10.5.2 Construction Cost of Substations

The total amount of the construction cost of substations in the respectively scheduled commissioning years indicated in Clause 10.2.2 is presented in the table below in terms of the price level in 1955. The exchange rate is US$1 = 25 Baht.

(Unit: M.Baht)

Planning year	2001	2006	2011	2016
Period from the last year	5	5	5	5
Total amount	15,796 (631.82)	9,772 (390.89)	6,702 (268.06)	5,646 (225.85)
Annual investment	3,159 (126.36)	1,954 (78.18)	1,340 (53.61)	1,129 (45.17)

Figures in parenthesis are construction cost in Million US$.

The total construction cost of substation is estimated at 37,916 million Baht (US$ 1,516.62 million), and the construction cost of distribution substations shares 81.7% (30,979 million Baht) of the total cost.

The yearly average amount of investment to be required for construction and modernization of substations is estimated to range from 1,129 ~ 3,159 million Baht per year (from 45.17 ~ 126.36 million US$ per year) in terms of the price level in FY 1995. Particularly during the 5 years (Eighth Plan) from FY 1997 through to FY 2001, 15,796 million Baht (US$ 631.82 million) corresponding to as much as 41.7% of the total amount of investment will have to be invested.

115 kV or 69 kV Distribution Substation

(Unit: M.Baht)

Planning year	2001	2006	2011	2016
Foreign currency	7,790	4,399	3,114	2,080
Local currency	5,897	3,309	2,645	1,744
Total amount	13,687 (547.48)	7,708 (308.32)	5,759 (124.56)	3,824 (83.20)

Figures in parenthesis are construction cost in Million US$.

230 kV Terminal Station

(Unit: M.Baht)

Planning year	2001	2006	2011	2016
Foreign currency	1,358	1,468	615	1,166
Local currency	750	596	328	656
Total amount	2,108 (84.32)	2,064 (82.56)	943 (37.72)	1,822 (72.88)

Figures in parenthesis are construction cost in Million US$.

The construction cost of the respective substations to be allocated in the respective fiscal years is presented in Tables 10.5-1 and 10.5-2.

Although the work period required for construction of substations may vary more or less depending on the construction system of MEA (Refer to Clause 10.2.2), such a period is estimated to range from 15 months to 25 months after entering into a contract with an equipment manufacturer or contractor. Therefore, it is estimated that 40% of the total construction cost be disbursed in the initial fiscal year as a partial portion of the land acquisition and civil work costs as well as part of the procurement cost of materials, and remaining 60% be disbursed in the next fiscal year.

Meanwhile, the breakdown of the construction and addition costs of the respective substation (divided into foreign and local currency portions, direct and indirect costs) is presented in Appendix 10.5-2 and 10.5-3.

Table 10.5-1 Construction Cost Disbursement for Terminal Stations

No.	Substation	Voltage (kV)	Number and Capacity (MVA)				Construction Cost Disbursement (Price level in Year 1995, Million Baht)								
			1997 ~ 2001	~ 2006	~ 2011	~ 2016	1997	1998	1999	2000	2001	2006	2011	2016	Total
1	South Thonburi	230 - 69	4×200	4×200	4×200	2×200 2×300	6.319 (2.528)							58.056	64.375
2	Klongrangsit	230 - 115 230 - 69	2×200 2×200	2×200 3×200	3×200 3×200	4×200 3×200	29.028 (11.611)					29.028	29.028	29.028	116.112
3	Nongjok	230 - 115	2×200 1×300	2×200	4×300	4×300	29.028 (11.611)						29.028		58.056
4	Teparak	230 - 115 230 - 69	1×300 2×300 1×300 2×300 (1998)	2×300 2×300	2×300 2×300	2×300 2×300	2.528	3.791							6.319
5	Jangwatana	230 - 115	2×300 3×300 (1998)	4×300	4×300	4×300	6.053	9.079				6.319			21.451
6	Sainoi	230 - 115	1×300 2×300 (1999)	2×300	2×300	3×300		11.611	17.417					29.028	58.056
7	Bangkoknoi	230 - 115	1×300 2×300 (2000)	2×300	3×300	4×300			2.528	3.791			212.939	6.319	225.577
8	Bangkapi	230 - 69	4×200 2×200 2×300	2×200 2×300	2×200 2×300	4×300				23.222	34.833			58.056	116.111
9	North Bangkok	230 - 69	2×200 4×200 1×285	4×200	4×200	2×200 2×300				23.222	34.833			58.056	116.111
10	South Bangkok	230 - 69 230 - 115	4×200 2×200 2×300 2×200	2×200 2×300 3×200	4×300 3×200	4×300 3×200				23.222	34.833	29.028	58.056		145.139
11	Bangplee	230 - 115	3×200	4×200	4×200	2×200 2×300						29.028		58.056	87.084
12	Bangbor	230 - 115	1×300	2×300	3×300	3×300				86.189	129.284	6.319	212.939		434.731
13	Onnuj	230 - 115	2×300 (1998)	3×300	4×300	4×300	86.189	129.284				15.132	212.939		443.544
14	Lardprao	230 - 69	4×200	2×200 2×300	2×200 2×300	4×300						58.056		58.056	116.112
15	Sanampao	230 - 115 230 - 69	1×300 1×300 (2000)	1×300 2×300	2×300 2×300	3×300 2×300			355.652	533.479		68.023	75.615	75.615	1,108.384
16	Ratchada	230 - 115 230 - 69	1×300 (2000) 2×300	1×300 2×300	2×300 2×300	2×300 3×300			86.189	129.284			29.028	29.028	273.529
17	Talingchan	230 - 115		2×300	3×300	4×300						215.473	15.132	6.319	236.924
18	Thonburi	230 - 69		1×300	2×300							527.910	68.023		595.933
19	Klongtoei	230 - 115		2×300	2×300	3×300						756.720		75.615	832.335
20	Patanakarn	230 - 115		3×300	3×300	4×300						323.211		6.319	329.530
21	Thanontok	230 - 115	2×300 (1999)	2×300	2×300	2×300		110.822	166.234						277.056
22	Ramintra	230 - 115				2×300								926.901	926.901
23	Ratburana	230 - 115 230 - 69				2×300 2×300								347.701	347.701
			Total				159.145 (25.750)	264.587	628.020	822.409	233.783	2,064.247	942.727	1,822.153	6,937.071

Note : Figures in parenthesis are construction cost to be disbursed in FY 1996.

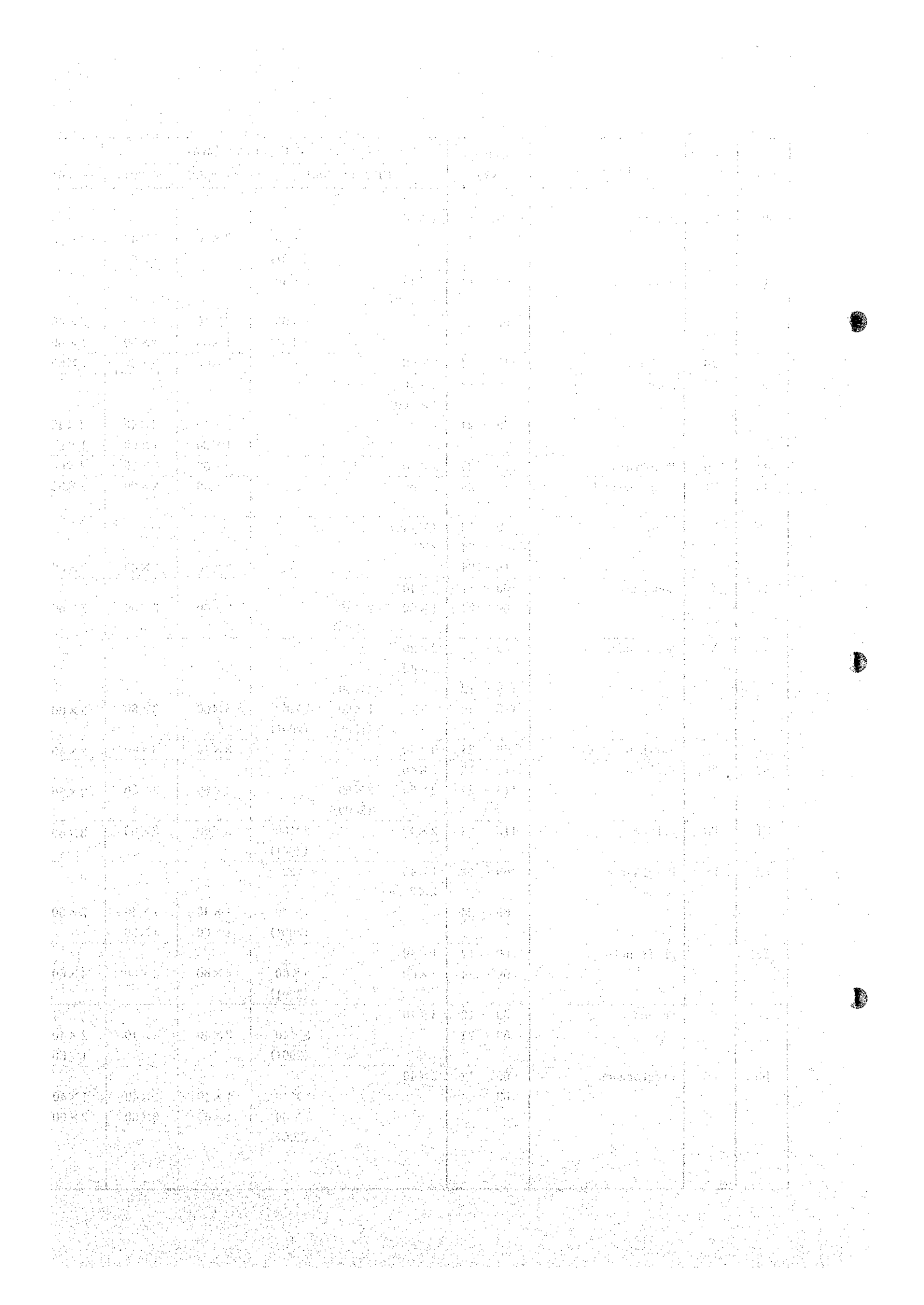
Table 10.5-2 Construction Cost Disbursement for Distribution Substations

No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA) 1997 ~ 2001	~ 2006	~ 2011	~ 2016	Construction Cost Disbursement (Price level in Year 1995) 1997	1998	1999	2000	2001	2006	2011	2016	Total
1	BB	Bangbon	69 - 12 69 - 24	3×40 2×40 1×40 3×40 (1999) (2001)	3×40	3×40	3×40									0
2	BN	Bangchalong	115 - 24	2×60	3×60	3×60	3×60	178.232 (71.293)					22.551			200.783
3	BA	Bangkapi	69 - 12 69 - 24	2×40 1×60	1×40 2×60	1×40 2×60	1×40 2×60						21.322			21.322
4	KA	Bangkhaen	115 - 24	1×60 2×60 (1999)	3×60	3×60	3×60		84.255	126.383			22.551			233.189
5	BR	Bangkhunprom	69 - 12	3×40	3×40	3×40	3×40									0
6	BL	Bangklo	69 - 12 69 - 24	1×40 1×40 2×40 (2001)	2×40	2×40	1×40 2×60								21.322	21.322
7	BO	Bangkoknoi	69 - 12 69 - 24	1×40 1×60	1×40 2×60	1×40 2×60	1×40 2×60	22.551 (9.020)					21.322			43.873
8	BC	Bangkrachao	69 - 12 69 - 24	2×10	1×60	2×60	2×60						31.585	158.094		189.679
9	BM	Bangmod	69 - 12 69 - 24	2×(40) 2×(40) 1×60 (1999)	3×60	3×60	3×60		8.529	12.793						21.322
10	BG	Bangna	69 - 24	2×40	2×40	2×40	1×40 1×60								21.322	21.322
11	BJ	Bangnamjued	115 - 24	1×20 2×60	1×20 2×60	1×20 2×60	1×20 2×60									0
12	BI	Bangping	115 - 24	2×60	2×60	3×60	3×60							22.551		22.551
13	BK	Bangplakod	69 - 12 69 - 24	3×(40)	3×60	3×60	3×60									0
14	BP	Bangplee	69 - 24	2×60	2×60	2×60	2×60									0
15	PG	Bangpongpang	69 - 12 69 - 24 115 - 24	1×40 1×60 2×60 (1999)	3×60	3×60	3×60		9.020	13.531			22.551			45.102
16	BD	Bangpood	115 - 24	2×60	3×60	3×60	3×60						22.551			22.551
17	BU	Bangpu	115 - 24	2×40	3×60	3×60	3×60						233.189			233.189
18	RY	Bangrakyai	115 - 24	2×60	2×60	2×60	2×60									0
19	BS	Bangsaotong	115 - 24	1×60	2×60	3×60	3×60						178.232	22.551		200.783
20	BY	Bangyeekhan	69 - 12 69 - 24	1×40 1×40 2×40 (2001)	2×40	2×40	2×40									0
21	CG	Chalongkrung	115 - 24	1×60	2×60	2×60	2×60						178.232			178.232
22	CK	Chankasem	69 - 12 69 - 24	2×40 1×40 1×60 1×40 1×60 (1999)	2×40 1×60	2×40 1×60	2×40 1×60									0

Note : Figures in parenthesis are construction cost to be disbursed in FY 1996.

No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA) 1997 ~ 2001	~ 2006	~ 2011	~ 2016	Construction Cost Disbursement (Price level in Year 1995) 1997	1998	1999	2000	2001	2006	2011	2016	Total
23	CL	Chidlom	230 - 12 69 - 24	2×50	2×60	2×60	2×60						189.25			189.250
24	DM	Donmuang	115 - 24	2×40 2×60 (1998) 1×60	3×60	3×60	3×60	84.255	126.383				22.551			233.189
25	HK	Huaykwang	69 - 24	2×60 3×60 (2001)	3×60	3×60	3×60				8.529	12.793				21.322
26	KP	Kingpetch	69 - 12 69 - 24	3×(40) 2×(40) 1×60 (2001)	3×60	3×60	3×60									0.000
27	KJ	Klongjan	69 - 24	1×40 2×60	1×40 2×60	1×40 2×60	1×40 2×60									0.000
28	KM	Klongmai	69 - 24	1×40 2×60 (2000)	2×60	3×60	3×60			75.700	113.550			21.322		210.572
29	SC	Klongsanamchai	69 - 12 69 - 24 115 - 24	1×40 1×40 1×(40) 1×60 (1999)	2×60	2×60	3×60	158.094 (63.238)					210.638		22.551	391.283
30	KS	Klongsanpasamit	69 - 12 69 - 24	2×20 1×40	1×40 1×60	1×40 1×60	2×60						21.322		21.322	42.644
31	KN	Klongsarn	69 - 24	2×40	2×40	2×60	2×60							164.744		164.744
32	KT	Klongtoei	69 - 12 69 - 24	2×40 1×40 1×40 2×40 (1998) (2001)	2×40	3×60	3×60							183.112		183.112
33	WG	Klongwatsing	69 - 12 69 - 24	2×(40) 2×60 (2001)	2×60	3×60	3×60							21.322		21.322
34	KU	Krunai	69 - 12 69 - 24	1×40 1×(40)	2×60	3×60	3×60						21.322	21.322		42.644
35	LK	Lardplakao	115 - 24	1×60	1×60	1×60	2×60								158.094	158.094
36	LP	Lardprao	69 - 12 69 - 24	2×(40) 1×(40) 2×(40) 1×60 1×60 (1999) (2001)	3×60	3×60	3×60	183.112 (73.245)			8.529	12.793				204.434
37	LN	Lumpini	69 - 12 69 - 24	4×40 1×40 2×40 1×60 (2001)	3×40 1×60	3×40 1×60	3×40 1×60				8.529	12.793				21.322
38	MN	Mahaisawan	69 - 12 69 - 24	2×40 1×40 1×60 1×40 2×40 1×60 1×60 (2000) (2001)	2×40 1×60	2×40 1×60	2×40 1×60									0
39	MM	Mahamek	69 - 12 115 - 24	2×40 1×(40) 3×60 (2001)	3×60	3×60	3×60				93.276	139.913				233.189

No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA)				Construction Cost Disbursement (Price level in Year 1995)								
				1997 ～ 2001	～ 2006	～ 2011	～ 2016	1997	1998	1999	2000	2001	2006	2011	2016	Total
40	MA	Mai-ad	69 - 12 69 - 24	2×40 2×40 (2001)	2×40	1×40 1×60	2×60							21.322	21.322	42.644
41	MS	Makasan	69 - 12 69 - 24	2×40 2×40 1×(40) 1×60 (2001)	2×40 1×60	2×40 1×60	2×40 1×60	21.322 (8.529)								21.322
42	MB	Minburi	115 - 24	2×60	3×60	3×60	3×60						22.551			22.551
43	MC	Mochit	69 - 12 69 - 24	2×40 1×(40)	2×40 1×60	2×40 1×60	2×40 1×60									0
44	MG	Muangmain	115 - 24	2×60	2×60	2×60	2×60									0
45	MI	Muangthong 1	115 - 24	2×60	2×60	2×60	2×60	178.232 (71.293)								178.232
46	NN	Na-na	69 - 12 69 - 24 115 - 24	1×(40) 2×60	3×60	3×60	3×60						233.189			233.189
47	NH	Nongkham	69 - 12 69 - 24	1×40 1×60 2×60 (1998)	3×60	3×60	3×60	8.529	12.793				21.322			42.644
48	NR	Nonthaburi	69 - 12 115 - 12 115 - 24	2×20 1×40 1×40 1×60 2×60 (1998) (2001)	3×60	3×60	3×60	82.094	123.140		9.020	13.531	22.551			250.336
49	NK	North Bangkok	69 - 24	3×40	3×40	3×40	3×40									0
50	PE	Pakkred	115 - 12 115 - 24	1×40 2×60 3×60 (2000)	3×60	3×60	3×60	228.944 (91.578)		9.020	13.531					251.495
51	PN	Paknam	115 - 24	2×40 2×60 (2001)	3×60	3×60	3×60				18.040	27.061	22.551			67.652
52	PS	Petchkasem	69 - 12 69 - 24	1×40 2×22.4 2×22.4 1×40 (2001)	1×40 1×60	1×40 1×60	2×60						31.585		21.322	52.907
53	PI	Phaisingto	69 - 12 69 - 24	1×40 2×60 3×60 (2001)	4×60	4×60	4×60				8.529	12.793	60.971			82.293
54	PJ	Poojao	69 - 12 69 - 24	3×40 3×40 (2001)	3×40	3×40	2×40 1×60								21.322	21.322
55	PC	Prachachuen	69 - 12 69 - 24	2×40 1×40 1×60 (2001)	1×40 1×60	1×40 2×60	1×40 2×60				8.529	12.793		21.322		42.644

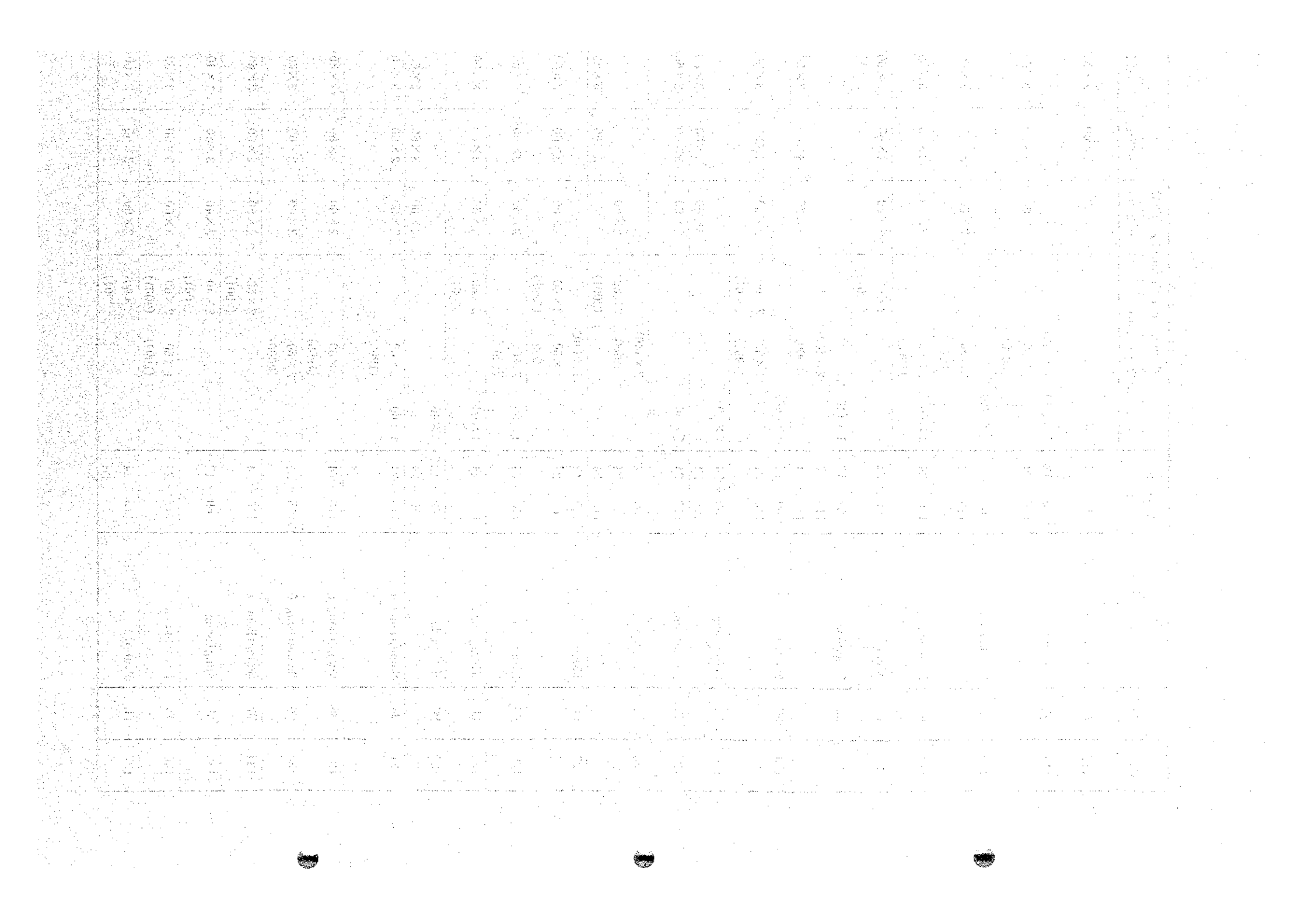


No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA) 1997 ~ 2001	~ 2006	~ 2011	~ 2016	Construction Cost Disbursement (Price level in Year 1995) 1997	1998	1999	2000	2001	2006	2011	2016	Total
56	PK	Prakanong	69 - 12 69 - 24	2×40 1×40 1×40 2×40 (1998) (2001)	2×40	2×40	2×60								183.112	183.112
57	PR	Prakasa	115 - 24	2×40 1×60	2×40 1×60	2×40 1×60	2×40 1×60									0
58	PO	Pranok	69 - 12 69 - 24	2×40 1×40 1×40 2×40 (2000) (2001)	2×40	2×40	2×40									0
59	PD	Prapradaeng	69 - 12 69 - 24	3×40	3×40	3×40	3×40									0
60	PA	Prasanmit	69 - 12 69 - 24	2×40 2×40 1×40 1×40 3×40 (1998) (2000)	3×40	3×40	3×40									0
61	PM	Prathumwan	69 - 12 69 - 24	3×40 1×40 2×40 (2001)	3×40	3×40	3×40									0
62	RT	Ramintra	115 - 24	2×60	3×60	3×60	3×60						22.551			22.551
63	RH	Ramkhamhaeng	69 - 24	2×40 1×60	2×40 1×60	2×40 1×60	2×40 1×60									0
64	RN	Rasburana	69 - 12 69 - 24	3×40	3×40	3×40	3×40									0
65	RK	Romklao	115 - 24	2×60	2×60	3×60	3×60							22.551		22.6
66	RC	Rungpracha	69 - 24	3×60	3×60	3×60	3×60									0
67	SM	Sailom	69 - 12 69 - 24	2×40	2×40	2×40	1×40 1×60								21.322	21.322
68	SR	Samrong	69 - 12 69 - 24	2×40 1×40 1×60 2×60 3×60 (1999) (2001)	3×60	3×60	3×60		8.529	12.793	8.529	12.793				42.644
69	SN	Samsen	69 - 12 69 - 24	3×40 2×40 1×40 (2001)	3×40	3×40	2×40 1×60								21.322	21.322
70	SS	Sansah	69 - 12 69 - 24	1×40 2×40	2×40 1×60	2×40 1×60	1×40 2×60						21.322		21.322	42.644
71	SD	Sapandam	69 - 12	4×40	4×40	4×40	4×40									0
72	SP	Sapanmai	69 - 24	2×60	3×60	3×60	3×60						21.322			21.322
73	SL	Silom	69 - 12 69 - 24	2×40	2×40	2×40	1×40 1×60								21.322	21.322
74	SY	Sipraya	69 - 12 69 - 24	2×40 1×40 1×40 (2001)	2×40	2×40	2×40									0
75	SV	Soonvijai	69 - 12 69 - 24	1×40 2×60	1×40 2×60	1×40 2×60	1×40 2×60									0

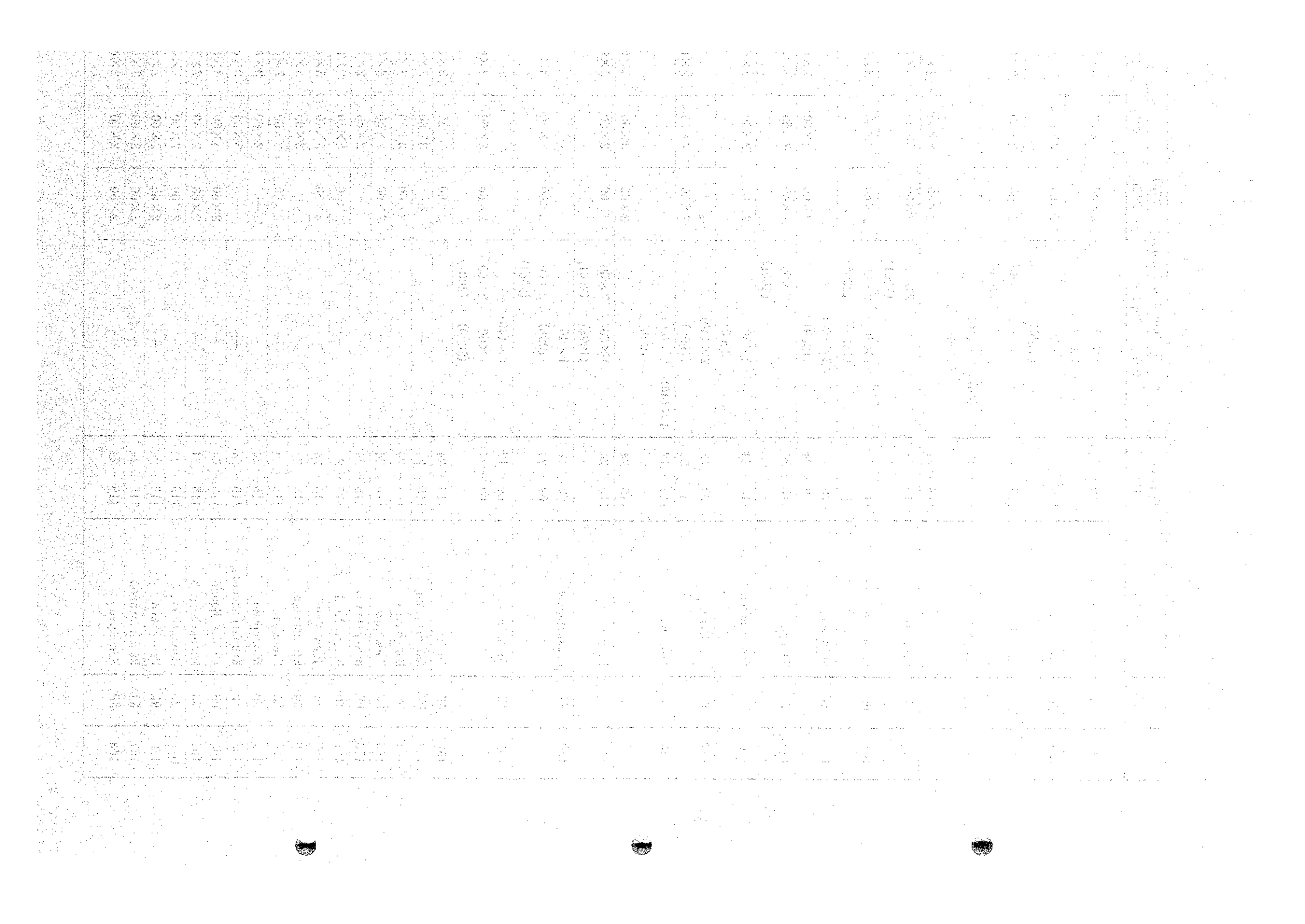
No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA) 1997 ~ 2001	~ 2006	~ 2011	~ 2016	Construction Cost Disbursement (Price level in Year 1995) 1997	1998	1999	2000	2001	2006	2011	2016	Total
76	SK	South Bangkok	69 - 12 69 - 24	2×20 1×60 (2001)	1×60	1×60	1×60				65.736	98.603				164.339
77	ST	South Thonburi	69 - 12 69 - 24	2×(40) 1×(40) 1×60 (1999) 2×60 (2000)	3×60	3×60	3×60						21.322			21.322
78	YA	Srithanya	69 - 12 69 - 24 115 - 24	1×(40) 1×(40) (1999)	2×60	3×60	3×60						210.638	22.551		233.189
79	SO	Suansom	69 - 12 69 - 24	2×40 2×60 (2001)	2×60	3×60	3×60				73.245	109.867		21.322		204.434
80	SU	Surawong	69 - 12 69 - 24	3×40 1×40 2×60 (2001)	3×60	3×60	3×60				17.057	25.586	21.322			63.965
81	TS	Taksin	69 - 12 69 - 24	1×40 1×40 2×40 (1999)	2×40	2×40	2×40									0
82	TP	Teparak	69 - 24	2×40 1×60	2×40 1×60	2×40 1×60	2×40 1×60									0
83	TT	Thanontok	69 - 12 69 - 24	1×40 1×40 1×(40) 2×60 (1998) (2001)	2×60	3×60	3×60	68.191	102.287		8.529	12.793		21.322		213.122
84	TB	Thonburi	69 - 12 69 - 24	2×40 1×60	2×40 1×60	2×40 1×60	2×40 1×60									0
85	TK	Tongkung	69 - 12 69 - 24	2×40 2×40 (2001)	2×40	2×40	2×40									0
86	WB	Wangpetchaboon	69 - 12 69 - 24	2×40 2×40 1×(40) 3×60 (1999) (2001)	3×60	3×60	3×60		8.529	12.793	73.245	109.867				204.434
87	WT	Wangthonglang	69 - 24	3×60	3×60	3×60	3×60									0
88	WL	Watlieb	69 - 12	3×40	3×40	3×40	4×40								58.842	58.842
89	YT	Yothee	69 - 12 69 - 24	2×40	2×40	2×40	2×40									0
90	BE	Bangkaen	69 - 12 115 - 12 115 - 24	1×40 2×(40) 1×(40) 1×60 (1999) (2001)	3×60	3×60	3×60		71.293	106.939			22.551			200.783
91	BZ	Bangson	69 - 12 69 - 24	2×(40) 1×(40) 1×60 2×60 (1999) (2001)	2×60	2×60	3×60	158.094 (63.238)							21.322	179.416

No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA) 1997 ～ 2001	～ 2006	～ 2011	～ 2016	Construction Cost Disbursement (Price level in Year 1995) 1997	1998	1999	2000	2001	2006	2011	2016	Total
92	RI	Bearing	115 - 24	2×60	2×60	3×60	3×60	210.638 (84.255)						22.551		233.189
93	EM	Ekamai	69 - 12 69 - 24 115 - 24	2×(40) 1×(40) 1×60 2×60 (1998)	3×60	3×60	3×60	189.250 (75.700)					233.189			422.439
94	EB	Ekuburi	115 - 24	1×60 2×60 (2000)	2×60	2×60	3×60			71.293	106.939				22.551	200.783
95	HA	Huamak	69 - 24 115 - 24	1×40 1×60 (2001)	2×60	2×60	3×60				8.529	12.793	210.638		22.551	254.511
96	IN	Intamara	69 - 24	2×60	3×60	3×60	3×60						21.322			21.322
97	JR	Jangron	69 - 12 69 - 24	1×(40)	2×60	3×60	3×60						158.094	21.322		179.416
98	KO	Khotor	115 - 24	2×60 3×60 (2001)	3×60	3×60	3×60	178.232 (71.293)			9.020	13.531				200.783
99	KI	Kingkaew	115 - 24	2×60	2×60	2×60	2×60									0
100	KH	Klongmahasawad	115 - 24	2×60	2×60	3×60	3×60							22.551		22.6
101	LB	Lardkrabang	115 - 24	2×60	2×60	3×60	3×60							22.551		22.6
102	M3	Muangthong 3	115 - 24	2×60	2×60	2×60	3×60	178.232 (71.293)							22.551	200.783
103	NS	Nonsee	69 - 12 69 - 24	2×(40) 1×(40) 1×60 2×60 (1998) (2001)	2×60	3×60	3×60							21.322		21.3
104	PP	Pradipat	69 - 12 69 - 24	2×(40) 1×(40) 1×60 2×60 (1998) (2001)	2×60	3×60	3×60							21.322		21.3
105	SA	Sainamtip	69 - 12 69 - 24 115 - 24	1×(40) 1×60 2×60 3×60 (1998) (2001)	3×60	3×60	3×60	158.094 (63.238)			8.529	12.793				179.416
106	SB	Sanambinnam	115 - 12 115 - 24	1×(40) 1×60 2×60 (2001)	3×60	3×60	3×60						22.551			22.551
107	RG	Saorahong	115 - 24	1×60	2×60	2×60	2×60						178.232			178.232
108	OB	South Bangplee	115 - 24	2×60	2×60	2×60	2×60	178.232 (71.293)								178.232
109	SE	Srieiam	115 - 24	2×60 3×60 (2001)	3×60	3×60	3×60				9.020	13.531				22.551
110	SG	Suanluang	115 - 24	3×60	3×60	3×60	3×60									0
111	UK	Surasak	69 - 12 69 - 24	2×(40) 2×60 (2001)	2×60	2×60	2×60	158.094 (63.238)								158.094
112	TN	Taiban	115 - 24	1×60 2×60 (2000)	2×60	2×60	2×60	58.328 (23.331)		71.293	106.939					236.560
113	TW	Taweewattana	115 - 24	1×60 2×60 (1998)	2×60	2×60	2×60	71.293	106.939							178.232
114	TR	Thonburirom	69 - 12 115 - 24	1×(40) 2×(40) (1998)	2×60	2×60	2×60	63.238	94.856							158.094
115	TH	Tungsonghong	115 - 24	2×60	2×60	3×60	3×60							22.551		22.6
116	YK	Yenarkart	69 - 12 69 - 24	2×(40) 2×60 (2001)	3×60	3×60	3×60						21.322			21.322

No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA)				Construction Cost Disbursement (Price level in Year 1995)								
				1997 ~ 2001	~ 2006	~ 2011	~ 2016	1997	1998	1999	2000	2001	2006	2011	2016	Total
117	AB	Bangbor	115 - 24	2×60	2×60	2×60	2×60	178.232 (71.293)								178.232
118	JK	Bangjak	115 - 12 115 - 24	1×(40) 1×(40) 1×60 (2000)	3×60	3×60	3×60			71.293	106.939		22.551			200.783
119	KD	Bangkradee	69 - 12 115 - 24	1×(40) 2×60 (1999)	2×60	3×60	3×60		84.255	126.383				22.551		233.189
120	BH	Bangshan	115 - 24	1×60 2×60 (1998)	2×60	3×60	3×60	71.293	106.939					22.551		200.783
121	MI	Banmai	69 - 24	2×60 (2001)	2×60	2×60	3×60				81.631	122.446			21.322	225.399
122	DD	Dindaeng	69 - 12 115 - 12 115 - 24	1×(40) 2×(40) (2000)	2×60	3×60	3×60	161.132 (64.453)		63.238	94.856			22.551		341.777
123	EC	Ekachai	69 - 12 115 - 24	1×(40) 1×60 2×60 (1999) (2001)	2×60	3×60	3×60		13.510	20.266	71.293	106.939		22.551		234.559
124	GK	Ghoaklang	69 - 24 115 - 24	2×60	3×60	3×60	3×60	158.094 (63.238)					233.189			391.283
125	JW	Jangwatana	115 - 24	2×60	3×60	3×60	3×60	178.232 (71.293)					22.551			200.783
126	JJ	Jatujag	69 - 12 69 - 24 115 - 24	2×(40) (1998) 2×60 (2001)	2×60	3×60	3×60	75.700	113.550					233.189		422.439
127	KE	Kaset	69 - 12 69 - 24	1×(40) 1×60 2×60 (1998) (1999)	2×60	3×60	3×60	75.700	113.550					21.322		210.572
128	KG	Klongkum	115 - 24	1×60 2×60 (1999)	2×60	3×60	3×60	53.418	71.293	106.939				22.551		254.201
129	KL	Klongprapa	115 - 24	1×60 2×60 (2001)	2×60	3×60	3×60				71.293	106.939		22.551		200.783
130	MU	Mitr-udom	69 - 12 69 - 24	1×40	2×60	3×60	3×60						189.250	21.322		210.572
131	M4	Muangthong 4	115 - 24	1×60 2×60 (1998)	2×60	2×60	3×60	33.776 (13.510) 71.293	106.939						22.551	234.559
132	M5	Muangthong 5	115 - 24	2×60 (1999)	2×60	2×60	2×60		84.255	126.383						210.638
133	M6	Muangthong 6	115 - 24	2×60 (2000)	2×60	2×60	2×60			84.255	126.383					210.638
134	M7	Muangthong 7	115 - 24	2×60 (2001)	2×60	2×60	3×60				84.255	126.383			22.551	233.189
135	NL	Nanglerng	69 - 12	2×40 (2001)	3×40	3×40	4×40				113.070	169.604	16.184		58.842	357.700
136	TA	Patanakarn	115 - 24	1×60 2×60 (1999) (2001)	3×60	3×60	3×60		50.611	75.917	71.293	106.939	22.551			327.311
137	PL	Plubpla	115 - 24	2×60 (2001)	2×60	2×60	2×60				120.265	180.397				300.662



No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA) 1997 ~ 2001	~ 2006	~ 2011	~ 2016	Construction Cost Disbursement (Price level in Year 1995) 1997	1998	1999	2000	2001	2006	2011	2016	Total
138	PW	Prawes	115 - 24	2×60 (2000)	2×60	2×60	3×60			120.674	181.012				22.551	324.237
139	RP	Prompong	115 - 24	2×60 (2000)	2×60	3×60	3×60			138.270	207.404			22.551		368.225
140	SI	Sainoi	115 - 24	2×60 (2001)	2×60	2×60	2×60				88.838	133.257				222.095
141	YN	Samyarn	115 - 12	1×(40) 2×(40) (1998)				197.456 (78.982)						22.551		398.239
			115 - 24		2×60	3×60	3×60	71.293	106.939							
142	SH	Satorn	115 - 24	2×60 (2001)	2×60	3×60	3×60				166.095	249.143		22.551		437.789
143	HP	Shimplee	115 - 24	1×60 (1998) 2×60 (2000)	2×60	3×60	3×60	30.697	46.045	71.293	106.939			22.551		277.525
144	SW	Sriwiang	69 - 12	2×(40) (1999)					75.700	113.550						189.250
			69 - 24		2×60	2×60	2×60									
145	YI	Suanyai	115 - 24	2×60 (2001)	2×60	2×60	2×60				106.352	159.527				265.879
146	WW	Suwintawong	115 - 24	2×60 (2000)	2×60	2×60	2×60			92.112	138.168					230.280
147	TI	Tha-kwian	69 - 12	2×(40) (1999)					85.521	128.281						213.802
			69 - 24		2×60	2×60	2×60									
148	TC	Trokchan	115 - 12	1×(40) 2×(40) (1998)				115.613 (46.245)					22.551			316.396
			115 - 24		3×60	3×60	3×60	71.293	106.939							
149	TY	Tubyao	115 - 24	1×60 (1998) 2×60 (2001)	2×60	2×60	3×60	20.058	30.086		71.293	106.939			22.551	250.927
150	WK	Watkampaeng	69 - 12	1×40 (1998)				29.603	44.405		75.700	113.55		21.322		284.580
			69 - 24	2×60 (2001)	2×60	3×60	3×60									
151	WR	Wuttakart	69 - 12	1×(40)						85.521	128.281					213.802
			69 - 24	1×60 (2000) 2×60 (2001)	2×60	2×60	2×60									
152	AK	Asoke	115 - 24	—	2×60	3×60	3×60						279.493	22.551		302.044
153	BT	Bangbuotong	115 - 24	—	—	3×60	3×60							302.044		302.044
154	HS	Banghuasae	115 - 24	—	2×60	3×60	3×60						279.493	22.551		302.044
155	BW	Bangkaew	115 - 24	—	2×60	2×60	2×60						279.493			279.493
156	PY	Bangpleeyai	115 - 24	—	—	2×60	2×60							279.493		279.493
157	TD	Bangtalard	115 - 24	—	2×60	2×60	2×60						279.493			279.493
158	JB	Jorakabuo	115 - 24	—	3×60	3×60	3×60						302.044			302.044
159	KB	Klongbangpi	115 - 24	—	—	3×60	3×60							302.044		302.044
160	LA	Klongna	115 - 24	—	2×60	2×60	2×60						279.493			279.493
161	GP	Klongpume	115 - 24	—	—	2×60	3×60							279.493	22.551	302.044
162	KR	Krungtepkreeta	115 - 24	—	—	3×60	3×60							302.044		302.044
163	LH	Land & House	115 - 24	—	2×60	3×60	3×60						279.493	22.551		302.044
164	M8	Muangthong 8	115 - 24	—	2×60	2×60	2×60						210.638			210.638
165	M9	Muangthong 9	115 - 24	—	2×60	2×60	2×60						210.638			210.638
166	RL	Praramkao	115 - 24	—	2×60	2×60	2×60						279.493			279.493
167	RJ	Rajchaprarop	115 - 24	—	3×60	3×60	3×60						302.044			302.044
168	NP	Sanampao	115 - 24	—	2×60	2×60	2×60						279.493			279.493



No.	ABB	Substation	Voltage (kV)	Number and Capacity (MVA)				Construction Cost Disbursement (Price level in Year 1995)								
				1997 ~ 2001	~ 2006	~ 2011	~ 2016	1997	1998	1999	2000	2001	2006	2011	2016	Total
169	OM	Sananikom	115 - 24	—	2×60	2×60	3×60						279.493		22.551	302.044
170	OS	Songsunikom	115 - 24	—	2×60	2×60	2×60						279.493			279.493
171	IR	Srinakarin	115 - 24	—	2×60	2×60	3×60						279.493		22.551	302.044
172	LO	Thonglor	115 - 24	—	—	2×60	2×60							279.493		279.493
173	TU	Tungkru	115 - 24	—	—	2×60	2×60							279.493		279.493
174	WD	Watdeedod	69 - 24	—	2×60	2×60	3×60						259.104		21.322	280.426
175	GY	Bangkruay	115 - 24	—	—	—	2×60								279.493	279.493
176	GG	Bangpang	115 - 24	—	—	—	2×60								279.493	279.493
177	AA	Bangpla	115 - 24	—	—	—	2×60								279.493	279.493
178	LD	Klongdan	115 - 24	—	—	—	2×60								279.493	279.493
179	GT	Klonggratiam	115 - 24	—	—	—	3×60								302.044	302.044
180	LG	Luangpang	115 - 24	—	—	2×60	2×60							279.493		279.493
181	LS	Lumpagshe	115 - 24	—	—	—	3×60								302.044	302.044
182	NI	Nimitmai	115 - 24	—	—	2×60	2×60							279.493		279.493
183	NY	Nongyai	115 - 24	—	—	2×60	2×60							279.493		279.493
184	IL	Pinklao	115 - 24	—	—	3×60	3×60							302.044		302.044
185	PH	Pongpetch	115 - 24	—	—	—	2×60								279.493	279.493
186	PT	Puttamonton	115 - 24	—	—	—	2×60								279.493	279.493
187	RO	Rajchakru	115 - 24	—	—	2×60	2×60							279.493		279.493
188	RR	Rajdamri	115 - 24	—	—	—	2×60								279.493	279.493
189	AT	Satorntai	115 - 24	—	—	3×60	3×60							302.044		302.044
190	TL	Talingchan	115 - 24	—	—	—	2×60								279.493	279.493
191	TM	Tiamruammit	115 - 24	—	—	2×60	2×60							279.493		279.493
192	RM	Trimit	69 - 12	—	—	3×40	3×40							243.313		243.313
Total								4,408.164 (1,384.089)	1,997.090	1,936.913	2,996.739	2,348.690	7,707.983	5,758.866	3,824.169	30,978.614

10.5.3 Telecommunication Equipment

The total amount of the construction cost of telecommunication facilities in the respectively relevant fiscal years is presented in the Table below based on the price level in FY 1995.

The exchange rate is US$ 1 = 25.0 Baht.

Telecommunication Facilities (Cost in FY 1995)

Planned Year		1997	1998	1999	2000	2001
Period from the last		1	1	1	1	1
Total	(M.Baht)	52.2	43.1	36.5	54.8	52.2
Total	(M.US$)	2.1	1.7	1.5	2.2	2.1

Planned Year		2006	2011	2016
Period from the last		5	5	5
Total	(M.Baht)	120.0	68.4	54.2
Total	(M.US$)	4.8	2.7	2.2
Annual Invest.	(M.Baht)	24.0	13.7	10.8
Annual Invest.	(M.US$)	1.0	0.5	0.4

The total construction cost of the telecommunication facilities is US$19.30 million based on the exchange rate of US dollar in FY 1995. The telecommunication facilities implied herein refer to those for the SCADA system (RTUs and UHF radio equipment). Therefore, the construction cost of the optical fiber telecommunication system between district offices is not included in the above total construction cost. Moreover, the construction cost of the telecommunication facilities (voice radio system, etc.) other than the SCADA system related to construction of substations are not allocated in the total cost since this cost is included in the substation construction cost.

CHAPTER 11

ECONOMIC EVALUATION

CHAPTER 11 ECONOMIC EVALUATION

11.1 General

The economic performance of this Power Distribution Improvement and Expansion Plan in the Metropolitan Area (the Project) is assessed from the increased benefit (B-C), the ratio of benefit against the cost (B/C), and the Economical Internal Rate of Return (EIRR) which provides a value equal to the Project when its value is converted to the present value.
In this feasibility study by JICA, we did not estimate the construction cost of distribution facilities. But without the distribution facilities construction cost, we can not asses the reasonable economic and financial performance of this Project. So, by using the data from the Annual Report of MEA FY 1994, we estimate the construction cost as follows.

Distribution Facilities Construction Cost = Construction Cost by this project x[Distribution Facilities Increase during FY 1994 / (Transmission and Distribution Substation + Subtransmission Lines Increase during FY 1994)]

This construction cost ratio is estimated at 66.98%.

11.2 Premises Conditions for Economic Evaluation

The calculation for the economic assessment is conducted according to the following premises;

(1) Electricity tariff rate

The average sales price of MEA based on the current tariff system is applied. This average sales price is the tariff charged by MEA to every consumer. It is based on the invested amount and the cost of MEA for the subtransmission and distribution network.

(2) Total investment

Only MEA's construction cost related to this Project is appropriated. However, the interest during the construction, import taxes, VAT tax and the escalation factor are excluded. The construction cost is estimated based on the cost in FY 1995.

The part of this Project is conducted by EGAT. Considering that the current electricity tariff system is based on the investment of each power company, EGAT's investment is excluded from the study.

(3) Currency exchange rate

Currency exchange rate is assumed that 1 US$ = 25.0 Baht

(4) Operation and maintenance cost

The annual operation and maintenance cost is predetermined based on discussions with MEA. Accordingly, the cost of the subtransmission lines is 3.0% of the construction cost (import taxes and VAT tax excluded). The cost of terminal station and distribution substation, telecommunication facilities and distribution facilities are 4.0% of the construction cost, excluding the import taxes and VAT tax.

(5) Calculation period

The service life of the related facilities is specified for each facility by MEA. Since the subtransmission lines, distribution substations and telecommunication facilities consist of wide range of materials and equipment, a cumulative calculation is required to acquire an accurate total service life. In this Study, the service life of the major equipment and materials at each facility is regarded as being the total service life of the facility. In the case of the subtransmission lines, their service life is calculated from the weighted average service life of the overhead cables and underground cables. The total service life of the subtransmission, distribution substation, telecommunication facilities and distribution facilities are calculated from the weighed average of each facilities.
The calculations show this to be 22 years.

(a) Subtransmission line:	
Overhead Line:	30 years
Underground cable:	25 years
Sub total:	26 years
(b) Substation:	25 years
(c) Telecommunication Facilities:	10 years
(d) Distribution Facilities:	20 years
Total:	22 years

Considering that the facilities to be constructed under this Project will be completed one by one from FY 1997 to FY 2016 and their commercial operations will last 20 years from FY 1998 to FY 2017, the end period of this calculation is set from the middle point of the commercial operation period (that is FY 2008) for 22 years, until FY 2029. So, the basic calculation period is 32 years from FY 1998 to FY 2029.

(6) Discount rate

The discount rate is predetermined at 10% p.a.

(7) Electricity purchase

MEA's average purchase price from EGAT, based on the current fee system, is applied.

11.3 Benefit Evaluation

The following items are considered as the benefits of this Project.

(1) Increased power to consumers

When the facility completed in the end of FY 1997 starts providing the benefit from FY 1998, the electricity that exceeds the capacity in FY 1997 with the current facilities, is the actual benefit realized by this reinforcement project. Also, a new reinforcement project shall be conducted in response to increased demands after FY 2017.
Therefore, the balance after deducting the load (estimated demand) in FY 1997 in the MEA district from the yearly power consumption (estimated demand; flat after FY 2017 for the previously described reason) in the MEA district between FY 1998 and 2019 is regarded as the increased electricity made available to consumers. The benefit of this reinforcement project is acquired by multiplying this increased electricity and unit price (described later herein), then deducting the power generation cost. The increased electricity for each fiscal year is described in Table 11.3-2.

(2) Value of increased distribution power due to decreased outages realized by this Project.

The purpose of this Project is to expand the transmission and distribution and substation facilities in response to the increasing demand for MEA. The expansion project is planned to ensure the required supply reliability in the future, considering the current MEA facility standards. Regarding each facility to be installed, MEA's present technological level has been studied thoroughly and it is seen as adequate for future application. The facilities to be installed for this Project are designed assuming that no specification changes will be required. However, the exact failure ratio of MEA is unavailable, although it will be improved and is not, therefore, considered in this economic assessment.

(3) Reduced maintenance cost of power system facilities

As previously described, the failure ratio will be improved from the present level. However, the reduction of possible failure recovery cost is not considered in this economic assessment due to difficulties in acquiring the exact ratio.

(4) Pollution prevention cost not required by this Project

This Project improves Subtransmission loss. The loss ratio is described in Table 11.3-3. Currently, the cost of desulfurization and denitrogen oxide is not included in the purchase price from EGAT. When it is added to the current fee, however, it will be 16 Stang/kWh for desulfurization and 0.33 Stang/kWh for nitrogen removal. Therefore, the amount equivalent to the improved transmission and distribution loss becomes the pollution prevention cost. The pollution prevention cost is described in Table 11.4-4.

11.4 Economic assessment

11.4.1 Cost

(1) Construction cost

Regarding the total investment for this reinforcement Project, the import taxes and VAT tax are excluded from the construction cost estimated in the CHAPTER 10. Escalation is also not considered. The details for each fiscal year are described in Table 11.4-1.

(2) Operation and maintenance cost

The operation and maintenance cost is calculated based on the previously described premises conditions. The details for each fiscal year are described in Table 11.4-2.

(3) Electricity purchase

The purchase price for the increased electricity required by MEA is described in Table 11.3-2. The unit price is described in Table 11.4-3.

11.4.2 Benefit

(1) Unit benefit cost of electricity

It is appropriate to use the amount after deducting the power subtransmission and distribution cost from MEA's average sales price as the unit price to evaluate the benefit of this Project. The reason for this is that the electricity fee is calculated by the power company for the public service based on the cost method, thus reflecting a "willingness to pay" on the part of the consumers in general.
MEA's average sales price is given in Table 11.4-3.
The present values of FY 1995 are applied as the standard values.
The amount, after multiplying the increased electricity and the unit price, and MEA's purchase price are described in Table 11.4-4.

(2) Unnecessary pollution prevention cost

The cost for desulfurization and nitrogen removal that is not required due to an improved loss ratio is described in Table 11.4-4.

11.4.3 Economic Assessment Result

The benefit and cost flow in this Project are described in Table 11.4-5. The EIRR calculation is described in Table 11.4-6. The acquired EIRR, B-C, and B/C are described below:

(1) EIRR: 12.58%
(2) B-C: Baht 8,528.32 Million (US$ 341,133 Thousand)
(3) B/C: 1.03

The economic assessment of this Project shows a satisfactory EIRR, B-C, and B/C. This reinforcement project is, therefore, feasible in terms of its economical performance.

Table 11.3-1 Estimation for Energy Purchase and Energy Sales

FY	MEA Forecast							JICA Forecast			
	Energy Purchase A GWh	Energy Sales B GWh	Street Lighting Consumption C GWh	C/B %	Energy Sales Exclude Street Lighting D GWh	D/B %	Energy Loss 1-B/A %	Energy Purchase E GWh	Energy Sales B GWh	Energy Loss 1-B/A %	Energy Saving E-A GWh
1990	18,623	17,725	84	0.47%	17,641	99.53%	4.82%	18,623	17,725	4.82%	0
1991	20,777	19,851	99	0.50%	19,761	99.55%	4.46%	20,777	19,851	4.46%	0
1992	22,946	21,968	99	0.45%	21,869	99.55%	4.26%	22,946	21,968	4.26%	0
1993	24,873	23,849	106	0.44%	23,743	99.56%	4.12%	24,873	23,849	4.12%	0
1994	27,525	26,370	115	0.44%	26,255	99.56%	4.20%	27,525	26,370	4.20%	0
1995	30,387	28,959	126	0.44%	28,833	99.56%	4.70%	30,387	28,959	4.70%	0
1996	33,226	31,664	138	0.44%	31,526	99.56%	4.70%	33,226	31,664	4.70%	0
1997	35,881	34,194	149	0.44%	34,045	99.56%	4.70%	35,881	34,194	4.83%	0
1998	38,632	36,817	161	0.44%	36,656	99.56%	4.70%	38,577	36,817	4.56%	-55
1999	41,573	39,619	173	0.44%	39,446	99.56%	4.70%	41,488	39,619	4.50%	-85
2000	44,644	42,546	186	0.44%	42,360	99.56%	4.70%	44,525	42,546	4.44%	-119
2001	48,085	45,825	200	0.44%	45,625	99.56%	4.70%	47,980	45,825	4.49%	-105
2002	51,085	48,684	212	0.44%	48,472	99.56%	4.70%	50,974	48,684	4.49%	-111
2003	54,009	51,471	224	0.44%	51,247	99.56%	4.70%	53,892	51,471	4.49%	-117
2004	57,066	54,384	237	0.44%	54,147	99.56%	4.70%	56,942	54,384	4.49%	-124
2005	60,181	57,353	250	0.44%	57,103	99.56%	4.70%	60,051	57,353	4.49%	-130
2006	63,345	60,367	263	0.44%	60,104	99.56%	4.70%	63,202	60,367	4.49%	-143
2007	66,549	63,421	277	0.44%	63,144	99.56%	4.70%	66,399	63,421	4.49%	-150
2008	69,794	66,514	290	0.44%	66,224	99.56%	4.70%	69,637	66,514	4.49%	-157
2009	73,080	69,646	304	0.44%	69,342	99.56%	4.70%	72,916	69,646	4.49%	-164
2010	76,407	72,816	318	0.44%	72,498	99.56%	4.70%	76,235	72,816	4.49%	-172
2011	79,775	76,026	332	0.44%	75,694	99.56%	4.70%	79,607	76,026	4.50%	-168
2012	82,587	78,705	343	0.44%	78,362	99.56%	4.70%	82,412	78,705	4.50%	-175
2013	85,398	81,385	355	0.44%	81,030	99.56%	4.70%	85,218	81,385	4.50%	-180
2014	88,210	84,064	367	0.44%	83,697	99.56%	4.70%	88,024	84,064	4.50%	-186
2015	91,021	86,743	378	0.44%	86,365	99.56%	4.70%	90,829	86,743	4.50%	-192
2016	93,833	89,423	390	0.44%	89,033	99.56%	4.70%	93,665	89,423	4.53%	-168

Table 11.3-2 Incremental Electric Energy Purchase and Sales in MEA Area, which will become available by this Project

(GWh)

FY	Energy Purchase			Energy Sales, Including Street Lighting			Energy Sales, Excluding Street Lighting		
	Electric Energy	FY 1997 Forecast	Incremental Electric Energy	Electric Energy	FY 1997 Forecast	Incremental Electric Energy	Electric Energy	FY 1997 Forecast	Incremental Electric Energy
1998	38,577	35,881	2,696	36,817	34,194	2,623	36,656	34,045	2,612
1999	41,488	35,881	5,607	39,619	34,194	5,425	39,446	34,045	5,401
2000	44,525	35,881	8,644	42,546	34,194	8,352	42,360	34,045	8,316
2001	47,980	35,881	12,099	45,825	34,194	11,631	45,625	34,045	11,580
2002	50,974	35,881	15,093	48,684	34,194	14,490	48,472	34,045	14,427
2003	53,892	35,881	18,011	51,471	34,194	17,277	51,247	34,045	17,202
2004	56,942	35,881	21,061	54,384	34,194	20,190	54,147	34,045	20,102
2005	60,051	35,881	24,170	57,353	34,194	23,159	57,103	34,045	23,058
2006	63,202	35,881	27,321	60,367	34,194	26,173	60,104	34,045	26,059
2007	66,399	35,881	30,518	63,421	34,194	29,227	63,144	34,045	29,100
2008	69,637	35,881	33,756	66,514	34,194	32,320	66,224	34,045	32,179
2009	72,916	35,881	37,035	69,646	34,194	35,452	69,342	34,045	35,297
2010	76,235	35,881	40,354	72,816	34,194	38,622	72,498	34,045	38,454
2011	79,607	35,881	43,726	76,026	34,194	41,832	75,694	34,045	41,650
2012	82,412	35,881	46,531	78,705	34,194	44,511	78,362	34,045	44,317
2013	85,218	35,881	49,337	81,385	34,194	47,191	81,030	34,045	46,985
2014	88,024	35,881	52,143	84,064	34,194	49,870	83,697	34,045	49,653
2015	90,829	35,881	54,948	86,743	34,194	52,549	86,365	34,045	52,320
2016	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2017	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2018	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2019	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2020	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2021	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2022	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2023	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2024	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2025	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2026	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2027	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2028	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
2029	93,665	35,881	57,784	89,423	34,194	55,229	89,033	34,045	54,988
Total	2,480,214	1,148,192	1,332,022	2,368,308	1,094,208	1,274,100	2,357,980	1,089,436	1,268,544

Table 11.3-3 Total Energy Losses

FY	Subtransmission MW Loss			Subtransmission GWh Loss					Total Energy Losses	
	Terminal Station (Transformer) A MW	Distribution Substation (Power Load) B, MW	Subtransmission Loss C=A-B MW	Load D=Ax8760x0.65 GWh	Loss E=Cx8760x0.50 GWh	Loss Ratio F=E/D %	1996 MEA Forecast Loss Ratio G	Decrement Percent Compare with 1996 MEA Forecast, H=F-G	MEA Forecast I, %	JICA Forecast J=H+I, %
1996							0.51%		4.70%	
1997	6,331.4	6,279.0	52.4	36,051.0	229.5	0.64%		0.13%	4.70%	4.83%
1998	6,807.0	6,774.1	32.9	38,759.1	144.1	0.37%		-0.14%	4.70%	4.56%
1999	7,364.0	7,333.9	30.1	41,930.6	131.8	0.31%		-0.20%	4.70%	4.50%
2000	7,814.1	7,788.2	25.9	44,493.5	113.4	0.25%		-0.26%	4.70%	4.44%
2001	8,396.0	8,363.0	33.0	47,806.8	144.5	0.30%		-0.21%	4.70%	4.49%
2002								-0.21%	4.70%	4.49%
2003								-0.21%	4.70%	4.49%
2004								-0.21%	4.70%	4.49%
2005								-0.21%	4.70%	4.49%
2006	10,890.7	10,848.9	41.8	62,011.6	183.1	0.30%		-0.21%	4.70%	4.49%
2007								-0.21%	4.70%	4.49%
2008								-0.21%	4.70%	4.49%
2009								-0.21%	4.70%	4.49%
2010								-0.21%	4.70%	4.49%
2011	13,675.2	13,620.4	54.8	77,866.6	240.0	0.31%		-0.20%	4.70%	4.50%
2012								-0.20%	4.70%	4.50%
2013								-0.20%	4.70%	4.50%
2014								-0.20%	4.70%	4.50%
2015								-0.20%	4.70%	4.50%
2016	16,062.9	15,992.2	70.7	91,462.2	309.7	0.34%		-0.17%	4.70%	4.53%

Load Factor : 0.65
Loss Factor : 0.50

Table 11.4-1 Construction Cost for Economic Analysis

(Million Baht)

FY	Subtransmission Line				Distribution Substation				Telecommunication				Distribution Facilities				Total
	Construction Cost for	Value Added Tax	Import Duty	Construction Cost for for Analysis	Construction Cost for	Value Added Tax	Import Duty	Construction Cost for for Analysis	Construction Cost for	Value Added Tax	Import Duty	Construction Cost for for Analysis	Construction Cost for	Value Added Tax	Import Duty	Construction Cost for for Analysis	Construction Cost for Analysis
	A	B	C	D=A-(B+C)	E	F	G	H=E+(F+G)	I	J	K	L=I+(J+K)	M	N	O	P=M-(N+O)	Q=H+L+P
1996					1,431.21	81.47	69.97	1,279.77	0.00	0.00	0.00	0.00	958.63	54.57	46.87	857.19	2,136.96
1997	701.20	39.92	34.77	626.51	3,136.11	178.54	155.92	2,801.65	73.69	4.33	17.18	52.18	2,619.59	149.22	139.24	2,331.14	5,811.48
1998	592.24	33.67	24.11	534.47	2,261.69	128.80	117.44	2,015.45	60.82	3.57	14.20	43.06	1,952.31	111.21	104.32	1,736.78	4,329.75
1999	997.60	56.79	49.48	891.33	2,564.93	145.96	122.10	2,296.87	51.48	3.02	11.95	36.50	2,420.66	137.83	122.93	2,159.91	5,384.61
2000	2,901.10	165.40	169.66	2,566.04	3,819.14	217.31	178.71	3,423.12	77.21	4.53	17.93	54.76	4,552.94	259.37	245.34	4,048.22	10,092.14
2001	341.37	19.45	18.75	303.17	2,582.48	147.05	131.70	2,303.73	73.69	4.33	17.18	52.18	2,007.76	114.42	112.28	1,781.06	4,440.14
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.00	0.00	0.00	3,909.26	222.53	192.10	3,494.63	0.00	0.00	0.00	0.00	2,618.43	149.05	128.67	2,340.71	5,835.34
2006	8,261.94	470.96	475.59	7,315.39	5,863.90	333.79	288.16	5,241.95	169.60	9.95	39.60	120.04	9,575.10	545.69	538.08	8,491.32	21,168.70
2007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	0.00	0.00	0.00	0.00	2,680.64	152.58	130.52	2,397.54	0.00	0.00	0.00	0.00	1,795.50	102.20	87.42	1,605.87	4,003.41
2011	1,348.36	76.77	67.98	1,203.61	4,029.95	228.87	195.76	3,596.32	96.52	5.66	22.41	68.45	3,661.02	208.51	191.66	3,260.85	8,129.22
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	0.00	0.00	0.00	0.00	2,258.53	128.52	105.83	2,024.18	0.00	0.00	0.00	0.00	1,512.77	86.08	70.89	1,355.80	3,379.98
2016	2,056.60	117.37	120.53	1,820.70	3,387.79	192.76	158.75	3,036.28	76.61	4.50	17.94	54.17	3,699.31	210.74	199.08	3,289.50	8,200.65
Total	17,202.42	980.33	960.87	15,261.22	37,916.63	2,158.18	1,846.96	33,911.49	679.61	39.89	158.39	481.34	37,374.00	2,128.89	1,986.77	33,258.33	82,912.39

Table 11.4-2 Operation and Maintenance Cost

(Million Baht)

FY	Subtransmission Line		Distribution Substation		Telecommunication		Distribution Facilities		Total
	Construction Cost without VAT and Import Duty	Operation and Maintenance Cost 3.00%	Construction Cost without VAT and Import Duty	Operation and Maintenance Cost 4.00%	Construction Cost without VAT and Import Duty	Operation and Maintenance Cost 4.00%	Construction Cost without VAT and Import Duty	Operation and Maintenance Cost 0.00%	Operation and Maintenance Cost
1996	0.00	0.00	1,279.77	0.00	0.00	0.00	857.19	0.00	0.00
1997	626.51	0.00	2,801.65	0.00	52.18	0.00	2,331.14	0.00	0.00
1998	534.47	18.80	2,015.45	127.98	43.06	2.09	1,736.78	103.90	252.76
1999	891.33	34.83	2,296.87	216.18	36.50	3.81	2,159.91	178.45	433.27
2000	2,566.04	61.57	3,423.12	285.42	54.76	5.27	4,048.22	249.69	601.95
2001	303.17	138.55	2,303.73	411.24	52.18	7.46	1,781.06	404.18	961.43
2002	0.00	147.65	0.00	564.82	0.00	9.55	0.00	516.57	1,238.59
2003	0.00	147.65	0.00	564.82	0.00	9.55	0.00	516.57	1,238.59
2004	0.00	147.65	0.00	564.82	0.00	9.55	0.00	516.57	1,238.59
2005	0.00	147.65	3,494.63	564.82	0.00	9.55	2,340.71	516.57	1,238.59
2006	7,315.39	147.65	5,241.95	564.82	120.04	9.55	8,491.32	516.57	1,238.59
2007	0.00	367.11	0.00	914.29	0.00	14.35	0.00	949.85	2,245.60
2008	0.00	367.11	0.00	914.29	0.00	14.35	0.00	949.85	2,245.60
2009	0.00	367.11	0.00	914.29	0.00	14.35	0.00	949.85	2,245.60
2010	0.00	367.11	2,397.54	914.29	0.00	14.35	1,605.87	949.85	2,245.60
2011	1,203.61	367.11	3,596.32	914.29	68.45	14.35	3,260.85	949.85	2,245.60
2012	0.00	403.22	0.00	1,154.04	0.00	17.09	0.00	1,144.52	2,718.87
2013	0.00	403.22	0.00	1,154.04	0.00	17.09	0.00	1,144.52	2,718.87
2014	0.00	403.22	0.00	1,154.04	0.00	17.09	0.00	1,144.52	2,718.87
2015	0.00	403.22	2,024.18	1,154.04	0.00	17.09	1,355.80	1,144.52	2,718.87
2016	1,820.70	403.22	3,036.28	1,154.04	54.17	17.09	3,289.50	1,144.52	2,718.87
2017		457.84		1,356.46		19.25		1,330.33	3,163.88
2018		457.84		1,356.46		19.25		1,330.33	3,163.88
2019		457.84		1,356.46		19.25		1,330.33	3,163.88
2020		457.84		1,356.46		19.25		1,330.33	3,163.88
2021		457.84		1,356.46		19.25		1,330.33	3,163.88
2022		457.84		1,356.46		19.25		1,330.33	3,163.88
2023		457.84		1,356.46		19.25		1,330.33	3,163.88
2024		457.84		1,356.46		19.25		1,330.33	3,163.88
2025		457.84		1,356.46		19.25		1,330.33	3,163.88
2026		457.84		1,356.46		19.25		1,330.33	3,163.88
2027		457.84		1,356.46		19.25		1,330.33	3,163.88
2028		457.84		1,356.46		19.25		1,330.33	3,163.88
2029		457.84		1,356.46		19.25		1,330.33	3,163.88
Total	15,261.22	10,795.46	33,911.49	31,840.55	481.34	473.84	33,258.33	31,285.29	74,395.14

Table 11.4-3 MEA's Average Energy Purchase and Sales Price

No.	FY	Energy Purchase Price, per kWh Purchase			Energy Sales Price, per kWh Sales		
		Actual Average Purchase Price	Constant 1995 Price	Estimation Purchase Price	Actual Average Sales Price	Constant 1995 Price	Estimation Sales Price
		(Baht/kWh)	(Baht/kWh)	(Baht/kWh)	(Baht/kWh)	(Baht/kWh)	(Baht/kWh)
	1990				1.7905		
	1991				1.8039		
	1992	1.4426			1.7510		
	1993	1.4637			1.7766		
	1994	1.4460			1.7720		
	1995	1.3893	1.3893	1.3893	1.7444	1.7444	1.7444
1	1996		1.3893	1.4588		1.7444	1.8316
2	1997		1.3893	1.5317		1.7444	1.9232
3	1998		1.3893	1.6083		1.7444	2.0194
4	1999		1.3893	1.6887		1.7444	2.1203
5	2000		1.3893	1.7731		1.7444	2.2263
6	2001		1.3893	1.8618		1.7444	2.3377
7	2002		1.3893	1.9549		1.7444	2.4545
8	2003		1.3893	2.0526		1.7444	2.5773
9	2004		1.3893	2.1553		1.7444	2.7061
10	2005		1.3893	2.2630		1.7444	2.8414
11	2006		1.3893	2.3762		1.7444	2.9835
12	2007		1.3893	2.4950		1.7444	3.1327
13	2008		1.3893	2.6197		1.7444	3.2893
14	2009		1.3893	2.7507		1.7444	3.4538
15	2010		1.3893	2.8883		1.7444	3.6265
16	2011		1.3893	3.0327		1.7444	3.8078
17	2012		1.3893	3.1843		1.7444	3.9982
18	2013		1.3893	3.3435		1.7444	4.1981
19	2014		1.3893	3.5107		1.7444	4.4080
20	2015		1.3893	3.6862		1.7444	4.6284
21	2016		1.3893	3.8705		1.7444	4.8598
22	2017		1.3893	4.0641		1.7444	5.1028
23	2018		1.3893	4.2673		1.7444	5.3580
24	2019		1.3893	4.4806		1.7444	5.6259
25	2020		1.3893	4.7047		1.7444	5.9072
26	2021		1.3893	4.9399		1.7444	6.2025
27	2022		1.3893	5.1869		1.7444	6.5126
28	2023		1.3893	5.4462		1.7444	6.8383
29	2024		1.3893	5.7185		1.7444	7.1802
30	2025		1.3893	6.0045		1.7444	7.5392
31	2026		1.3893	6.3047		1.7444	7.9162
32	2027		1.3893	6.6199		1.7444	8.3120
33	2028		1.3893	6.9509		1.7444	8.7276
34	2029		1.3893	7.2985		1.7444	9.1639

Escalation : 5.00%

Table 11.4-4 Energy Purchase, Sales and Environmental Pollution Prevention Cost

FY	Energy Purchase			Energy sales			Environmental Pollution Prevention Cost			Benefit
	Incremental Energy A	Purchase Price of MEA B	Purchase Baht C=AxB	Incremental Energy without Street Lighting D	Sales Price of MEA E	Sales Baht F=DxE	Energy Saving G	De-SOx & De-NOx Operation Cost H	Benefit Baht I=GxH	Total Baht F+I
	GWh	Baht/kWh	Million Baht	GWh	Baht/kWh	Million Baht	GWh	Baht/kWh	Million Baht	Million Baht
1998	2,696	1.3893	3,745.26	2,612	1.7444	4,555.61	55	0.1633	9.02	4,564.62
1999	5,607	1.3893	7,789.50	5,401	1.7444	9,422.10	85	0.1633	13.92	9,436.02
2000	8,644	1.3893	12,009.28	8,316	1.7444	14,505.69	119	0.1633	19.41	14,525.10
2001	12,099	1.3893	16,809.76	11,580	1.7444	20,200.64	105	0.1633	17.07	20,217.71
2002	15,093	1.3893	20,968.60	14,427	1.7444	25,166.13	111	0.1633	18.14	25,184.26
2003	18,011	1.3893	25,022.70	17,202	1.7444	30,006.57	117	0.1633	19.10	30,025.67
2004	21,061	1.3893	29,260.09	20,102	1.7444	35,065.84	124	0.1633	20.24	35,086.09
2005	24,170	1.3893	33,578.94	23,058	1.7444	40,222.38	130	0.1633	21.28	40,243.66
2006	27,321	1.3893	37,956.72	26,059	1.7444	45,457.07	143	0.1633	23.39	45,480.47
2007	30,518	1.3893	42,398.88	29,100	1.7444	50,761.24	150	0.1633	24.47	50,785.71
2008	33,756	1.3893	46,897.77	32,179	1.7444	56,133.14	157	0.1633	25.57	56,158.71
2009	37,035	1.3893	51,453.39	35,297	1.7444	61,572.77	164	0.1633	26.70	61,599.48
2010	40,354	1.3893	56,064.28	38,454	1.7444	67,078.41	172	0.1633	28.03	67,106.44
2011	43,726	1.3893	60,748.42	41,650	1.7444	72,653.51	168	0.1633	27.45	72,680.96
2012	46,531	1.3893	64,645.66	44,317	1.7444	77,306.38	175	0.1633	28.56	77,334.94
2013	49,337	1.3893	68,544.36	46,985	1.7444	81,960.98	180	0.1633	29.34	81,990.32
2014	52,143	1.3893	72,441.60	49,653	1.7444	86,613.85	186	0.1633	30.45	86,644.30
2015	54,948	1.3893	76,338.84	52,320	1.7444	91,266.72	192	0.1633	31.40	91,298.12
2016	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2017	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2018	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2019	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2020	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2021	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2022	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2023	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2024	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2025	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2026	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2027	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2028	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
2029	57,784	1.3893	80,278.86	54,988	1.7444	95,921.32	168	0.1633	27.49	95,948.81
Total	1,332,022		1,850,578.07	1,268,544		2,212,847.51	4,889		798.39	2,213,645.89

Control Sulfur Oxide Cost : 16.00 Stang/kWh
Control Nitrogen Oxides Cost 0.33 Stang/kWh

Table 11.4-5 Benefit Flow and Cost Flow of the Project

(Million Baht)

Discount Rate	No.	FY	Cost					Benefit		NPV
			Construction	O & M	Energy Purchase	Total	PV	Total	PV	
10.00%	1	1996	2,136.96			2,136.96	1,942.69		0.00	-1,942.69
	2	1997	5,811.48			5,811.48	4,802.87		0.00	-4,802.87
	3	1998	4,329.75	252.76	3,745.26	8,327.77	6,256.78	4,564.62	3,429.47	-2,827.31
	4	1999	5,384.61	433.27	7,789.50	13,607.39	9,294.03	9,436.02	6,444.93	-2,849.10
	5	2000	10,092.14	601.95	12,009.28	22,703.38	14,097.01	14,525.10	9,018.95	-5,078.06
	6	2001	4,440.14	961.43	16,809.76	22,211.33	12,537.72	20,217.71	11,412.37	-1,125.35
	7	2002	0.00	1,238.59	20,968.60	22,207.19	11,395.80	25,184.26	12,923.51	1,527.71
	8	2003	0.00	1,238.59	25,022.70	26,261.29	12,251.09	30,025.67	14,007.20	1,756.11
	9	2004	0.00	1,238.59	29,260.09	30,498.68	12,934.42	35,086.09	14,879.93	1,945.51
	10	2005	5,835.34	1,238.59	33,578.94	40,652.86	15,673.44	40,243.66	15,515.67	-157.77
	11	2006	21,168.70	1,238.59	37,956.72	60,364.01	21,157.22	45,480.47	15,940.63	-5,216.59
	12	2007	0.00	2,245.60	42,398.88	44,644.48	14,225.11	50,785.71	16,181.89	1,956.78
	13	2008	0.00	2,245.60	46,897.77	49,143.37	14,235.08	56,158.71	16,267.18	2,032.09
	14	2009	0.00	2,245.60	51,453.39	53,698.99	14,140.62	61,599.48	16,221.07	2,080.45
	15	2010	4,003.41	2,245.60	56,064.28	62,313.29	14,917.31	67,106.44	16,064.75	1,147.44
	16	2011	8,129.22	2,245.60	60,748.42	71,123.24	15,478.49	72,680.96	15,817.49	339.01
	17	2012	0.00	2,718.87	64,645.66	67,364.53	13,327.71	77,334.94	15,300.31	1,972.59
	18	2013	0.00	2,718.87	68,544.36	71,263.22	12,817.32	81,990.32	14,746.68	1,929.36
	19	2014	0.00	2,718.87	72,441.60	75,160.47	12,289.34	86,644.30	14,167.04	1,877.70
	20	2015	3,379.98	2,718.87	76,338.84	82,437.69	12,253.84	91,298.12	13,570.88	1,317.05
	21	2016	8,200.65	2,718.87	80,278.86	91,198.37	12,323.69	95,948.81	12,965.62	641.93
	22	2017		3,163.88	80,278.86	83,442.74	10,250.60	95,948.81	11,786.92	1,536.32
	23	2018		3,163.88	80,278.86	83,442.74	9,318.73	95,948.81	10,715.39	1,396.65
	24	2019		3,163.88	80,278.86	83,442.74	8,471.57	95,948.81	9,741.26	1,269.69
	25	2020		3,163.88	80,278.86	83,442.74	7,701.43	95,948.81	8,855.69	1,154.26
	26	2021		3,163.88	80,278.86	83,442.74	7,001.30	95,948.81	8,050.63	1,049.33
	27	2022		3,163.88	80,278.86	83,442.74	6,364.82	95,948.81	7,318.75	953.93
	28	2023		3,163.88	80,278.86	83,442.74	5,786.20	95,948.81	6,653.41	867.21
	29	2024		3,163.88	80,278.86	83,442.74	5,260.18	95,948.81	6,048.56	788.38
	30	2025		3,163.88	80,278.86	83,442.74	4,781.98	95,948.81	5,498.69	716.70
	31	2026		3,163.88	80,278.86	83,442.74	4,347.26	95,948.81	4,998.81	651.55
	32	2027		3,163.88	80,278.86	83,442.74	3,952.05	95,948.81	4,544.37	592.32
	33	2028		3,163.88	80,278.86	83,442.74	3,592.77	95,948.81	4,131.25	538.47
	34	2029		3,163.88	80,278.86	83,442.74	3,266.16	95,948.81	3,755.68	489.52
		Total	82,912.39	74,395.14	1,850,578.07	2,007,885.59	338,446.62	2,213,645.89	346,974.94	8,528.32

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Table 11.4-6 Calculation of EIRR

(million Baht)

Discount Rate	No.	FY	Cost					Benefit		NPV
			Construction	O & M	Energy Purchase	Total	PV	Total	PV	
12.5811%	1	1996	2,136.96	0.00		2,136.96	1,898.15		0.00	-1,898.15
	2	1997	5,811.48	0.00		5,811.48	4,585.17		0.00	-4,585.17
	3	1998	4,329.75	252.76	3,745.26	8,327.77	5,836.23	4,564.62	3,198.95	-2,637.27
	4	1999	5,384.61	433.27	7,789.50	13,607.39	8,470.56	9,436.02	5,873.89	-2,596.67
	5	2000	10,092.14	601.95	12,009.28	22,703.38	12,553.43	14,525.10	8,031.40	-4,522.03
	6	2001	4,440.14	961.43	16,809.76	22,211.33	10,908.90	20,217.71	9,929.75	-979.15
	7	2002	0.00	1,238.59	20,968.60	22,207.19	9,688.00	25,184.26	10,986.77	1,298.77
	8	2003	0.00	1,238.59	25,022.70	26,261.29	10,176.33	30,025.67	11,635.04	1,458.71
	9	2004	0.00	1,238.59	29,260.09	30,498.68	10,497.61	35,086.09	12,076.59	1,578.98
	10	2005	5,835.34	1,238.59	33,578.94	40,652.86	12,428.96	40,243.66	12,303.86	-125.11
	11	2006	21,168.70	1,238.59	37,956.72	60,364.01	16,392.92	45,480.47	12,351.03	-4,041.89
	12	2007	0.00	2,245.60	42,398.88	44,644.48	10,769.12	50,785.71	12,250.51	1,481.38
	13	2008	0.00	2,245.60	46,897.77	49,143.37	10,529.60	56,158.71	12,032.73	1,503.13
	14	2009	0.00	2,245.60	51,453.39	53,698.99	10,219.92	61,599.48	11,723.53	1,503.61
	15	2010	4,003.41	2,245.60	56,064.28	62,313.29	10,534.07	67,106.44	11,344.36	810.28
	16	2011	8,129.22	2,245.60	60,748.42	71,123.24	10,679.76	72,680.96	10,913.67	233.90
	17	2012	0.00	2,718.87	64,645.66	67,364.53	8,984.95	77,334.94	10,314.78	1,329.83
	18	2013	0.00	2,718.87	68,544.36	71,263.22	8,442.76	81,990.32	9,713.63	1,270.87
	19	2014	0.00	2,718.87	72,441.60	75,160.47	7,909.38	86,644.30	9,117.87	1,208.48
	20	2015	3,379.98	2,718.87	76,338.84	82,437.69	7,705.72	91,298.12	8,533.94	828.21
	21	2016	8,200.65	2,718.87	80,278.86	91,198.37	7,571.97	95,948.81	7,966.39	394.42
	22	2017		3,163.88	80,278.86	83,442.74	6,153.82	95,948.81	7,076.13	922.31
	23	2018		3,163.88	80,278.86	83,442.74	5,466.12	95,948.81	6,285.36	819.24
	24	2019		3,163.88	80,278.86	83,442.74	4,855.27	95,948.81	5,582.96	727.69
	25	2020		3,163.88	80,278.86	83,442.74	4,312.69	95,948.81	4,959.06	646.37
	26	2021		3,163.88	80,278.86	83,442.74	3,830.74	95,948.81	4,404.87	574.14
	27	2022		3,163.88	80,278.86	83,442.74	3,402.65	95,948.81	3,912.62	509.98
	28	2023		3,163.88	80,278.86	83,442.74	3,022.39	95,948.81	3,475.38	452.98
	29	2024		3,163.88	80,278.86	83,442.74	2,684.64	95,948.81	3,087.00	402.36
	30	2025		3,163.88	80,278.86	83,442.74	2,384.62	95,948.81	2,742.02	357.40
	31	2026		3,163.88	80,278.86	83,442.74	2,118.14	95,948.81	2,435.60	317.46
	32	2027		3,163.88	80,278.86	83,442.74	1,881.43	95,948.81	2,163.41	281.98
	33	2028		3,163.88	80,278.86	83,442.74	1,671.18	95,948.81	1,921.65	250.47
	34	2029		3,163.88	80,278.86	83,442.74	1,484.42	95,948.81	1,706.90	222.48
		Total	82,912.39	74,395.14	1,850,578.07	2,007,885.59	240,051.63	2,213,645.89	240,051.63	0.00

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CHAPTER 12

FINANCIAL ANALYSIS

CHAPTER 12 FINANCIAL ANALYSIS

12.1 General

The following calculations are made for the financial analysis of this Project. The calculations are based on the electricity value (sales revenue) acquired in the economic assessment and the total cost of this Project, calculated at the domestic cost in Thailand.

Described in CHAPTER 11, JICA study team did not estimate the construction cost of distribution facilities. But the construction cost of distribution facilities are necessary to asses the financial performance or to calculate the debt service ratio for this Improvement and Expansion Plan. So we estimate the construction cost of distribution facilities is 66.98 % of total construction cost.

(1) Calculation of Financial Internal Rate of Return (FIRR)
(2) Production of loan reimbursement schedule
(3) Production of profit and loss statement
(4) Cash flow analysis
(5) Calculation of debt service ratio

12.2 Analysis Method

(1) Calculation of Financial Internal Rate of Return (FIRR)

The Financial Internal Rate of Return (FIRR) is calculated so that the annual cost and profit become equal respectively to the current value when they are converted to the present value. It is then compared with the social discount rate that reflects the capital opportunity cost.

The costs applied to this evaluation are the total invested capital (construction cost including import taxes) and the operation and maintenance cost. Fund procurement conditions such as the interest on the loan, the interest during the construction, principal reimbursement, and the loan reimbursement period are not considered in the total invested capital.

Consequently, the profitability of the investment is evaluated regardless of the fund procurement conditions.

(2) Calculation of debt service ratio

The Debt Service Ratio is the ratio of internal fund procurement (total of sales profit and depreciation) against the debt (total of interest and principal). The following three procedures are required to acquire this ratio:

(1) Production of loan reimbursement schedule
(2) Production of profit and loss statement
(3) Cash flow analysis

The costs applied to this evaluation are the operation and maintenance cost and the depreciation. The depreciation is calculated based on the construction cost including the import taxes, interest during the construction and the escalation.

12.3 Premises Conditions of Financial Analysis

The financial analysis is conducted based on the following premises;

12.3.1 Financial Internal Rate of Return (FIRR)

(1) Electricity sales revenue

The benefit related to the distribution facilities improvement project calculated in CHAPTER 11: ECONOMIC EVALUATION, is applied.

(2) Construction cost

The construction cost for MEA is applied as in the Economic Evaluation. However, the construction cost includes the import taxes in this analysis.

(3) Operation and maintenance cost

The cost calculated in the CHAPTER 11 is applied.

(4) Electricity purchase

The price calculated in the CHAPTER 11 is applied.

(5) Escalation

Escalation is not considered.

12.3.2 Debt Service Ratio

(1) Electricity sales revenue

The same value in FIRR calculation is applied. However, a local currency escalation ratio of 5.0% is applied, considering the escalation.

(2) Construction cost

The construction cost includes import taxes, interest during the construction, and the escalation.

(3) Operation and maintenance cost

Same as FIRR. However, the escalation is considered.

(4) Electricity purchasing

The same value in the FIRR calculation is applied. However, considering the escalation, a local currency escalation ratio of 5.0% is applied.

(5) Escalation

2.2% is applied to the foreign currencies and 5.0%/annum is applied to the local currency.

(6) Fund procurement conditions

(a) Foreign currencies: interest; 7% p.a.
20 years principal equal payment

(b) Local currency: interest; 13% p.a.
8 years principal equal payment

The reimbursement period starts from FY 1998 for the loans acquired during FY 1996 and 1997. The details are described below.

Table 12.3-1 Construction and Reimbursement Period

Commercial Operation	Construction Period	Foreign Currency Portion Reimbursement Period	Local Currency Portion Reimbursement Period
FY 1998	FY 1996-1997	FY 1998-2017	FY 1998-2005
FY 1999	FY 1997-1998	FY 1999-2018	FY 1999-2006
FY 2000	FY 1998-1999	FY 2000-2019	FY 2000-2007
FY 2001	FY 1999-2000	FY 2001-2020	FY 2001-2008
FY 2002	FY 2000-2001	FY 2002-2021	FY 2002-2009
FY 2007	FY 2005-2006	FY 2007-2026	FY 2007-2014
FY 2012	FY 2010-2011	FY 2012-2031	FY 2012-2019
FY 2017	FY 2015-2016	FY 2017-2036	FY 2017-2024

(7) Depreciation

The service life is 22 years as calculated in CHAPTER 11. It is the amortization with no remaining assets.

12.4 Financial Internal Rate of Return (FIRR)

(1) Construction cost

The construction cost for FIRR calculation is described in Table 12.4-1.