Chapter 6

IMPLEMENTATION PROGRAM OF PILOT DISTRIBUTION SYSTEM DISPATCHING CENTER

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6-1 Necessity of Pilot Distribution System Dispatching Center

Since the automated distribution dispatching system is the first attempt for PEA, the construction of pilot distribution dispatching center and the provision of training unit were planned for the following reasons.

(1) Confirmation, evaluation and improvement of proposed dispatching system at the pilot distribution system dispatching center and determination of optimum system for the future.

(2) Acquisition of operation and maintenance techniques of automated distribution dispatching system.

(3) Study and training on evaluation, planning, design and construction of automated distribution dispatching system.

(4) Training of engineers/technicians for the pilot project and the master project by using the training unit.

6-2 Selection of Sites of Pilot Distribution System Dispatching Center

One pilot distribution system dispatching center was planned to be constructed in Central Region 3 for the following reasons.

(1) As the same system can be applied to all regions, one pilot dispatching center is sufficient for the system confirmation and evaluation.

(2) For the site of pilot distribution system dispatching center, Central Region 3 is suitable for the system confirmation and evaluation, being located at Nakhorn Pathom, approximately 60 km west of Bangkok, with the good road connecting to the head office.

(3) The regional office is located close to the Training Center and is suitable as the place of training. Since the practical training at the pilot distribution system dispatching center is limited, the provision of the training unit in the Training Center was planned under the pilot project. As the Training Center is located close to the proposed pilot dispatching center, the efficient training, including the field training using actual dispatching system, can be performed.

(4) A new office building of Central Region 3 was completed this year and the fourth floor of the building may be available for the pilot dispatching center.

(5) The high reliability of power supply is required in the Region because there are a large quantities of power demand involved, with the industrial area located in the south. The energy sales of the Region in FY 1985 amounted to 1,428 GWh accounting for 16.7 percent of the total energy sales of PEA, of which the energy sales for industrial use was 895 GWh accounting for 62.7 percent of the total energy sales of the Region (see Annex 3-5). Table 6-1 shows the past records and forecast of supply energy in the Region.

(6) As the control stations have been installed or being planned for all substations in the Region, the conditions for the construction of pilot dispatching center are well-ordered.

6-3 Facilities to be Supervisory Controlled

(1) Present Status of Substations and High Voltage Feeders

Fig. 6-1 shows the distribution system diagram in the service area of the Region and Table 6-2 shows the present status of substations and high voltage feeders. There are 10 substations with the transformers having a total installed capacity of 470 MVA. There are 7 control stations and 3 additional control stations are being planned. The number of high voltage feeders and reclosers amounts to 67 feeders and 19 units, respectively.

(2) Substation and High Voltage Feeder Expansion Plans

Tables 6-3 and 6-4 show the substation expansion plan and the high voltage feeder expansion plan, respectively.

Under the plan, two additional substations are expected to be installed in FY 1989, with a total installed capacity of substations in the Region reaching 680 MVA in FY 1989 and 805 MVA in FY 1992. The number of high voltage feeders is expected to reach 80 in FY 1989 and 86 in FY 1992.

(3) Facilities to be Supervisory Controlled

The facilities to be supervisory controlled were planned to be 12 substations, 86 circuit breakers, 19 reclosers and 95, 127 and 179 sectionalizers for Cases 1, 2 and 3, respectively.

6-4 Function and Structure of Distribution Dispatching System

The functions and structure of the proposed pilot distribution dispatching system are as described in Clause 5-3 and 5-4, respectively. The pilot dispatching center will be located on the fourth floor of the new building of the regional office. Fig. 6-2 shows the tentative layout of pilot distribution dispatching center.

6-5 Data Transmission System

Shown in Fig. 6-3 is the proposed radio route diagram in the Region. During the field survey, the propagation test was conducted from Khao Phu Liab (a repeater station is being constructed

by TOT), about 18 km west of Kanchanaburi. If the repeater station is constructed at this location, an additional repeater station will be required in the area near Suphanburi. For the reason, Khao Rang Kapoet was selected as the site for the repeater station. This site is 226 m above the sea level and the road is provided up to the point about 170 m above the sea level.

The structure of main equipment for the data transmission system is as follows.

(1) Center and Repeater Stations

- Multi-channel UHF transmitter-receiver with standby (duplex operation, transmitter output 10W) 2 sets
- Single-channel UHF transmitter-receiver with standby (duplex operation, transmitter output 10 W) 2 sets
- Single-channel UHF transmitter-receiver (simplex operation, transmitter output 10 W) 2 sets
- Remote supervisory equipment 2 sets
- Grid parabolic antenna 2 sets
- Eight-stages co-linear antenna 4 sets

(2) Substation Remote Stations

- Single-channel UHF transmitter-receiver with standby (simplex operation, transmitter output 10 W) 12 sets
- Remote supervisory equipment 12 sets
- Five-elements Yagi antenna 12 sets

(3) Feeder Remote Stations

- Single-channel UHF transmitter-receiver
  (simplex operation, transmitter output 10 W)
  114 sets (Case 1)
  146 sets (Case 2)
  198 sets (Case 3)
- Five-elements Yagi antenna 114 sets (Case 1)
  146 sets (Case 2)
  198 sets (Case 3)

6-6 Education and Training Program and Training Unit

The education and training are important and indispensable for the smooth execution of the project and for the optimum operation of the distribution dispatching system. The training is divided into the training for the trainers of PEA, training for the pilot project and training for the master project for remaining 11 Regions. The training program will be implemented in the following manner.

(1) Training for the Trainers of PEA

This training is for the trainers of PEA, who will be the leaders of training on the distribution dispatching system of PEA. The training will be conducted in Japan and will be given to two system engineers, two operation engineers and one communication engineer. The system engineers will be responsible mainly for the planning, design and software

development, the operation engineers for the operation and maintenance, and the communication engineer for the communication related subjects. The training duration will be about three months, and the timing of training is preferably from the stage of manufacturing to the stage of testing of equipment for the pilot project.

(2) Training for the pilot project

This training is for the staffs of the central distribution dispatching center, dispatching operators and staffs concerned of Central Region 3. The training will be conducted by the trainers at the Training Center and the pilot dispatching center. The training will be given for about three months and will probably start about three months prior to the commissioning of the pilot dispatching center. The number of personnel required to be trained will be about 260, but it is advisable to limit the number of trainees to a minimum so that the intensive training may be conducted. Following the commissioning of the pilot dispatching center, the on-the-job training or follow-up training will be required. Table 6-5 shows the training course for distribution dispatching system (tentative).

(3) Training for the Master Project

This training is for the dispatching operators and staffs concerned of all regions and will be conducted by the trainers at the Training Center and the pilot dispatching center.

There is no limitation as to the duration and timing for this training, therefore, it can be conducted systematically throughout the year. It is considered that approximately 2,300 personnel are required to be trained. Assuming the project will last for five years, the training of about 460 personnel will be required every year during this period. The training of this scale is considered possible in view of the fact that the technical training was conducted for 2,067 personnel in FY 1985 and there is the plan for the expansion of Training Center (see Clause 3-6).

As the pilot dispatching center will be operated in the live power system, the practical training on the operation and maintenance will naturally be limited. Moreover, the project requires the training for a large number of personnel. Accordingly, to conduct the substantial training, the use of the training unit is essential. For the reason, the training unit equipped with the minimum requirement such as the computer, master terminal unit, operator console and others, was planned to be provided in the Training Center so that the simulation training on the operation and maintenance can be conducted.

Fig 6-1 DISTRIBUTION SYSTEM DIAGRAM (C3)

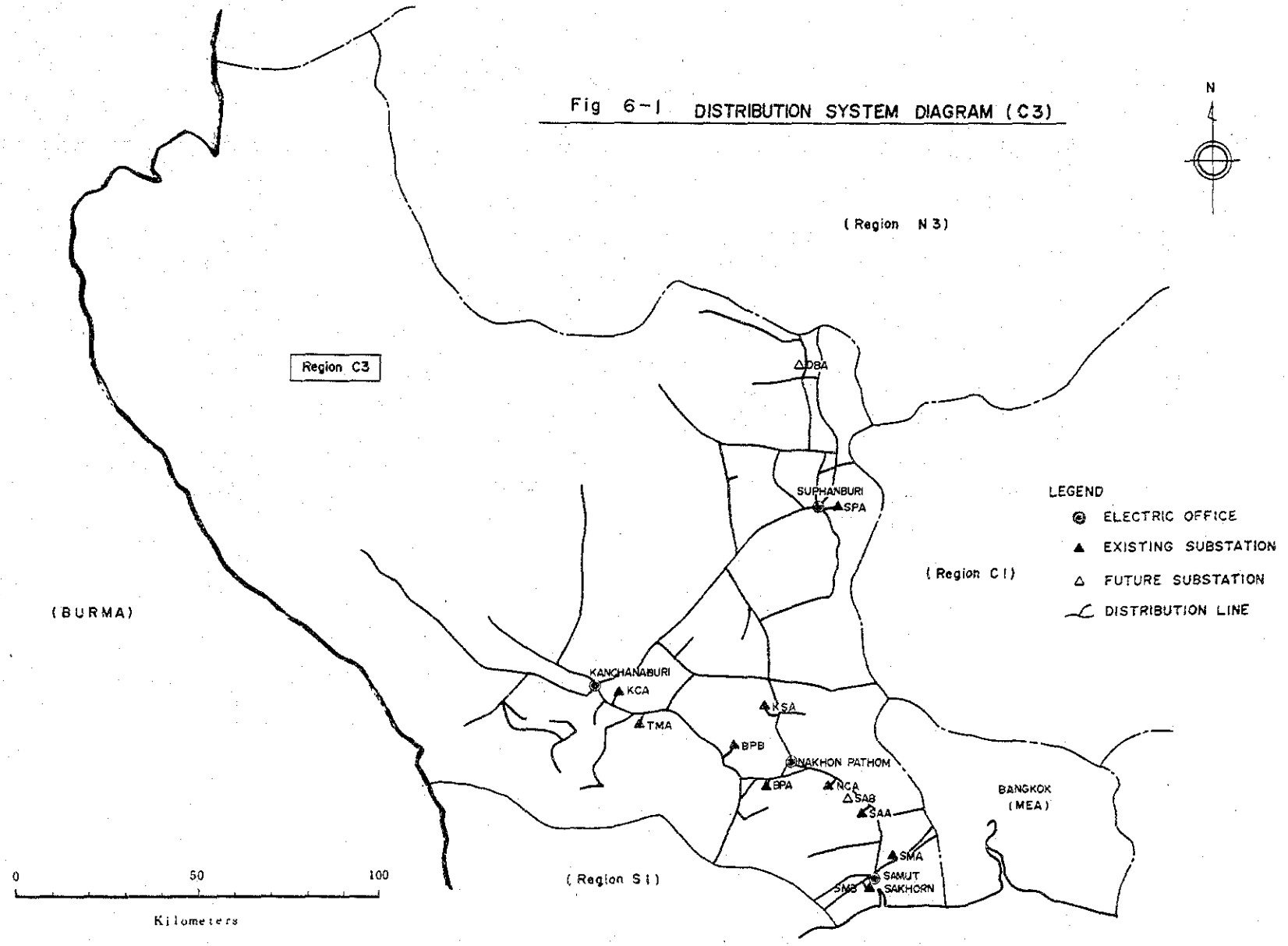


Fig 6 — 2 TENTATIVE LAYOUT OF DISTRIBUTION DISPATCHING CENTER (C3)

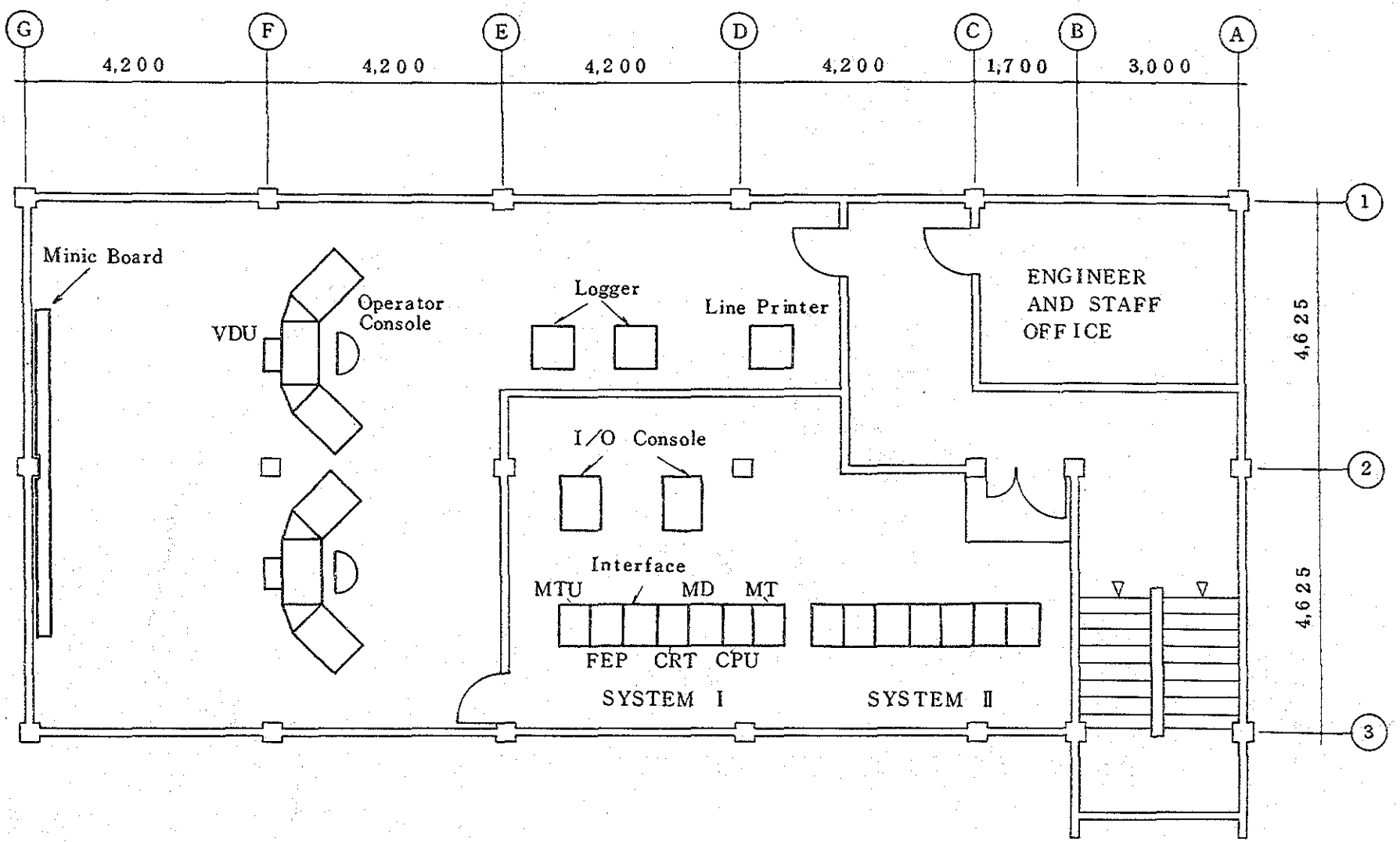


Fig 6-3 RADIO ROUTE DIAGRM (REGION C3)

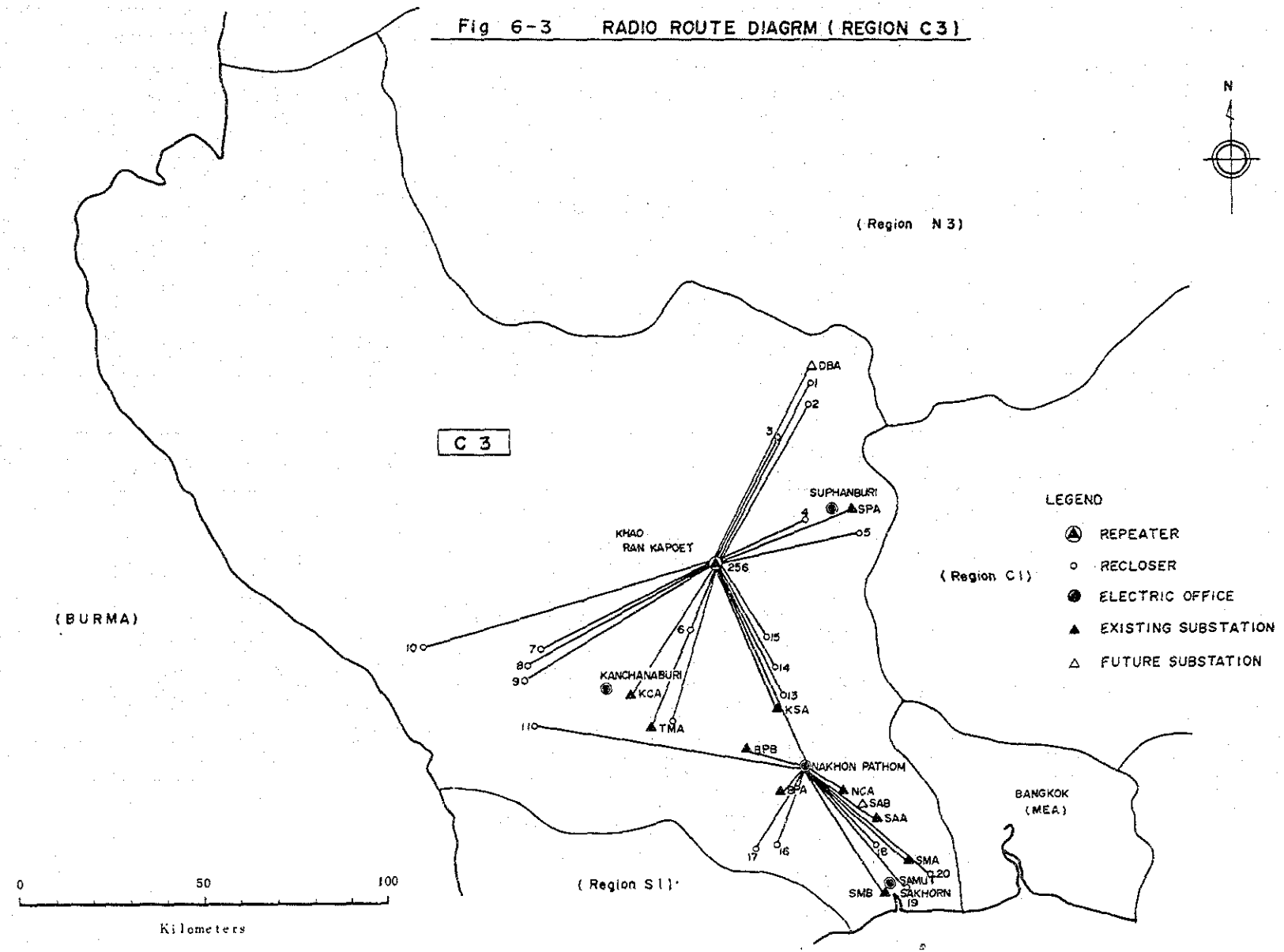


Table 6-1 ENERGY DEMAND BY SUBSTATION (C3)

(UNIT: GWh)

SUBSTATION	ACTUAL											GROWTH RATE (%/YEAR)
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	
BAN PONG 1	47.34	54.86	85.44	100.56	107.19	98.69	104.54	109.65	130.90	178.12	195.50	14.7
BAN PONG 2	106.36	117.07	125.02	136.36	155.53	167.55	177.02	175.27	208.73	228.40	235.09	7.0
KANCHANA BURI	26.62	28.53	31.23	45.60	52.94	52.22	58.84	58.99	75.64	63.62	72.09	6.7
KAMPHAENG SAEN												
NAKHON CHAISI	102.92	118.89	143.74	165.41	196.91	229.87	247.81	254.12	246.02	270.48	282.27	4.2
SAM PHRAN 1	69.78	93.53	100.03	102.24	136.40	157.18	188.58	197.85	236.73	239.92	299.84	13.8
SAMUTSAKHON 1 & 2	93.03	155.36	169.47	195.62	251.35	237.25	225.83	249.80	276.27	282.26	281.01	3.4
SUPHAN BURI	18.02	23.34	26.71	28.12	43.90	50.39	52.92	60.46	62.00	81.23	89.11	12.1
THAMUANG		16.64	27.49	34.15	28.42	29.30	27.00	30.08	38.55	41.10	45.68	9.3
SRINAGARIND				0.04	0.08	0.16	0.26	0.29	0.38	0.61	0.73	35.0
KHAO LAEM								0.15	0.50	0.77	3.93	
TOTAL	464.06	608.22	709.13	808.09	972.73	1,022.61	1,082.78	1,136.66	1,275.71	1,386.51	1,505.24	8.0

SUBSTATION	FORECAST											GROWTH RATE (%/YEAR)
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995		
BAN PONG 1	210.99	195.77	212.15	228.62	245.59	262.48	279.10	295.35	311.16	326.39		5.3
BAN PONG 2	237.03	255.20	271.55	288.57	306.74	325.40	344.45	363.64	382.94	402.23		5.5
KANCHANA BURI	125.66	140.59	153.01	165.89	179.42	193.18	207.03	220.73	234.18	247.24		7.7
KAMPHAENG SAEN	33.44	75.01	82.71	90.57	98.63	107.03	115.51	124.05	132.64	141.22		17.4
NAKHON CHAISI												
SAM PHRAN 1	620.48	680.72	738.58	800.17	866.96	937.43	1,011.46	1,088.50	1,168.72	1,251.94		8.0
SAMUTSAKHON 1	273.85	299.50	323.89	349.49	377.15	406.19	436.51	467.86	500.25	533.58		6.6
SAMUTSAKHON 2												
SUPHAN BURI	99.97	113.53	126.27	138.77	151.45	163.81	176.24	188.52	200.56	212.21		9.1
THAMUANG												
SRINAGARIND	0.89	1.02	1.16	1.32	1.48	1.65	1.83	2.01	2.20	2.38		12.6
KHAO LAEM	13.95	15.12	15.32	15.52	15.73	15.94	16.16	16.39	16.63	16.86		15.7
TOTAL	1,616.25	1,776.46	1,924.63	2,078.91	2,243.15	2,413.12	2,588.29	2,767.05	2,949.28	3,134.04		7.6

Table 6-2 SUBSTATION DATA (C3)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
				RECLOSURE		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
			C B	HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. BAN PONG 1	2 x 25	22	V 7			1												4		7	2	
2. BAN PONG 2	2 x 25	22	B 8			1												4		9		1
3. KANCHANA BURI	1 x 25	22	V 7							1									3	7	6	
4. KAMPHAENG SAE	1 x 25	22			2										1				3	5	2	
5. NAKHON CHAISI	1 x 40 2 x 25	22	B 7			1												4		6	1	
6. SAM PHRAN 1	2 x 40	22	B 8			1												4		8	1	
7. SAMUT SAKHON 1	2 x 25	22	M 1 B 9			1												4		10		
8. SAMUT SAKHON 2	1 x 25	22			3										1				3	6	2	
9. SUPHAN BURI	2 x 25	22	V 4	1		1												4		5	4	
10. THAMUANG	1 x 25	22	B 4			1												3		4		
11.																						
12.																						
13.																						
14.																						
TOTAL 10	17 470		55	1	5	7	0	0	0	1	0	0	0	0	2	0	0	27	9	67	18	1

Table 6-3 SUBSTATION EXPANSION PLAN (C3)

(UNIT: MVA)

NO. SUBSTATION NAME	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. BANG PONG 1	2 x 25.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0	2 x 25.0 1 x 40.0
2. BANG PONG 2	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0
3. KANCHANA BURI	1 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0
4. KAMPHAENG SAEN	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0
5. NAKHON CHAISI	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0	1 x 40.0 2 x 25.0
6. SAM PHRAN 1	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 50.0	2 x 50.0	2 x 50.0	2 x 50.0	2 x 50.0	2 x 50.0	2 x 50.0	2 x 50.0	2 x 50.0
7. SAMUT SAKHON 1	2 x 25.0	2 x 25.0	2 x 25.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0	2 x 40.0
8. SAMUT SAKHON 2	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0 1 x 40.0	1 x 25.0 1 x 40.0	1 x 25.0 1 x 40.0	1 x 25.0 1 x 40.0	1 x 25.0 1 x 40.0	1 x 25.0 1 x 40.0
9. SUPHAN BURI	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0
10. THAMUANG	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0	2 x 25.0
11. SAM PHRAN 2				1 x 50.0	1 x 50.0	1 x 50.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0	1 x 50.0 2 x 40.0
12. DOEMBANG NANGBUAT				1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 25.0	1 x 40.0	1 x 40.0
CAPACITY (MVA)	500.0	565.0	565.0	670.0	670.0	670.0	795.0	795.0	795.0	835.0	835.0	835.0	835.0	850.0	850.0
NO. OF SUBSTATIONS	10	10	10	12	12	12	12	12	12	12	12	12	12	12	12
NO. OF BANKS	17	19	19	21	21	21	24	24	24	25	25	25	25	25	25
NO. OF TRANSFORMERS	17	19	19	21	21	21	24	24	24	25	25	25	25	25	25

Table 6-4 H.V. FEEDER EXPANSION PLAN (C3)

(UNIT: cct)

NO. SUBSTATION NAME	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. BANG PONG 1	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8
2. BANG PONG 2	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
3. KANCHANA BURI	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
4. KAMPHAENG SAEN	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
5. NAKHON CHAISI	6	7	7	7	7	7	7	7	7	8	8	9	9	9	9
6. SAM PHRAN 1	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
7. SAMUT SAKHON 1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
8. SAMUT SAKHON 2	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
9. SUPHAN BURI	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
10. THAMUANG	4	4	4	4	4	4	6	6	6	6	6	6	6	6	6
11. SAM PHRAN 2				6	6	6	10	10	10	10	10	10	10	10	10
12. DOEMBANG NANGBUAT				4	4	4	4	4	4	4	4	4	4	4	4
13.															
14.															
15.															
16.															
17.															
18.															
19.															
TOTAL	67	69	69	80	80	80	86	86	86	87	87	88	88	88	88

Table 6-5 DISTRIBUTION DISPATCHING SYSTEM TRAINING COURSE (DRAFT)

1. Objective

To promote the working knowledge of PEA's personnel concerning the distribution dispatching system operations and maintenances.

2. Training Subjects

2.1 Structure and equipments of dispatching system

(1) Data transmission devices
- . Master terminal unit
- . Substation terminal unit
- . Feeder remote terminal unit

(2) Man-machine interface devices
- . Dispatching console
- . CRT
- . Typewriter, etc.

(3) Computer

(4) Communication system
- . Transmitter ad receiver
- . communication control unit

(5) Power source

(6) Circuit breaker

(7) Recloser

(8) Sectionalizer

2.2 Functions of dispatching system

(1) Data aquisition

(2) Data processing

(3) Data logging

(4) Display

(5) Supervisory control

(6) Fault detection and isolation

(7) Service restoration

2.3 Operation procedure

2.4 Maintenance procedure

3. Training Methodologies

3.1 Lecture in the classroom with texts, manuals and visual aids such as

- Overhead projector
- Slide projector
- Video tape

3.2 Practice

- at training center by means of training unit
- at pilot dispatching center
- at control station
- at working site

4. Trainees

Engineers and technicians

5. Number of trainees per course

about 30 persons

6. Duration of training

Ten (10) days

Chapter 7

CONSTRUCTION COST

Chapter 7 CONSTRUCTION COST

Tables 7-1 and 7-2 show the construction costs of the project and the pilot project, respectively. The construction cost shown in Table 7-1 includes the construction cost of the pilot project. Tables 7-1-1 to 7-1-3 show the construction cost of the project for each Region, and Annexes 7-1 to 7-6 show the construction cost of the project for each equipment and for each region.

The exchange rates as of September 22, 1986 used for the conversion are 1 U.S. dollar to 25.936 Baht and 1 U.S. dollar to 153.80 Yen. The import duties rates on foreign currency are as shown in the following table.

Item	Import Duties Rates (%)
Center Terminal Unit Power Supply Unit Other Equipment	 54 36.6
Substation Remote Terminal Unit	52
Feeder Remote Terminal Unit	52
Data Transmission System	30

Table 7-1 CONSTRUCTION COST OF THE PROJECT

(Unit: 1,000 US$)

Item	Case 1				Case 2				Case 3			
	F.C.	L.C.		Total	F.C.	L.C.		Total	F.C.	L.C.		Total
		Duties	Others			Duties	Others			Duties	Others	
Center Terminal Unit	20,417	8,062	1,899	30,378	20,417	8,062	1,899	30,378	20,417	8,062	1,899	30,378
Substation Remote Terminal Unit	6,920	3,598	147	10,665	6,920	3,598	147	10,665	6,920	3,598	147	10,665
Feeder Remote Terminal Unit	11,972	6,228	581	18,781	14,510	7,543	741	22,794	21,967	11,423	1,015	34,405
Data Transmission System	17,348	5,206	1,064	23,618	18,687	5,606	1,154	25,447	22,615	6,785	1,416	30,816
Sub-total (CIF)	56,657	23,094	3,691	83,422	60,534	24,809	3,941	89,284	71,919	29,868	4,477	106,264
Contingency (incl. Eng. Fee)	5,666	2,309	369	8,344	6,053	2,481	394	8,928	7,192	2,987	448	10,627
Total	62,323	25,403	4,060	91,786	66,587	27,290	4,335	98,212	79,111	32,855	4,925	116,891

Table 7-2 CONSTRUCTION COST OF THE PILOT PROJECT

(Unit: 1,000 US$)

Item	Case 1				Case 2				Case 3			
	F.C.	L.C.		Total	F.C.	L.C.		Total	F.C.	L.C.		Total
		Duties	Others			Duties	Others			Duties	Others	
Pilot Distribution Dispatching Center	6,275	2,562	328	9,165	6,964	2,867	373	10,204	8,083	3,364	426	11,873
Training Unit	575	219	1	795	575	219	1	795	575	219	1	795
Sub-total (CIF)	6,850	2,781	329	9,960	7,539	3,086	374	10,999	8,658	3,583	427	12,668
Contingency (incl. Eng. Fee)	685	278	33	996	754	309	37	1,100	866	358	43	1,267
Total	7,535	3,059	362	10,956	8,293	3,395	411	12,099	9,524	3,941	470	13,935

Table 7-3-1 CONSTRUCTION COST BY REGION (CASE 1)

(Unit: 1,000 US$)

Region	Center Terminal Unit		Substation Remote Terminal Unit		Feeder Remote Terminal Unit		Data Transmission System		Total		
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	
										Duties	Others
N1	1,419	146	545	12	984	50	1,393	61	4,341	1,777	269
N2	1,419	146	543	11	817	40	1,529	88	4,308	1,730	285
N3	1,419	146	546	12	894	44	1,375	109	4,234	1,726	311
NE1	1,419	146	633	13	1,017	50	1,857	131	4,926	1,979	340
NE2	1,419	146	451	10	638	32	1,299	107	3,807	1,521	295
NE3	1,419	146	483	10	857	40	1,336	86	4,095	1,662	282
C1	1,419	146	904	19	1,851	90	1,832	85	6,006	2,547	340
C2	1,419	146	678	14	1,326	60	1,447	93	4,870	2,041	313
C3	2,814	146	598	13	1,440	73	1,423	96	6,275	2,562	328
S1	2,838	292	523	11	744	38	1,440	85	5,545	2,219	426
S2	1,419	146	517	11	610	28	1,174	71	3,720	1,502	256
S3	1,419	146	499	11	794	36	1,243	52	3,955	1,609	245
Training Center	575	1	-	-	-	-	-	-	575	219	1
Total	20,417	1,899	6,920	147	11,972	581	17,348	1,064	56,657	23,094	3,691

Table 7-3-2 CONSTRUCTION COST BY REGION (CASE 2)

(Unit: 1,000 US$)

Region	Center Terminal Unit		Substation Remote Terminal Unit		Feeder Remote Terminal Unit		Data Transmission System		Total		
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	
										Duties	Others
N1	1,419	146	545	12	1,266	69	1,541	71	4,771	1,967	298
N2	1,419	146	543	11	958	48	1,603	93	4,523	1,825	298
N3	1,419	146	546	12	1,091	57	1,479	116	4,535	1,859	331
NE1	1,419	146	633	13	1,158	59	1,932	136	5,142	2,075	354
NE2	1,419	146	451	10	723	38	1,343	110	3,936	1,578	304
NE3	1,419	146	483	10	970	47	1,396	90	4,268	1,738	293
C1	1,419	146	904	19	2,358	122	2,100	103	6,781	2,890	390
C2	1,419	146	678	14	1,552	74	1,566	101	5,215	2,194	335
C3	2,814	146	598	13	1,891	102	1,661	112	6,964	2,867	373
S1	2,838	292	523	11	941	50	1,544	92	5,846	2,352	445
S2	1,419	146	517	11	723	35	1,234	75	3,893	1,579	267
S3	1,419	146	499	11	879	40	1,288	55	4,085	1,666	252
Training Center	575	1	-	-	-	-	-	-	575	219	1
Total	20,417	1,899	6,920	147	14,510	741	18,687	1,154	60,534	24,809	3,941

Table 7-3-3 CONSTRUCTION COST BY REGION (CASE 3)

(Unit: 1,000 US$)

Region	Center Terminal Unit		Substation Remote Terminal Unit		Feeder Remote Terminal Unit		Data Transmission System		Total		
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	
										Duties	Others
N1	1,419	146	545	12	1,703	85	1,772	86	5,439	2,265	329
N2	1,419	146	543	11	1,550	70	1,915	114	5,427	2,227	341
N3	1,419	146	546	12	1,613	76	1,754	134	5,332	2,213	368
NE1	1,419	146	633	13	1,736	80	2,236	156	6,024	2,467	395
NE2	1,419	146	451	10	1,146	52	1,566	125	4,582	1,865	333
NE3	1,419	146	483	10	1,590	69	1,723	112	5,215	2,159	337
C1	1,419	146	904	19	3,415	161	2,657	140	8,395	3,607	466
C2	1,419	146	678	14	2,581	111	2,108	137	6,786	2,891	408
C3	2,814	146	598	13	2,624	129	2,047	138	8,083	3,364	426
S1	2,838	292	523	11	1,364	66	1,766	107	6,491	2,639	476
S2	1,419	146	517	11	1,174	53	1,471	91	4,581	1,884	301
S3	1,419	146	499	11	1,471	63	1,600	76	4,989	2,068	296
Training Center	575	1	-	-	-	-	-	-	575	219	1
Total	20,417	1,899	6,920	147	21,967	1,015	22,615	1,416	71,919	29,868	4,477

Chapter 8

IMPLEMENTATION PROGRAM OF THE PROJECT

Chapter 8 IMPLEMENTATION PROGRAM OF THE PROJECT

8-1 General Concept of Project Implementation

As mentioned in Clause 5-1, the distribution dispatching operations of PEA have become extremely difficult with the conventional system. When the complexity of future dispatching operations and the increasing social demand for a more reliable electric power supply are taken into consideration, this project requires early implementation. Moreover, since the project requires the system confirmation and evaluation in the pilot dispatching center and the aquisition of advanced techniques as mentioned in chapter 6, it is advisable to commence the pilot project as early as possible.

The project is divided into two parts, the pilot project in Central Region 3 and the master project in remaining 11 regions. For the implementation of the master project, the following two alternatives were considered.

(1) Alternative 1

The project will be implemented region by region in steps. The ranking of project implementation is as shown in Table 8-1.

(2) Alternative 2

The 11 regions will be divided into A-zone (urban and industrial areas) and B-zone (rural area), and the project will be implemented in A-zone first and then in B-zone.

8-2 Implementation Program

The study was made on the foregoing alternatives for Case 2 which was adopted as the optimum case. As the construction cost of the master project amounts to US$86.1 million (2,233 M.Baht) in Case 2, the project period was determined to be five years, three years in the first stage and two years in the second stage. The following are the implementation program corresponding to the aforementioned two alternatives.

(1) Alternative 1

Table 8-2 shows the names of regions to be implemented and the construction cost for each year, while Table 8-3 shows the facilities to be supervisory controlled and the construction cost for each region.

The work will be carried out for two regions each year and for three regions in the last year of the project period according to the ranking of implementation shown in Table 8-1.

(2) Alternative 2

Table 8-2 shows the names of zones to be implemented and the construction cost for each year, while Table 8-4 shows the facilities to be supervisory controlled and the construction cost for each zone.

The work will be carried out for A-zone in the first three years and then for B-zones in the last two years according to the ranking of implementation shown in Table 8-1.

(3) Comparison of Two Alternatives

When the foregoing two plans are compared with each other, Alternative 1 is superior for the ease of work execution. In Alternative 1, the project planning, construction work and the application of software may be executed at one time for each region, while Alternative 2 requires to divide these works into two stages for each region. For the operation of dispatching system, however, Alternative 2 is superior as it provides the dispatching centers in all regions in three years and gives the priority of implementation to urban and industrial areas.

In general, the project for the improvement of supply reliability gives the priority to the area where the high supply reliability is required. In the case of this project, however, Alternative 1 was selected because of the fact that the automated distribution dispatching system is the first attempt for PEA and also because of the following reason.

(a) The project can be executed efficiently by executing the various works at one time.

(b) Minimization of software maintenance is preferable.

(4) Implementation Program

Based on the foregoing study, the project was scheduled to be carried out in the following three stages.

(a) First Stage

Pilot distribution dispatching center (Central Region 3) and training unit (Training Center)

(b) Second Stage

Distribution dispatching centers in six regions (C1, C2, S1, S2, S3, NE3)

(c) Third Stage

Distribution dispatching centers in five regions (N1, N2, N3, NE1, NE2)

In each stage of the project, the detailed survey of the sites of radio repeater stations and radio routes, the study on the optimum arrangement of sectionalizers based on the future plan of distribution system, detailed design, preparation of detailed specifications for various equipment, training, etc. will be required. To carry out the project efficiently including the foregoing works, it will be necessary for PEA to establish an appropriate institutional framework for the project implementation as shown in Table 8-5 and the assistance of an experienced consultant will also be needed.

As the various equipment of proposed distribution dispatching system, including the equipment for dispatching centers, radio repeater stations, substations and distribution lines, are required to be designed and manufactured as an integrated system, a package order system is essential for the procurement of equipment and materials.

8-3 Implementation Schedule

The implementation schedule of the project is shown in Table 8-6.

Table 8-1 IMPLEMENTATION RANKING BY REGIONS

Region	Construction Cost A (1,000 US$)	Benefit (1995)								Supply Energy (1995) (Gwh)	Ranking
		Reduction of Interruption Energy		Reduction of C/S Operators		Reduction of Big Customer's Losses		Total B (1,000 US$)	B/A (%)		
		Energy (MWh)	Amount (1,000 US$)	Operators	Amount (1,000 US$)	Energy (MWh)	Amount (1,000 US$)				
N1	7,740	924.1	15	12	34	14.1	30	79	1.0	1,448	9
N2	7,311	632.2	10	16	46	20.7	43	99	1.4	1,049	11
N3	7,397	636.5	10	9	26	18.0	38	74	1.0	993	12
NE1	8,327	2,071.8	33	14	40	230.5	485	558	6.7	1,229	8
NE2	6,400	765.7	12	10	28	31.4	66	106	1.7	957	10
NE3	6,929	538.7	9	21	60	212.6	448	517	7.5	1,262	7
C1	11,067	1,925.7	31	23	65	1,567.3	3,301	3,397	30.7	4,042	2
C2	8,518	1,187.0	19	17	48	363.7	766	833	9.8	2,939	3
C3	11,224	1,491.4	24	20	57	851.2	1,793	1,874	16.7	3,134	1
S1	9,508	1,693.5	27	13	37	402.0	847	911	9.6	1,277	5
S2	6,313	1,489.6	24	8	23	372.9	785	832	13.2	1,182	4
S3	6,603	2,058.6	33	10	28	238.2	502	563	8.5	1,448	6
Total	97,337	15,414.8	247	173	492	4,322.6	9,104	9,843	10.1	20,960	

Table 8-2 IMPLEMENTATION SCHEDULE FOR 11 REGIONS

Alternatives	Year	Regions or Zones to be Implemented	Construction Cost (1,000 US$)
Alternative 1	1990	C1 C2	19,585
	1991	S1 S2	15,821
	1992	NE3 S3	13,532
	1993	NE1 N1	16,067
	1994	N2 N3 NE2	21,108
Alternative 2	1990	C1-A C2-A S1-A	18,434
	1991	S2-A S3-A NE1-A NE3-A	17,488
	1992	NE2-A N1-A N2-A N3-A	17,503
	1993	C1-B C2-B S1-B S2-B NE1-B	16,382
	1994	S3-B NE2-B NE3-B N1-B N2-B N3-B	16,306

Table 8-3 FACILITIES TO BE SUPERVISORY CONTROLLED AND CONSTRUCTION COST BY REGIONS (1994)

Region	Supply Energy (GWh)	No. of Dispatching Center	No. of Repeater Station	No. of Substation	No. of Bank	No. of Feeder	No. of Sectionalizer	No. of Recloser	Construction Cost (1,000 US$)
N1	1,344	1	2	12	19	59	77	34	7,740
N2	993	1	3	12	20	58	54	37	7,311
N3	945	1	2	12	16	60	65	33	7,397
NE1	1,168	1	3	14	20	68	55	72	8,327
NE2	893	1	2	10	19	47	29	59	6,400
NE3	1,206	1	2	10	18	64	53	42	6,929
C1	3,875	1	1	19	31	115	159	22	11,067
C2	2,800	1	1	14	26	90	101	24	8,518
C3	-	-	-	-	-	-	-	-	-
S1	1,202	2	3	12	15	48	57	26	9,508
S2	1,117	1	2	12	16	45	43	22	6,313
S3	1,357	1	2	11	16	54	51	30	6,603
Total	16,900	12	23	138	216	708	744	401	86,113

Table 8-4 FACILITIES TO BE SUPERVISORY CONTROLLED AND CONSTRUCTION COST BY ZONES (1994)

Zone	Substation	Supply Energy (GWh)	No. of Dispatching Center	No. of Repeater Station	No. of Substation	No. of Bank	No. of Feeder	No. of Sectionalizer	No. of Recloser	Construction Cost (1,000 US$)
N1-A	CMA, CMB, CMC, CRA	779	1	2	4	8	24	33	18	4,895
N2-A	PLA, PIA, UTA	485	1	1	3	6	19	17	18	3,142
N3-A	LPA, LPB, SBA, NSA	588	1	1	3	7	26	32	19	4,677
NE1-A	UDA, UDB, KKA, KKB	606	1	1	4	6	22	29	25	4,789
NE2-A	UBA, SJA, YTA	442	1	1	3	8	16	4	26	3,789
NE3-A	NRA, NRB	544	1	-	2	5	20	23	15	3,940
C1-A	BKA, BMA, PQA, TYA, NVA, SRB, SRC	2,570	1	1	7	12	49	79	5	6,411
C2-A	CBA, CCA, BLA, RAA, RAC	1,976	1	1	5	14	45	52	10	5,405
S1-A	PBA, SSA, CAA, CPA	734	2	-	4	6	20	24	17	6,618
S2-A	NTA, PPA, SNA, LRA	625	1	1	4	7	20	19	12	4,128
S3-A	HYA, HYB, SLA, PTA	887	1	2	4	7	27	34	3	4,631
Total		10,236	12	11	43	86	288	346	168	53,425
N1-B		565	-	-	8	11	35	44	16	2,845
N2-B		509	-	2	9	14	39	37	19	3,169
N3-B		357	-	1	9	9	34	33	14	2,720
NE1-B		562	-	2	10	14	46	26	47	3,538
NE2-B		451	-	1	7	11	31	25	33	2,611
NE3-B		662	-	2	8	13	44	30	27	2,989
C1-B		1,305	-	-	12	19	66	80	17	4,656
C2-B		824	-	-	9	12	45	49	14	3,113
S1-B		468	-	3	8	9	28	33	9	2,890
S2-B		492	-	1	8	9	25	24	10	2,185
S3-B		469	-	-	7	9	27	17	27	1,972
Total		6,664	-	12	95	130	420	398	233	32,688

Table 8-5 INSTITUTIONAL FRAMEWORK FOR THE PROJECT

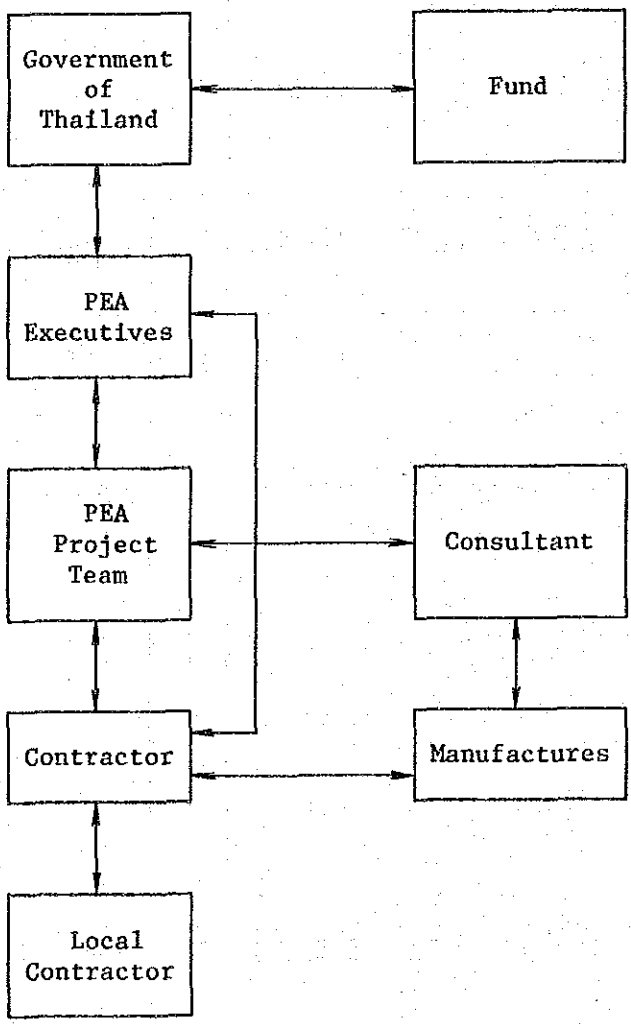
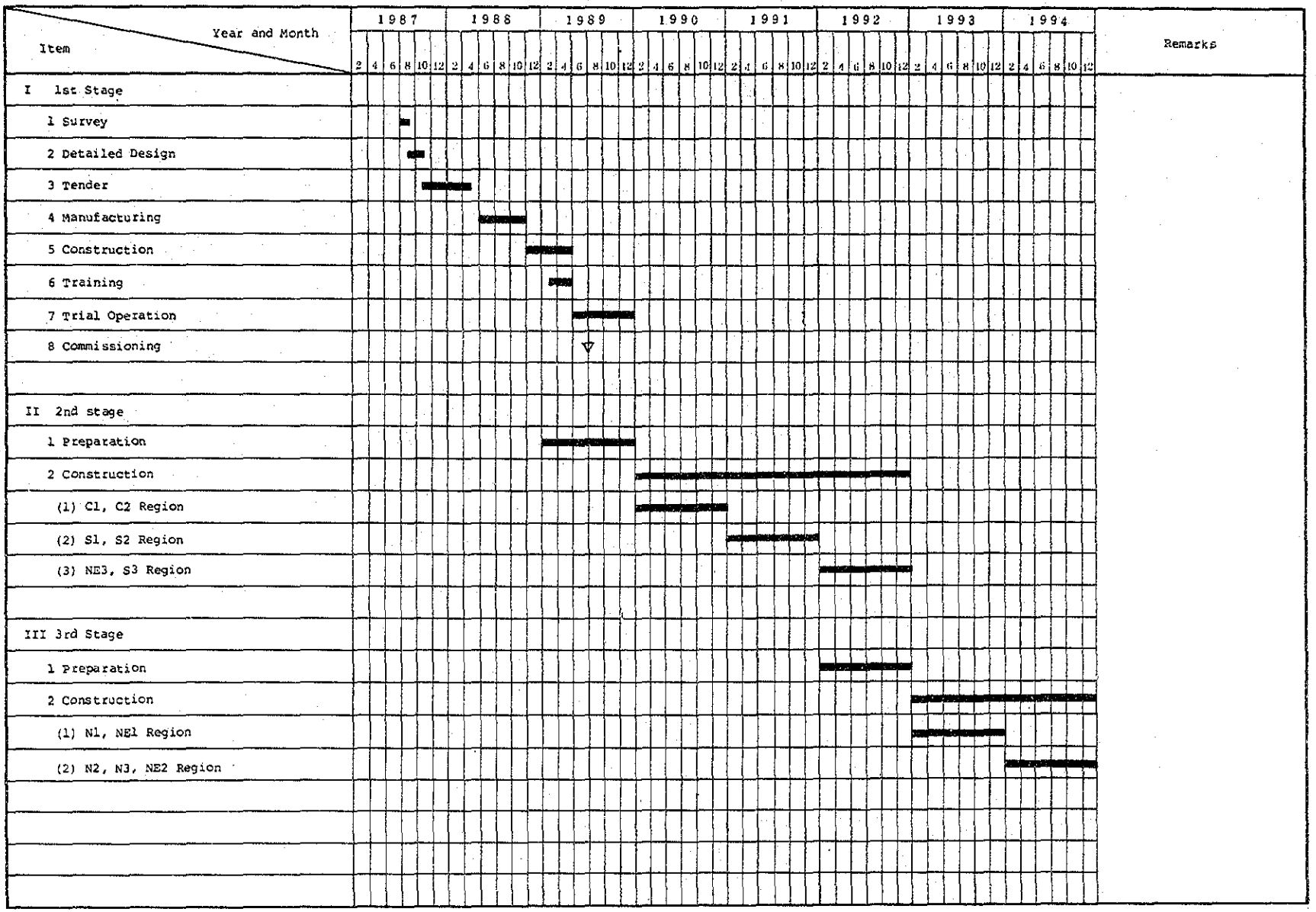


Table 8-6 IMPLEMENTATION SCHEDULE



Chapter 9

ECONOMIC EVALUATION

Chapter 9 ECONOMIC EVALUATION

9-1 Methodology of Economic Evaluation

In this report, the economic evaluation of the project was made with the internal rate of return (IRR) which is generally used for the economic evaluation of power system expansion projects. However, the project brings about no direct economic effect on the finance of PEA and the evaluation was made with the economic internal rate of return (EIRR), including the benefit of big customers derived from the reduction of supply interruption.

9-2 Economic Evaluation

(1) Cost

The details of the construction cost are described in Chapter 7, For the construction cost, the amount of investment required, excluding import duties, was considered and the balance of depreciation cost after the calculation period was converted to the present value and subtracted from the amount of investment. The investment schedule is as described in Chapter 8.

The operation cost was determined to be 1 percent of the amount of investment in consideration of the past records of PEA.

(2) Benefit

The following benefits were considered to be derived from the project.

(a) Benefit of PEA Derived from the Decremental Supply Interruption

This benefit was calculated by multiplying the decremental interruption energy by 0.016 US$ (0.41 Baht = unit sales price of 1.69 Baht - unit purchase price of 1.28 Baht in 1985) (see Table 9-1). The decremental interruption energy was obtained by multiplying the estimated interruption energy by the interruption reduction ratio (see Clause 5-2-(4)). The estimated interruption energy, in turn, was calculated by assuming that the frequency of supply interruption would be reduced by 5 percent every year from now on. Annexes 9-1-1 to 9-1-3 show the estimated interruption energy and decremental interruption energy.

(b) Benefit of PEA Derived from the Reduction of Control Station Operators

By implementing the project, it is possible to reduce the operators working at control stations. PEA intends to reduce the current three or four operators to one operator per station. As mentioned in Clause 3-4-(1), 242 operators are now working at control

stations. With the project implemented, 173 operators are expected to be reduced (see Table 9-1). For the calculations, PEA's per capita personnel expenditure of 2,845 US$ (73,795 Baht) in FY 1985 was used.

(c) Benefit of Big Customers Derived from the Decremental Supply Interruption

The damages/losses of big customers due to supply interruption are estimated at 2.106 US$ (54.62 Baht) for every kilowatt-hour of interruption energy (see Table 3-14). This benefit of big customers was calculated by multiplying the decremental interruption energy for Large Industrial customers by the above-mentioned unit price (see Table 9-1). The decremental interruption energy was estimated by using the same method as mentioned in (a) above. Annexes 9-2-1 to 9-2-3 show the estimated interruption energy and decremental interruption energy for Large Industrial customers.

(3) EIRR

Table 9-2 shows Net In-Flow, and Table 9-3 and Fig. 9-1 show Net Present Value.

On the basis of the above-mentioned conditions, EIRR was calculated as follows.

Case 1: 11.20 percent

Case 2: 13.44 percent

Case 3: 11.89 percent

9-3 Financial Analysis

The financial analysis was made for Case 2.

(1) Fund Requirement

The construction cost of the project and the investment schedule are as described in Chapters 7 and 8, respectively.

The annual interest rate and repayment term were considered as follows in consideration of PEA's past borrowings.

	Annual Interest Rate	Repayment Term (Grace Period)
Foreign currency	3.0%	20 years (10 years)
Local currency	12.0%	15 years (5 years)

(2) Revenue

The revenue from the project was obtained by subtracting the operation cost from the benefit of PEA derived from the reduction of supply interruption and the reduction of control station operators.

(3) Amortization Schedule

The amortization schedule based on the condition under the proceeding item (1) is as shown in Table 9-4.

(4) Cash Flow

The cash flow based on the conditions under the proceeding items (1) and (2) is as shown in Table 9-5.

The cash balance will be in the red, with the deficit amounting to 119.3 M.US$, during the period from 1988 to 2007. This amount is equivalent to 0.40 percent of the electric revenue for the same period. By year, the deficit will continue to increase up to the year 2004. After reaching the maximum amount of 8.7 M.US$ in the year 2004, the deficit will decrease gradually. For the calculation of electric revenue, the unit sales price of 1.69 Baht/kWh in 1985 was used and the energy sales after 1996 was calculated by applying an annual growth rate of 5.567 percent (growth rate of FY 1994 - FY 1995) to the estimated energy sales in FY 1995 (see Annex 9-3).

9-4 Sensitivity Analysis

(1) EIRR

EIRR is influenced largely by the number of sectionalizers to be installed and the benefit of big customers. Accordingly, the sensitivity analysis was made on these two factors.

(a) Effect of the Number of Sectionalizers to be Installed

As mentioned in Clause 5-2-(4), the contribution rate of sectionalizers to the interruption reduction decrease with the increase of the number of sectionalizers to be installed. In the report, the analysis was made to check the effect of the number of sectionalizes to be installed on EIRR for Case 4 and Case 5 in addition to the three cases already studied. The result of the analysis is as shown in the following table, which may be summarized as follows.

- The first one unit has the greatest effect.
- EIRR is highest in Case 2 (2 units for interconnected line and one unit for radial line).
- EIRR decreases when the number of sectionalizers is increased from that in Case 2.

Case	No. of Sectionalizers	EIRR (%)	Installation Criteria	
			Interconnected Line	Radial Line
Case 1	691	11.20	1	1
Case 2	871	13.44	2	1
Case 3	1,400	11.89	2	2
Case 4	1,580	12.18	3	2
Case 5	2,164	10.06	3	3

(b) Effect of the Benefit of Big Customers

The analysis was made to check the effect of the losses of big customers per 1 kWh of interruption energy on EIRR for Case 2. The result of the analysis is as shown below.

Losses/1 kWh of Interruption Energy	EIRR
54.62 Baht/kWh (Base Case)	13.44%
60.08 (10% up)	15.51%
49.16 (10% down)	11.35%
43.70 (20% down)	9.26%
38.23 (30% down)	7.13%

(2) FIRR

As the benefit of PEA derived from the project is extremely small as compared with the required construction cost, it is not possible to calculate the financial internal rate of return (FIRR). Accordingly, the analysis was made on the relation between FIRR and the required incremental revenue. The study was made for Case 2 and the required incremental revenue was expressed by the percentage of electric revenue (see Annexes 9-3 and 9-4). The result of analysis is shown in the following table.

FIRR (%)	5	10	15
Required Incremental Revenue (% of Electric Revenue)	0.306	0.419	0.522

9-5 Conclusion

On the basis of the foregoing studies, Case 2 was selected as the optimum case.

There is no doubt that the project is feasible from a national economic point of view. When the necessity of the project mentioned in Clause 5-1, particularly the future growth of industrial power demand in the service area of PEA, is taken into consideration, the project is considered to have a major effect on the improvement of productivity of customer's factories and activate the industrial investments, thereby contributing greatly to the economic development of Thailand. The effect of the project is not limited to the direct economic effect analyzed by the study but includes,

(1) improvement of power supply reliability,

(2) activation of industrial investment and electric power consumption,

(3) improvement of people's livelihood.

The so-called social rate of return will be considerably higher than EIRR calculated in the study.

The project brings about some benefits on the finance of PEA because the achievement of acceptable degree of reliability and service efficiency requires high investment cost. However a lot of additional benefits which are difficult to measure financially are expected as shown in the followings:-

(1) Effective utilization of system resources through appropriate and timely collection of necessary information.

(2) Improvement of the accuracy of reports used for the operation and planning of distribution system.

(3) Considerable contribution to the efficient implementation of PEA's other projects such as the rural electrification projects, power distribution systems reinforcement projects, etc. with the automated dispatching system and improved communication system.

(4) Reduction in labour works for system operations such as the detection of faulty sections, system operation for the interchange of power to sound sections, etc.

(5) Contribution to meeting the expectations of the publics in terms of safety and better services which will eventually create positive response to PEA and the Government.

Even though the financial burden of the project is estimated to be a considerable amount but it will be soundly managed within the overall balance of PEA by seeking financial support from local or foreign financial institutions.

Fig 9-1 NET PRESENT VALUE CURVE

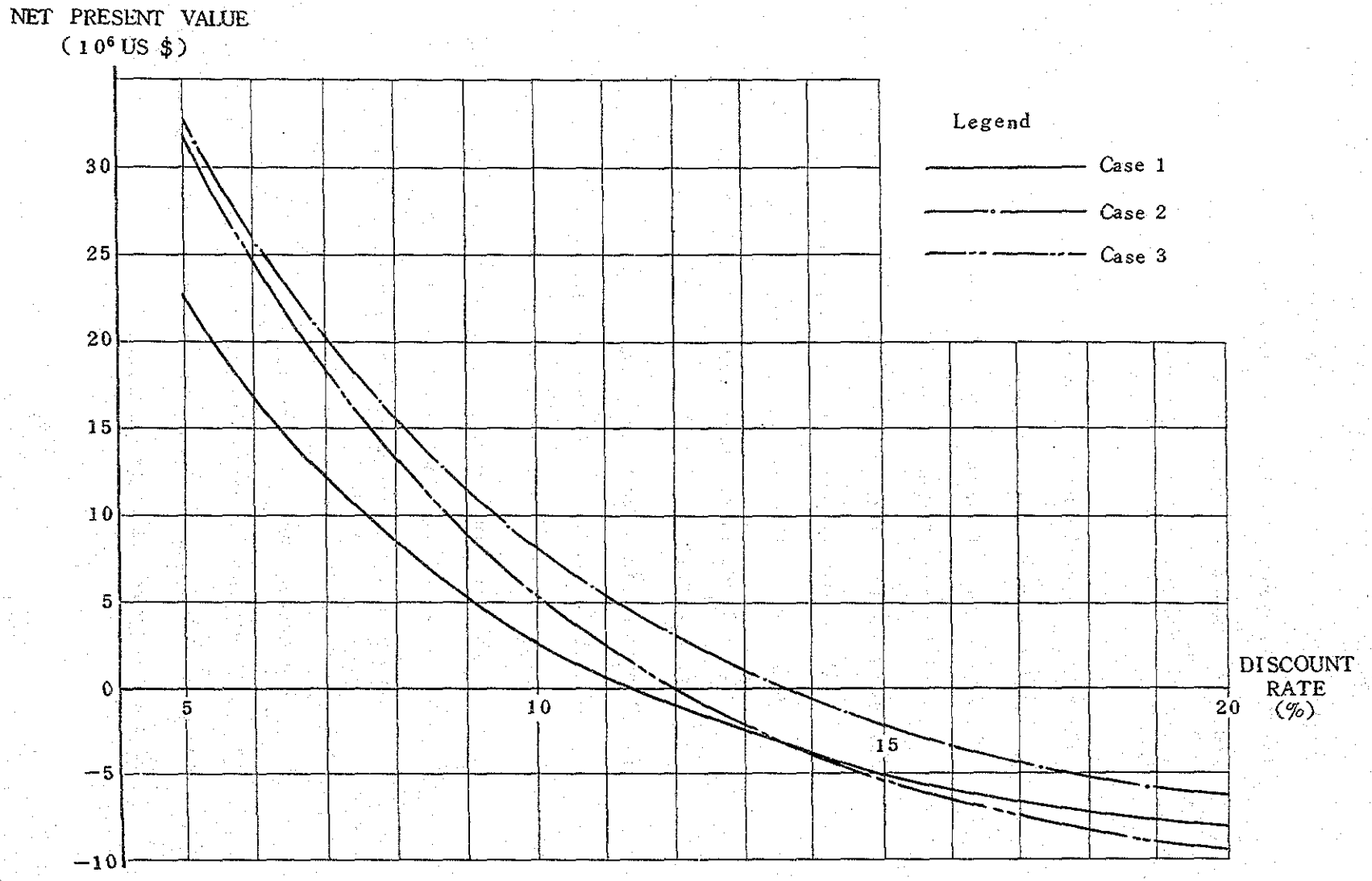


Table 9-1-1 COST AND BENEFIT (CASE 1)

(Unit: 1,000 US$)

Year	Implementation Schedule	Investment Cost			Benefit						Remarks
					Decremental Interruption Energy		Reduction of C/S Operators		Reduction of Big Customer's Losses		
		F.C.	L.C.	Total	Energy (MWh)	Amount	Operators	Amount	Energy (MWh)	Amount	
1986		-	-	-	0	0	0	0	0	0	
1987		-	-	-	0	0	0	0	0	0	Exchange Rate:
1988	C3, Training C	7,535	362	7,897	0	0	0	0	0	0	$1.00
1989					1,085	17	20	57	666	1,402	= 25.9359 Baht
1990	C1, C2	11,964	718	12,682	1,110	18	20	57	673	1,418	$1.00
1991	S1, S2	10,192	751	10,943	3,787	61	60	171	2,265	4,771	= 153.8 Yen
1992	NE3, S3	8,854	580	9,434	6,462	103	82	233	2,947	6,206	
1993	NE1, N1	10,194	670	10,864	8,738	140	104	296	2,347	7,050	Estimated Rate
1994	N2, N3, NE2	13,584	979	14,563	11,306	181	138	393	3,553	7,483	of Interrupted
1995					13,121	210	173	492	3,603	7,588	Energy:
1996					13,190	211	173	492	3,595	7,571	0.016 $/kWh
1997					13,264	212	173	492	3,587	7,554	
1998					13,324	213	173	492	3,579	7,538	Salaries &
1999					13,396	214	173	492	3,572	7,522	Wages:
2000					13,464	215	173	492	3,563	7,505	2,845
2001					13,534	217	173	492	3,555	7,487	$/Operator
2002					13,609	218	173	492	3,548	7,471	
2003					13,682	219	173	492	3,539	7,454	Big Customer's
2004					13,761	220	173	492	3,532	7,438	Losses:
2005					13,831	221	173	492	3,524	7,422	2.106 $/kWh
2006					13,910	223	173	492	3,516	7,405	
2007					13,987	224	173	492	3,508	7,389	

Table 9-1-2 COST AND BENEFIT (CASE 2)

(Unit: 1,000 US$)

Year	Implementation Schedule	Investment Cost			Benefit						Remarks
					Decremental Interruption Energy		Reduction of C/S Operators		Reduction of Big Customer's Losses		
		F.C.	L.C.	Total	Energy (MWh)	Amount	Operators	Amount	Energy (MWh)	Amount	
1986		-	-	-	0	0	0	0	0	0	
1987		-	-	-	0	0	0	0	0	0	Exchange Rate:
1988	C3, Training C	8,293	411	8,704	0	0	0	0	0	0	$1.00
1989					1,336	21	20	57	820	1,727	= 25.9359 Baht
1990	C1, C2	13,195	798	13,994	1,367	22	20	57	829	1,746	$1.00
1991	S1, S2	10,713	784	11,497	4,606	74	60	171	2,777	5,848	= 153.8 Yen
1992	NE3, S3	9,189	599	9,788	7,744	124	82	233	3,578	7,535	
1993	NE1, N1	10,904	717	11,621	10,310	165	104	296	4,030	8,486	Estimated Rate
1994	N2, N3, NE2	14,293	1,026	15,319	13,344	214	138	393	4,187	8,819	of Interrupted
1995					15,415	247	173	492	4,323	9,104	Energy:
1996					15,495	248	173	492	4,313	9,084	0.016 $/kWh
1997					15,581	249	173	492	4,304	9,064	
1998					15,651	250	173	492	4,295	9,044	Salaries &
1999					15,734	252	173	492	4,285	9,025	Wages:
2000					15,814	253	173	492	4,276	9,004	2,845
2001					15,895	254	173	492	4,266	8,983	$/Operator
2002					15,982	256	173	492	4,257	8,964	
2003					16,068	257	173	492	4,247	8,943	Big Customer's
2004					16,159	259	173	492	4,237	8,924	Losses:
2005					16,241	260	173	492	4,229	8,905	2.106 $/kWh
2006					16,333	261	173	492	4,218	8,884	
2007					16,423	263	173	492	4,209	8,865	

Table 9-1-3 COST AND BENEFIT (CASE 3)

(Unit: 1,000 US$)

Year	Implementation Schedule	Investment Cost			Benefit						Remarks
					Decremental Interruption Energy		Reduction of C/S Operators		Reduction of Big Customer's Losses		
		F.C.	L.C.	Total	Energy (MWh)	Amount	Operators	Amount	Energy (MWh)	Amount	
1986		-	-	-	0	0	0	0	0	0	
1987		-	-	-	0	0	0	0	0	0	Exchange Rate:
1988	C3, Training C	9,524	470	9,994	0	0	0	0	0	0	$1.00
1989					1,447	23	20	57	888	1,870	= 25.9359 Baht
1990	C1, C2	16,699	961	17,660	1,480	24	20	57	898	1,891	$1.00
1991	S1, S2	12,179	854	13,033	5,050	81	60	171	3,021	6,361	= 153.8 Yen
1992	NE3, S3	11,225	697	11,922	8,616	138	82	233	3,929	8,275	
1993	NE1, N1	12,609	797	13,406	11,650	186	104	296	4,463	9,399	Estimated Rate
1994	N2, N3, NE2	16,875	1,146	18,021	15,075	241	138	393	4,737	9,977	of Interrupted
1995					17,495	280	173	492	4,804	10,117	Energy:
1996					17,587	281	173	492	4,793	10,095	0.016 $/kWh
1997					17,686	283	173	492	4,783	10,072	
1998					17,765	284	173	492	4,772	10,051	Salaries &
1999					17,861	286	173	492	4,762	10,029	Wages:
2000					17,952	287	173	492	4,751	10,006	2,845
2001					18,045	289	173	492	4,740	9,983	$/Operator
2002					18,146	290	173	492	4,730	9,962	
2003					18,243	292	173	492	4,719	9,939	Big Customer's
2004					18,348	294	173	492	4,709	9,917	Losses:
2005					18,442	295	173	492	4,699	9,896	2.106 $/kWh
2006					18,546	297	173	492	4,688	9,873	
2007					18,650	298	173	492	4,678	9,852	

Table 9-2-1 NET IN-FLOW (CASE 1)

(Unit: 1,000 US$)

Year	Cost			Benefit				Net In-Flow
	Investment	Operating	Total (1)	Decremental Int. Energy	Reduction C. Center Operator	Reduction Customer's Losses	Total (2)	(2) - (1)
1986	-	0	0	0	0	0	0	0
1987	-	0	0	0	0	0	0	0
1988	7,897	0	7,897	0	0	0	0	(7,897)
1989		79	79	17	57	1,402	1,476	1,397
1990	12,682	79	12,761	18	57	1,418	1,493	(11,268)
1991	10,943	206	11,149	61	171	4,771	5,003	(6,146)
1992	9,434	315	9,749	103	233	6,206	6,542	(3,207)
1993	10,864	409	11,273	140	296	7,050	7,486	(3,787)
1994	14,563	518	15,081	181	393	7,483	8,057	(7,024)
1995		664	664	210	492	7,588	8,290	7,626
1996		664	664	211	492	7,571	8,274	7,610
1997		664	664	212	492	7,554	8,258	7,594
1998		664	664	213	492	7,538	8,243	7,579
1999		664	664	214	492	7,522	8,228	7,564
2000		664	664	215	492	7,505	8,212	7,548
2001		664	664	217	492	7,487	8,196	7,532
2002		664	664	218	492	7,471	8,181	7,517
2003		664	664	219	492	7,454	8,165	7,501
2004		664	664	220	492	7,438	8,150	7,486
2005		664	664	221	492	7,422	8,135	7,471
2006		664	664	223	492	7,405	8,120	7,456
2007	(11,881)	664	(11,217)	224	492	7,389	8,105	19,322
	54,502	10,238	64,740	3,337	7,603	125,674	136,614	71,874

Table 9-2-2 NET IN-FLOW (CASE 2)

(Unit: 1,000 US$)

Year	Cost			Benefit				Net In-Flow
	Investment	Operating	Total (1)	Decremental Int. Energy	Reduction C. Center Operator	Reduction Customer's Losses	Total (2)	(2) - (1)
1986	-	0	0	0	0	0	0	0
1987	-	0	0	0	0	0	0	0
1988	8,704	0	8,704	0	0	0	0	(8,704)
1989		87	87	21	57	1,727	1,805	1,718
1990	13,993	87	14,080	22	57	1,746	1,825	(12,255)
1991	11,497	227	11,724	74	171	5,848	6,093	(5,631)
1992	9,788	342	10,130	124	233	7,535	7,892	(2,238)
1993	11,621	440	12,061	165	296	8,486	8,947	(3,114)
1994	15,319	556	15,875	214	393	8,819	9,426	(6,449)
1995		709	709	247	492	9,104	9,843	9,134
1996		709	709	248	492	9,084	9,824	9,115
1997		709	709	249	492	9,064	9,805	9,096
1998		709	709	250	492	9,044	9,786	9,077
1999		709	709	252	492	9,025	9,769	9,060
2000		709	709	253	492	9,004	9,749	9,040
2001		709	709	254	492	8,983	9,729	9,020
2002		709	709	256	492	8,964	9,712	9,003
2003		709	709	257	492	8,943	9,692	8,983
2004		709	709	259	492	8,924	9,675	8,966
2005		709	709	260	492	8,905	9,657	8,948
2006		709	709	261	492	8,884	9,637	8,928
2007	(12,582)	709	(11,873)	263	492	8,865	9,620	21,493
	58,340	10,956	69,296	3,929	7,603	150,954	162,486	93,190

Table 9-2-3 NET IN-FLOW (CASE 3)

(Unit: 1,000 US$)

Year	Cost			Benefit				Net In-Flow
	Investment	Operating	Total (1)	Decremental Int. Energy	Reduction C. Center Operator	Reduction Customer's Losses	Total (2)	(2) - (1)
1986	-	0	0	0	0	0	0	0
1987	-	0	0	0	0	0	0	0
1988	9,994	0	9,994	0	0	0	0	(9,994)
1989		100	100	23	57	1,870	1,950	1,850
1990	17,660	100	17,760	24	57	1,891	1,972	(15,788)
1991	13,033	277	13,310	81	171	6,361	6,613	(6,697)
1992	11,922	407	12,329	138	233	8,275	8,646	(3,683)
1993	13,406	526	13,932	186	296	9,399	9,881	(4,051)
1994	18,021	660	18,681	241	393	9,977	10,611	(8,070)
1995		840	840	280	492	10,117	10,889	10,049
1996		840	840	281	492	10,095	10,868	10,028
1997		840	840	283	492	10,072	10,847	10,007
1998		840	840	284	492	10,051	10,827	9,987
1999		840	840	286	492	10,029	10,807	9,967
2000		840	840	287	492	10,006	10,785	9,945
2001		840	840	289	492	9,983	10,764	9,924
2002		840	840	290	492	9,962	10,744	9,904
2003		840	840	292	492	9,939	10,723	9,883
2004		840	840	294	492	9,917	10,703	9,863
2005		840	840	295	492	9,896	10,683	9,843
2006		840	840	297	492	9,873	10,662	9,822
2007	(14,863)	840	(14,023)	298	492	9,852	10,642	24,665
	69,173	12,990	82,163	4,449	7,603	167,565	179,617	97,454

Table 9-3 NET PRESENT VALUE

(Unit: 1,000 US$)

Items		Discount Rate (%)							
		5	6	7	8	9	10	11	12
Net Present Value (1986 Price)	Case 1	22,344	16,843	12,263	8,443	5,263	2,616	408	(1,424)
	Case 2	32,803	25,978	20,260	15,458	11,425	8,037	5,189	2,798
	Case 3	31,734	24,386	18,248	13,120	8,836	5,251	2,261	(234)

Items		Discount Rate (%)							
		13	14	15	16	17	18	19	20
Net Present Value (1986 Price)	Case 1	(2,937)	(4,191)	(5,224)	(6,071)	(6,758)	(7,315)	(7,758)	(8,108)
	Case 2	789	(895)	(2,306)	(3,484)	(4,470)	(5,284)	(5,957)	(6,513)
	Case 3	(2,316)	(4,044)	(5,476)	(6,661)	(7,633)	(8,424)	(9,065)	(9,578)

Table 9-4 AMORTIZATION SCHEDULE (CASE 2)

(Unit: 1,000 US$)

Year	Loan Schedule			Amortization Schedule								
				Principal			Balance			Interest		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1986												
1987												
1988	8,293	3,806	12,099				8,293	3,806	12,099	249	457	706
1989							8,293	3,806	12,099	249	457	706
1990	13,195	6,390	19,585				21,488	10,196	31,684	645	1,223	1,868
1991	10,713	5,108	15,821				32,201	15,304	47,505	966	1,836	2,802
1992	9,189	4,343	13,532				41,390	19,647	61,037	1,242	2,358	3,600
1993	10,904	5,163	16,067		254	254	52,294	24,556	76,850	1,569	2,947	4,516
1994	14,293	6,815	21,108		254	254	66,587	31,117	97,704	1,998	3,734	5,732
1995					680	680	66,587	30,437	97,024	1,998	3,652	5,650
1996					1,021	1,021	66,587	29,416	96,003	1,998	3,530	5,528
1997					1,311	1,311	66,587	28,105	94,692	1,998	3,373	5,371
1998				415	1,655	2,070	66,172	26,450	92,622	1,985	3,174	5,159
1999				415	2,109	2,524	65,757	24,341	90,098	1,972	2,921	4,893
2000				1,075	2,109	3,184	64,682	22,232	86,914	1,940	2,668	4,608
2001				1,611	2,109	3,724	63,071	20,123	83,194	1,892	2,415	4,370
2002				2,070	2,109	4,179	61,001	18,014	79,015	1,830	2,162	3,992
2003				2,615	2,109	4,724	58,386	15,905	74,291	1,751	1,909	3,660
2004				3,330	2,109	5,439	55,056	13,796	68,852	1,651	1,655	3,306
2005				3,330	2,109	5,439	51,726	11,687	63,413	1,552	1,402	2,954
2006				3,330	2,109	5,439	48,396	9,578	57,974	1,452	1,149	2,601
2007				3,330	2,105	5,435	45,066	7,473	52,539	1,352	897	2,249
Sub-Total	66,587	31,625	98,212	21,521	24,152	45,673	-	-	-	30,289	43,919	74,208

Table 9-4 AMORTIZATION SCHEDULE (CASE 2)

(Continued)

(Unit: 1,000 US$)

Year	Loan Schedule			Amortization Schedule								
				Principal			Balance			Interest		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
2008				3,330	1,855	5,185	41,736	5,618	47,354	1,252	674	1,926
2009				3,330	1,855	5,185	38,406	3,763	42,169	1,152	452	1,604
2010				3,330	1,422	4,752	35,076	2,341	37,417	1,052	281	1,333
2011				3,330	1,081	4,411	31,746	1,260	33,006	952	151	1,103
2012				3,330	801	4,131	28,416	459	28,875	853	55	908
2013				3,330	459	3,789	25,086	0	25,086	753	0	753
2014				3,330		3,330	21,756		21,756	653		653
2015				3,330		3,330	18,426		18,426	553		553
2016				3,330		3,330	15,096		15,096	453		453
2017				3,323		3,323	11,773		11,773	353		353
2018				2,915		2,915	8,858		8,858	266		266
2019				2,910		2,910	5,948		5,948	178		178
2020				2,248		2,248	3,700		3,700	111		111
2021				1,728		1,728	1,972		1,972	59		59
2022				1,264		1,264	708		708	21		21
2023				708		708	0		0	0		0
Sub-Total				45,066	7,473	52,539	-	-	-	8,661	1,613	10,274
Total	66,587	31,625	98,212	66,587	31,625	98,212	-	-	-	38,950	45,532	84,482

Table 9-5 CASH FLOW STATEMENT (CASE 2)

(Unit: 1,000 US$)

Item		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1. Sources of Funds		12,099	(9)	19,577	15,839	13,547	16,088	21,159	30	31	32	33
Operating Profit		-	(9)	(8)	18	15	21	51	30	31	32	33
Long Term Debt		12,099	-	19,585	15,821	13,532	16,067	21,108	-	-	-	-
2. Uses of Funds		12,805	706	21,453	18,623	17,132	20,837	27,094	6,330	6,549	6,682	7,229
Investment		12,099	-	19,585	15,821	13,532	16,067	21,108	-	-	-	-
Repayment		-	-	-	-	-	254	254	680	1,021	1,311	2,070
Interest		706	706	1,868	2,802	3,600	4,516	5,732	5,650	5,528	5,371	5,159
3. Cash Balance	(1)	(706)	(715)	(1,876)	(2,784)	(3,585)	(4,749)	(5,935)	(6,300)	(6,518)	(6,650)	(7,196)
Electric Revenues	(2)	775,398	862,954	924,948	990,336	1,054,024	1,118,787	1,184,209	1,250,132	1,319,723	1,393,192	1,470,746
(1)/(2)	(%)	(0.09)	(0.08)	(0.20)	(0.28)	(0.34)	(0.42)	(0.50)	(0.50)	(0.49)	(0.48)	(0.49)

Item		1999	2000	2001	2002	2003	2004	2005	2006	2007		Total
1. Sources of Funds		35	36	37	39	40	42	43	44	46		98,788
Operating Profit		35	36	37	39	40	42	43	44	46		576
Long Term Debt		-	-	-	-	-	-	-	-	-		98,212
2. Uses of Funds		7,417	7,792	8,027	8,171	8,384	8,745	8,393	8,040	7,684		218,093
Investment		-	-	-	-	-	-	-	-	-		98,212
Repayment		2,524	3,184	3,720	4,179	4,724	5,439	5,439	5,439	5,435		45,673
Interest		4,893	4,608	4,307	3,992	3,660	3,306	2,954	2,601	2,249		74,208
3. Cash Balance	(1)	(7,382)	(7,756)	(7,990)	(8,132)	(8,344)	(8,703)	(8,350)	(7,996)	(7,638)		(119,305)
Electric Revenues	(2)	1,552,620	1,639,056	1,730,300	1,826,620	1,928,304	2,035,649	2,148,970	2,268,605	2,394,893		29,869,466
(1)/(2)	(%)	(0.48)	(0.47)	(0.46)	(0.45)	(0.43)	(0.43)	(0.39)	(0.35)	(0.32)		(0.40)

A N N E X

Contents of ANNEX

ANNEX 2-1-1

POWER PLANT EXPANSION PLAN (EGAT)

(UNIT: MW)

TYPE OF POWER PLANT	FISCAL YEAR										
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
HYDRO POWER PLANT	1,813.62	1,998.12	2,238.12	2,238.12	2,238.12	2,238.12	2,238.12	2,418.12	2,418.12	2,418.12	2,998.12
(%)	28.08	30.07	32.51	32.21	30.88	29.89	29.89	31.11	30.37	28.74	32.79
THERMAL											
OIL FIRED	342.50	342.50	342.50	417.50	417.50	417.50	417.50	417.50	180.00	180.00	180.00
(%)	5.30	5.15	4.98	6.01	5.76	5.58	5.58	5.37	2.26	2.14	1.97
LIGNITE FIRED	885.00	885.00	885.00	885.00	1,185.00	1,425.00	1,425.00	1,500.00	1,500.00	1,500.00	1,500.00
(%)	13.70	13.32	12.86	12.74	16.35	19.03	19.03	19.30	18.84	17.83	16.41
NATURAL GAS FIRED	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00
(%)	37.15	36.12	34.86	34.54	33.11	32.05	32.05	30.87	30.14	28.53	26.25
SUB-TOTAL	3,627.50	3,627.50	3,627.50	3,702.50	4,002.50	4,242.50	4,242.50	4,317.50	4,080.00	4,080.00	4,080.00
(%)	56.16	54.60	52.69	53.28	55.22	56.65	56.65	55.54	51.24	48.50	44.62
GAS TURB. POWER PLANT	265.00	265.00	265.00	265.00	265.00	265.00	265.00	145.00	145.00	145.00	145.00
(%)	4.10	3.99	3.85	3.81	3.66	3.54	3.54	1.87	1.82	1.72	1.59
TURB. & CON. PO. PLANT	720.00	720.00	720.00	720.00	720.00	720.00	720.00	870.00	1,320.00	1,770.00	1,920.00
(%)	11.15	10.84	10.46	10.36	9.93	9.61	9.61	11.19	16.58	21.04	21.00
DIESEL POWER PLANT	33.60	33.60	33.60	23.00	23.00	23.00	23.00	23.00			
(%)	0.52	0.51	0.49	0.33	0.32	0.31	0.31	0.30	0.00	0.00	0.00
TOTAL	6,459.72	6,644.22	6,884.22	6,948.62	7,248.62	7,488.62	7,488.62	7,773.62	7,963.12	8,413.12	9,143.12

ANNEX 2-1-2

EXPANSION PLAN OF HYDRO POWER PLANT (EGAT)

(UNIT: MW)

PLANT NAME	FISCAL YEAR										
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
BHUMIBOL	535.00	535.00	535.00	535.00	535.00	535.00	535.00	535.00	535.00	535.00	535.00
SIRIKIT	375.00	375.00	375.00	375.00	375.00	375.00	375.00	375.00	375.00	375.00	375.00
UBOL RATANA	25.20	25.20	25.20	25.20	25.20	25.20	25.20	25.20	25.20	25.20	25.20
SIRINDHORN	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
CHULABHORN	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
KANG KRACHAN	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00
NAM PUNG	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
SRINAGARIND	360.00	540.00	540.00	540.00	540.00	540.00	540.00	720.00	720.00	720.00	720.00
BANG LANG	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00
THA THUNG NA	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00
KHAO LAEM	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
MAE NGAT	4.50	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
HUAI KUM	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
BAN SANTI	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
BANYANG	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
BAN KHUN KLANG	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
KLONG CHONG KLUM	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
CHIEW LARN	-	-	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00
NAM CHON	-	-	-	-	-	-	-	-	-	-	580.00
TOTAL	1,813.62	1,998.12	2,238.12	2,238.12	2,238.12	2,238.12	2,238.12	2,418.12	2,418.12	2,418.12	2,998.12

ANNEX 2-1-3

EXPANSION PLAN OF THERMAL POWER PLANT (EGAT)

(UNIT: MW)

PLANT NAME	FISCAL YEAR										
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
OIL FIRED											
NORTH BANGKOK	237.50	237.50	237.50	237.50	237.50	237.50	237.50	237.50	-	-	-
SURAT THANI	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
KHANOM	75.00	75.00	75.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
SUB-TOTAL	342.50	342.50	342.50	417.50	417.50	417.50	417.50	417.50	180.00	180.00	180.00
LIGNITE FIRED											
KRABI	60.00	60.00	60.00	60.00	60.00	-	-	-	-	-	-
MAE MOH	825.00	825.00	825.00	825.00	1,125.00	1,425.00	1,425.00	1,425.00	1,425.00	1,425.00	1,425.00
KRABI 2	-	-	-	-	-	-	-	75.00	75.00	75.00	75.00
SUB-TOTAL	885.00	885.00	885.00	885.00	1,185.00	1,425.00	1,425.00	1,500.00	1,500.00	1,500.00	1,500.00
NATURAL GAS FIRED											
SOUTH BANGKOK	1,300.00	1,300.00	1,300.00	1,300.00	1,300.00	1,300.00	1,300.00	1,300.00	1,300.00	1,300.00	1,300.00
BANG PAKONG	1,100.00	1,100.00	1,100.00	1,100.00	1,100.00	1,100.00	1,100.00	1,100.00	1,100.00	1,100.00	1,100.00
SUB-TOTAL	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00	2,400.00
TOTAL	3,627.50	3,627.50	3,627.50	3,702.50	4,002.50	4,242.50	4,242.50	4,317.50	4,080.00	4,080.00	4,080.00

ANNEX 2-1-4

EXPANSION PLAN OF GAS TURBINE PLANT (EGAT)

(UNIT: MW)

PLANT NAME	FISCAL YEAR										
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
DIESEL OIL FIRED											
NAKHON RATCHASIMA	15.00	15.00	15.00	15.00	15.00	15.00	15.00	-	-	-	-
HAT YAI	45.00	45.00	45.00	45.00	45.00	45.00	45.00	-	-	-	-
UDON THANI	15.00	15.00	15.00	15.00	15.00	15.00	15.00	-	-	-	-
SURAT THANI	45.00	45.00	45.00	45.00	45.00	45.00	45.00	-	-	-	-
SUB-TOTAL	120.00	120.00	120.00	120.00	120.00	120.00	120.00	-	-	-	-
NATURAL GAS FIRED											
SOUTH BANGKOK	25.00	-	-	-	-	-	-	-	-	-	-
LAN KRABUE	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
CHANGWAT SONGKHLA	-	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
SUB-TOTAL	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00
TOTAL	265.00	265.00	265.00	265.00	265.00	265.00	265.00	145.00	145.00	145.00	145.00

ANNEX 2-1-5

EXPANSION PLAN OF GAS TURBINE & COMBINE CYCLE (EGAT)

(UNIT: MW)

PLANT NAME	FISCAL YEAR										
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
BANG PAKONG											
TERMAL PLANT	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00
GAS TERBINE PLANT	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00
KHANOM	-	-	-	-	-	-	-	150.00	300.00	450.00	600.00
NAM PHONG	-	-	-	-	-	-	-	-	300.00	600.00	600.00
TOTAL	720.00	720.00	720.00	720.00	720.00	720.00	720.00	870.00	1,320.00	1,770.00	1,920.00

ANNEX 2-1-6

EXPANSION PLAN OF DIESEL POWER PLANT (EGAT)

(UNIT: MW)

PLANT NAME	FISCAL YEAR										
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
PHUKET	10.60	10.60	10.60								
CHIAN MAI	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	-	-
MAE MOH	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	-	-	-
BANG LANG	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	-	-	-
KHAO LAEM	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	-	-	-
NAKHON SI THAMMARAT	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	-	-	-
KRABI	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	-	-	-
TOTAL	33.60	33.60	33.60	23.00	23.00	23.00	23.00	23.00	-	-	-

ANNEX 3-1

NUMBER OF OFFICES

OFFICE \ REGION		N1	N2	N3	NE1	NE2	NE3	C1	C2	C3	S1	S2	S3	TOTAL
ELECTRIC OFFICE	A	10	10	10	11	10	8	11	9	8	7	7	10	111
1st GRADE		1			2	1	1	1						6
2nd GRADE		3	2	3	1	4	3	3	4	5	1	2	3	34
3rd GRADE		4	8	6	5	2	3	4	3	3	6	4	6	54
4th GRADE		2		1	3	3	1	3	2			1	1	17
CUSTOMER S.C.	B	17	19	13	16	8	17	15	6	18	11	13	5	158
CUSTOMER S. SUB-C	C	113	111	74	178	154	92	66	38	47	36	48	76	1,033
TOTAL (A+B+C)		140	140	97	205	172	117	92	53	73	54	68	91	1,302
AREA (KM)	D	71,946	74,147	40,655	61,034	57,640	49,475	22,644	21,963	27,864	28,145	37,349	24,830	517,692
CCT LENGTH OF H.V. LINE	E	7,624	7,256	6,616	11,824	11,768	7,363	7,087	6,084	8,566	4,200	5,626	5,050	89,064
D/(A+B)		2,665	2,557	1,768	2,261	3,202	1,979	871	1,464	1,072	1,564	1,867	1,655	1,925
E/(A+B)		282	250	288	438	654	295	273	406	329	233	281	337	331

ANNEX 3-2

NUMBER OF STAFFS

REGION / OFFICE	N1	N2	N3	NE1	NE2	NE3	C1	C2	C3	S1	S2	S3	TOTAL
ELECTRIC OFFICE	915	864	791	870	800	640	890	763	811	604	542	761	9,251
1st GRADE	186			298	147	158	136						925
2nd GRADE	439	232	331	86	401	291	365	448	571	110	213	351	3,838
3rd GRADE	229	632	421	364	134	169	300	232	240	494	279	373	3,867
4th GRADE	61		39	122	118	22	89	83			50	37	621
CUSTOMER S.C.	313	265	269	284	96	247	303	152	405	199	138	96	2,767
CUSTOMER S. SUB-C.	214	172	175	296	271	128	147	96	96	64	65	169	1,893
TOTAL	1,442	1,301	1,235	1,450	1,167	1,015	1,340	1,011	1,312	867	745	1,026	13,911

ANNEX 3-3

NUMBER OF MAINTENANCE STAFFS

OFFICE \ REGION	N1	N2	N3	NE1	NE2	NE3	C1	C2	C3	S1	S2	S3	TOTAL
ELECTRIC OFFICE	180	167	132	150	139	130	187	155	150	117	109	140	1,756
1st GRADE	35			62	27	36	27						187
2nd GRADE	83	45	59	10	69	51	82	97	104	24	45	69	738
3rd GRADE	42	122	67	59	27	30	60	45	46	93	55	68	714
4th GRADE	20		6	19	16	13	18	13			9	3	117
CUSTOMER S.C.	176	163	140	138	53	157	175	80	208	108	85	42	1,525
CUSTOMER S. SUB-C.	214	172	175	296	271	128	147	96	96	64	65	169	1,893
TOTAL	570	502	447	584	463	415	509	331	454	289	259	351	5,174

ANNEX 3-4

NUMBER OF VEHICLES

OFFICE \ REGION	N1	N2	N3	NE1	NE2	NE3	C1	C2	C3	S1	S2	S3	TOTAL
CONSTRUCTION													
REGIONAL OFFICE	5	19	3	21	33	17	10	20	4	9	11	15	167
ELECTRIC OFFICE	75	28	35	34	48	33	57	32	42	34	29	29	476
CUSTOMER S.C.		12	8	15	3	14	8		26	4	6	2	98
CUSTOMER S. SUB-C.			3			6							9
SUB-TOTAL	80	59	49	70	84	70	75	52	72	47	46	46	750
MAINTENANCE													
REGIONAL OFFICE	16	18	9	13	13	14	8	13	1	8	12	19	144
ELECTRIC OFFICE	96	61	45	44	69	35	62	67	22	38	44	56	639
CUSTOMER S.C.		20	14	24	12	14	28		7	11	12	9	151
CUSTOMER S. SUB-C.		1	8			8	2		1	7			27
SUB-TOTAL	112	100	76	81	94	71	100	80	31	64	68	84	961
OTHERS													
REGIONAL OFFICE	13	13	10	9	10	11	19	15	20	18	21	20	179
ELECTRIC OFFICE	31	25	19	43	25	33	17	46	48	40	38	22	387
CUSTOMER S.C.		17	8	16	9	6	2		40	7	7	1	113
CUSTOMER S. SUB-C.			3			3			1				7
SUB-TOTAL	44	55	40	68	44	53	38	61	109	65	66	43	686
TOTAL													
REGIONAL OFFICE	34	50	22	43	56	42	37	48	25	35	44	54	490
ELECTRIC OFFICE	202	114	99	121	142	101	136	145	112	112	111	107	1,502
CUSTOMER S.C.	0	49	30	55	24	34	38	0	73	22	25	12	362
CUSTOMER S. SUB-C.	0	1	14	0	0	17	2	0	2	7	0	0	43
TOTAL	236	214	165	219	222	194	213	193	212	176	180	173	2,397

ANNEX 3-5

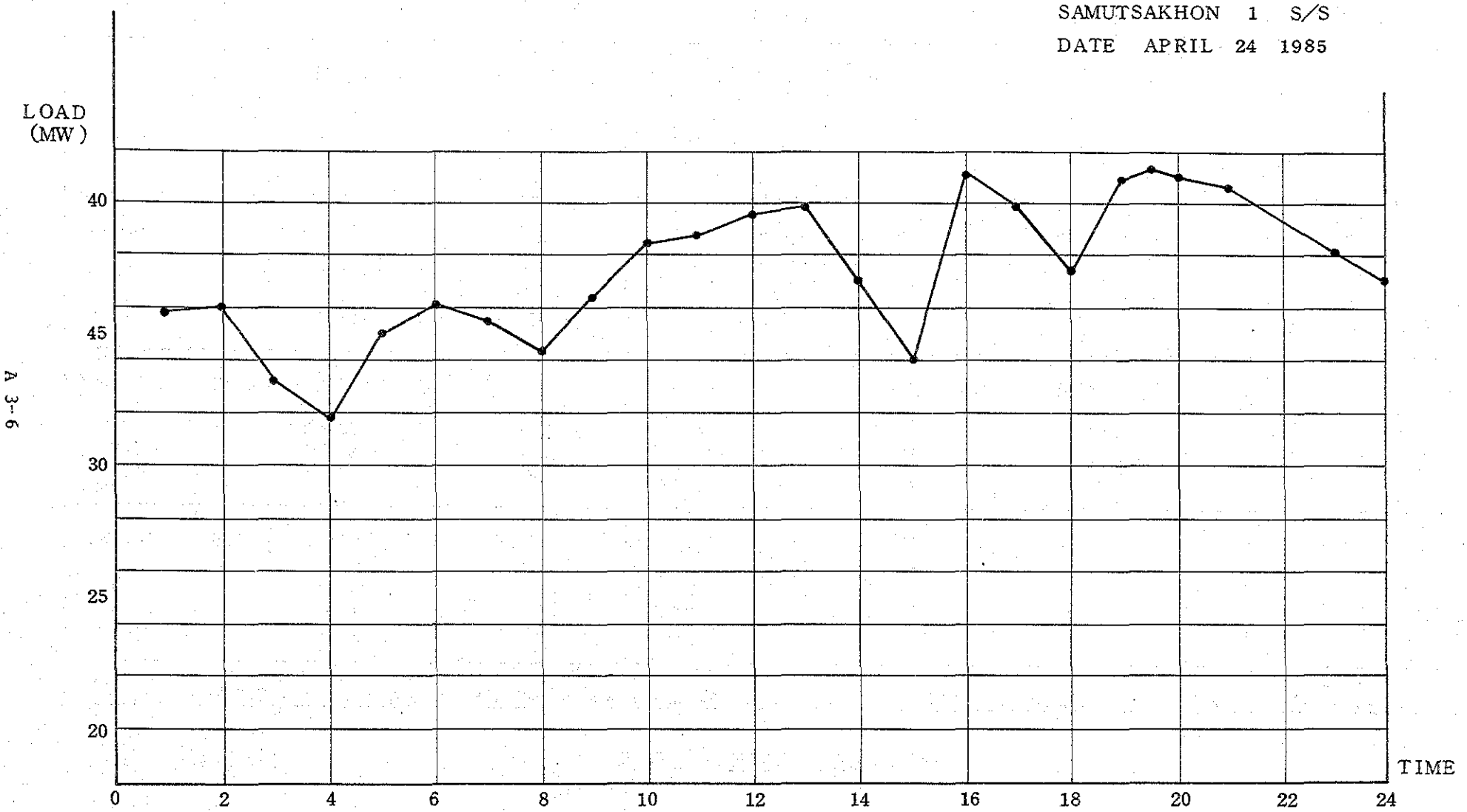
ENERGY SALES BY REGION OF PEA

(UNIT: GWh)

REGIONS	RESIDENTIAL (%)		SMALL BUSINESS (%)		LARGE BUSINESS (%)		SMALL INDUSTRIAL (%)		LARGE INDUSTRIAL (%)		OTHERS (%)		TOTAL (%)	
N1		275.50		67.40		78.95		52.74		7.46		44.71		526.76
N2		262.87		44.10		48.48		39.83		11.70		39.74		446.72
N3		235.94		51.75		60.24		47.29		9.49		22.77		427.48
SUB-TOTAL	26.6	774.31	23.8	163.25	26.4	187.67	11.0	139.86	1.1	28.65	24.0	107.22	16.4	1,400.96
NE1		259.78		67.80		58.62		65.32		46.10		49.25		546.15
NE2		203.54		37.82		26.06		36.39		13.27		30.64		347.72
NE3		242.57		51.79		61.90		73.87		168.09		23.84		622.06
SUB-TOTAL	24.2	705.89	22.9	156.69	20.6	146.58	13.8	175.58	9.0	227.46	23.2	103.73	17.7	1,515.93
C1		263.36		50.92		44.58		154.16		1,109.87		29.20		1,652.09
C2		290.92		98.48		127.52		170.32		304.00		23.47		1,014.71
C3		297.12		78.41		38.72		291.42		603.34		118.95		1,427.96
SUB-TOTAL	29.2	851.40	33.3	227.81	29.7	210.82	48.5	615.90	79.7	2,017.21	38.4	171.62	47.9	4,094.76
S1		173.18		35.54		34.44		120.98		102.35		13.90		480.39
S2		188.08		48.26		54.22		112.62		99.73		18.66		521.57
S3		219.14		53.35		76.97		105.56		56.60		31.87		543.49
SUB-TOTAL	19.9	580.40	20.0	137.15	23.3	165.63	26.7	339.16	10.2	258.68	14.4	64.43	18.1	1,545.45
TOTAL	100.0	2,912.00	100.0	684.90	100.0	710.70	100.0	1,270.50	100.0	2,532.00	100.0	447.00	100.0	8,557.10

ANNEX 3-6-1 DAILY LOAD CURVE

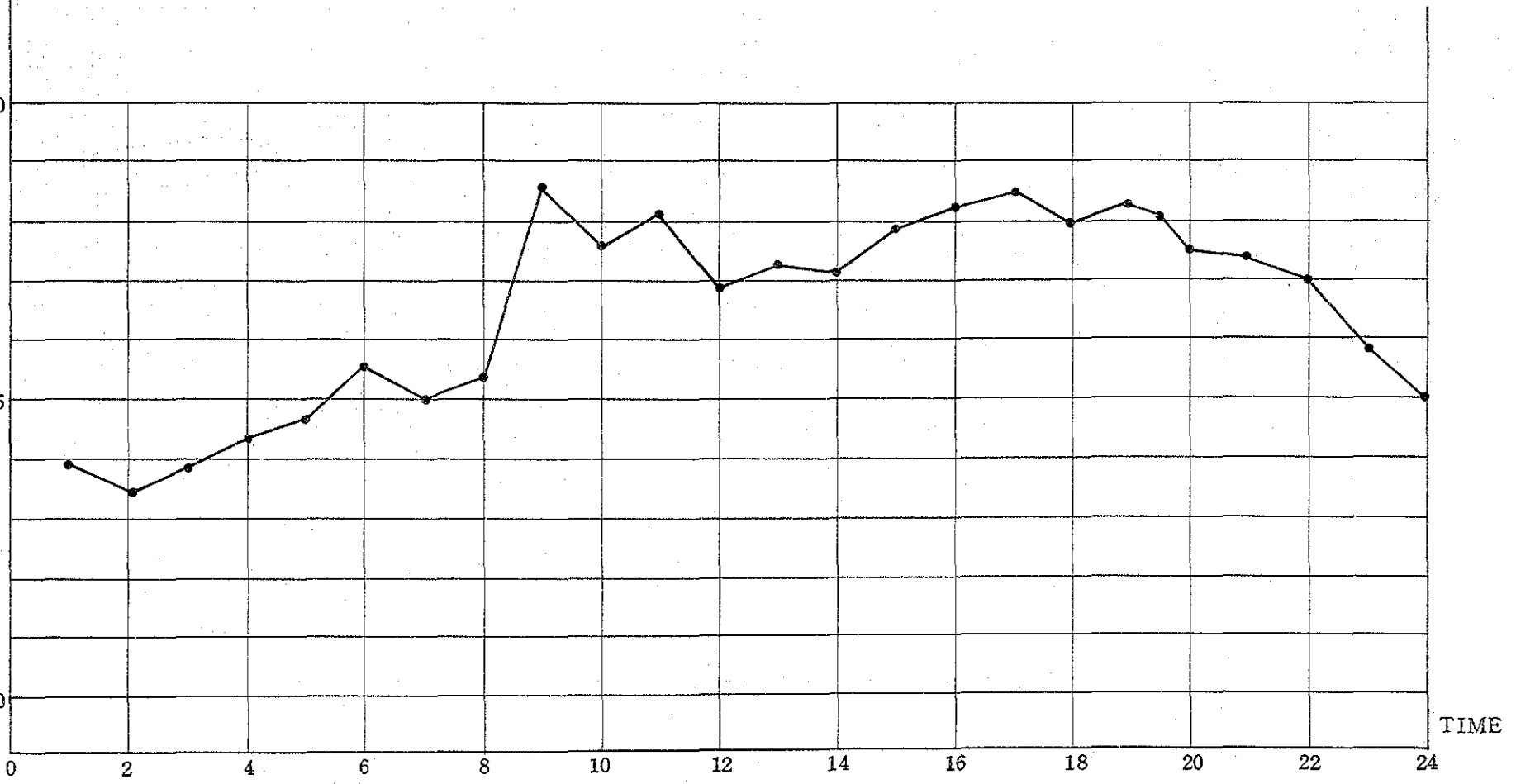
SAMUTSAKHON 1 S/S
DATE APRIL 24 1985



ANNEX 3-6-2 DAILY LOAD CURVE

SAMUTSAKHON 1 S/S

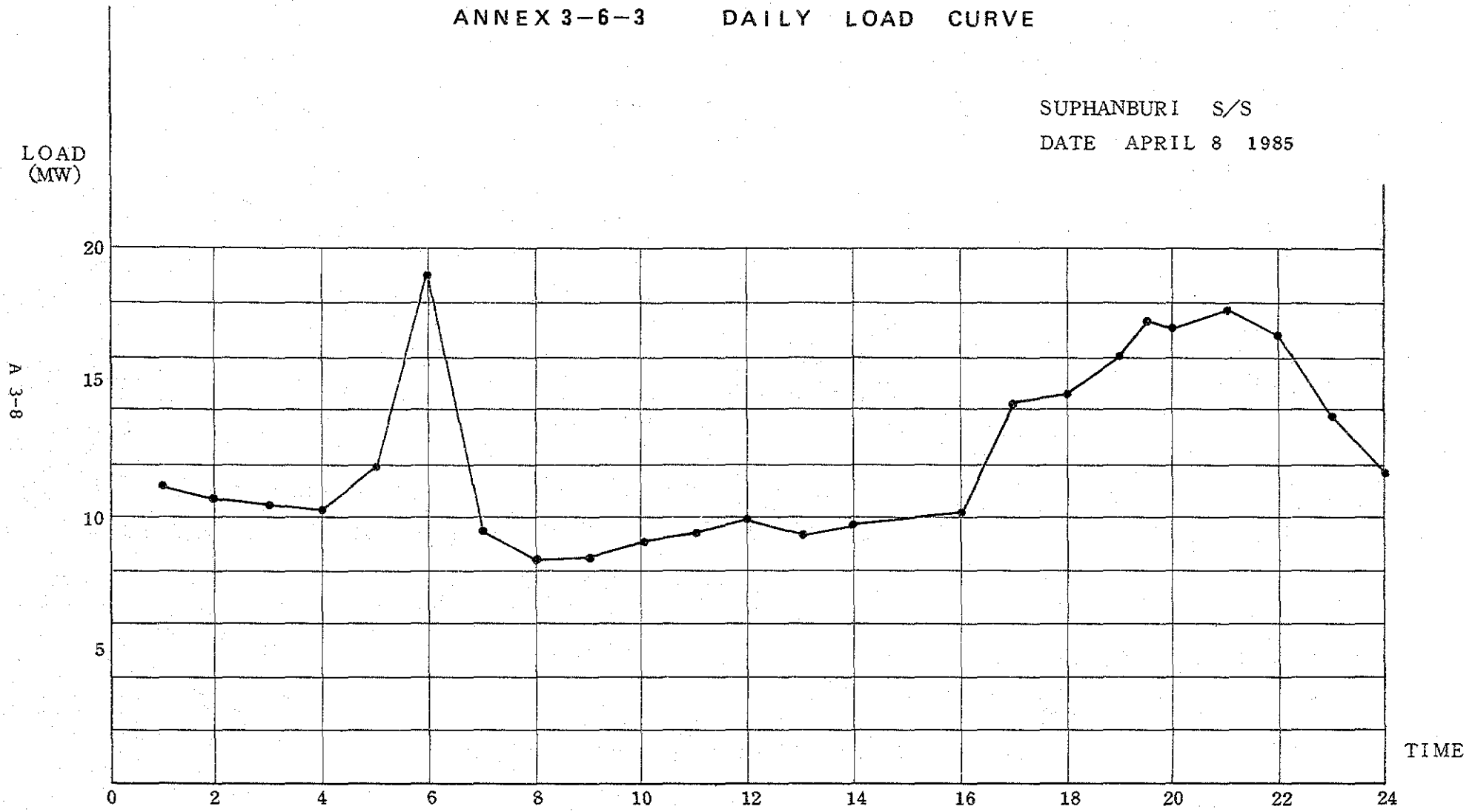
DATE AUGUST 14 1985



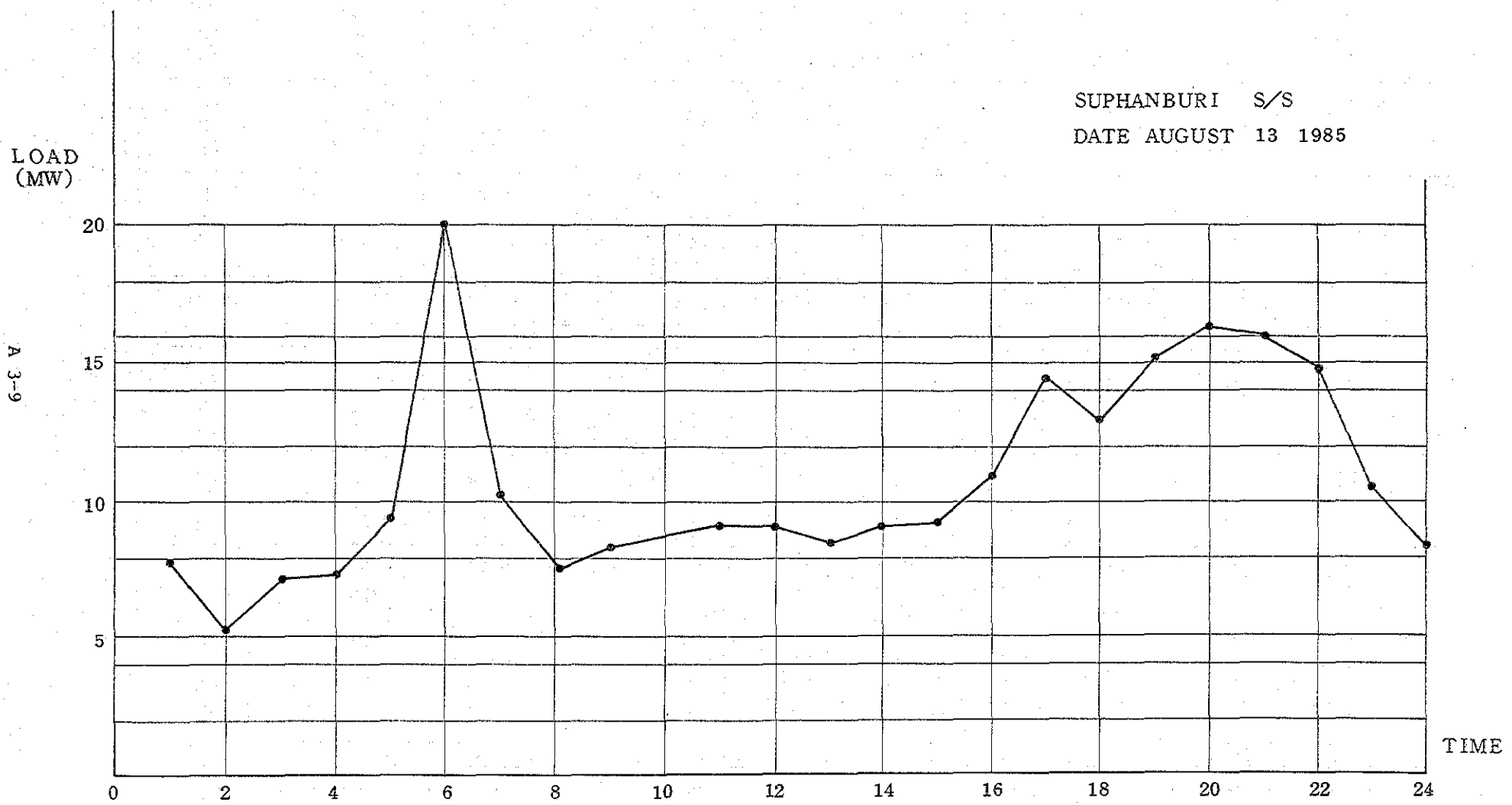
ANNEX 3-6-3 DAILY LOAD CURVE

SUPHANBURI S/S

DATE APRIL 8 1985



ANNEX 3-6-4 DAILY LOAD CURVE



ANNEX 3-7

LOAD FACTOR BY REGION

(%)

REGION	ACTUAL										
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
N1	47.6	40.3	43.2	43.3	46.0	44.3	40.8	41.5	42.1	42.8	42.9
N2	42.4	41.9	41.0	44.2	45.7	44.3	42.3	44.6	47.1	46.5	46.1
N3	46.1	45.9	45.8	48.5	46.9	48.9	51.2	48.7	50.1	50.4	51.6
NE1	43.2	44.1	44.1	45.3	45.2	46.4	43.6	42.5	41.4	41.6	41.1
NE2	39.8	38.0	41.3	42.8	41.1	41.0	36.8	40.3	35.9	38.2	38.4
NE3	50.7	52.0	50.4	50.8	51.9	55.2	52.0	46.7	48.9	48.2	49.9
C1	40.5	45.5	50.7	50.4	51.7	50.7	44.6	46.6	46.7	56.9	58.1
C2	49.8	51.7	51.3	52.7	55.9	58.1	56.5	56.8	58.2	56.7	58.9
C3	53.4	57.6	58.0	59.5	64.3	61.6	64.9	64.0	61.4	64.2	64.2
S1	49.7	50.8	47.8	48.2	59.3	56.3	51.4	54.1	58.6	53.5	58.3
S2	53.0	51.3	54.5	56.0	56.8	58.0	58.0	57.7	57.6	57.6	57.8
S3	51.3	41.5	51.0	52.2	54.3	56.6	53.1	52.1	50.4	54.2	54.8

REGION	FORECAST										
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	
N1	44.2	44.7	45.1	45.3	45.6	45.7	46.1	46.5	47.1	47.7	
N2	47.1	47.5	47.8	48.2	48.5	48.9	49.2	49.6	49.9	50.2	
N3	51.8	52.1	52.5	52.9	53.2	53.6	54.0	54.4	54.8	55.1	
NE1	43.4	43.8	44.1	44.5	44.9	45.3	45.7	46.0	46.4	46.8	
NE2	35.8	40.3	40.7	41.1	41.6	42.0	42.4	42.8	43.2	43.7	
NE3	52.0	52.4	52.8	53.2	53.6	54.0	54.4	54.8	55.2	55.6	
C1	66.9	65.7	66.4	67.5	67.6	67.8	68.0	68.1	68.3	68.6	
C2	59.0	61.9	61.6	61.6	61.7	61.7	62.1	62.4	62.7	63.1	
C3	61.1	64.5	64.9	65.2	65.6	66.0	66.4	66.8	67.2	67.6	
S1	58.6	59.1	60.1	60.5	61.0	61.4	61.8	62.3	62.7	63.2	
S2	57.4	58.4	58.8	59.3	59.7	60.1	60.5	61.0	61.4	61.8	
S3	46.9	54.5	54.9	55.3	55.7	56.1	56.6	57.2	57.7	58.3	

ANNEX 3-8-1

ENERGY DEMAND BY REGION

(UNIT: GWh)

REGION	ACTUAL											GROWTH RATE (%/YEAR)
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	
N1	122.38	154.00	210.25	248.84	285.73	306.35	339.30	391.72	467.31	524.88	583.94	13.8
N2	88.92	112.49	144.84	179.10	210.45	252.77	302.42	342.97	404.90	459.57	519.89	15.5
N3	133.72	161.87	212.74	249.76	277.37	304.51	338.91	367.05	421.15	459.08	504.29	10.6
SUB-TOTAL	345.03	428.37	567.83	677.70	773.55	863.63	980.63	1,101.73	1,293.35	1,443.53	1,608.12	13.2
NE1	161.57	186.84	215.34	257.40	282.48	309.43	365.10	438.91	502.62	561.78	609.44	14.5
NE2	71.16	88.84	113.07	142.40	160.44	184.02	225.36	253.16	307.91	359.73	406.18	17.2
NE3	172.50	209.65	250.90	294.62	337.93	383.39	433.13	472.52	543.77	622.98	682.69	12.2
SUB-TOTAL	405.23	485.33	579.31	694.43	780.85	876.84	1,023.60	1,164.60	1,354.30	1,544.49	1,698.31	14.1
C1	285.52	370.68	475.45	540.88	571.50	642.79	739.20	864.34	1,111.93	1,292.20	1,762.19	22.3
C2	221.79	278.24	339.34	442.89	505.24	571.53	650.16	712.38	863.11	979.52	1,113.03	14.3
C3	464.06	608.22	709.13	808.09	972.73	1,022.61	1,082.78	1,136.66	1,275.71	1,386.51	1,505.24	8.0
SUB-TOTAL	971.38	1,257.14	1,523.92	1,791.85	2,049.47	2,236.93	2,472.14	2,713.38	3,250.75	3,658.23	4,380.46	14.4
S1	179.60	207.22	246.84	274.56	342.76	328.22	372.62	429.77	479.06	511.58	567.38	11.6
S2	164.50	188.60	230.99	272.89	318.03	354.30	391.84	417.88	471.05	513.74	580.61	10.4
S3	81.15	109.13	166.29	212.11	271.24	315.79	362.28	412.01	481.04	528.86	577.46	12.8
SUB-TOTAL	425.24	504.95	644.12	759.56	932.03	998.30	1,126.74	1,259.66	1,431.16	1,554.19	1,725.45	11.6
GRAND TOTAL	2,146.87	2,675.78	3,315.18	3,923.54	4,535.90	4,975.70	5,603.11	6,239.37	7,329.56	8,200.44	9,412.34	13.6

REGION	FORECAST											GROWTH RATE (%/YEAR)
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995		
N1	635.97	707.76	773.56	850.09	936.72	1,035.28	1,138.12	1,241.78	1,344.01	1,447.94		9.5
N2	542.30	600.39	653.02	707.28	763.89	821.28	879.00	936.40	993.35	1,049.47		7.3
N3	548.76	607.07	651.69	698.11	747.19	796.79	846.59	895.96	944.86	993.02		7.0
SUB-TOTAL	1,727.02	1,915.22	2,078.28	2,255.47	2,447.80	2,653.36	2,863.70	3,074.14	3,282.22	3,490.42		8.1
NE1	654.75	721.05	781.96	844.30	909.21	974.66	1,040.09	1,104.54	1,167.79	1,229.36		7.3
NE2	439.66	492.86	543.42	596.38	652.11	709.46	769.85	831.26	893.53	957.08		8.9
NE3	719.44	786.49	845.23	904.67	966.24	1,027.58	1,088.46	1,147.97	1,206.11	1,262.25		6.3
SUB-TOTAL	1,813.85	2,000.41	2,170.61	2,345.35	2,527.55	2,711.70	2,898.40	3,083.76	3,267.44	3,448.70		7.3
C1	2,110.74	2,415.86	2,956.06	3,128.46	3,266.71	3,410.00	3,558.71	3,713.61	3,874.66	4,041.93		8.7
C2	1,218.52	1,405.87	1,565.01	2,098.79	2,234.31	2,391.41	2,525.56	2,661.74	2,799.69	2,938.61		10.2
C3	1,616.25	1,776.46	1,924.63	2,078.91	2,243.15	2,413.12	2,588.29	2,767.05	2,949.28	3,134.04		7.6
SUB-TOTAL	4,945.50	5,598.19	6,445.70	7,306.16	7,744.16	8,214.53	8,672.56	9,142.40	9,623.63	10,114.58		8.7
S1	596.09	661.62	781.55	845.37	912.63	982.50	1,054.40	1,127.85	1,202.32	1,277.24		8.5
S2	618.73	677.57	736.42	796.08	858.57	922.42	987.25	1,052.24	1,117.18	1,181.59		7.4
S3	633.90	723.00	796.54	892.47	992.40	1,095.60	1,180.10	1,267.11	1,356.50	1,447.87		9.6
SUB-TOTAL	1,848.73	2,062.18	2,314.51	2,533.92	2,763.60	3,000.52	3,221.75	3,447.20	3,676.00	3,906.70		8.5
GRAND TOTAL	10,335.10	11,576.00	13,009.10	14,440.89	15,483.12	16,580.10	17,656.40	18,747.50	19,849.29	20,960.40		8.3

ANNEX 3-8-2

PEAK DEMAND BY REGION

(UNIT: MW)

REGION	ACTUAL											GROWTH RATE (%/YEAR)
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	
N1	29.37	43.61	55.60	65.64	70.96	78.96	95.04	107.68	126.62	140.07	155.41	14.5
N2	23.94	30.64	40.37	46.23	52.61	65.18	81.64	87.74	98.05	112.91	128.67	14.6
N3	33.11	40.30	52.97	58.83	67.52	71.13	75.51	86.04	96.00	104.00	111.63	9.4
SUB-TOTAL	86.41	114.55	148.94	170.69	191.09	215.27	252.19	281.45	320.67	356.98	395.70	12.9
NE1	42.74	48.33	55.71	64.91	71.30	76.19	95.57	117.95	138.55	154.03	169.37	17.3
NE2	20.41	26.71	31.26	37.97	44.55	51.19	69.82	71.78	98.04	107.46	120.88	18.7
NE3	38.87	46.01	56.85	66.21	74.27	79.23	95.01	115.44	126.97	147.48	156.26	14.5
SUB-TOTAL	102.02	121.05	143.81	169.08	190.12	206.62	260.40	305.17	363.56	408.97	446.51	16.7
C1	80.43	92.90	107.13	122.54	126.30	144.72	189.16	211.71	271.95	259.19	346.05	19.0
C2	50.83	61.48	75.45	95.94	103.10	112.36	131.34	143.19	169.37	197.07	215.83	13.9
C3	99.28	120.45	139.60	155.12	172.82	189.62	190.31	202.84	237.00	246.37	267.80	7.1
SUB-TOTAL	230.53	274.83	322.19	373.59	402.23	446.70	510.81	557.73	678.32	702.63	829.69	13.2
S1	41.25	46.60	58.96	65.04	65.93	66.60	82.72	90.61	93.30	109.17	111.08	10.8
S2	35.41	41.99	48.35	55.62	63.88	69.74	77.15	82.61	93.34	101.77	114.66	10.5
S3	18.06	30.02	37.25	46.43	57.02	63.67	77.91	90.23	109.01	111.32	120.22	13.6
SUB-TOTAL	94.71	118.61	144.56	167.09	186.82	200.01	237.78	263.44	295.65	322.26	345.96	11.6
GRAND TOTAL	513.67	629.04	759.49	880.45	970.26	1,068.60	1,261.19	1,407.79	1,658.20	1,790.84	2,017.86	13.6

REGION	FORECAST											GROWTH RATE (%/YEAR)
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995		
N1	164.17	180.60	195.62	214.04	234.75	258.46	282.01	304.62	325.66	346.48		8.3
N2	131.39	144.39	155.87	167.60	179.72	191.85	203.89	215.70	227.25	238.46		6.4
N3	120.98	132.93	141.69	150.72	160.20	169.65	178.99	188.12	197.00	205.60		6.3
SUB-TOTAL	416.54	457.92	493.18	532.36	574.66	619.96	664.89	708.44	749.91	790.54		7.2
NE1	172.13	188.02	202.19	216.48	231.17	245.74	260.06	273.88	287.20	299.89		5.9
NE2	140.17	139.50	152.29	165.48	179.14	192.95	207.31	221.65	235.93	250.27		7.5
NE3	158.08	171.45	182.85	194.21	205.85	217.27	228.43	239.14	249.40	259.10		5.2
SUB-TOTAL	470.38	498.97	537.33	576.17	616.16	655.96	695.79	734.67	772.53	809.26		6.1
C1	360.42	419.58	508.41	529.43	551.53	574.29	597.81	622.12	647.21	673.07		6.9
C2	235.68	259.15	289.99	388.75	413.10	442.18	464.51	486.92	509.36	531.67		9.4
C3	302.14	314.30	338.75	363.92	390.46	417.58	445.25	473.15	501.26	529.42		7.1
SUB-TOTAL	898.23	993.03	1,137.16	1,282.10	1,355.09	1,434.05	1,507.57	1,582.19	1,657.83	1,734.16		7.7
S1	116.08	127.81	148.38	159.40	170.89	182.69	194.68	206.75	218.82	230.77		7.6
S2	122.96	132.34	142.98	153.36	164.22	175.18	186.16	197.00	207.67	218.09		6.6
S3	154.13	151.39	165.51	184.07	203.31	222.92	237.86	252.99	268.29	283.65		9.0
SUB-TOTAL	393.17	411.54	456.87	496.83	538.43	580.79	618.69	656.75	694.78	732.50		7.8
GRAND TOTAL	2,178.32	2,361.46	2,624.53	2,887.45	3,084.34	3,290.76	3,486.95	3,682.05	3,875.04	4,066.46		7.3

ANNEX 3-9-1

SUBSTATION DATA (N1)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
			C B	RECLOSER		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
				HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. CHIANG MAI 1	1 x 13.3	11			3										1				3	3		
2. CHIANG MAI 2	2 x 25 3 x 3.3	11 & 22	B 5	4		1												4		9	4	4
3. CHIANG MAI 3	1 x 50	22			4										1				4	4		
4. CHIANG RAI	2 x 25	33	B 7			1												4		7	10	
5. LANPHUN 1	1 x 6.5 1 x 4	22		1	1										1				3	2	3	
6. LANPHUN 2	1 x 13.3	22	B 8			1												3		8	4	3
7. LANPANG 1	3 x 6.5 1 x 5	22	M 5												1				3	5		1
8. LANPANG 2	1 x 25	22	B 4			1												3		4		
9. FANG	1 x 4 2 x 2	22			2															2	1	1
10. MAE HONG SON	2 x 1	22	M 1																	2		
11. MAE MHAO 2 (EGAT)	1 x 4	11		1																1		
12. MAE SARING (NEA)	1 x 2 2 x 0.8	22	M 2																	2		
13. PHAYAO	1 x 25 1 x 16.7	33	B 4			1												3		4	5	
14. THOEN	2 x 2.5	22		3																3		
TOTAL 14	30 310.8		36	9	10	5	0	0	0	0	0	0	0	0	4	0	0	17	13	56	27	9

ANNEX 3-9-2

SUBSTATION DATA (N2)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
			C B	RECLOSER		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
				HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. BHUMIBOL	1 x 2.5	22		1																1		
2. KAMPHAENG PHET	2 x 12.5	22	V 4			1												3		4	4	
3. NAN	1 x 4	22	M 3												1				3	3	4	
4. PHARE	2 x 25	22	B 5			1												4		5	4	
5. PHICHIT	1 x 25	22	B 3			1												4		3	7	
6. PHITSANULOK 1	2 x 25	22	B 6			1												4		7	5	2
7. PHITSANULOK 2	1 x 12.5	22			1									1					3	2		
8. SIRIKIT	1 x 5	22		2																1		
9. SUKHO THAI	1 x 25	22	B 4			1												3		5	4	
10. TAK	1 x 12.5	22	M 2		2												1		3	4	2	1
11. UTTARADIT	1 x 25	22	B 4			1												4		4	4	
12.																						
13.																						
14.																						
TOTAL 11	14 236.5		31	3	3	6	0	0	0	0	0	0	0	1	1	0	1	22	9	39	34	3

ANNEX 3-9-3

SUBSTATION DATA (N3)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
				RECLOSER		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
			C B	HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. LOP BURI 1	1 x 25 2 x 6.25	22	B 6			1												3		5	2	
2. LOP BURI 2	1 x 25	22			3										1				3	6	5	
3. MANOROM	2 x 12.5	22	V 3			1												3		4	6	
4. NAKHON SAWA	2 x 40	22	M 6							1									4	6	9	
5. PHETCHABUN	1 x 25	22	M 4			1												3		7	4	1
6. SING BURI	1 x 25	22	B 3			1												4	3	3	3	
7. TAKHLI 2	1 x 6.25	22		2											1					3	3	
8.																						
9.																						
10.																						
11.																						
12.																						
13.																						
14.																						
TOTAL 7	11 223.75		22	2	3	4	0	0	0	1	0	0	0	0	2	0	0	13	10	34	32	1

ANNEX 3-9-4

SUBSTATION DATA (NE1)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
			C B	RECLOSER		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
				HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. CHUN PHAE	3 x 6.25	22			3										1				3	5	10	
2. KHON KHAEN 1	2 x 25	22	V 6			1												4		6	7	
3. LOEI	1 x 25	22	V 4 B 1			1												3		5	9	
4. NAKHON PHANOM	1 x 12.5	22	M 1	2											1				3	3	3	
5. NAM PHONG	1 x 12.5	22	V 4			1												3		2	4	
6. NAM PHUNG	1 x 3.6	22	B 1																	1	1	
7. NONG KHAI	1 x 31.5	22	B 5							1									3	5	7	
8. PHANG KHON	2 x 13	22	V 4			1												3		4	4	
9. SAKON NAKHON	1 x 25	22	B 4			1												3		4	6	
10. THAT PHANOM	1 x 6.3	22		2											1				3	2	4	
11. UDON THANI 1	1 x 31.5	22	B 5							1									3	4	11	
12. UDON THANI 2	2 x 25	22	B 4 V 2			1												4		6	7	
13.																						
14.																						
TOTAL 12	17 292.65		41	4	3	6	0	0	0	2	0	0	0	0	3	0	0	20	15	47	73	0

ANNEX 3-9-5

SUBSTATION DATA (NE2)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
			C B	RECLOSER		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
				HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. KALASIN	1 x 25	22	V 4			1												3		4	6	1
2. MAHA SARAKHAM	2 x 25	22	B 6							1									4	6	7	
3. MUKDAHAN	1 x 13	22	M 1														1		3	3	5	
4. ROIET	1 x 25	22			2										1				3	2	6	
5. SIRINDHON	1 x 6	22	B 2																	2	5	
6. SISAKET	1 x 25 2 x 10	22	V 4			1												3		4	7	
7. SOMDET	1 x 12.5	22		3																3	3	
8. UBON RATCHATHANI 1	2 x 31.5	22	B 6			1												4		6	12	
9. YOSOTHON	2 x 25	22	V 3		1	1												4		6	7	
10.																						
11.																						
12.																						
13.																						
14.																						
TOTAL 9	14 289.5		26	3	3	4	0	0	0	1	0	0	0	0	1	0	1	14	10	36	58	1

ANNEX 3-9-6

SUBSTATION DATA (NE3)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
			C B	RECLOSER		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
				HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. BURI RAM	2 x 12.5	22	V 4	1		1												4		5	6	
2. CHIYA PHUM	2 x 13	22	V 4			1												3		5	3	
3. NAKHON RATCHASIMA 1	2 x 31.5	22	M10			1												4		10	12	
4. NAKHON RATCHASIMA 2	1 x 25	22	V10			1												4		10	2	1
5. PAK CHONG	1 x 25	22	V 4			1												3		4	2	
6. PHON	1 x 25	22	V 5			1												4		5	7	
7. SHIKHIU	1 x 31.5	22	V 6			1												3		6	2	
8. SURIN	2 x 25	22	M 4 V 1			1												4		5	6	1
9.																						
10.																						
11.																						
12.																						
13.																						
14.																						
TOTAL 8	12 270.5		48	1	0	8	0	0	0	0	0	0	0	0	0	0	0	29	0	50	40	2

ANNEX 3-9-7

SUBSTATION DATA (C1)

SUBSTATION	POWER TRANSFORMER CAPACITY (MVA)	VOLTAGE (kV)	NO. OF SWITCHGEAR			NO. OF CONTROL ROOM												NO. OF STAFF AT CONTROL STATION		NO. OF FEEDER	NO. OF RECLOSER ON DISTRIBUTION LINE	
						EXISTING				UNDER CONST.				FUTURE PLAN								
			C B	RECLOSER		TYPE				TYPE				TYPE				PRESENT	FUTURE PLAN			
				HYDRAULIC	ELECTRONIC	1	2	3	4	1	2	3	4	1	2	3	4				HYDRAULIC	ELECTRONIC
1. ANG THONG 1	1 x 10	22			1									1					3	3		
2. ANG THONG 2	1 x 25	22		2	1									1					3	4		
3. AYUTHAYA 1	1 x 40	22		3	1									1					3	4	2	
4. BANG KHAN	2 x 40	69 22	M 2 B 10						1									4		7	1	1
5. BAM MAI	2 x 40	115 69 22	SF6 1 1 SF6 2 V 11					1										8		8	2	1
6. BAM PA IN	2 x 25	22	B 7			1												4		6	2	
7. PRACHIN BURI	2 x 25	22	B 9			1												3		10	8	
8. PATHUM THANI	1 x 40	115 22	SF6 3 V 7					1										4		8		
9. SARABURI 1	2 x 40	22	M 7																	5	3	
10. SARABURI 2	1 x 25	115 22	SF6 3 M 5			1												4		5		
11. SARABURI 3	1 x 25	22	M 4								1								4	3		
12. SARABURI 4	1 x 25	22	M 5			1												3		5	2	
13. THALAN	1 x 25 1 x 6	22 11	V 6	1		1												3		7		
14.																						
TOTAL 13	19 546		92	6	3	5	0	2	1	0	1	0	0	3	0	0	0	33	13	75	20	2