2009			
<b>Transmission</b>											
1. Transmission System Project No. 10	310.4	3,319.5	6,967.6	4,638.8							15,236.3
2. TS to receive power from Laos Phase 1		318.3	3,113.2	14,097.3	8,800.6						26,329.4
3. 500 kV Region 1-Region3 Tie Line	4.8	106.1	866.0	3,132.5	3,349.7	1,021.1					8,480.2
4. TS to receive power from Laos Phase 2		4.6	10.8	465.7	2,528.5	2,618.2	1,243.0				6,870.8
5. Transmission System Project No. 11		7.6	292.1	5,468.4	10,880.0	7,244.8					23,892.9
6. TS to receive power from Hong Sa			6.4	674.5	3,021.7	1,424.2	1,034.1				6,160.9
7. 115 kV Chiangmai 2-Maehongson Tie Line			4.3	53.1	56.2	430.2	275.2				819.0
8. Transmission System Project No. 12				9.7	371.6	6,972.3	13,869.0	9,238.2			30,460.8
9. 500 kV Lines for IPPs (circuits # 3&4)				12.1	478.0	470.2	2,109.2	3,710.9			6,780.4
10. TS in Metropolitan Area Phase 2							2,925.3	8,698.6			11,623.9
11. Transmission System Project No. 13						10.5	404.0	7,626.9	15,171.2	10,087.9	33,300.5
Sub-total	315.2	3,756.1	11,260.4	28,552.1	29,486.3	20,191.5	21,859.8	29,274.6	15,171.2	10,087.9	169,955.1
<b>Hydroelectric Project</b>											
1. Renovation of Old Hydro Plants		182.8	380.8	1,101.3	335.9	470.4					2,471.2
<b>Thermal Power Plants</b>											
1. Repowering of South Bangkok Th # 1&2		306.5	2,642.6	7,597.7	8,119.3	6,813.5	2,339.7				27,819.3
2. Repowering of North Bangkok Th				3,247.3	2,896.8	1,168.2					7,312.3
3. Repowering of Bang Pakong CC #1&2					815.1	4,136.9	6,788.3	5,040.3	716.6		17,497.2
Sub-total		306.5	2,642.6	10,845.0	11,831.2	12,118.6	9,128.0	5,040.3	716.6	0.0	52,628.8
<b>Total</b>	<b>630.4</b>	<b>8,001.5</b>	<b>25,544.2</b>	<b>69,050.5</b>	<b>71,139.7</b>	<b>52,972.0</b>	<b>52,847.6</b>	<b>63,589.5</b>	<b>31,059.0</b>	<b>20,175.8</b>	<b>395,010.2</b>

Source : EGAT

## 5.6 Fuel Requirement for Power Development Program

The main fuels to be used for power generation in the next 15-16 years will be natural gas, lignite and imported coal, with hydropower and diesel to supply the peak generation requirement. The generation from heavy oil, which used to play the major role in the power system in the past, will be less significant and will only be dispatched from the remaining oil-fired power plants which could not be converted to generate energy from other types of fuels. Lignite will be consumed by the Mae Moh Thermal Power Plant. However, the level of generation will be gradually reduced as the older units will be retired according to the retirement schedule.

Natural gas will remain the core fuel for power generation in the future since it is considered to be the most environmentally friendly option. Furthermore, natural gas is also the most appropriate fuel to be used for the combined cycle power plant because it is cheaper than diesel and the efficiency of the combined cycle power plant is close to 50 % which is higher than any other existing means of energy conversion for electricity generation. Although the use of coal is encouraged by the government is governed by the fuel diversification policy, the generation from coal in the next 15 years will reach the level of merely 10 % of the total generation requirement. The utilization of coal, though, may be higher if some of the future IPPs from the year 2010 onwards choose coal-fired alternatives.

According to the privatization policy, all the future generation projects will be financed by the private sector. At the end of the 11<sup>th</sup> NESDP (in the year 2016), the generation from the future IPPs will account for almost 50 % of the total generation requirement. Details of fuel requirement for power generation in the period (2001-2016) are shown in Table 5-9.

Table 5-9 Forecast of EGAT's Energy Generation and Fuel Requirement

Type of Fuel	Unit	Fiscal Year															
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Hydropower - EGAT	GWh	5,052	3,552	3,552	4,407	4,507	4,551	4,482	4,252	4,409	4,457	4,454	4,462	4,528	4,483	5,132	5,550
	%	5.0	3.3	3.1	3.6	3.4	3.2	3.0	2.7	2.6	2.5	2.3	2.2	2.1	2.0	2.1	2.1
Natural Gas - EGAT	GWh	36,044	33,703	29,525	32,354	35,232	34,359	38,760	36,279	42,617	48,705	46,719	43,869	40,752	38,115	34,329	32,583
	%	35.9	31.3	25.6	26.2	26.7	24.4	25.9	22.8	25.0	26.9	24.3	21.5	18.8	16.6	14.1	12.6
- EGCO	MMSCFD	857	753	678	699	775	752	816	753	876	999	953	888	819	761	677	635
	GWh	11,393	8,904	9,931	12,756	13,139	12,980	10,998	10,509	11,159	10,825	9,483	5,149	3,149	1,775	964	766
- RATCH	%	11.4	8.3	8.6	10.3	10.0	9.2	7.3	6.6	6.5	4.9	2.5	1.5	0.8	0.4	0.3	
	MMSCFD	270	221	245	289	298	295	249	238	253	245	215	116	71	40	21	17
- IPP	GWh	7,343	18,120	21,184	21,681	22,952	22,554	19,698	17,987	18,885	18,849	17,987	17,617	17,073	16,857	16,479	16,524
	%	7.3	16.8	18.4	17.6	17.4	16.0	13.2	11.3	11.1	10.4	9.4	8.6	7.9	7.4	6.8	6.4
Total	MMSCFD	176	183	435	436	469	459	386	542	366	343	333	319	314	304	305	
	GWh	8,217	12,163	16,446	18,640	18,570	18,502	17,957	18,257	18,288	18,127	17,726	16,076	14,277	11,608	8,587	7,007
Total	%	8.2	11.3	14.3	15.1	14.1	13.2	12.0	11.5	10.7	10.0	9.2	7.9	6.6	5.1	3.5	2.7
	MMSCFD	172	261	357	375	373	372	360	367	367	364	356	323	286	233	172	140
Heavy Oil - EGAT	GWh	62,999	72,890	77,086	85,411	89,893	88,395	87,393	83,032	90,949	96,506	91,915	82,711	75,251	68,355	60,359	56,880
	%	62.8	67.6	62.9	58.4	58.4	58.4	58.4	52.2	53.3	53.2	47.8	40.6	34.8	29.8	24.7	22.0
- EGCO	MLitres	1,475	1,419	1,709	1,799	1,915	1,878	1,812	1,700	1,862	1,973	1,866	1,660	1,495	1,347	1,175	1,097
	GWh	3,759	2,787	4,794	1,072	1,132	1,168	1,073	1,051	1,048	1,050	1,049	1,052	1,048	1,050	1,049	1,053
- RATCH	%	3.7	2.6	4.2	0.9	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4
	MLitres	964	684	1,137	260	274	283	260	255	254	254	254	255	254	255	254	255
Total	GWh	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	MLitres	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GWh	411	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	%	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MLitres	4	3	4	1	1	1	1	1	1	1	1	1	1	0	0	0
Total	GWh	4,178	2,787	4,794	1,072	1,132	1,168	1,073	1,051	1,048	1,050	1,049	1,052	1,048	1,050	1,049	1,053
	%	4.2	2.6	4.2	0.9	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4
Total	MMSCFD	970	686	1,141	261	275	284	261	255	255	255	255	256	255	255	255	256
	GWh	34	12	12	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel Oil - EGAT	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MLitres	36	39	37	72	71	71	71	71	71	71	71	71	71	71	57	43
Lignite - EGAT	GWh	15,213	14,602	15,106	15,797	15,749	15,750	15,749	15,799	15,750	15,750	15,747	15,792	15,751	15,751	15,781	11,258
	%	15.2	13.5	13.1	12.8	11.9	11.2	10.5	9.9	9.2	8.7	8.2	7.8	7.3	6.9	5.7	4.4
- IPP	Mtons	14510	14,770	15,179	16,718	16,666	16,666	16,666	16,718	16,666	16,666	16,666	16,718	16,666	16,666	14,562	11,873
	GWh	0	0	0	0	3,809	15,979	23,291	25,170	25,094	25,094	25,094	25,170	25,094	25,094	25,094	25,170
Imported Coal - IPP	%	0.0	0.0	0.0	0.0	2.9	9.9	15.6	15.8	14.7	13.8	13.1	12.4	11.6	10.9	10.3	9.7
	Mtons	0.000	0.000	0.000	0.000	1,523	5,342	8,803	9,503	9,473	9,473	9,503	9,473	9,473	9,473	9,473	9,503
Purchase - SPP	GWh	10,215	11,232	12,057	13,786	13,786	13,786	14,417	14,417	14,417	14,417	14,417	14,417	14,417	14,417	14,417	14,417
	%	10.2	10.4	10.5	11.2	10.5	9.5	9.6	9.1	8.5	8.0	7.5	7.1	6.7	6.3	5.9	5.6
- Lao PDR	GWh	2,631	2,690	2,640	2,922	2,946	3,010	3,329	15,332	18,835	18,787	18,722	18,699	18,635	18,585	18,335	18,499
	%	2.6	2.5	2.3	2.4	2.2	2.1	2.2	9.6	11.0	10.4	9.7	9.2	8.6	8.1	7.6	7.1
- New IPP	GWh	0	0	0	0	0	0	0	0	0	5,191	20,744	41,453	61,602	81,499	105,540	125,930
	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	10.8	20.3	28.5	35.6	43.3	48.7
Total	GWh	12,846	13,922	14,697	16,708	16,732	16,796	17,746	29,749	33,252	38,395	53,883	74,571	94,654	114,501	138,492	158,846
	%	12.8	12.9	12.8	13.5	12.7	11.9	11.9	18.7	19.5	21.2	28.0	36.6	43.8	49.9	56.8	61.4
Grand Total	GWh	100,322	107,765	115,247	123,395	131,822	140,639	149,734	159,053	170,502	181,252	192,142	203,758	216,326	229,234	243,907	258,757

Source: EGAT



## 5.7 Demand Side Management Program (DSM)

EGAT started the demand side management program in 1993. The main objective is to encourage the energy savings and efficiency improvement among the consumers. The funding for the program comes from three sources :-

- 1) Grants from GEF and the Australian Government totaling 15.5 million USD,
- 2) Soft loan from JBIC for an amount of 25 million USD and,
- 3) Income from the electricity tariff through the Ft (Fuel Adjustment Mechanism).

The total budget for the DSM from the three sources amounted to 189 million USD. At the end of December 2000, the savings from the implementation of DSM activities were estimated at 597 MW in capacity saving and 3,325 GWh in energy saving. One-third of the allocated budget was used to achieve these savings.

Due to the substantial savings in electricity during the initial phase, EGAT has planned to continue the DSM program in the next 5 year-period between 2001-2005. For this 5-years, EGAT aims to induce further savings of 521 MW and 2,203 GWh in power and energy respectively. The energy efficiency program will be launched so as to increase the penetration level of appliances consuming less electricity, especially in residential, business, governmental and industrial customers. Details of the expected annual electricity savings within the period of 2001-2005 are given in Table 5-10.

To achieve the target shown in Table 5-10, a total budget of 1,551 million Baht has been allocated for the related activities. In addition, EGAT will launch the public awareness in DSM program at the same time so as to create a better understanding in the DSM. This will require another sum of 320 million Baht, bringing the total budget for the overall DSM program for the 2001-2005 to 1,871 million Baht.

To evaluate the benefit of the DSM program, a B/C analysis for all the activities to be conducted in the period has been carried out, as shown in Table 5-11. The economic analysis of all the programs results in the overall B/C ratio of 1.81.

Evaluation of the environmental benefit of the DSM program has also been considered. The result of using less energy can be seen as the reduction in the pollutants associated with the process of electricity generation. The harmful substances which have been included in the study of emission reduction are:- CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, NO<sub>x</sub>, SO<sub>x</sub>, and PM<sub>10</sub>. Summary of the expected decreases in emissions is shown in Table 5-12. The total reduction of pollutants in 2005 is 1.6 million tons of CO<sub>2</sub>, 56.2 tons of CH<sub>4</sub>, 11.188 tons of N<sub>2</sub>O, 4,016 tons of NO<sub>x</sub>, 23 tons of SO<sub>x</sub> and 18.5 thousand tons of PM<sub>10</sub>, respectively.

**Table 5-10 Electricity Savings in the 2001-2005 Period**

Sector/Activity	Fiscal Year										Total		
	2001		2002		2003		2004		2005		MW	GWh	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh			
<b>Residential Sector</b>													
Refrigerator	19.7	200.1	20.6	209.1	21.5	218.5	22.5	228.3	23.5	238.6	107.8	1,094.6	
Air Conditioner	17.4	66.2	18.8	71.5	20.3	77.2	21.9	83.4	23.7	90.0	102.1	388.2	
Compact Fluorescent Tube	3.0	17.5	4.8	28.0	6.6	38.51	7.3	42.4	8.0	46.6	29.8	172.9	
Ballast	0.5	3.3	0.6	3.5	0.6	3.7	0.6	3.9	0.7	4.0	3.0	18.4	
<b>Sub-total</b>	<b>40.6</b>	<b>287.1</b>	<b>44.8</b>	<b>312.1</b>	<b>49.0</b>	<b>337.9</b>	<b>52.3</b>	<b>358.0</b>	<b>55.9</b>	<b>379.2</b>	<b>242.7</b>	<b>1,674.1</b>	
<b>Business/Government</b>													
Cooling System	0.1	0.2	0.2	0.6	0.4	0.9	0.4	0.9	0.1	0.4	1.2	3.0	
Energy Management	0.9	0.3	4.4	1.6	9.7	3.5	14.9	5.4	17.4	6.4	47.3	17.3	
Co-generation	-	-	-	-	23.4	-	46.2	-	44.8	-	114.4	-	
Lighting	2.8	5.7	11.9	24.1	17.5	35.4	17.0	34.4	7.7	15.6	56.9	115.2	
Building Design	-	-	-	-	0.2	0.4	0.5	0.9	0.4	0.8	1.1	2.1	
<b>Sub-total</b>	<b>3.8</b>	<b>6.2</b>	<b>16.5</b>	<b>26.3</b>	<b>51.2</b>	<b>40.2</b>	<b>79.0</b>	<b>41.6</b>	<b>70.4</b>	<b>23.2</b>	<b>220.9</b>	<b>137.6</b>	
<b>Industrial Sector</b>													
Motor	1.5	10.8	5.9	40.5	12.1	84.1	16.1	109.9	19.9	134.3	55.6	379.6	
ESCO	-	-	0.7	12.2	-	-	-	-	-	-	0.7	12.2	
SME Efficiency	0.1	-	0.3	-	0.3	-	0.3	-	0.3	-	1.1	-	
<b>Sub-total</b>	<b>1.6</b>	<b>10.8</b>	<b>6.9</b>	<b>52.7</b>	<b>12.4</b>	<b>84.1</b>	<b>16.4</b>	<b>109.9</b>	<b>20.2</b>	<b>134.3</b>	<b>57.4</b>	<b>391.8</b>	
<b>Total</b>	<b>46.0</b>	<b>304.1</b>	<b>68.2</b>	<b>391.1</b>	<b>112.6</b>	<b>462.2</b>	<b>147.7</b>	<b>509.5</b>	<b>146.5</b>	<b>536.7</b>	<b>521.0</b>	<b>2,203.5</b>	

Source : EGAT's DSM Office

**Table 5-11 Expenditure for DSM Program (2001-2005) and the B/C Ratio**

Unit : million Baht

Sector/Activity	Fiscal Year					Total	B/C Ratio
	2001	2002	2003	2004	2005		
<b>Residential Sector</b>							
Refrigerator	54	52	54	58	60	278	1.78
Air Conditioner	53	52	56	60	65	286	1.26
Compact Fluorescent Tube	15	24	33	37	39	148	1.11
Ballast	9	9	10	10	11	49	0.95
<b>Sub-total</b>	<b>131</b>	<b>137</b>	<b>153</b>	<b>165</b>	<b>175</b>	<b>761</b>	<b>1.45</b>
<b>Business/Government</b>							
Cooling System	0.5	2	2	2	1	7	1.38
Energy Management	4	27	4	6	8	49	7.42
Co-generation	20	41	62	85	108	316	4.81
Lighting	5	21	31	32	16	105	2.55
Building Design	7	9	8	12	15	51	0.49
Electricity Quality	-	3	-	-	-	3	N/A
<b>Sub-total</b>	<b>36</b>	<b>103</b>	<b>107</b>	<b>137</b>	<b>148</b>	<b>531</b>	<b>3.37</b>
<b>Industrial Sector</b>							
Motor	45	44	46	47	49	231	1.38
ESCO	-	28	-	-	-	28	1.11
SME Efficiency	-	-	-	-	-	-	N/A
<b>Sub-total</b>	<b>45</b>	<b>72</b>	<b>46</b>	<b>47</b>	<b>49</b>	<b>259</b>	<b>1.37</b>
<b>Total</b>	<b>212</b>	<b>312</b>	<b>306</b>	<b>349</b>	<b>372</b>	<b>1,551</b>	<b>2.09</b>
<b>Public Awareness</b>							
<b>Sub-total</b>	<b>30</b>	<b>72</b>	<b>72</b>	<b>73</b>	<b>73</b>	<b>320</b>	<b>N/A</b>
<b>Grand Total</b>	<b>242</b>	<b>384</b>	<b>378</b>	<b>422</b>	<b>445</b>	<b>1,871</b>	<b>1.81</b>

Source : EGAT's DSM Office

**Table 5-12 Estimated Reduction of Polluting Gases in Fiscal Year 2005**

Sector/Activity	Amount of Emission Reduction					
	CO <sub>2</sub> (Tons)	CH <sub>4</sub> (Kgs)	N <sub>2</sub> O (Kgs)	NO <sub>x</sub> (Kgs)	SO <sub>x</sub> (Kgs)	PM <sub>10</sub> (Tons)
<b>Residential Sector</b>						
Refrigerator	808,996	27,963	5,558	1,994,748	11,510	9,220
Air Conditioner	286,930	9,918	1,971	707,486	4,082	3,270
Compact Fluorescent Tube	127,814	4,418	878	315,151	1,181	1,457
Ballast	13,564	469	93	33,445	193	155
<b>Sub-total</b>	<b>1,237,304</b>	<b>42,768</b>	<b>8,500</b>	<b>3,050,830</b>	<b>17,603</b>	<b>14,102</b>
<b>Business/Government</b>						
Cooling System	2,188	76	15	5,394	31	25
Energy Management	12,766	441	88	31,478	182	146
Co-generation	12	0	0	29	0	0
Lighting	85,150	2,943	585	209,955	1,211	970
Building Design	1,577	55	11	3,890	22	18
<b>Sub-total</b>	<b>101,693</b>	<b>3,515</b>	<b>699</b>	<b>250,746</b>	<b>1,446</b>	<b>1,159</b>
<b>Industrial Sector</b>						
Motor	280,556	9,697	1,927	691,769	3,992	3,198
ESCO	9,033	312	62	22,272	129	103
SME Efficiency	N/A	N/A	N/A	N/A	N/A	N/A
<b>Sub-total</b>	<b>289,589</b>	<b>10,009</b>	<b>1,989</b>	<b>714,041</b>	<b>4,121</b>	<b>3,301</b>
<b>Total</b>	<b>1,628,586</b>	<b>56,292</b>	<b>11,188</b>	<b>4,015,617</b>	<b>23,170</b>	<b>18,562</b>

Source : EGAT's DSM Office

## Chapter 6

### Private Power Generation and International Power Purchase

#### 6.1 Introduction

Generally, the structure of Electricity Supply Industry (ESI) in Thailand can be said that most of generation is supplied by EGAT. However, Thai government has a policy to encourage the private sector to participate in the power generation business in the form of Independent Power Producers (IPPs) and Small Power Producers (SPPs). The generated electricity from IPPs and SPPs will be sold to EGAT. EGAT sells it to the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA).

At present, Thailand is the single largest purchaser of electricity energy in South-East Asia. It purchases power from the neighbor countries: Lao People's Democratic Republic (Lao PDR), Malaysia, Union of Myanmar and China. These countries have potential to develop their power projects and sell or exchange power with Thailand. Some of the countries conclude the Memorandum of Understanding (MOU) with Thailand for cooperation in power development. High voltage transmission lines are also planned to be built for ASEAN Power Grid System.

#### 6.2 Independent Power Producers (IPPs) : Status and Opportunities in the PDP

The Independent Power Producer (IPP) is a power producer who generates power with a large capacity. The fuel type is usually natural gas or coal. Based on 1994 solicitation, request for proposals (RFP) for power purchases from IPPs, EGAT requested proposals for the supply and sell of electric capacity and energy to EGAT. As the result of this RFP, the first 1,000 MW from IPPs was implemented in year 2000 and the second 2,800 MW will be implemented in year 2002. EGAT also showed an intention to purchase annually 1,700 MW of electricity from 2003 to 2006 from IPPs, however, the actual amount of electricity to be purchased will depend upon EGAT's evaluation of the proposals received.

The implementation of the IPP program started with the first solicitation, issued in December 1994, to purchase 3,800 MW of capacity in two stages: Stage 1 for 1,000 MW to come on-line by the year 2000 and Stage 2 for 2,800 MW to come on-line by 2002. The 1994 Request for Proposals (RFP) included instructions on preparation and submission of proposals, a summary of the proposal evaluation criteria EGAT would use so as to ensure a uniform and impartial evaluation and ranking of each bid, a model PPA and EGAT's Grid Code, with covers certain

technical requirements which must be met by each IPP and EGAT's dispatching procedures.

By the closing date for submission of sealed proposals, EGAT had received a total of 50 proposals, totaling 39,067 MW, from 32 international consortia, most of which included significant Thai participation. The process of evaluation was completed by early 1996 and followed by EGAT's negotiation and conclusion of PPAs with seven companies for about 5,800 MW of total contracted capacity. All of the PPAs were singled before the onset of financial crisis and the *de facto* devaluation of the Baht in 1997. Following the devaluation of the Baht, the tariffs in these PPAs were amended to include a mechanism for indexing payments based on movements in the foreign exchange value of the Baht.

In the evaluation process of EGAT's IPP Program, several steps were taken to ensure the objectivity, consistency, fairness, and transparency of the evaluation and selection process. A subcommittee comprised of high level government officials from EGAT and other relevant government agencies (the Evaluation Subcommittee) was formed to oversee and monitor the entire evaluation process. The Evaluation Subcommittee's members included a senior representative from each of the following governmental agencies; the National Energy Policy Office (NEPO), the Office of the National Economic and Social Development Board (NESDB), the Fiscal Policy Office of the Ministry of Finance (FPO), and EGAT. EGAT was represented by its Governor, who was also the Evaluation Subcommittee's Chairman.

In addition, EGAT formed an Evaluation Working Group which was comprised of individuals from a newly established Business Ventures Department and supplemented with personnel from other EGAT departments (including, for example, the engineering, legal, and environmental planning departments), as well as staff from NEPO, NESDB, and FPO.

As a result of the evaluation process, EGAT developed short-lists of the preferred bidders for both Stage 1 and Stage 2 of the 1994 IPP Program. With the exception of one short-listed bidder who withdrew, the seven bidders who were invited to negotiate PPAs with EGAT successfully concluded the negotiations and entered into PPAs.

In general, EGAT approached the negotiation of the PPAs with a view to developing an improved standard PPA: adjusting, to the extent necessary, certain risk allocations to meet requirements for obtaining international and local financial perspective. At the same time, attention was also given to EGAT's future movement towards overall privatization.

Although EGAT negotiated separately with each of the preferred bidders, the negotiations were simultaneous and EGAT internally sought to assure that the negotiating teams coordinated positions they would be offered to the different bidders. Thus, to the extent a modification was requested by more than one bidder, EGAT attempted to respond in a uniform fashion. Also, with respect to certain key risk allocation issues, EGAT sought to assure that bidders received identical provisions in the PPA. Thus, while there are differences among the PPAs, they are very similar in respect to the fundamental risk allocation issues.

The one of major risk allocation issues in the PPAs is the tariff. The principal components of the tariff in the PPAs are:

- an Availability Payment (AP), which are payable based on the IPP's provision of generating capacity available for dispatch by EGAT; the APs are intended to allow the IPP to recover its capital costs, cover the plant's fixed operating and maintenance costs (FOM), and achieve a return on its equity investment over the term of the PPA;
- an Energy Payment which is based upon a heat rate guaranteed by the IPP and is intended to cover the cost of fuel consumed to generate dispatched electricity if that guarantee is being met;
- a Variable Operation and Maintenance (VOM) allowance which is intended to cover the plant's variable costs based on dispatch electricity; and
- an Added Facility Charge which is intended to cover the cost of the connection from the facility switchyard to relevant EGAT substation, as estimated by EGAT.

The APs are structured to be fixed amounts per kW of available capacity (denominated in Baht) provided over the term of the PPA. A component of the APs which relates to fixed operating and maintenance requirements is indexed to the Thai Consumer Price Index. The determination of actual APs payable to the IPP in any billing period is subject to a variety of penalty deduction if the IPP's performance does not meet certain contracted characteristics such as loading and de-loading rates, minimum generation, short notice response, inadequate response capability or spinning reserve, insufficient reactive power. In negotiations, penalties were adjusted to provide the IPP with some exemptions, principally in the start-up period of operations.

The decision to determinate APs in Baht was driven by a desire to insulate Thai consumers from potentially volatile foreign currency movements, as well as the historically stable U.S. dollar and the Thai Baht exchange rate prior to 1997. It was felt that the IPPs and their financial advisors would be best able to manage their individual foreign exchange exposures. In fact, only a few bidders submitted

alternative bids containing mechanisms to index the APs to foreign exchange movements. However, as noted above, following the de facto devaluation of the Baht in mid-1997, EGAT and the successful bidders negotiated tariff amendments to index certain components of the tariff to reflect the effect of movements of the exchange value of the Baht on the IPPs ability to meet debt and other payment obligations incurred in foreign currencies.

### **6.3 Regulation of IPPs**

EGAT gave an opportunity to the private sector to enter into the power supply industry as an Independent Power Producer (IPP). The IPP process started with submitting proposals specifying the generation technology, the plant location, the fuel sources, the type and pricing structure.

The first solicitation to purchase electricity from IPP for an amount of 3,800 MW was announced on 15 December 1994 with the last date of proposal submission being 30 June 1995. The first stage 1,000 MW (without transmission reinforcement) was planned to be on line during 1996-2000, and the second stage (with 500 kV lines) 2,800 MW was expected to be commissioned during 2001-2002 (1,400 MW each year).

In April 1995, EGAT announced for the additional 10% power purchase, then bringing the total purchase from IPP to 4,180 MW. In August 1996, EGAT increased the purchase power from IPP by 1,600 MW: the first stage, 300 MW, and the second stage, 1,300 MW.

#### **6.3.1 IPP Power Purchase Agreement**

The power purchase agreement (PPA) forms the basis of the contract to be executed by IPP and EGAT. The successful bidders for the first and second stage selected by the evaluation committee signed their PPAs with EGAT. Both parties have to work under the PPA and this provides guarantee for EGAT and IPPs for the electricity transaction. PPA stipulates target date and milestones for major activities, price for electric energy and capacity, conditions for interconnection with EGAT's system, penalties for both parties, Grid Code, location of the project, and etc. The PPA made the project finance possible.

#### **6.3.2 IPP Bidding and Evaluation Procedures**

During the IPP bidding and evaluation, EGAT reserved the right, without notification, to select any proposal or reject any or all proposals, or waive any formality or technicality in proposals received. No cost was reimbursed to any bidder



for the expense for the preparation or submission of a proposal and/or in negotiation for PPA. EGAT used price and non-price criteria in the bid evaluation process. The weight for the price factors were 60% and 40% for non-price factors. EGAT made a short list for selection of the proposals before the final award.

### **6.3.3 Price Factors (60%)**

The price factors include the following:

#### **Prices for energy and capacity**

The price escalation proposals set forth in the PPA for energy and capacity prices were preferred. EGAT applied escalation assumptions to evaluate the net present value of the supply cost in its system. The prices for energy and capacity were separated for each year of the PPA period and expressed in Baht/kW/year. The price for capacity is called Availability Payment (AP). The fixed cost components of fuel stock was included in the Availability Payment and only variable fuel charges was included in the energy charges. The energy price was divided into fuel and variable operational maintenance components. This would be escalated separately.

#### **Term of contract**

EGAT preferred the term of PPA for at least 20 years.

#### **Connection Cost**

The connection costs was the total costs of constructing a transmission line linking the facility to EGAT's system. For the bid evaluation purpose, EGAT outlined the approach to estimate of such connection costs, including any additional modifications of EGAT's system, and used these estimated connection costs in comparing competing bids. The cost for 500 kV transmission lines for the second stage was not included in the bid evaluation, except in particular IPP projects that required EGAT to modify its 500 kV transmission expansion plan. In such cases, the bid evaluation included any increased or decreased cost due to the modification of EGAT's 500 kV transmission expansion plan.

#### **Structure of Availability Payments**

EGAT preferred that not more than 80% of the net present value of the Availability Payments be amortized over the first three quarters of the term of PPA. The remaining 20% of the present value may be amortized over the remainder of the contract period. Term of differing lengths and differing payment structures were

evaluated for their effects on the security of the project and on EGAT's payment and financial status.

#### **6.3.4 Non-price Factor (40%)**

The non-price factors are as follows:

##### **Viability of the Project (25% weight)**

EGAT assessed overall project viability by evaluating the following:

- (1) **Level of Development (11% weight)**  
EGAT preferred the higher level of development (both technical and environmental).
- (2) **Financial Status of the bidder and Ability to Arrange Financing (7% weight)**  
EGAT preferred the project which solid financial back up.
- (3) **Experience (7% weight)**  
EGAT preferred the developer who has experiences in constructing, financing, operating and maintaining power production facilities and the relevance of that experience to the technology proposed by the bidder.

##### **Fuel and Fuel Diversity (4% weight)**

- (1) EGAT gave priority to fuel types, which have environmentally clean, acceptable to the general public, stable prices and assured supplies. EGAT preferred on fuel in the following order of priority:
  - ◆ Non-conventional energy included energy sources such as wind and solar but not hydropower.
  - ◆ Natural gas, including LNG, hydrocarbon gas and its associated liquid.
  - ◆ Coal
  - ◆ Orimulsion
- (2) EGAT preferred a mix of fuel types for generation of power.
- (3) EGAT preferred multi-fuel capable facilities for the flexibility they provide in future.
- (4) The reserve fuels must be sufficient to cover any interruption, and on site, it has to be provided for full load operation at a specified number of days.

### **Other Factors (11% weight)**

These are further divided into two categories:

### **Location (6% weight)**

The proposed location of the project effects to transmission facilities to EGAT's existing power system. While connection costs were treated as a "Pricing Factor". EGAT could reject any project, which was located less than 10 kilometers from of any of EGAT's steam generation facilities, as it could jeopardize EGAT's existing or future environmental regulations.

### **Exceptions of Model Power Purchase Agreement (5% weight)**

EGAT preferred no revision of the requested for proposal (RFP) of Model Power Purchase Agreement, which was prepared by EGAT. EGAT may reject the proposals, which included many changes in the Model Power Purchase Agreement.

After evaluation the first and second invitations, seven IPPs were selected and notified of acceptance for the power purchase by EGAT. The total offered sale was than 39,000 MW from 32 project proposals, which reflected the interest of the private sector to participate in the ESI. The list of Thailand's awarded IPP is shown in Table 6-1. In summary, the first stage has three IPPs, all of them are combined cycle power plant and the second stage has four IPPs, which only one is combined cycle power plant and the other three are coal fired power plant.

Currently, two IPP projects have commercially supplied electricity into the system, i.e. Tri Energy Co., Ltd., with the commercial operation date (COD) on 30 June 2000, and Independent Power (Thailand) Co., Ltd. (IPT), with the COD on 15 August 2000. Their supply performances are found to comply with their PPAs. The power purchase prices for these two IPP are as below:

1. IPT has AP of 0.491 Baht/kWh and fuel cost of 1.087 Baht/KWh (1.578 Baht/KWh in total), and
2. Tri Energy has AP of 0.626 Baht/kWh and fuel cost of 1.053 Baht/KWh (1.679 Baht/KWh in total).

Table 6-1 Thailand's Awarded IPP

Company	Investors	Capacity (MW)	Fuel Type	Commercial Operation Date (COD)
<b>PHASE I (1996-2000)</b>				
<b>Eastern Region</b>				
<b>1. Independent Power (Thailand) Co., Ltd.</b> Ao Phai, Chonburi	<ul style="list-style-type: none"> <li>• Thairoil 56%</li> <li>• Unocal 24%</li> <li>• Westinghouse 20%</li> </ul>	700	Natural Gas	15 Aug 2000
<b>2. Eastern Power &amp; Electric Co., Ltd. (Bang Bo)</b> Bang Bo, Sumut Prakarn	<ul style="list-style-type: none"> <li>• GMS Power PLC. 32%</li> <li>• Marubeni 28%</li> <li>• CDB (China Development Bank) 12%</li> <li>• TOTAL 28%</li> </ul>	350	Natural Gas	31 Jul 2002
<b>Western Region</b>				
<b>1. Tri Energy Co., Ltd.</b> Ratchaburi	<ul style="list-style-type: none"> <li>• Banpu 37.5%</li> <li>• Texaco 37.5%</li> <li>• EME (Edison Mission Energy) 25.0%</li> </ul>	700	Natural Gas	1 Jul 2000
<b>PHASE II (2001-2003)</b>				
<b>1. Union Power Development Co., Ltd.</b> Bang Sa Phan, Prachuap Kirikhan	<ul style="list-style-type: none"> <li>• Union Energy 10%</li> <li>• Tomen 34%</li> <li>• Imatran Voima Oy 28% <sup>1/</sup></li> <li>• CEPA (Consolidated Electric Power Asia) 28%</li> </ul>	1,400 (2 x 700)	Coal	<b>Unit 1:</b> 1 Oct 2005 <b>Unit 2:</b> 1 Jan 2006
<b>2. Bowin Power Co., Ltd.</b> Bowin, Chonburi	<ul style="list-style-type: none"> <li>• Hemaraj 25%</li> <li>• Tractebel 75%</li> </ul>	713	Natural Gas	1 Apr 2002
<b>3. BLC Power Ltd.</b> Rayong	<ul style="list-style-type: none"> <li>• Banpu 47.5%</li> <li>• Loxley 5%</li> <li>• PowerGen 47.5%</li> </ul>	1,346.5 (2 x 673.25)	Coal	<b>Unit 1:</b> 1 Oct 2006 <b>Unit 2:</b> 1 Feb 2007
<b>4. Gulf Power Generation Co., Ltd.</b> Bo Nok, Prachup Kirikhan	<ul style="list-style-type: none"> <li>• Gulf Electric 60%</li> <li>• Mission Energy 40%</li> </ul>	734 (2 x 367)	Coal	<b>Unit 1:</b> 1 Oct 2004 <b>Unit 2:</b> 1 Apr 2005
<b>Total</b>		<b>5,943.50</b>		

Source: NEPO

Note : <sup>1/</sup> taken over by Shubu Electric Power Co., Ltd. (Japan)

The prices of power purchase from IPPs were determined by competitive bidding. IPPs usually show a lower generation cost when compared with that of EGAT. This made it possible to bring down power generation cost for Thailand, and the promotion of the private sector participation in ESI will help to reduce EGAT's investment burden.

#### **6.4 Small Power Producers (SPPs)**

The Small Power Producer (SPP) means a power project that produces electricity using the co-generation (thermal and electricity) system or using renewable energy, such as waste or residues from agricultural activities, garbage, biogas, solar energy. These fuels contribute to more efficient use of domestic energy resources.

##### **6.4.1 Status of the Program**

After the flotation and swinging of Thai Baht in July 1997, the government amended requirements and conditions for SPPs. Particularly, it was stipulated that the major part of the capacity payment fluctuate in line with the foreign exchange rates so as to alleviate the impact of economic crisis. Such amendments of power purchase agreements helped to reduce problems on financing for many SPP operators, and hence their projects could proceed until completion. However, some SPP projects still have problems on financing and construction. SPPs helped alleviate the investment burden of the public sector in power plant construction by EGAT by approximately Baht 100,000 million.

##### **6.4.2 Regulation of SPPs**

At present, purchase of power from SPPs using non-conventional energy, waste or residues as fuel is still ongoing under both firm and non-firm contracts without limit on the purchase volume or period. The firm contract means the contract to purchase power of longer than 5 years and has both payments for energy and capacity. The non-firm contract means the contract to purchase power of shorter than 5 years and has only the energy payment. Determination of purchasing price is in line with the current regulations for power purchase from SPPs. However, the available capacity of transmission and distribution systems of the power utilities is considered in power purchase.

Furthermore, a scheme has been initiated under the government's Energy Conservation Promotion Fund to promote SPPs using non-conventional energy, waste or residues as fuel. A price subsidy is provided to cover the difference of power purchase price and the price offered according to the regulations for power purchase from SPPs, at a rate not exceeding 0.36 Baht/kWh. The scheme is currently under the

feasibility study and it will examine the approach and procedures and to issue the requests for proposal include criteria for evaluation of proposals submitted by SPPs for such financial assistance. The total generating capacity to be subsidized under this scheme is 300 MW at the maximum.

Nevertheless, for power producers using non-conventional energy, waste or residues from agricultural activities, or biogas from livestock farms as fuel, particularly small-scale producers, if they have to comply with the SPP regulations, substantial costs for grid connection will be required, which will not be cost effective. Promotion of such small-scale projects should be made by introducing of net metering (to exchange of energy with the utility systems.) This method has been in use by the municipal waste-fueled power plant of the Public Works Department in Phuket province and the rooftop PV grid connected demonstration project of EGAT. Besides, additional regulations should be established for power purchase from such small-scale SPP projects.

Table 6-2 shows current status of SPP projects. Until April 2001, there are 44 of SPPs currently in operating and connecting to EGAT. Table 6-2 indicates 3,157.13 MW for SPP generating capacity and 1,799.90 MW is sold to EGAT.

**Table 6-2 Power Purchase from Small Power Producers**  
(as of April 2001)

	<b>Firm</b>	<b>Non-Firm</b>	<b>Total</b>
<b>1. Proposals submitted</b>			
1.1 Number of Projects	69	34	103
1.2 Generating Capacity (MW)	7,823.81	722.46	8,546.27
1.3 Sale to EGAT (MW)	4,558.70	246.65	4,805.35
<b>2. Received Notification of Acceptance*</b>			
2.1 Number of Projects	32	29	61
2.2 Generating Capacity (MW)	3,631.41	682.90	4,314.31
2.3 Sale to EGAT (MW)	2,057.20	240.90	2,298.10
2.4 Type of Fuels			
◆ Bagasse	-	19	19
◆ Paddy Husk, Wood Chips	4	4	8
◆ Natural Gas	21	1	22
◆ Coal	6	2	8
◆ Oil	1	-	1
◆ Black Liquor	-	1	1
<b>3. Contract Signed</b>			
3.1 Number of Projects	30	25	55
3.2 Generating Capacity (MW)	3,471.51	620.70	4,092.21
3.3 Sale to EGAT (MW)	1,958.40	209.40	2,167.80
<b>4. Supplying Power to The Grid</b>			
4.1 Number of Projects	24	20	44
4.2 Generating Capacity (MW)	2,598.93	558.20	3,157.13
4.3 Sale to EGAT (MW)	1,613.40	186.50	1,799.90

Source : NEPO

Note : \* Excluded Small Power Producers which did not attach the security bond in the proposal, and withdraw their proposals.

Following the strategies promoting private sector investment in power generation projects, in both IPP and SPP, to sell generated electricity to EGAT, the purchase of power from IPP and SPP will help to reduce EGAT's investment burden in power generation by approximately Baht 300,000 million.

List of SPP's as of April 2001 are presented in Appendix 1.

## **6.5 EGAT's Generation Subsidiaries**

The government policy of privatization also affects to EGAT. The government has been promoting greater role of the private sector in power generation since 1992. The cabinet approved the establishment of the two generation EGAT's subsidiaries: Electricity Generating Company (EGCO) and Ratchaburi Electricity Generating Holding Public Co., Ltd. (RHCO).

### **6.5.1 Electricity Generating Company (EGCO)**

The Electricity Generating Company (EGCO) was formed in May 1992. At the first stage, EGCO purchased the 1,200-MW Rayong Combined Cycle Power Plant and, later, Khanom Power Plant (150-MW Thermal and 600-MW Combined Cycle) from EGAT. At a later stage, EGCO may expand its generating capacity by itself. EGCO raised its capital through initial public offering (IPO) in the Stock Exchange of Thailand (SET) in November 1994 and commenced trading in SET in January 1995, since then EGAT's shareholding in EGCO diluted to 40.7%.

Later, the 14.9% of EGAT's shares in EGCO was sold to the China Light & Power Company, which was selected by the Strategic Investor Selection. EGAT's stake lower from 40.7% to 25.8%. Consideration may be made by EGAT to further reduce its shareholding in EGCO to 20% in the future.

The EGCO's status of last four years are presented in Table 6-3 as follows:



**Table 6-3 EGCO's Financial Highlights-Consolidated**

Financial Position	Million Baht			
	1999	1998	1997	1996
<b>Total Assets</b>	<b>49,898</b>	<b>45,113</b>	<b>45,610</b>	<b>43,855</b>
Cash, short-term and long-term investments	8,715	2,649	3,537	4,736
Short-term and long-term investment as	9,673	9,304	7,702	3,716
Investments in subsidiaries, associated and other companies	481	496	269	161
Property, plant and	27,271	28,633	29,806	31,123
Others	3,757	4,031	4,295	4,119
<b>Total Liabilities</b>	<b>33,079</b>	<b>30,351</b>	<b>36,256</b>	<b>28,052</b>
Long-term	32,327	29,463	35,287	27,417
Others	752	889	970	635
<b>Shareholders' Equity</b>	<b>16,819</b>	<b>14,762</b>	<b>9,353</b>	<b>15,803</b>
Issues and paid-up share capital	5,243	5,227	5,212	5,200
Premium on share	8,557	8,526	8,497	8,472
Unrealized gains on investment revaluation	41	-	-	-
Retained	2,921	959	(4,392)	2,131
Minority interest	56	49	36	-
Translation adjustments				
<b>Operating Results</b>				
<b>Total Revenues</b>	<b>9,452</b>	<b>10,234</b>	<b>8,867</b>	<b>6,933</b>
Electricity	8,438	8,766	7,677	5,987
O&M services	103	37	32	-
Others	910	1,431	1,159	946
<b>Total Expenses</b>	<b>6,563</b>	<b>7,284</b>	<b>7,096</b>	<b>5,237</b>
Cost of	2,687	3,614	2,934	2,250
Cost of services	89	63	48	-
Interest expenses	2,984	3,302	3,181	2,315
Others	905	383	936	672
Profit (loss) from/to	(102)	(78)	(4)	(0)
<b>Profit (loss) before FX</b>	<b>2,889</b>	<b>2,950</b>	<b>1,771</b>	<b>1,696</b>
Currency exchange losses	241	(3,232)	7,235	145
<b>Net Profit (Loss)</b>	<b>2,648</b>	<b>6,181</b>	<b>5,464</b>	<b>1,551</b>
<b>Cash flows from operating activities</b>				
Net profit (loss) before extra ordinary	2,648	6,181	1,771	1,551
Add (less) adjustment to reconcile net profit to net cash	1,843	(1,894)	2,082	1,575
Income from operations before changes in operating assets and liabilities	4,491	4,287	3,853	3,126
Operating assets (increase)	(647)	(2,322)	(26,915)	(3,602)
Operating liabilities increase	(205)	(63)	288	362
Extraordinary item realised exchange losses	0	0	9	0
Net cash provided by (used in) operating activities	3,638	1,901	1,459	(114)
Cash flows from investing	192	(991)	143	(18,100)
Cash flows from financing	2,061	(1,639)	(1,935)	19,080
Net increase (decrease) in cash and cash	5,891	(729)	(333)	866
Cash and cash equivalent as at January	2,452	3,181	3,514	2,648
Cash and cash equivalent as at December	8,344	2,452	3,181	3,514

Source : EGCO

### 6.5.2 Ratchaburi Electricity Generating Holding Public Co., Ltd. (RHCO)

The plan for capital raising from the private sector for Ratchaburi Power Plant Complex was revised on 30 November 1999. Therefore, EGAT implemented the plan by forming Ratchaburi Electricity Generating Holding Co., Ltd., with EGAT holding 100% of shares. A wholly owned subsidiary of the company, called Ratchaburi Electricity Generating Co., Ltd., was established to own the power generation units and all other assets of Ratchaburi Power Plant Complex.

Ratchaburi Power Plant Complex: It consists of 2 x 735 MW Thermal Units and 3 x 725 MW of Combined Cycle Gas Turbines, with a total installed capacity of about 3,645 MW. Certain parts of the plants are currently under construction. Details can be shown as follows:

**Table 6-4 Generating Capacity of Ratchaburi Power Plant Complex**

			Generating Capacity (MW)	Commercial Operation Date (COD)
<b>Combined Cycle Plants Blocks 1-3 (2,175 MW)</b>				
◆ Gas Turbine	Block 1	Unit 1	230	August 2000
		Unit 2	230	September 2000
	Block 2	Unit 1	230	October 2000
		Unit 2	230	November 2000
	Block 3	Unit 1	230	December 2000
		Unit 2	230	January 2001
◆ Steam Turbine	Block 1	Unit 1	265	March 2001
	Block 2	Unit 1	265	July 2001
	Block 3	Unit 1	265	April 2002
<b>Thermal Units 1 and 2 (1,470 MW)</b>				
		◆ Unit 1	735	June 2000
		◆ Unit 2	735	November 2000
<b>Total Combined Cycle and Thermal Plants</b>			<b>3,645 MW</b>	

Source: NEPO

## 6.6 International Power Purchases

The **Foreign Power Purchase Program** was initiated in response to the Government policy to promote the greater role of private power producers in Thailand's power supply industry and also its policy to jointly develop energy resources with neighboring countries

The objectives of the program are:

- (1) To reduce the country's massive investment in energy infrastructures;
- (2) To avoid the over-exploitation of indigenous energy resources;
- (3) To support the development of high potential energy resources in neighboring countries for sale to Thailand; and
- (4) To promote the power system interconnection among the countries in this region.

Under the current foreign power purchase program, EGAT has cooperated with neighboring countries, namely **Lao PDR, the Union of Myanmar, the People Republic of China and Malaysia**. The cooperation with the first three countries has been expected under the Memorandum of Understanding (MOU) between the Governments of Thailand and those countries. As of Malaysia, it has been enhanced through the power exchange and purchase program between the power utilities.

### 6.6.1 Lao PDR

The Government of Thailand and the Government of the Union of Lao PDR had entered into two MOUs, dated June 4, 1993 and June 19, 1996 expressing their intention to cooperate on the development of 3,000 MW of electric power in Lao PDR for sale to Thailand by the year 2006.

Each Government had appointed a committee to deal with this cooperation under the MOU, namely the **Coordinating Committee on Electricity Cooperation and Development in Lao PDR (CECD-L)** for Thailand and the **Committee for Energy and Electric Power (CEEP)** for Lao PDR. CEEP was subsequently replaced with the newly established **Lao National Committee for Energy (LNCE)** in late 1999.

A list of 8 power projects, 1 of thermal and 7 of hydro, was proposed by Lao PDR for power export to Thailand under the aforesaid MOU. The major present future power purchase scheme is presented in Table 6-5 and can be summarized as follows:

**Projects with Achieved COD:**

1. Theun-Hinboun Hydropower Project (187 MW)
2. Houay Ho Hydropower Project (126 MW)

The Power Purchase Agreement (PPA) of **Theun-Hinboun** and **Houay Ho** were executed in June 1996 and June 1997 for a period of 25 and 30 years respectively. **Theun-Hinboun** started supplying electric energy to EGAT power system on March 31, 1998 and **Houay Ho** on September 3, 1999 as scheduled.

**Project with SCOD:**

Six other projects are included in the Thai-Lao Power Purchase Program. Their Schedule Commercial Operation Dates (SCOD) are listed below:

**First Stage SCOD: DEC 2006**

1. Nam Theun 2 Hydroelectric Power Project (920 MW)
2. Nam Ngum 2 Hydroelectric Power Project (553 MW)
3. Nam Ngum 3 Hydroelectric Power Project (430 MW)

**Second Stage SCOD: MAR 2008**

1. Lignite-fired Power Plant Project (608 MW)
2. Xe Pian-Xe Namnoy Hydropower Project (365 MW)
3. Xe-Kaman 1 Hydroelectric Project (407 MW)

EGAT has entered into Tariff/MOU with the First Stage projects and is now negotiating the Power Purchase Agreement with Nam Theun 2 Project Developer. Apart from Nam Theun 2, the remaining projects will be invited to participate into direct bidding of the Power Pool, schedule for operation around 2003, so as to eliminate any addition stranded costs to the system in the long run and to allow the tariff fluctuated upon the condition of electricity demand and supply of the whole market. However, this policy has not yet been firmly settled and is subject to be reviewed for decisiveness by the Thai Government.

The international power purchase of Thailand currently is only Lao PDR, while power purchase from Malaysia (see Section 6.6.2) is aimed as power-exchange program. The electricity import from Laos had begun for several years ago, first is from Nam Ngum Dam then Xeset, Thuen Hinboun, and Houay Ho Dams at the latest. The annual purchased energy during 1996-2000 from these are shown in Table 6-5a.

**Table 6-5 Existing and Planned Power Purchase from the Lao PDR**

Project	Purchase Capacity (MW)	Investors	Commercial Operation Date
<b>Projects with PPAs signed</b>			
Nam Theum-Hinboun	187	Lao PDR, Nordic, MDX	31 March 1998
Houay Ho	126	Lao PDR, Daewoo, Loxley	3 September 1999
<b>Total</b>	<b>313</b>		
<b>Project with MOU signed and currently under negotiation and will be synchronized to the system by December 2006</b>			
Nam Theun 2	920	Lao PDR, Transfield, EDF, Italian-Thai, EGCO	December 2006*
<b>Total</b>	<b>920</b>		
<b>Project in the List for negotiation</b>			
Nam Ngum 2	553	Shlapak, Bilfinger&Berger, Boith, Noell, Siemens, Ch. Kranchang, Sri U-Thong	December 2006*
Nam Ngum 3	430	Lao PDR, MDX	December 2006*
Lignite-fired	608	Thia-Lao Lignite	March 2008*
Xe Pian-Xe Namnoy	365	Dong Ah Construction, Thai-Lao Hydro Power, Intertrade Co., Ltd.	March 2008*
Xe-Kaman 1	407	Lao PDR, HECCE, Sri U-Thong	March 2008*
<b>Total</b>	<b>2,363</b>		

Source: EGAT

Note : \* Under the revised PDP 99-01, EGAT has delayed the schedule of power purchase from the Lao PDR, with the initial purchase of 1,600 MW by December 2006 and 1,700 MW by March 2008.

**Table 6-5a Annual Purchased Energy from Lao PDR**

Unit : GWh

Power Station	Year				
	1996	1997	1998	1999	2000
1. Nam Ngum	578.90	633.40	486.53	327.83	741.50
2. Xeset	135.91	138.04	61.66	111.18	123.67
3. Thuen-Hinboun	*	*	827.05	1,400.34	1,497.81
4. Houay Ho	*	*	*	55.55	610.30
Note : * Not in serviced					

Source : EGAT

### 6.6.2 Malaysia

This power exchange program is primary targeted as a regular peak reserve for Thailand and Malaysia. At present, the power is exchanged for a maximum of 80 MW via the **Tie Line Stage I**, at a voltage level of 115/132 kV, linking the power system of EGAT and Tenaga Nasional Berhad (TNB).

In order to optimize the benefit of this power exchange program, the **Tie Line Stage II Project**, a 300 kV High Voltage Direct Current (HVDC), was initiated for an additional power exchange/purchase of 300 MW. EGAT and TNB agreed to construct the HVDC transmission line to strengthen the link between the two countries. After completion in 2001, an additional power exchange of 300 MW makes through this HVDC tie-line. The next step of stage II Interconnection project aiming at the power exchange of 300 MW has been recommended.

### 6.6.3 Myanmar

The Government of Thailand and the Government of the Union of Myanmar had entered into the MOU on July 4, 1997 expressing their intention to cooperate on the development of electric power in the Union of Myanmar for sale to Thailand of up to 1,500 MW by the year 2010.

Each country had established a committee to be responsible for the cooperation under this MOU, namely the **Committee on the Implementation of Power Purchase Program from the Union of Myanmar for Thailand** and the **Committee on the Implementation of Power Export to Thailand** for the Union of Myanmar.

Three hydro power projects, namely **Nam Kok** (55 MW), **Hytgyi** (400 MW) and **Tasang** (3,600 MW) and one combined cycle project, **Kanbauk** (1,500 MW) have been proposed by the Union of Myanmar as potential projects for power export to Thailand under the MOU. Negotiation on individual project will be commenced after the completion of its feasibility study by the Myanmar side.

Due to the current power shortage in the Union of Myanmar, the Myanmar Committee has recently proposed the idea of early interconnection to import from Thailand about 100-200 MW of electric power. The most possible route of linking two nation grids was via Mae Sod on the Thai border to Bago in the Union of Myanmar over the distance of 431 kilometers. Preliminary study on the technical aspects was completed in mid 1999 and detailed study for the most appropriate and economic interconnection is underway.

This tie-line project will be the first to link Thailand's grid with Myanmar's. In the short term, it will be used to transmit energy from Thailand to relieve the power shortage of Myanmar and later to export electric energy to Thailand when the power projects in Myanmar are ready for sale.

#### **6.6.4 China**

The Government of Thailand and the Government of the People's Republic of China had entered into the MOU on November 12, 1998 expressing their intention to cooperate in the development of energy resources in China for sale to Thailand of up to 3,000 MW by year 2017. The MOU also stated the intention of the two countries to interconnect the power systems as well as to acquire the transmission system's right of way from the third country.

Each government had appointed a committee to deal with this cooperation under the MOU, namely the **Thai Coordinating Committee on the Implementation of the Power Purchase Program from the P.R.C. (TCC)** for Thailand, and the **Chinese Coordinating Committee for the Project of Thailand's Purchasing Power from China (CCC)** for the P.R.C. In addition, a working group has also been appointed under each committee.

The first cooperative project for power transmission from China to Thailand shall be the joint development of hydropower resources and construction of the Yunnan Jinghong Hydropower Station. This 1,500 MW project is located on the downstream reach of the Lanchang River, near the Jinghong City of Yunnan Province, and is approximately 300 kilometers from Thai border at Chiengrai.

Under the updated power purchase scheme from the P.R.C., EGAT will incorporate the purchase of 1,500 MW of power from the Yunnan Jinghong Hydropower Station around the year 2013 and another 1,500 MW from Yunnan Province around the year 2014 into the EGAT's Power Development Plan.

## 6.7 Prospect of ASEAN Power Grid System

The ASEAN Power Grid System is planned as shown in Figure 6-1 and can be summarized in Table 6-6. The grid is not only interconnection among ASEAN countries themselves but also it is included south of China in the system. Thailand and Malaysia have played as main countries for the grid because of their location. The feasibility studies for the main grid and subsystem have been done for several versions and they still require further studies in, but not limited to, technical, economical, political and environmental issues. The High Voltage Direct Current (HVDC) links may be suitable for long transmission interconnection and for some point to point for this program. The HVDC has many better things than the High Voltage Alternating Current (HVAC) Interconnection, for example: reduce problems of stability, low investment cost, save the right-of-way and easy for operation. However, there is no major development in the ASEAN Power Grid System since January 2000.

The ASEAN Power Grid is a programme mandated in 1997 by the ASEAN Heads of States and Governments under ASEAN Vision 2020. This vision pictures an integrated system of electricity transmission, dispatching and trading among the 10 member countries of the ASEAN. It requires the interconnection of the existing electricity grids of the ten countries and a system of electricity trading across national borders. The vision started shaping up in 1982 when the Forum of Heads of ASEAN Power Utilities/Authorities (HAPUA) was established. The pursuit of the vision has been carried out under the ASEAN Plan of Action for Energy Cooperation 1999-2004.

The plan of the ASEAN Power Grid consists of high voltage DC lines (HVDC) connecting the Indochina Peninsula, the Malay Peninsula, Sumatra, Java and the lesser Indonesian Islands east of Java. It connects Singapore with Malaysia and Batam, Indonesia and the Malay Peninsula with Sarawak, Kalimantan Brunei, Sabah and the Philippines.

Six interconnection projects in the Indo-China Peninsula are being pursued strongly under the Greater Mekong Subregion (GMS) Power Interconnection Programme. This programme is being supported by the Mekong River Commission, ADB, World Bank, Japan and Norway. Some feasibility studies have already been



made and some agreements have been made among the countries concerned in the interconnection projects. The agreements made so far include:

- 1) Thailand buys power from Lao PDR since 1998.
- 2) Thailand to buy from IPPs in Lao PDR 3,000 MW from 2006 (1,883 MW from December 2006 and 1,380 from March, 2008).
- 3) Vietnam to buy from Lao PDR 2000 MW by 2010. The MOU for the Lao PDR – Vietnam power interconnection project has been signed. Further study for the interconnection projects (Ban Sok-Pleiku and Nam Theun 2 – Ha tinh) will be carried out.
- 4) Cambodia to buy 35 MW from Kong Falls in Lao PDR. The MOU for the power agreement was signed in 1999. EDL is conducting the study for power supply to the border of Cambodia.
- 5) Thailand to buy from Cambodia 100 MW from Stung Mnam Project. The power cooperation agreement was signed in February 2000. Meanwhile, the study for the system interconnection to export power from Thailand to the 3 provinces on the western part of Cambodia was carried out by EGAT and completed in February 2001. The interconnection project is expected for commissioning in 2003.
- 6) Thailand to buy 3,000 MW from Myanmar by 2010. A feasibility study of system interconnection was carried out by EGAT and completed in October 1999. A feasibility study to interconnect Mae Sot to Bago was funded and undertaken by TEPCO and Mitsui. The study was completed in March 2001 and was presented to concerned authorities.
- 7) Myanmar to buy 100-150 MW from Thailand from 2002-2003 to relieve power shortage.
- 8) Thailand to buy 3,000 MW from Yunnan Province of China by 2017.
- 9) Cambodia to buy power from Vietnam. A power purchase agreement was signed in 2000. The estimated project cost is about US\$54.5 million. Expected commissioning is in 2004.

Compared to the GMS Interconnection Projects, the nine other interconnection projects have been less active during the past three or four years. The action has been concentrated on the work of the ASEAN Interconnection Masterplan Study Working Group (AIMS-WG) which plans to develop a master plan for the regional interconnection programme by mid-2002.

The status of the eight other interconnection projects is as follows:

- 1) Peninsular Malaysia – Singapore  
Interconnected since 1985. Upgraded in 1996 and planned to be upgraded again in line with the new power pooling arrangement in Singapore.

- 2) Peninsular – Malaysia – Thailand  
Interconnected since 1981. Upgraded in 2001 from 80 MW to 300 MW capacity, with further upgrading to 600 MW capacity possible in the future.
- 3) Peninsular Malaysia – Sarawak  
Subject to the implementation of 2,400 MW Bakun Hydroelectric project in Sarawak which is designed to transfer 2,100 MW to Peninsular Malaysia through 500 KV HVDC submarine cables and converter stations at Tanjung Sedili, Peninsula, Malaysia.
- 4) Peninsular Malaysia – Sumatra  
Initially to develop 600 MW hydropower along Asahan River in Sumatra to be transported by HVDC submarine cable, 50 km across the Strait of Malacca between Dumai, Sumatra and Port Dickson, Peninsular Malaysia. Since 1999, another plan is being considered to put up a coal-fired mine-mouth power plant in Sumatra and transfer this to Peninsular Malaysia at Kerteh.
- 5) Batam – Bintan – Singapore – Johore  
Feasibility studies have been finalized. Financing is being sought by Indonesia. An IPP has proposed to build the submarine cable from Batam to Singapore.
- 6) Sarawak – West Kalimantan  
Feasibility study by Sargent and Lundy in 1994, financed by the US Trade Development Agency estimated an economic return of 38%. The transmission project will involve a 231 km, 150 KV cable at 150 MW capacity between Sarawak and West Kalimantan. PLN and SESCO have been expected to implement this projects.
- 7) Sabah – Philippines  
The National Power Corporation (NPC) of the Philippines has been designated to coordinate this project. A feasibility study is still to be made.
- 8) Sarawak – Brunei Darussalam – Sabah  
Feasibility study undertaken by Snowy Mountain Engineering Co., Ltd. for the Malaysian Government. Recommended the construction of 275 KV transmission connecting SESCO, Sabah Electric and DES of Brunei Darussalam. Now being updated under coordination by SESCO.

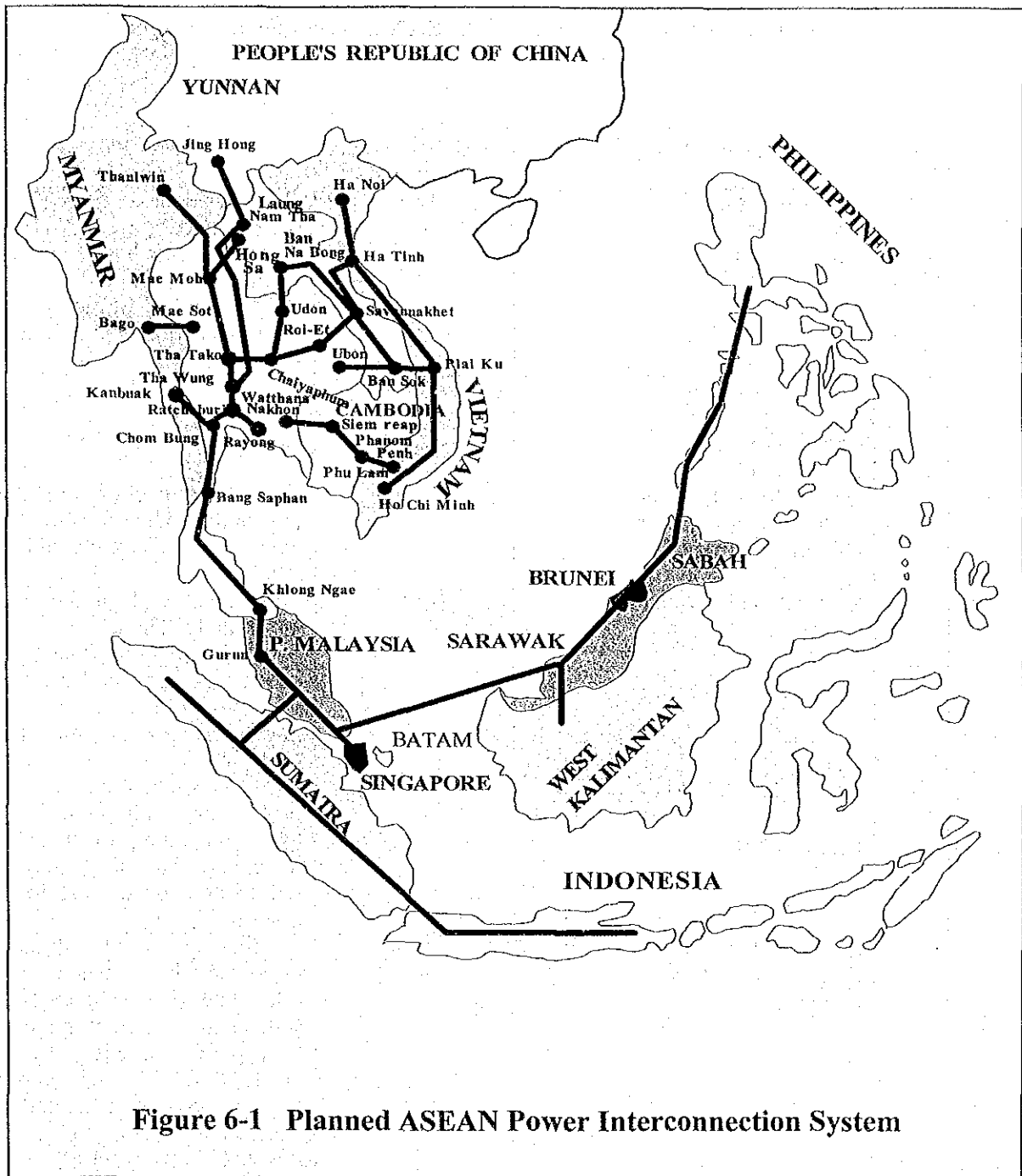


Figure 6-1 Planned ASEAN Power Interconnection System

**Table 6-6 Summary of Progress of the ASEAN Interconnection Projects  
(As of January 2000)**

No.	Project Description	Coordinating Utility	Status
1	Peninsular Malaysia-Singapore (Short term)	TNB	Commissioned in 1985. (The interconnection on the Malaysian side has been shifted to Plentong) The availability of the interconnection is more than 99.0%
2	Thailand – Peninsular Malaysia Sadao – Bukit Keteri (Short term) HVDC Links between Khlong Ngae – Gurun (Medium term)	EGAT	Commissioned in 1981.  The Interconnection project is in progress. The project is expected to be completed by end 2001.
3	Sarawak – Peninsular Malaysia (Long term)	SESCo	The project has been deferred indefinitely. There is a possibility that the project will be revived on a smaller scale and without the interconnection to Peninsular Malaysia.
4	Peninsular Malaysia-Sumatra (Long term)	TNB	PLN has conducted a preliminary study on this interconnection project. TOR for the pre-feasibility study will be done once a task force is set up.
5	Batam – Bintan-Singapore – Johore (Long term)	PLN	Seeking sponsors for studies or cost-sharing between related utilities. Natuna gas is scheduled to be supplied to Singapore via pipelines by 2001. Draft TOR revision has been proposed by PLN and has been circulated to TNB and Power Grid (Singapore). Natural gas to Batam island will be fed from Asamera, Sumatra.
6	Sarawak – West Kalimantan (Long Term)	SESCo	There has been no progress for this project. SESCO will coordinate the commercial portion of this project while PLN will coordinate the technical activities after the commercial portion has been confirmed.

**Table 6-6 Summary of Progress of the ASEAN Interconnection Projects**  
 --(Continued)  
 (As of January 2000)

No.	Project Description	Coordinating Utility	Status
7	Philippines-Sabah (Long term)	NPC	No progress. This interconnection may not be needed until at least 2010.
8	Sarawak- Sabah- Brunei Darussalam (Long term)	SESCo	No progress since last meeting. The study was made available to BIMP-EAGA Working group for possible implementation by private sectors.
9	Thailand-Lao PDR Udon Thani-Nabong (Medium term) Mae Moh 3-Hongsa (Medium term) Roi Et-Savannakhet (Medium term) Ubol Ratchathani-Ban Sok (Long term)	EGAT	Feasibility study and a survey for suitable interconnection locations has been carried out. ditto  ditto  No progress.
10	Lao PDR-Vietnam Ban Sok-Pleiku (Medium term) Nam Theun No.2-Ha Tinh (Long Term)	EDL	MOU has been signed by Vietnam and LAO to carry out these projects. Further study on the master plan for these interconnections will be carried out.
11	Thailand – Myanmar (Long term)	EGAT	New proposed project
12	Vietnam – Cambodia (Short term)	EVN	New proposed project
13	Lao PDR-Cambodia (Long term)	EDL	New proposed project
14	Thailand-Cambodia (Medium term)	EGAT	New proposed project

Source: EGAT

## Chapter 7

### Privatization and Restructuring of Power Sector

#### 7.1 Introduction

The privatization and restructuring of the Electricity Supply Industry (ESI) in Thailand has systematically been implemented over a number of years. The cabinet resolution of 5 March 1996 gave consent to the separation of generation, transmission and distribution businesses. To comply with this resolution, EGAT's thermal power plants will be separated into business units (BUs) and then corporatized, registered and listed on the Stock Exchange of Thailand (SET).

In addition, the cabinet resolution of 1 September 1998 approved the Master Plan for State Enterprise Sector Reform (the Master Plan), which serves as a framework in determining the scope and direction of restructuring and privatization of the energy sector. Pursuant to the Master Plan, a framework for efficient and independent regulation is being developed. Under the framework, an independent regulatory body will be established as an independent entity responsible for the regulation of the future energy industry.

Subsequently, on 19 October 1999 the cabinet approved a guideline on the establishment of the Independent Regulatory Body, as per the resolution of the State Enterprise Policy Commission (SEPC). Moreover, the National Energy Policy Office (NEPO) and the Ministry of Industry were assigned to form a working group to draft a law on the establishment of the regulatory body in the energy sector as soon as possible to be submitted to the cabinet and the Parliament respectively for further consideration.

Under the ESI reform plan being now implemented, the structure of the ESI will allow greater competition in the industry and, simultaneously, encourage the private sector investment and shareholding in the power industry. The main underlying principle is to deregulate the industry wherever possible to increase competition. However, for certain natural monopoly businesses, like power transmission and distribution systems for which new investment would duplicate the existing ones and hence would not be cost-effective, they will be subject to regulation so as to protect consumers' benefits.

The above-mentioned approach of the ESI reform will bring about more efficiency of the overall industry operation and will bring down electricity prices compared with those under the former monopolistic structure. At the initial stage, the focus of competition was on the power generation sector. Since 1992, the

government has promoted greater roles of the private sector in the power generation business, in the forms of Small Power Producer (SPP) and Independent Power Producer (IPP). Capital raising from the private sector has been implemented through sale of shares of Rayong and Khanom Power Plants (later transformed into Electricity Generating Public Co., Ltd. or EGCO) to generate and sell electricity to EGAT, instead of having EGAT as the single producer.

The ESI restructuring at this level has no direct impact on the general public since most power consumers still have to buy electricity from the MEA or PEA. That is, there are no other options for power consumers, unlike the case of telephone installation (where consumers can choose whether to have the Telephone Organization of Thailand or the Telecom Asia connect their telephone lines, or the case of a mobile phone, where consumers can choose among various service providers). Exceptions are for industrial customers whose facilities are located near an SPP project, and hence options are available for them whether to have the SPP or the PEA/MEA as their power supplier.

Several obstacles have been encountered in the attempt to corporatize the three power utilities. However, the government will continue to reform state enterprises in the power sector. To this effect, the reform plan has been incorporated into the Master Plan for State Enterprise Sector Reform, in the Energy Sector. Under this Master Plan, the main organization, i.e. EGAT or EGAT's subsidiaries, continues to be the major power supplier of the country. Meanwhile, the transmission business will be separated to be independent from the generation business to allow direct purchase between power producers and customers, aiming at eventual liberalization of the ESI.

The guidelines provided in the Master Plan above are only the general framework to determine the scope and direction of the implementation. In practice, detailed studies are required to specify the most suitable approach for energy sector reform. For state enterprises in the energy sector, NEPO was assigned to undertake a detailed study and determine a suitable implementation plan. In this connection, NEPO commissioned a consultant consortium comprising National Economic Research Associates (NERA), Barker Dunn & Rossi, Cameron McKenna and Presko Shanwick, led by Arthur Andersen Co., Ltd., to undertake the study on "Thailand Power Pool and Electricity Supply Industry Reform - Phase 1". The Final Report was prepared by the consultant team and was considered by the Sub-Committee on the Future Structure of the Electricity Supply Industry. The Sub-Committee's comments on the report were taken into account in the development of the ESI reform plan and the Power Pool establishment. The revised reform plan was presented to the cabinet for consideration and was approved on 25 July 2000.

Besides, in compliance with the cabinet resolution of 19 October 1999, the Minister to the Prime Minister's Office has issued an order of the Prime Minister's Office, appointing a working group to be responsible for the drafting of a law on the establishment of a regulatory agency for the energy industry. The Working Group comprises representatives of all stakeholders, i.e. concerned government organizations, energy business operators, consumers, experts in law/economics/finance, to jointly draft the law. At present, the Working Group has finished the Draft Energy Industry Act (see Appendix 2), which was approved by the cabinet on 31 October 2000. The Draft Act is currently under review by the Office of the Council of State, prior to submission to the Parliament for further consideration.

Appendix 4 shows comparisons of Thailand's Power Pool and other countries.

## **7.2 Privatization Master Plan (3-Stage Plan)**

The implementation of the ESI reform can be divided into three stages as follows:

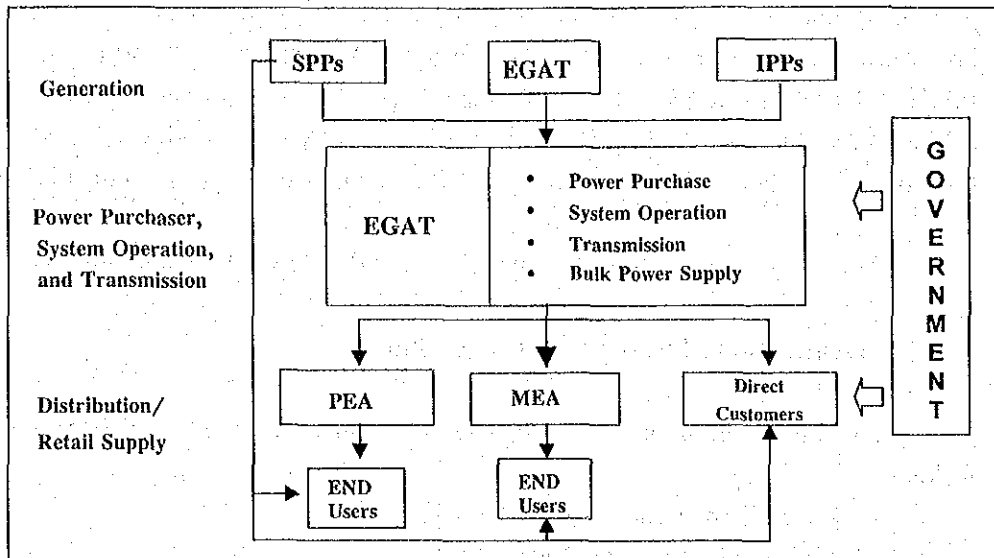
- Short-Term Structure (2000-2001)
- Mid-Term Structure (2001-2002)
- Long-Term Structure (2003 onwards)

### **7.2.1 Short-Term ESI Structure (2000-2001)**

At this stage, the draft of the legislation on the establishment of an independent regulatory body in the energy sector, together with related rules and regulations under the law, including the Market Rules for the Power Pool, has been developed. With regard to the reorganization of the three power utilities, EGAT's different internal departments would be commercialized to form autonomous business units (BUs) operating as profit centers while Ratchaburi Power Plant was privatized.

At this stage, EGAT will retain its dominant role as primary bulk power purchaser and provider. The MEA and PEA will retain their respective franchise customer bases (except for the case where consumers wish to purchase power directly from SPPs). In addition, the MEA will corporatize its core service businesses and separate non-core service businesses as BUs within the MEA. Figure 7-1 shows the Short-Term ESI Structure (2000-2001).





**Figure 7-1 Short-Term ESI Structure (2000-2001)**

**The key features and issues associated with the short-term structure are:**

- Private sector participation in the power generation business is still limited;
- Long-term planning of the power system remains under EGAT's responsibility;
- Accountability and incentives to increase generation efficiency are in small number due to lack of competition among generators (except for the project proposal submission);
- There is no direct access for customers to competitive power supply, except through purchase from SPPs; and
- Preparation for the establishment of an independent regulatory body in the power sector is under way.

### 7.2.2 Medium-Term ESI Structure (2001-2002)

During this stage, EGAT will retain its state enterprise status and remain the central supplier of power. EGAT's thermal generation business units will be corporatized as its subsidiaries (PowerGen 1 and PowerGen 2). Operation and accounting of the transmission and the system operation business units will be separated. Besides, EGAT will be responsible for the preparation of the three systems required to function as the System Operator (SO), Market Operator (MO) and Settlement Administrator (SA). These functions will eventually be transferred to one entity independent from EGAT.

Non-core service businesses of the MEA will be corporatized as wholly owned subsidiaries and then the MEA's shareholding will gradually be reduced. For the PEA, its internal organizational structure will be reorganized into 4 network business units and 12 Regulated Electricity Delivery Companies (REDCos); its non-core service businesses will be reorganized as business units within the PEA. Figure 7-2 shows the Medium-Term ESI Structure (2001-2002).

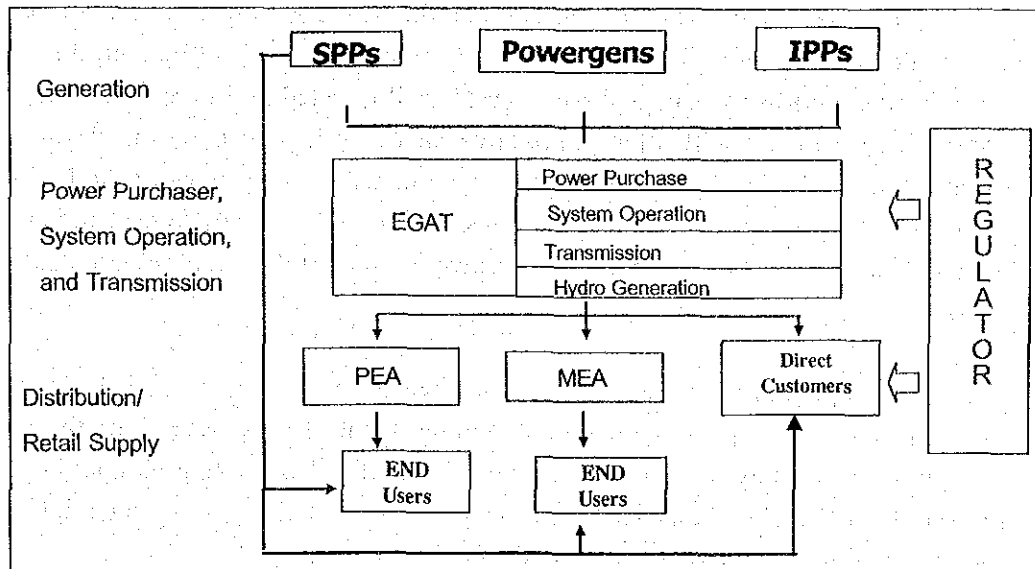


Figure 7-2 Medium-Term ESI Structure (2001-2002)

The key features and issues associated with the medium-term structure are:

- EGAT will still be the single buyer and act as the central agency for long-term planning and operation of the power system;
- The Independent Regulatory Body for the ESI is established;
- A regulatory framework for determining charges for transmission and distribution line utilization (wheeling charges) will be required, including an incentive regulatory regime by the Regulator;
- A transparent mechanism for funding subsidies will be adopted to place the MEA, PEA and new operators on a level playing field. The most possible mechanism is to collect contributions from power consumers for a fund to be used as subsidies for targeted consumer groups; and
- All internal business functions of EGAT will be transformed into business units, with distinct operation and accounting separation. PowerGens 1 & 2 will be corporatized.

### **7.2.3 Long-Term ESI Structure (from 2003 onwards)**

The final stage will commence around the year 2003 onwards. A competitive wholesale power pool will be established, separate from EGAT. Competition will be introduced at both wholesale and retail levels, as illustrated in Figure 7-3. Generation companies (GenCos) will offer competitive bids to sell power via the Power Pool, using the transmission system of EGAT or the distribution systems of the MEA and PEA. The Regulator will regulate the transmission and distribution system activities to ensure access for the third party to the power system of the country with reasonable charges.

To implement energy policies of the government, such as fuel diversity and maintenance of adequate competition among GenCos, regulation on the power generation sector may be required. This may be realized via setting fuel preference in the process of license issuance for power plant construction, or setting priorities of fuel types used in power generation in the pool purchase.

During this stage, sale of EGAT's shares in PowerGen 1 and PowerGen 2 in the Stock Exchange of Thailand will commence to increase the general public's shareholding.

The Independent System Operator (ISO) will be responsible for the security of the power system. The ISO shall not be involved in power generation business in order to be independent and transparent in carrying out its operation. The ISO will be responsible for economic merit order dispatch and the development of the national power system plan.

Regulated Electricity Delivery Companies (REDCOs), the future form of the MEA and PEA, will be responsible for power distribution within their respective customer franchise areas. Since the distribution system is a natural monopoly in nature, the Independent Regulator will regulate the criteria for distribution services and charges for delivery-related services. For retail customers, competitive Retail Companies (RetailCos) will be an alternative for consumers. RetailCos may offer value-added services (for example: give free advice on energy management system) to consumers together with their electricity delivery.

At this stage, EGAT still remains a state enterprise, responsible for the transmission system and hydro power plants, with shares in some power generation companies and other related businesses.

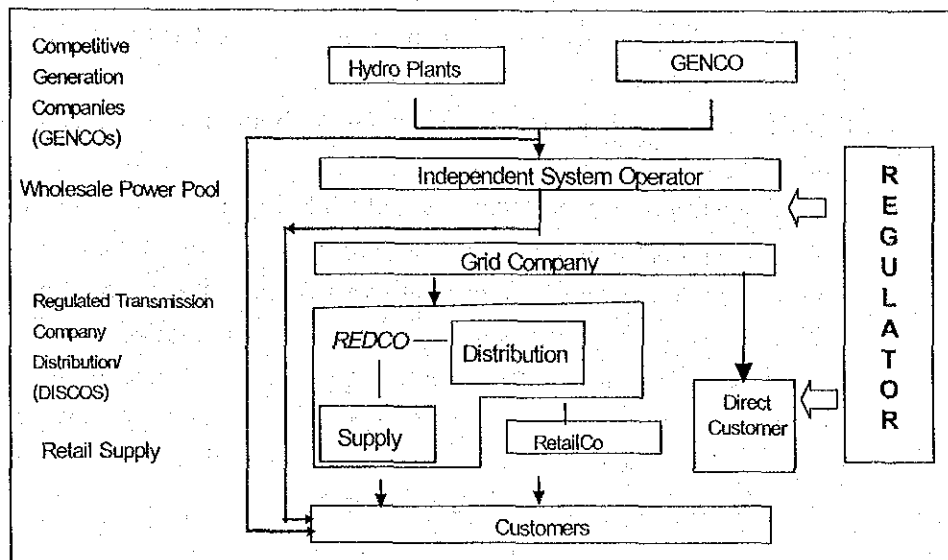


Figure 7-3 Long-Term ESI Structure (2003-2004 onwards)

In order to accomplish the long-term ESI structure, extensive reform of the existing ESI structure are essential, namely:

- Power generation, formerly operated solely by EGAT, will have to be spun off into various groups of GenCos (with the exception of hydro power generation, because hydro power in Thailand is multipurpose project for: irrigation, transportation, and etc. It has many government agencies to concern.);
- A power pool shall be established as an independent entity, separated from EGAT, comprising the System Operator (SO), Market Operator (MO) and Settlement Administrator (SA). At the initial term, EGAT may carry out

all or part of these functions of the Power Pool, but ultimately the SO/MO/SA will be transferred out of EGAT and the SO will become the Independent System Operator (ISO);

- The accounting system of the distribution system and that of the supply business shall be clearly separated so that competitive retailers could efficiently participate in the market; and
- The Independent Regulator will have an important role in regulating natural monopoly businesses and in promoting real competition in competitive activities, i.e. power generation and retail businesses.

The key features and issues associated with the competitive ESI structure are as follows:

- EGAT remains a state enterprise, in charge of the GridCo function and hydro power plants.
- Private sector participation is promoted in both power generation and retail supply;
- Fair competition between state-owned and private sector GenCos will foster real competition in both bulk and retail supply of power;
- With a suitable design of the competitive structure, there would be strong efficiency drivers in power generation and retail supply; and
- Market signals will replace central planning. Since large power consumers will have direct access to generators, new capacity will be added only when it is economically justified by competitive supply/demand relationships in the Power Pool.

### **7.3 Future Structure of Electricity Sector**

The future structure of the ESI and the Power Pool at the final stage are discussed below:

#### **7.3.1 Electricity Supply Industry Structure**

In the power generation sector, there will be a number of generators, including power plants that will be split from EGAT, participating in power trade bidding in the Power Pool. For retail supply, there will be competition among retailers. As a result, power consumers will not have to buy electricity only from the PEA or MEA as they can opt for any retailer to be their supplier. Such retailers can purchase power from various generators via the Power Pool and deliver power using the lines of EGAT, PEA or MEA. This will enhance retail competition not only in terms of prices but

also in terms of service quality. Hence, the future structure of the ESI in Thailand must suit and facilitate such business operation.

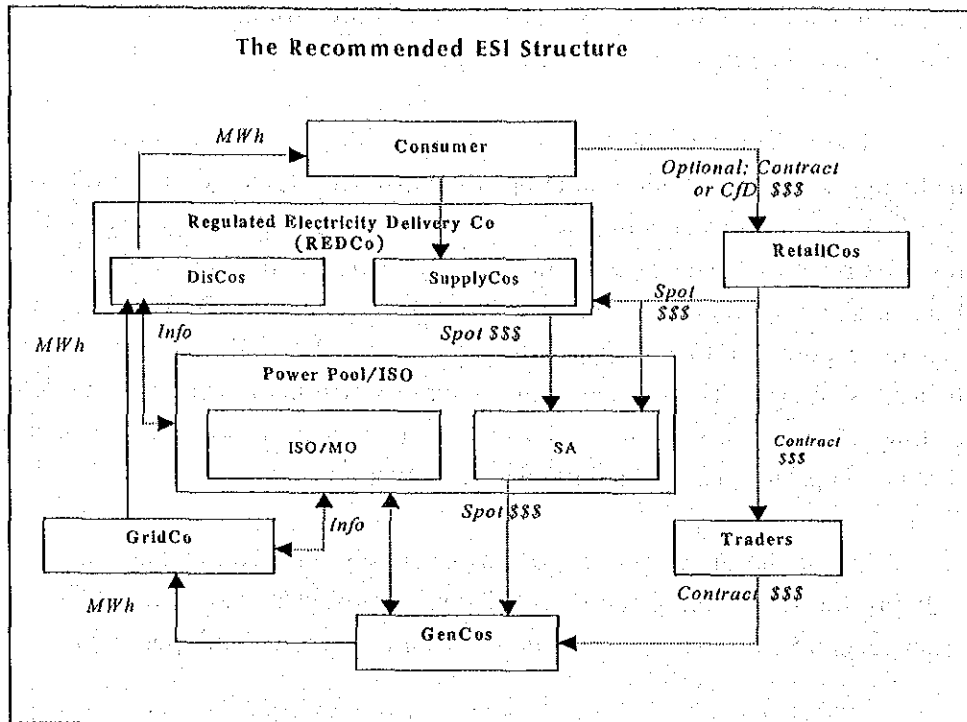
The structure of the ESI and the Power Pool have to properly accommodate both supply and distribution functions to consumers. Each generator will commence physical operation when a dispatch instruction, according to the generation cost merit order, is received. This is to ensure that the overall generation cost of the system is kept at the minimum. Then, the physical electricity (MWh) generated by each generator pursuant to the dispatching order will be delivered via a high-voltage transmission grid. The voltage of the electricity will be transformed and delivered to a low-voltage distribution system when it comes nearer to the consumption destination prior to being distributed to each customer.

Under the above process of power supply and distribution, final consumers will pay for their electricity to a retail service provider who usually buys electricity from generators through a combination of contract trading and spot trading.

GenCos can be competitive private generation entities. GridCo and DisCos still belong to the government, are subject to regulation, and are responsible for high-voltage transmission grid systems and low-voltage distribution systems respectively. RetailCos are unregulated private entities and are competitive providers of electricity and various delivery-related services for general customers. SupplyCos are regulated entities that supply electricity and provide related services to consumers who do not want to buy or are not allowed to choose to buy electricity from a competitive RetailCo so that power consumers under all categories could have access to the services.

Under the above structure if the existing IPPs agree to enter into in the Power Pool, Traders will negotiate and carry out the trading of contracts that were signed between EGAT and IPPs. And if any existing IPP does not agree to be in the Pool, he can still execute his PPA. In addition, there is a need to form an Independent System Operator (ISO) to monitor and control the power system operation in accordance with specified standards, a Market Operator (MO) to administer the Power Pool, and a Settlement Administrator (SA) to manage the billing and settlements among market participants. The ISO, MO and SA have to cooperate closely and be independent from any entity participating in the Power Pool; however, the functions of the ISO and MO may be handled by the same entity.

Given the basic functions and various functional entities concerned in the ESI, the recommended future ESI structure, from 2003 onwards, can be illustrated in Figure 7-4.



Note: CfD stands for Contract for Difference, see Chapter 8 for detail.

Figure 7-4 Recommended Future ESI Structure

Under the recommended structure, SupplyCo and DisCo functions are combined in a Regulated Electricity Delivery Company (REDCo) which is regulated by the Regulator. The REDCo will provide electricity to consumers at spot prices plus delivery-related costs (regulated by the Regulator). Competitive RetailCos will be able to offer to consumers such value-added services as electricity tariff risk-management (hedging) and energy conservation services.

The ISO, MO and SA functions are combined in the Power Pool. The ISO will be responsible for the economic merit order dispatch to generators, with close coordination with the MO, and will, control the operation of the GridCo. The SA, responsible for the billing and settlements among market participants, may be part of the Power Pool or be split off as a separate entity.

The GridCo owns, operates and carries out maintenance work of grid facilities under a contract made with the ISO. The GridCo must not have any affiliation with any competitive entities, especially those unregulated, and should be a different entity from the SO.

The recommended structure provides power consumers with options pertaining to retail services. Consumers can choose a competitive RetailCo to obtain risk-management against the fluctuating pool prices and other value-added services.

On the generation side, generation companies (**GenCos**) will compete in the bidding of electricity prices in the Power Pool. GenCos may be the existing power plants of EGAT, IPPs, SPPs, Ratchaburi Power Plant or power producers from neighboring countries.

**Traders** are entities that buy or sell energy without their own generation facilities. They will act as mediators between power producers and consumers or retailers, or as administrators of the existing Power Purchase Agreements (PPAs) made between EGAT and IPPs.

From the foregoing explanation, functional entities involved in the Power Pool can be categorized into regulated entities and competitive entities. Regulated entities are the **GridCo, REDCos and the Power Pool**, with well-defined duties and role, making them relatively easy to manage and regulate. Competitive entities are GenCos, RetailCos and Traders. They will compete in providing services to consumers, from generation to retailing levels. The establishment of RetailCos and Traders will be determined by the market forces. The SA, being responsible for the billing and settlements, may be part of the Power Pool or be split off as a separate entity.

#### **7.4 Privatization of EGAT**

In the year 2000, EGAT has worked on reorganizing its existing activities into business units. Engineering, Construction and Maintenance activities are largely distributed to the various business units. Mae Moh Mine will be grouped with PowerGen 2. Ratchaburi Power Plant is privatized. Commencement is made for discussions and management of the existing PPAs. The grid system will be separated from EGAT to be a business unit, and so is the Independent System Operator, so as to provide the access the grid system to the third party.



In the year 2002, the Independent Regulatory Body will be established. PowerGen 1 and PowerGen 2 (see Table 7-1) will be corporatized as EGAT's wholly owned subsidiaries. At this stage, EGAT's preparations for commencement of the Power Pool operation will become clearer into view, with reorganization of various activities into business units, such as the DebtCo, GridCo, Hydropower and Energy Management Agency (the integration of the current Demand Side Management Office, or DSMO, and the Research & Development Office). The functions pertaining to the Power Pool operation will also be established as a business unit, comprising the SO, MO and SA; the System Planning function will become part of the SO. However, EGAT will retain the state enterprise status.

In 2003, the Power Pool will be operational. The GridCo, Hydro and Energy Management Agency remain as business units within EGAT. From 2003 onwards, EGAT should dilute its shareholding in PowerGens 1 and 2 as well as in Ratchaburi Power Plant and EGCO. At the initial term, EGAT will act as the SO, MO and SA, but these functions will eventually be split off from the GridCo of EGAT. The PPA Traders will be separated as wholly owned subsidiaries of EGAT to independently handle power purchase in the Power Pool.

After 2003, consideration may be given to corporatization of Hydro and GridCo into subsidiaries, with EGAT holding 100% of shares at the initial stage. In addition, at this stage EGAT will further dilute its shareholding in all of its GenCos until EGAT can completely divest itself from all these entities. Figure 7-5 shows structure of EGAT after 2003. EGAT will be state enterprise and has small shares or no longer shareholder in GenCos.

**Table 7-1 Grouping of EGAT's Thermal Power Plants**

<b>PowerGen 1</b>	<b>PowerGen 2</b>
North Bangkok Bang Pakong Surat Thani Nam Phong Wang Noi Sai Noi	South Bangkok Mae Moh Lan Krabue Nong Chok Krabi Thermal
Total generating capacity 5,999 MW	Total generating capacity 4,600 MW

Source: NEPO

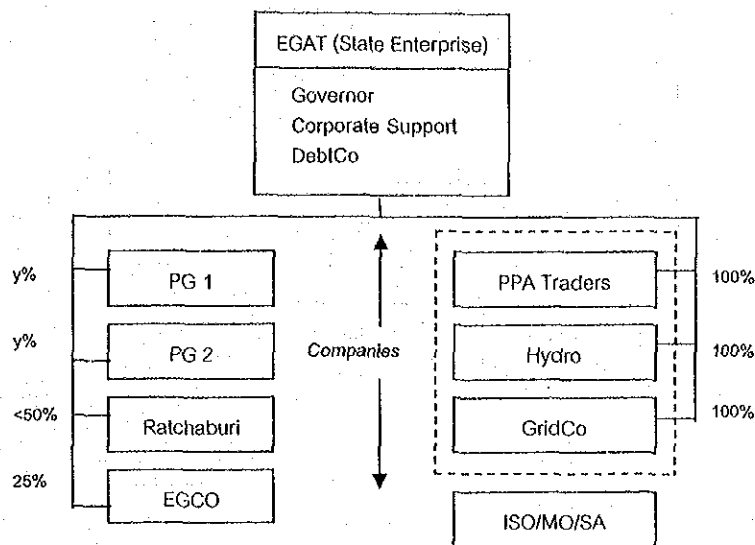


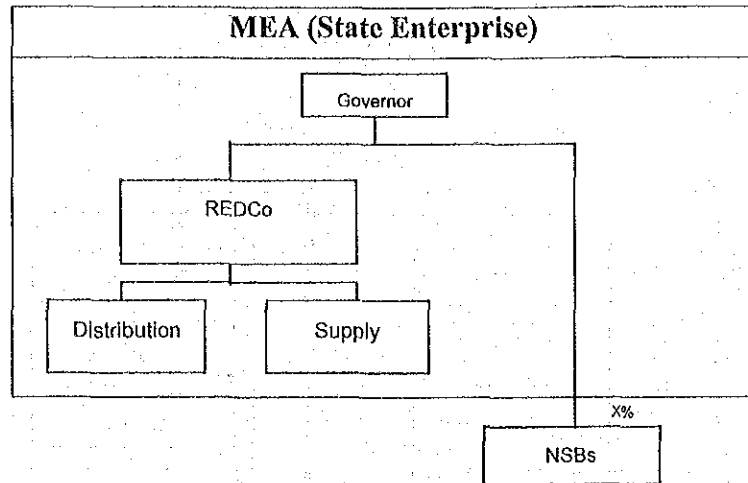
Figure 7-5 Structure of EGAT: After Year 2003

### 7.5 Privatization of MEA

During 2000-2001 the MEA will remain a single entity, but there will be accounting separation between the Distribution (DisCo) and Supply (SupplyCo) activities. Non-core Service Businesses (NSBs) will be divided into four business units, i.e. Electrical System Service Department (ESSD), Product Design and Manufacturing Office (PDMO), Information Technology Department (ITD) and Power System Maintenance Department (PSMD). Clear performance targets are put in place for the MEA.

During 2002-2003, ESSD and PDMO of the four units will be corporatized and eventually privatized.

After 2003, there will be the operational separation between the Distribution and Supply functions of the REDCo. Then, an evaluation of operating efficiency of the MEA will be undertaken performance measurable. If the performance targets are not achieved, corporatization of the REDCo will be considered. At this stage, the four business units will be all corporatized, and the structure of the MEA will be reviewed. Figure 7-6 shows structure of MEA after 2003.

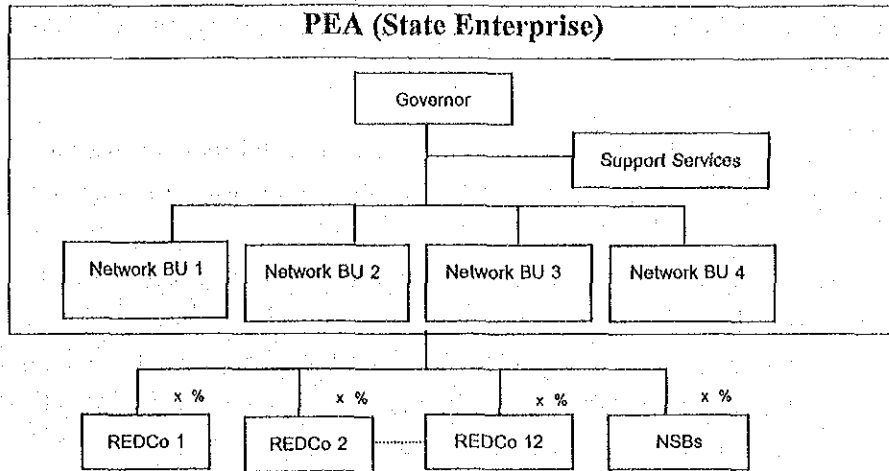


**Figure 7-6 Structure of MEA: 2003 onwards**

### 7.6 Privatization of PEA

During 2000-2002, internal reorganization of the PEA will be undertaken. The distribution (wire) business of 22 kV and above will be reorganized into four business units while the low voltage wire business (below 22 kV) and supply business will be reorganized into 12 REDCos, which they are possibility in the form of PEA's subsidiaries. Non-core Service Businesses (NSBs) will be reorganized into several business units.

After 2003, all REDCos and NSB business units will be corporatized and eventually privatized. If the overall performance improvement cannot reach the desired targets, corporatization of all Network BUs will be considered. Figure 7-7 shows the restructuring of PEA after 2003.



**Figure 7-7 Restructuring of PEA: 2003 onwards**

**7.7 Regulatory Issues**

Beside the directions for the electricity supply industry reform, the Master Plan for State Enterprise Sector Reform also stipulates a framework for efficient and independent regulation be established to create a level playing field for competition in the energy sector. To this effect, an Independent Regulatory Body will be established as an independent entity to be responsible for the regulation of energy business operations in the future.

The cabinet concurred with the approach for the Independent Regulatory Body establishment pursuant to the resolution of the State Enterprise Policy Commission (SEPC). For the energy sector, the National Energy Policy Office (NEPO) and the Ministry of Industry have been assigned to appoint a working group to develop the draft legislation on the establishment of the Independent Regulatory Body in due course.

The Thai ESI reform is an issue that has impacts on power producers, consumers and investors. Therefore, the establishment of an Independent Regulatory Body to regulate the ESI operation is one of the most crucial factors in creating an efficient system while providing fairness for all parties concerned. The principal roles of the ESI regulation, apart from the protection of consumers against abuse of monopoly power, also include regulation and promotion of competitive market with fair returns for investors.

Regulation is an important element in the ESI since provisions of some services are natural monopoly, such as transmission and distribution services. Regulation on such services operation is, therefore, required so that power

producers, distributors and consumers can jointly use these basic infrastructures on a fair basis.

The Independent Regulatory Body will be established under a new law, i.e. the Energy Industry Act (see Appendix 2). The Act can be summarized as follows:

1. The National Energy Regulatory Commission (NERC) shall be established to regulate business operations that are of monopolistic nature, such as the electricity and gas supply industries, and other businesses as specified in related Royal Decrees. The NERC will be responsible for license issuance for energy industry operation, promotion of competition, prevention of abusive use of monopoly power, and protection of energy consumers;
2. The National Energy Regulatory Office (NERO) shall be established as a state agency, acting as the Secretariat to the NERC in order to facilitate and enhance efficient implementation of the NERC's authority and duties; and
3. A Power Pool shall be established, under the name "Thailand Power Pool", to act as the System Operator (SO) of the transmission system of the country, the Market Operator (MO) and the Settlement Administrator (SA), under the supervision of the Thailand Power Pool Board. The objectives are to promote competition in the ESI, to provide choices in power purchase for consumers and to enhance efficient ESI operations.

#### **7.8 Prospect of Pool Introduction and Reform Movement**

According to the revised reform plan for the ESI and Power Pool establishment approved by the cabinet on 25 July 2000, the Power Pool will commence operation by the year 2003. In this regard, preparations have to begin from 2000 onwards and various activities have to be pursued simultaneously.

The overall timeframe for the Power Pool establishment can be summarized as follows:

- 2000 - Develop detailed implementation action plans for the ESI reform;
- The Working Group for Drafting the Legislation on the Establishment of the Independent Regulatory Body for the Energy Sector has completed the draft legislation to be submitted to the Parliament for approval.

- 2001 - The Market Rules is under development;
- The value assessment of stranded costs and propose measures for recovery is under development;
- Reorganize various functions within EGAT into business units (BUs).
- 2002 - Enforcement of the legislation establishing the Independent Regulatory Body;
- The Independent Regulatory Body for the Energy Sector established;
- PowerGens 1 and 2 established;
- Corporatize core service businesses of the MEA.
- 2003 - Dilute EGAT's shareholding in PowerGens 1 and 2;
- (onwards)- Corporatize the PEA businesses;
- Power Pool established and the system preparedness checked;
- Introduction of free competition in power purchase.

In order to achieve the objectives of the ESI reform and the Power Pool establishment, NEPO has commissioned the consultant team to develop detailed implementation plans to realize the commencement of Power Pool operation in 2003 as scheduled. In developing the implementation plans, several consultations were held between NEPO, together with the consultant team, and the three utilities until a consensus was reached. Details of the plans were revised to be in line with the Draft Energy Industry Act. Concerned agencies have then been assigned to implement the plans accordingly. The Ministry of Finance will use the plans as a criterion for the evaluation of the three power utilities' performance.

As regards the monitoring of implementation of the future ESI reform, the Sub-Committee on the Future Structure of the ESI has been empowered to approve and to monitor the operations of concerned agencies to ensure compliance with the implementation plans so that the objectives of the ESI reform can be successfully achieved.

The key elements are shown in Table 7-2 and of the implementation plans for the ESI reform and the Power Pool establishment as shown in Table 7-2 can be summarized as follows:

### **7.8.1 Development of the Market Rules**

The Market Rules will set out procedures which govern the operation of the wholesale trading of electricity as well as the technical requirements for maintaining the system security. The Market Rules will be crucial for the industry as they will be a factor determining the efficiency of competition and details of other activities, e.g.

the preparedness of the Power Pool system. As a result, NEPO will act as the focal agency for the drafting of the Market Rules. In this regard, a consultant company will be engaged to develop the rules in close consultation with agencies concerned. It is expected that the Draft Market Rules will be ready for submission to the National Energy Policy Council (NEPC) for approval around December 2001.

### **7.8.2 Draft Energy Industry Act**

In order to implement the ESI reform, it is essential to enforce the Energy Industry Act. According to the Draft Act, the National Energy Regulatory Commission will be established to regulate the energy industry, i.e. electricity and natural gas industries, to issue licenses for energy industry operations, to promote competition, to prevent abusive use of monopoly power and to protect consumers' benefits. The National Energy Regulatory Office will be established to act as the Secretariat to the National Energy Regulatory Commission (NERC). Also, a power pool will be established as a state agency. The Working Group for Drafting the Legislation on the Establishment of the Independent Regulatory Body for the Energy Sector has completed the drafting of the Act on 3 October 2000, and the cabinet approved the Draft Act. It is currently under review by the Office of the Council of State prior to submission to the Parliament.

### **7.8.3 Drafting of Secondary Legislation under the Draft Energy Industry Act**

Whereas the Draft Energy Industry Act is under consideration by the Parliament, drafting of rules, regulations, codes, announcements, etc. to be issued under this Act will be carried out. In this connection, NEPO will act as the focal implementing agency and will engage legal consultant companies to develop the drafts of required rules, regulations, codes, announcements, etc. as well as agreements and relevant requirements. In addition, criteria for the determination of transmission and distribution service charges (wheeling charge) and other legal issues necessary for the establishment of the Independent Regulatory Body and the future Power Pool operation will also be developed. With such preparations, the announcement of rules, regulations, codes, announcements, etc. in pursuant to this Act and the establishment of the Independent Regulatory Body can be expedited and actually put into force within two months and five months respectively after the enforcement of the Energy Industry Act.

### **7.8.4 Stranded Cost Management**

Due to the economic crisis, the growth rate of power demand has substantially decreased from what was initially forecasted. Some power plants cannot operate at their full capacity and state-owned power utilities have overstaffing. Besides,

existing power plants of EGAT may not be as efficient as newly constructed ones owned by private power producers due to rapid technological development. If a fully competitive power pool is established, electricity prices will considerably decrease. This will, however, severely threaten the financial viability of the state-owned power utilities, and finally the general public has to bear the burden via subsidies for the utilities through taxation since the government is the guarantor of loans of the three utilities. These excess costs are considered as "Stranded Costs" in the ESI.

These costs already exist under the current ESI structure, but they are implicitly included in the electricity tariffs. After competition is introduced in the ESI, these stranded costs still remain and unavoidable. However, they cannot be recovered through the competitive market. For these reasons it is essential to have a mechanism to recover the stranded costs under the competitive market. Hence, the establishment of the so-called Competition Transition Charge (CTC) to recover the stranded costs.

The CTC is the difference between the average cost of the monopoly ( $AC_{\text{Monopoly}}$ ) ESI and the wholesale price in the pool (shown in Figure 7-8). The amount of CTC to be collected will depend on the pool price and the revenue obtained from privatization of EGAT power plants. If the pool price is high, or if the revenue from privatization of EGAT power plants is high, the CTC will be low. In implementing this mechanism, the CTC will gradually decline in line with the decreasing stranded costs. Power consumers will pay for the CTC as part of the electricity tariffs. The CTC will be indicated in the electricity bills to be received by consumers.

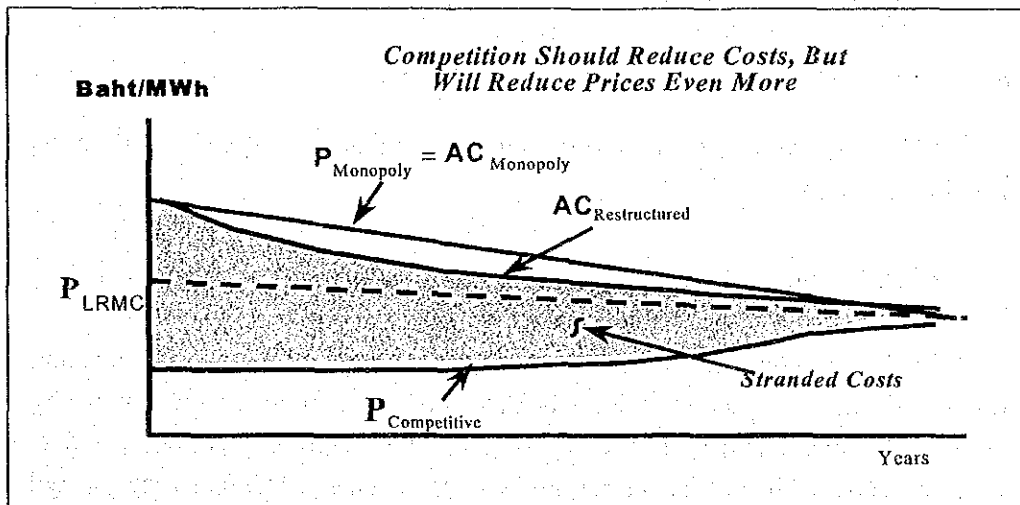


Figure 7-8 Stranded Costs



The stranded costs are unavoidable costs that result from sunk cost made before introduction of the reform of the electricity industry, which cannot be recovered in a competitive market environment. These costs mainly include the investment in power generating capacity to meet the peak demand, the employment of a large number of staff, and the operating costs of low-efficiency power plants. These costs have already existed in the system but have not been apparent. When the competitive ESI structure is introduced, the competition in the sale of power among GenCos will drive down the power prices, leaving some costs stranded. Competition therefore makes existing stranded costs more explicit.

NEPO is the focal agency for the implementation of the stranded costs management and commission a consultant to develop a financial model to assess the value of stranded costs and recommend methods to handle the problem, to estimate the overall value, and to design the mechanism for recovery of the stranded costs. Submission of the recommendations and approaches to the NEPC for approval is expected by November 2001.

#### **7.8.5 Power Transmission and Distribution System Management**

The three power utilities will jointly commission a consultant to develop the Grid Code and Distribution Code as well as to clearly determine the ownership, control and operational boundaries between the grid system and the distribution system. The outcome of above activities will be part of the development of the Market Rules, contract agreements and requirements pertaining to the future operation of the transmission and distribution systems. The activities of this part has to be undertaken in parallel with the development of the Market Rules, which is expected to complete by the end of 2002.

#### **7.8.6 Corporatization and Privatization of EGAT**

EGAT preparations in transition to the competitive system consist of the following key activities:

##### **7.8.6.1 EGAT Internal Reorganization**

EGAT has commenced separating the accounting and finance systems and has reorganized various functions within EGAT into commercial business units by the end of 2001. Such business units comprise the SO, GridCo, PowerGens 1 and 2, and Power Purchase Unit will be further studied. Besides, the DebtCo function will be established within EGAT in 2002. Further studies will be undertaken on the future management of hydropower plants of EGAT and whether the PPA Trader function should be handled by EGAT or contracted out.

### **7.8.6.2 Establishment of PowerGens 1 and 2 and Selling-down of EGAT's Shareholding**

EGAT established PowerGen 1 and 2 in February 2001. It is expected that the plan for corporatization and capital raising of the two GenCos will be approved by the cabinet around October 2001 and that transfer of assets and employees will be completed by October 2002. With respect to the selling-down of EGAT's shareholding in the two GenCos, complete divestiture is expected by October 2003.

### **7.8.6.3 Technology Preparedness of EGAT**

This consists of two parts: 1) preparedness of metering and communications system and 2) preparedness of the Power Pool system. The first part will be completed by the end of 2002. For the second part, EGAT is preparing for selection of a consultant company and will commence the system preparation in this part, including the System Operator (SO), the Market Operator (MO) and the Settlement Administrator (SA) when all stakeholders have concurred with the Draft Market Rules. This is to ensure that the design of the Power Pool system can accommodate power trade in line with the Market Rules. The preparation of the Power Pool system will be carried out by EGAT. It is expected that both the system and the human resources preparedness will be ready for the Power Pool opening by December 2003. For the expenditures to be incurred in this regard, EGAT has requested a budget for such implementations as a part of the long-term investment plan, which is now under consideration by the National Economic and Social Development Board (NESDB).

### **7.8.7 Corporatization and Privatization of MEA and PEA**

The key activities to be implemented by the MEA and PEA are:

#### **7.8.7.1 Internal Reorganization**

The MEA and PEA will commercialize their core activities and reorganize non-core service businesses into their subsidiaries, in which their shareholdings must be gradually diluted. For the PEA, the targeted organizational structure will consist of four network business units and 12 REDCos. It is expected that commercialization of the MEA and PEA will be completed before December 2003. To this effect, the two utilities will engage a consultant company to assist with the implementation strategies.

### **7.8.7.2 Technology Preparedness**

The MEA and PEA will improve their metering, billing and settlement systems as well as load profiles to be able to accommodate competitive power trades. The preparation in this part will be finished by 2002. In this regard, the two utilities will engage a consultant company to assist with the implementation strategies.

### **7.8.8 Power Pool Establishment**

In pursuant to the provisions stipulated in the Draft Energy Industry Act, after the enforcement of the Act, the Power Pool will have a status of a juristic person, with the objectives to act as the SO, MO and SA. The Power Pool Board will be appointed, being independent from EGAT, to control and monitor the Power Pool operation. But initially term, the Power Pool shall assign the Power Pool duties to EGAT, in whole (the SO, MO, SA functions) or in part (only the function of SO, or only those of SO and MO, while the SA function will have to be separated). Under the current conditions, the most appropriate approach is to have EGAT perform all the pool functions. However, the assets, rights, duties, employees and budget pertaining to the Power Pool functions will have to be transferred from EGAT to the Power Pool as from the date specified by the National Energy Regulatory Commission, but not exceeding three years as from the effective date of the Act or approximately not exceeding two years after the Power Pool becomes operational in December 2003. Therefore, the SO, which is part of the Power Pool, will be split off from the GridCo of EGAT to become the Independent System Operator (ISO) eventually (no later than end of 2005).

Table 7-2 Implementation Plan for the Reform Movement

Year	2000							2001												2002												2003																							
Month	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12												
Activities																																																							
Development of the Market Rules																																																							
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- Technology Preparedness of EGAT																																																							
Corporatization and Privatization of MEA and PEA																																																							
- Internal Reorganization																																																							
- Technology Preparedness																																																							
Power Pool Establishment																																																							

Source : NEPO

## 7.9 Recent Movement

Thai government has reservation on the power reform and instructed NEPO to make further study on four points: the sufficiency of power supply, competition among suppliers, the issue of subsidy for rural consumers and high power tariff. The California power crisis is another problem on the merits of the power pool in Thailand. The unclear point in the plan of power reform risen by Thai government is how large a share of EGAT should have in the new power generation firm to ensure that it would still not monopolize the ESI. The government wants the power market to delivering fair and stable prices to the consumers. Then, they affect to be delayed the reform by about one year to the end of 2004 or early 2005.

EGAT has advised the government to postpone the establishment of power pool until 2007. The Prime Minister's Office minister, Mr. Chaturont Chaisaeng, who is in charge of energy policy, has expressed concern that the NEPO's proposed power system would create a monopoly, with a great danger of discrepancies in power rates between urban and rural consumers. It is expected that under the original schedule for establishing power pool in 2003, there are six power producers being in operation: Cogeneration PLC, EGCO, RHCO, EGAT's privatized power houses, IPT and Tri Energy. Cogeneration PLC has many SPPs. IPT and Tri Energy are IPP. Many IPPs, who are interested in Thai's ESI, are now reconsidering plans to enter the market in future due to inability to obtain financing. However, NEPO has disagreed with delaying the establishment of power pool as it would send the wrong signal and foreign investors would be deterred from investing in Thai's ESI.