フィリピン共和国

ビサヤス地域
送電系統拡張および海底ケーブルによる連系計画
調査報告書

(APPENDIX)

昭和55年9月

国際協力事業団

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（目　　次）

A-1　ビサヤス地域の気象

A－1　ビサヤス地域の気象

1. フィリピンの気候

フィリピンの年間の気候を支配する要因は主に次の４つの型に分けることができる。

1.1　南西モンスーン（Southwest Monsoon）

南半球側の冬季に発生したインド洋高気圧から吹くインド洋貿易風によるもので，フィリピン附近では南西寄りの気流となる。この風は６月初頃に吹き初め，８月に最強となって，９月末頃まで吹き，時には１０月末まで持続することもある。フィリピンの西海岸（南シナ海側）一帯に６月から９月にかけて強雨をもたらし，いわゆる雨期となる。

ビサヤス地域では，SWが主風向でSSWからWまで変化し，パナイ寄りが比較的強く，レイテ側では弱風である。風速は概ね６月：3～6kt，７月：2～6kt，８月：3～8kt，９月：2～6ktである。

1.2　北東モンスーン（Northeast Monsoon）

アジア性の冬季高気圧による強い寒気流であり，フィリピンでは北東寄りの風となる。10月末頃吹き初めて，１月に最強となり，通常４月末頃まで吹く。この気流の影響で比較的寒い気候が続き，冬期に東海岸（大平洋側）地域に強雨がある。

ビサヤス地域では概ねNEの風向で，特にパナイ島西方のSulu海上で強風が吹き荒れる。風速は，１，２月：3～16kt，３月：2～14kt，４月：2～12kt，１０月：2～8kt，１１月：2～12kt，１２月：3～16ktである。

1.3　北太平洋貿易風

北太平洋高気圧からの気流で，フィリピンでは一般にNやEの方向から吹いて来る。４月，５月，１０月に優勢となり，東部地域で北東モンスーンの気団を抑える。フィリピンに影響を及ぼす最も暖かい気流であることが特徴で，晴天をもたらし，時には積雲から時雨がある。

ビサヤス地域では，５月にNEの風向であり，風速は2～10ktである。

1.4　南太平洋貿易風

南半球で発生する南太平洋高気圧から来る気流で，フィリピンでは６月に南西寄りの風となる。これは暖い気流であり，下層は湿度が高いが上層では比較的乾燥しており，前述の南西モンスーンと同様の特徴である。

フィリピンの気候を特徴づけるのは，以上の４種の気流の他に南洋性台風があるが，台風については後節で詳述する。また，前線や赤道無風帯などの影響を受けるとともに，フィリピンは四囲を海面でかこまれた列島であるため海流による影響も大きい。

マニラにおける気温は，年間で25.4℃～29℃で平均気温27℃であり，気温変化はせまい。マニラを含め南シナ海岸は乾・雨季の差が明瞭であるが，太平洋側では１年中雨が多いのが通常である。

2. ビサヤス地域の気象

ビサヤス地方の主要都市であるIloilo市，Cebu市およびTacloban市の３個所における気象データーをTable A－1－(1)に示す。統計期間は同表最右欄に示したように観測所によって異なるが概ね気温，湿度，気圧：１５～１６年，雨量：３６年，雷雨日数：６～１１年，風速：５年である。

ビサヤス地域の気象についてTable A－1－(1)から次の様に要約できる。

(i) 年平均気温は３個所ともほとんど同じく約27℃である。

最高，最低気温はそれぞれ36.7℃，17.8℃であるが，地域差，標高等を考慮すると，ビサヤス地域としては最高４０℃程度，最低１０℃程度の気温であるとみられる。

(ii) 降水量については，Iloilo市では乾，雨季が明瞭に分れており，年間降水量の大部分を雨季のスコールが占めている。Tacloban市では逆に乾，雨季の区別がなく，むしろ冬季の雨量が多い。

Cebu市はこれら両市の中間の特性であるが，ややIloilo市に近い。

(iii) 雷雨日数は，Iloilo市：９９.８日，Cebu市：１３１.５日，Tacloban市：６９.５日といずれも多雷地帯に属している。３個所の平均は１００日で，１２月から３月に幾分少ないものの，年間を通じて雷雨が発生している。

(iv) 平均風速は，５月，６月に比較的弱くなる傾向がみられる。このことは13.5m/s 以上の強風日数や静穏日数の統計からも認められる。

3. 台風時の強風について

フィリピン，特にその北部地域は世界でも有数の台風襲来地帯である。年平均２０個の台風がフィリピンへの影響圏に入り，この４２％がフィリピン列島を通過しており，ビサヤス地域に対しては，サマール北部：３１～４０％，レイテ北部：２１～３０％，パナイ北部およびネグロス西部：０～１０％，その他地域：１１～２０％の台風のコースとなる。

また年平均４個の台風がフィリピンの何処かに被害を及ぼしており，この３２％の年平均1.3個の台風はビサヤス地域に人的経済的損害をもたらしている。

台風は，６月～１２月に比較的多く襲来するが，ほぼ年間を通じて台風を全く避けることはできない。台風の月別襲来頻度をTable A－1－(2)に示す。

Table A-1-(1) Climatic Data in Visayas Region

Item		Station	Month												Annual	Observation period (years)
			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
Temperature (°C)	Average	Ilo	25.6	25.6	26.7	27.8	27.8	27.2	26.7	26.7	26.7	26.7	26.7	26.1	26.7	16
		Ceb	26.1	26.1	26.7	27.8	28.3	27.8	27.2	27.8	27.2	27.2	26.7	26.7	27.8	16
		Tac	25.6	25.6	26.1	27.2	27.8	27.2	27.2	27.8	27.2	26.7	26.7	26.1	26.7	15
	Highest	Ilo	33.3	35.6	36.7	36.7	36.7	35.6	35.0	34.4	36.1	34.4	35.0	36.7	36.7	16
		Ceb	32.8	32.2	32.8	33.3	35.0	35.0	34.4	33.9	33.9	34.4	33.9	32.8	35.0	16
		Tac	33.3	34.4	34.4	36.1	36.1	36.1	35.6	35.6	36.1	35.6	34.4	33.3	36.1	16
	Lowest	Ilo	18.3	17.8	19.4	21.1	21.7	21.7	20.0	20.0	20.6	20.6	20.6	18.3	17.8	16
		Ceb	18.9	18.3	18.9	21.1	21.1	22.2	21.7	21.1	21.1	20.6	20.0	20.0	18.3	16
		Tac	18.9	17.8	17.8	20.0	22.2	22.2	21.7	21.1	21.7	21.7	20.0	17.8	17.8	16
Atmospheric pressure (mb) (sea level)		Ilo	1011	1010	1010	1009	1008	1008	1008	1008	1008	1009	1009	1009	1009	15
		Ceb	1009	1010	1011	1011	1009	1008	1008	1008	1008	1008	1008	1009	1009	15
Relative humidity (%)		Ilo	80	78	75	73	78	81	83	83	84	84	83	82	80	16
		Ceb	76	75	73	73	75	76	77	76	77	78	78	78	76	16
		Tac	84	82	80	81	82	83	82	80	81	84	85	86	82	15
Total rainfall (mm)		Ilo	64	46	33	43	157	264	448	386	315	269	211	119	2355	36
		Ceb	107	71	51	43	114	163	184	141	175	195	162	128	1540	36
		Tac	338	216	170	137	155	183	165	140	155	213	302	373	2541	34
Thunderstorm (day)		Ilo	0.8	0.7	3.0	4.8	19.3	17.8	11.0	8.8	10.8	12.8	6.7	2.3	98.8	6
		Ceb	1.8	2.5	5.4	9.8	15.8	18.0	15.9	14.9	14.8	16.9	9.1	6.5	131.5	11
		Tac	0.9	1.0	2.2	4.5	10.5	11.4	10.2	7.6	8.7	8.0	2.9	1.6	69.5	10
Average wind velocity (Knots)		Ilo	8.8	9.6	9.0	8.4	6.8	5.6	7.4	7.2	5.8	6.4	6.4	8.2	74	5
		Ceb	5.2	5.8	5.6	5.4	4.4	3.0	3.4	3.2	2.8	2.8	3.4	4.2	4.2	5
		Tac	5.4	5.8	4.4	5.0	4.2	4.0	4.6	4.0	4.4	5.4	6.0	4.8	5.0	5
Strong wind over 15.3 m/s (day)		Ilo	3	1	1	0.3	0.3	0.3	2	3	1	1	1	2	16	15
		Ceb	0.5	0.1	0.2	0.4	1	2	7	7	4	2	1.5	0.4	26	15
Calm day (%)		Ilo	1	2	1	3	12	19	13	11	13	13	5	3	8	18
		Ceb	23	24	23	28	37	37	33	30	35	37	32	26	30	16

Table A-1-(2) No. of Tropical Cyclones

Month	Cyclone affected to the Philippines	Disastrous cyclone	
		Philippines	Visayas
Jan.	11	3	2
Feb.	8	0	0
Mar.	8	0	0
Apr.	10	5	3
May	23	6	4
Jun.	36	10	2
Jul.	80	12	1
Aug.	84	9	0
Sep.	72	11	0
Oct.	59	17	4
Nov.	61	24	14
Dec.	31	13	6
Total	483	110	36
No. per Year	20.1	3.93	1.29
Period	1948-1971	1948-1975	1948-1975

次に，１９４８年～１９７５年の２８年間にビサヤス地域附近を通過した３６個の台風に関するデーターから，最大風速，最低気圧ならびに最大２４時間降水量について，それぞれの第１０位までをとりまとめてTable A－1－(3)に示す。ビサヤス地域において観測された極値はそれぞれ次の通りである。

最　大　・風　速　：１３０kt＝６６.９m/s（Cebu市，１９５１年）

最　低　気　圧　：９５６mb（Dumaguete市，ネグロス，１９６８年）

最大２４時間降水量　：５６５mm（Surigao市，ミンダナオ，１９６８年）

他方，Philippines Atmospheric, Geophysical and Astromical Services Administration（PAGASA）のDr. Roman L. Kintanarによってフィリピン全土の主要観測所における年最大風速（１分間評価）について再現期間の統計解析が行われている。（“Climatology and Wind Related Problems in The Philippines”）この報告から再現期間５０年の風速マップをFig A－１－(1)に示す。ビサヤス地域ではサマール島北部およびレイテ島南部を除いて，ほぼ全域が９０kt（＝４６.３m/s）の領域でカバーされている。

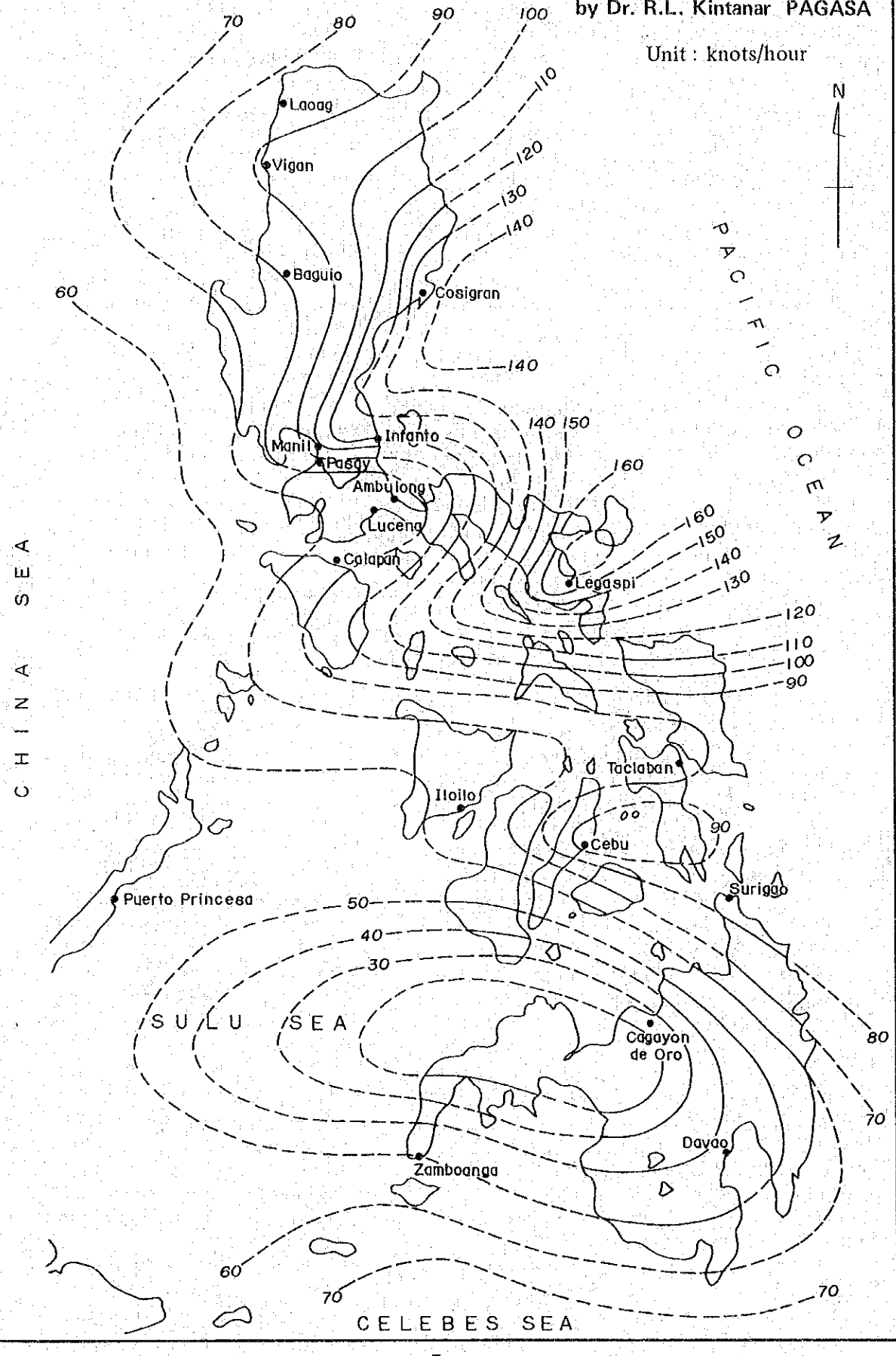
Table A-1-(3)　Highest Magnitude on Toroupical Cyclone Data (in Visayas region 1948 - 1975)

Order	Max. wind speed (knots)	Min. pressure (mb)	Max. 24 hour rainfall (mm)
1	130 (Cebu)	956 (Negros)	565 (Surigao)
2	115 (Lyete)	968 (Samar)	521 (Negros)
3	105 (Negros)	970 (Daet)	518 (Cebu)
4	100 (Calopan)	970 (Samar)	484 (Samar)
5	100 (Masbate)	972 (Legaspi)	391 (Daet)
6	100 (Masbate)	972 (Samar)	388 (Samar)
7	100 (Cuye)	977 (Samar)	378 (Samar)
8	95 (Samar)	985 (Leyte)	356 (Cebu)
9	89 (Surigao)	988 (Masbate)	355 (Cebu)
10	85 (Cebu)	989 (Cuye)	330 (Samar)

Fig. A-1-(1) Annual Max-Wind Speed at 50 years Return Period

by Dr. R.L. Kintanar PAGASA

Unit : knots/hour



A-2　電力需要想定

Table A-2-(1) Power Demand Forecast for Panay Grid

	Unit	Actual 1979	Estimated 1985	Estimated 1990
(1) Population				
PECO	10^3	271	314	347
AKELCO	10^3	282	294	303
ANTECO	10^3	459	499	533
CAPELCO	10^3	226	241	248
ILECO I	10^3	226	241	248
ILECO II	10^3	391	419	439
ILECO III	10^3	87	94	101
Total	10^3	2,053	2,224	2,354
(2) No. of customer and electrification ratio				
PECO	10^3/%	21.6/47.8	28.8/55	34.7/60
6 Cooperatives	10^3/%	59.1/19.9	95.5/30	133.8/40
Total	10^3/%	80.7/23.6	124.3/33.5	168.5/42.9
(3) Specific demand per customer				
PECO	kWh	3,205	3,310	4,220
6 Cooperatives	kWh	619	890	1,170
(4) Energy demand				
PECO	GWh	69	95	146
6 Cooperatives	GWh	37	85	157
(5) New industrial demand	GWh	0	50	56
(6) Total demand (4) + (5)	GWh	106	230	359
(A) Total demand at generation level	GWh	132	307	422
(B) NPC's estimated demand	GWh	114	283	366
(C) Relation (A)/(B)		1.16	1.08	1.15

Table A-2-(2) Power Demand Forecast for Negros Grid

	Unit	Actual 1979	Estimated 1985	Estimated 1990
(1) Population				
CENECO	10^3	427	453	471
NOCECO	10^3	575	615	641
VRESCO	10^3	575	610	636
NORECO I	10^3	364	391	413
NORECO II	10^3	383	415	442
Total	10^3	2,324	2,484	2,603
(2) No. of customer and electrification ratio				
CENECO	10^3/%	25.0/35.1	45.3/60	62.8/80
4 remains Cooperatives	10^3/%	31.5/10.0	186.2/55	248.7/70
Total	10^3/%	56.5/14.6	231.5/55.9	311.5/71.8
(3) Specific demand per customer				
CENECO	kWh	2,824	3,780	4,820
4 Cooperatives	kWh	1,380	1,850	2,360
(4) Energy demand				
CENECO	GWh	71	171	303
4 Cooperatives	GWh	44	344	587
(5) New industrial demand	GWh	0	251	282
(6) Total demand (4) + (5)	GWh	115	766	1,172
(A) Total demand at generation level	GWh	144	1,021	1,563
(B) NPC's estimated demand	GWh	145	1,301	1,674
(C) Relation (A)/(B)		0.99	0.78	0.93

Table A-2-(3) Power Demand Forecast for Cebu Grid

	Unit	Actual 1979	Estimated 1985	Estimated 1990
(1) Population				
VECO	10^3	778	883	952
CEBECO I	10^3	363	421	444
CEBECO II	10^3	248	265	270
CEBECO III	10^3	191	204	207
Total	10^3	1,580	1,773	1,873
(2) No. of customer and electrification ratio				
VECO	10^3/%	73.6/56.8	103.0/70	134.9/85
3 Cooperatives	10^3/%	5.9/ 4.4	66.7/45	107.5/70
Total	10^3/%	79.5/30.2	169.7/57.4	242.4/77.7
(3) Specific demand per customer				
VECO	kWh	3,837	5,140	6,560
3 Cooperatives	kWh	562	830	1,090
(4) Energy demand				
VECO	GWh	282	529	885
3 Cooperatives	GWh	3	55	117
(5) New industrial demand	GWh	0	139	156
(6) Total demand (4) + (5)	GWh	285	723	1,158
(A) Total demand at generation level	GWh	380	904	1,448
(B) NPC's estimated demand	GWh	453	1,123	1,664
(C) Relation (A)/(B)		0.84	0.81	0.87

Table A-2-(4) Power Demand Forecast for Leyte Grid

	Unit	Actual 1979	Estimated 1985	Estimated 1990
(1) Population				
DORELCO	10^3	259	272	281
LEYECO II	10^3	127	134	139
LEYECO III	10^3	165	173	179
LEYECO IV	10^3	175	183	189
LEYECO V	10^3	352	370	382
LEYECO VI	10^3	89	93	96
SOLECO	10^3	289	309	327
Total	10^3	1,456	1,534	1,593
(2) No. of customer and electrification ratio				
LEYECO II	10^3/%	12.3/58.0	14.5/65	16.2/70
6 Cooperatives	10^3/%	16.9/ 8.5	93.3/40	145.9/60
Total	10^3/%	29.2/12.0	107.8/42.2	162.1/61.1
(3) Specific demand per customer				
LEYECO II	kWh	1,286	1,720	2,190
6 Cooperatives	kWh	737	990	1,260
(4) Energy demand				
LEYECO II	GWh	16	25	35
6 Cooperatives	GWh	12	92	184
(5) New industrial demand	GWh	0	77	98
(6) Total demand (4) + (5)	GWh	28	194	317
(A) Total demand at generation level	GWh	35	259	422
(B) NPC's estimated demand	GWh	6	561	1,041
(C) Rleation (A)/(B)		-	0.43	0.41

Table A-2-(5) Power Demand Forecast for Samar Grid

	Unit	Actual 1979	Estimated 1985	Estimated 1990
(1) Population				
SAMELCO I	10^3	184	196	208
SAMELCO II	10^3	255	273	292
Northern Samar	10^3	344	364	397
Eastern Samar	10^3	301	318	332
Total	10^3	1,084	1,151	1,229
(2) No. of customer and electrification ratio				
SAMELCO II	10^3/%	4.2/13.7	8.2/25	10.4/30
Other Cooperatives	10^3/%	4.2/ 2.8	23.9/15	34.0/20
Total	10^3/%	8.4/ 4.5	32.1/16.7	44.4/21.7
(3) Specific demand per customer				
SAMELCO II	kWh	450	800	1,150
Other Cooperatives	kWh	-	710	1,090
(4) Energy demand				
SAMELCO II	GWh	2	7	12
Other Cooperatives	GWh	2	17	37
(5) New industrial demand	GWh	0	23	26
(6) Total demand (4) + (5)	GWh	4	47	75
(A) Total demand at generation level	GWh	5	59	94
(B) NPC's estimated demand	GWh	-	60	91
(C) Relation (A)/(B)		-	0.98	1.03

Table A-2-(6) Prospective Industrial Customers

Power Grid and Industrial Customers	Pick-up Year	Location	Initial Load (MW)	Initial Load (GWh)
A. Panay power grid				
1) PEPSI & 7-up INC.	1980	Iloilo City	0.17	0.95
2) SEAFDEC	1980	ditto	0.74	3.60
3) Barotac Ice Plant	1980	Barotac	0.12	0.22
4) Passi Sugar Central	1980	San Enrique	2.30	12.10
5) CALASUC	1980	Calinog	1.40	7.20
6) SANLOP Co. Inc.	1980	Barotac Passi	0.79	4.20
7) Alled Sugar Central	1980	Passi	0.88	4.60
8) Luxemburg Pulp. & Paper Co.	1980	Iloilo	2.00	10.50
9) Asturias Sugar Central	1980	Capiz	0.63	3.30
10) Pilar Sugar Central	1980	Capiz	0.57	3.00
11) Balasan Ice Plant	1982	Balasan	0.04	0.21
Total			9.64	49.88
B. Negros power grid				
(a) Talisay sub-grid				
1) Bacolod-Murcia Milling Co.	1981	Negros Occ.	0.90	1.28
2) MA-AO Sugar Central	1981	Negros Occ.	1.25	1.78
3) Hawaiian Phil. Sugar	1981	Negros Occ.	1.50	2.08
4) Talisay-Silay Milling Co., Inc.	1981	Talisay, Neg. Occ.	1.10	1.61
5) IST Parmer's Market & Milling Co.	1981	Negros Occ.	1.05	2.11
6) Aidisia Sugar Central	1981	Negros Occ.	1.80	3.28
7) North Negros Logging Ind. Corp.	1981	Negros Occ.	0.06	0.16
8) Planing Co. & Bejon Factory	1981	Negros Occ.	0.10	0.35
9) Kool Co-Alcohol Fermentation	1981	Negros Occ.	0.15	0.92
10) Victorias Milling Corp.	1982	Victorias, Neg. Occ.	5.12	11.20

Power Grid and Industrial Customers	Pick-up Year	Location	Initial Load (MW)	(GWh)
11) Victorias Cattle Feedmill	1983	Neg. Occ.	0.30	1.05
12) Lopez Sugar Central	1983	Neg. Occ.	1.60	3.50
13) Sacay Sugar Central	1983	Neg. Occ.	1.50	3.28
14) Danao Dev. Corp.	1983	Neg. Occ.	0.70	1.15
15) San Carlos Sugar Central	1983	San Carlos City	1.15	5.44
16) Sagay Cattle Feedmill	1983	Neg. Occ	0.20	0.70
Sub-total			13.36	28.69
(b) Sipalay sub-grid				
1) CDCP	1982	Neg. Occ.	12.80	61.67
2) MMIC	1982	Neg. Occ.	10.24	49.34
3) Lepanto Consolidated Mining	1982	Honobaan, Neg. Occ.	8.96	43.17
4) Ilco Philippines	1983	Neg. Occ.	1.00	5.25
5) Asia Alcohol Corp.	1983	Neg. Occ.	0.19	1.33
6) Total Bulk Corp.	1983	Neg. Occ.	0.05	0.11
7) Phil. Bulk Corp.	1983	Neg. Occ.	0.36	1.26
8) Nat'l Warehousing Corp.	1983	Neg. Occ.	0.36	1.19
9) San Enrique Ice Plant	1983	Neg. Occ.	0.14	0.73
10) Tasmic Ice & Cold Storage	1983	Neg. Occ.	0.14	0.73
11) Negros Integrated Ind. Corp.	1983	Neg. Occ.	0.04	0.10
12) Central Azucarera de la Carlota	1983	La Carlota City	3.45	15.11
13) BISCOM	1984	Binalbagan, Neg. Occ.	2.65	13.93
14) SONEDCO	1984	Neg. Occ.	1.90	7.66
15) Dacongcogon Sugar Central	1984	Neg. Occ.	0.70	1.84
16) Hingaran Ice Plant	1984	Neg. Occ.	0.12	0.65
17) Hinalayan Ice Plant	1984	Neg. Occ.	0.10	0.55
18) Triple-A Trading	1984	Neg. Occ.	0.10	0.36
Sub-total			43.30	204.98

Power Grid and Industrial Customers	Pick-up Year	Location	Initial Load (MW)	(GWh)
(c) Amlan sub-grid				
1) Ass. Agricola de Bais	1979	Bais City	0.21	0.56
2) Manuel L. Teves, Inc.	1979	Neg. Oriental	0.06	0.20
3) Mr. G. Fleisher	1979	Neg. Oriental	0.03	0.12
4) A.A. Ice Plant	1980	Neg. Oriental	0.01	0.08
5) UPSUMCO	1983	Neg. Oriental	1.20	5.78
6) NOROIL	1983	Neg. Oriental	0.60	3.42
7) PATIC	1983	Neg. Oriental	0.70	0.33
8) Tolong Sugar Central	1984	Neg. Oriental	1.15	4.73
9) Basay Sawmill	1984	Neg. Oriental	0.10	0.44
10) Pan Oriental Sawmill	1984	Neg. Oriental	0.25	1.09
11) Arnaiz Sawmill	1984	Neg. Oriental	0.15	0.65
12) Garvantiel Ice Plant	1984	Neg. Oriental	0.04	0.21
Sub-total			3.87	17.61
Total			60.53	251.28
C. Cebu power grid				
1) Dancar Ice Plant	1981	Danao City	0.55	1.40
2) Durano Industrial Complex	1981	Danao City	2.30	6.00
3) Liloan Shipyard	1981	Liloan	2.50	6.57
4) Bogo-Medellin Sugar Central	1981	Bogo	0.42	1.10
5) Dolomite Mining	1981	Dalaguete	1.50	3.90
6) Mactan Export Processing	1981	Lapu-Lapu City	2.19	5.70
7) General Milling Corp.	1981	Lapu-Lapu City	3.00	7.80
8) Cebu Shipyard	1981	Mactan	1.20	2.50
9) Apo Cement Corp.	1982	Naga	7.00	40.00
10) San Miguel Corp.	1982	Mandaue	6.70	35.20
11) Talisay Mini-Industrial	1982	Talisay	0.70	1.69
12) LUDO & LUYM	1982	Cebu City	4.40	19.30
13) Prime Cement	1983	Tuburan	1.50	7.50
Total			33.96	138.66

Power Grid and Industrial Customers	Pick-up Year	Location	Initial Load (MW)	(GWh)
D. Leyte power grid				
1) Fertilizer Plant	1981	Isabel	2.00	5.10
2) Pasar Copper Smelting	1981	Isabel	18.00	46.00
3) LSBDA (Sab-A Basin)	1982	Tacloban City	4.30	10.70
4) Ice Plant	1982	Carigara	0.02	0.11
5) FILMAG (Merida Bentamite Mine)	1982	Ormoc City	0.72	2.10
6) HIDECO	1982	Kananga	0.54	1.80
7) OSCO	1982	Ormoc City	0.19	0.67
8) BIOPHIL	1982	Ormoc City	3.40	10.60
9) Ice Plant	1982	Maasin	0.02	0.03
10) Ice Plant	1982	San Juan	0.03	0.04
11) VISCA	1983	Baybay	0.14	0.18
12) Ice Plant	1983	Hilongos	0.02	0.11
13) Ice Plant	1983	Almeria	0.01	0.03
Total			29.39	77.47
E. Samar power grid				
1) Ice Plant	1983	Catarman	0.05	0.26
2) Ice Plant	1983	Allen	0.10	0.53
3) Ice Plant	1983	Laoang	0.05	0.26
4) Bagacay Mines (MMIC)	1983	Hinabangan	3.10	19.10
5) UTIMCO	1983	S. Julian	0.45	2.40
6) MMIC Loading Sta.	1983	S. Julian	0.10	0.44
7) White Enterprises	1983	Sulat	0.03	0.11
Total			3.88	23.10

Fig. A-2-(1) Daily Load Curves of PECO System
(Iloilo City)

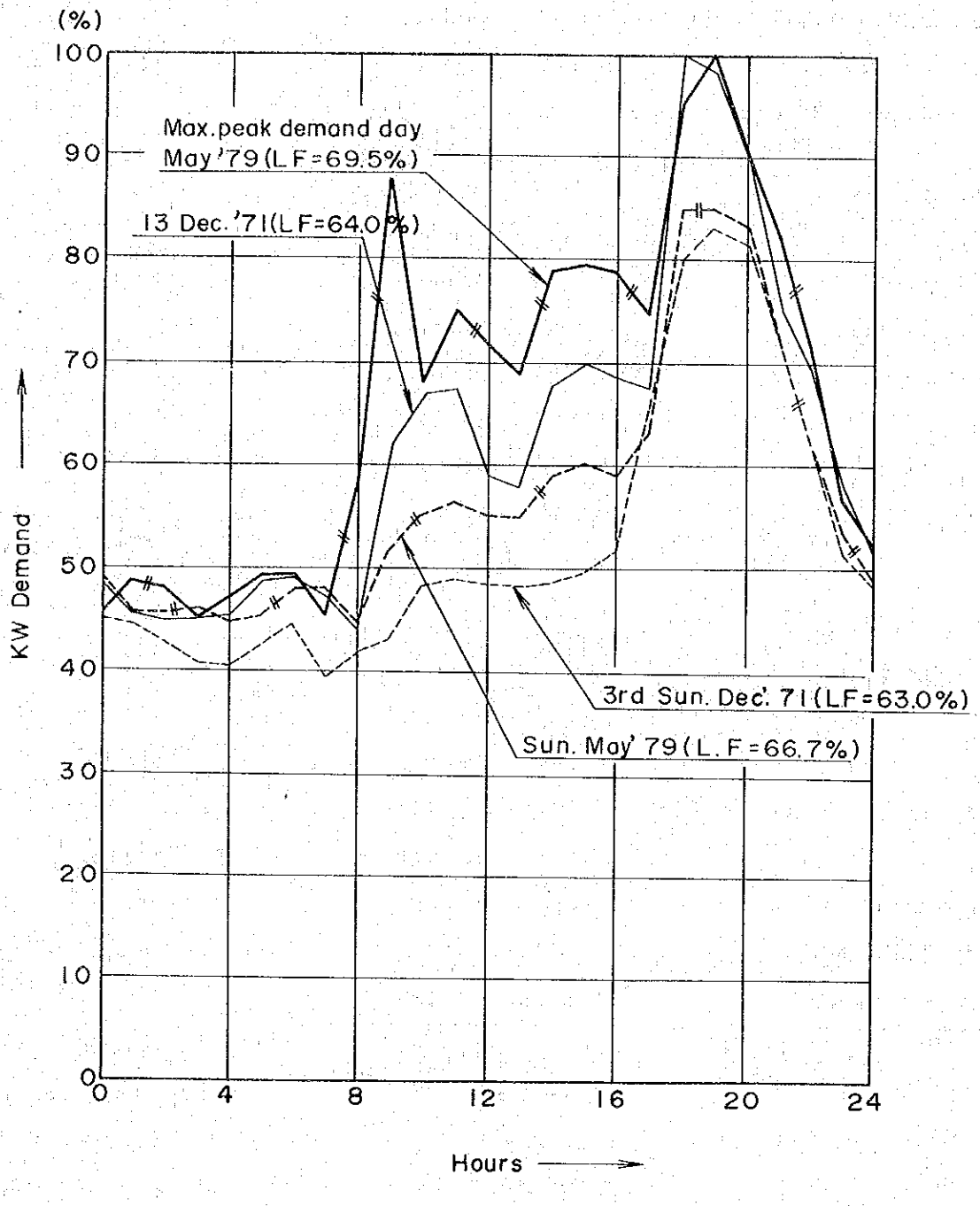


Fig. A-2-(2) Daily Load Curves of CENECO
(Bacolod City)

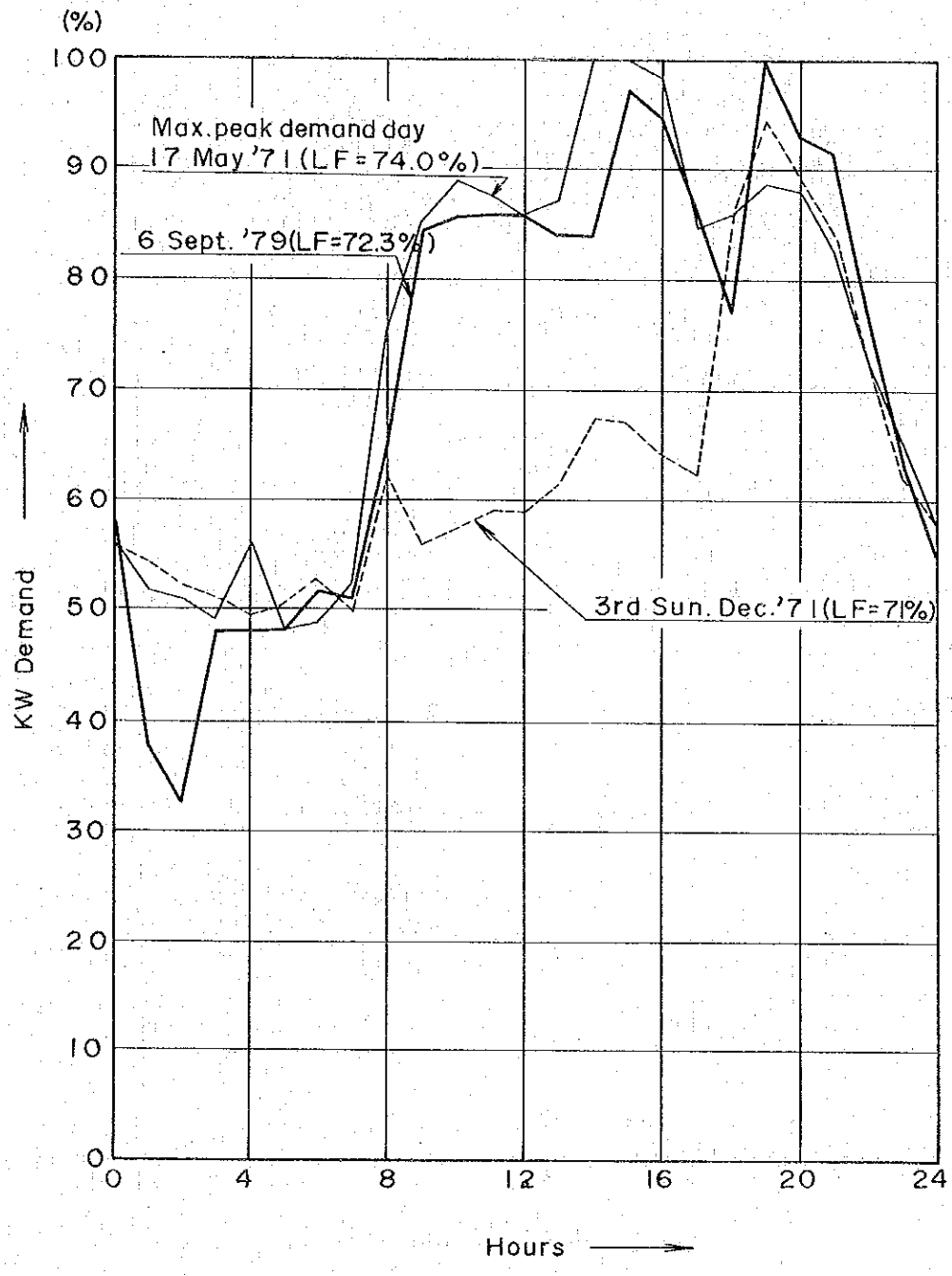


Fig. A-2-(3) Daily Load Curves of VECO System
(Cebu City)

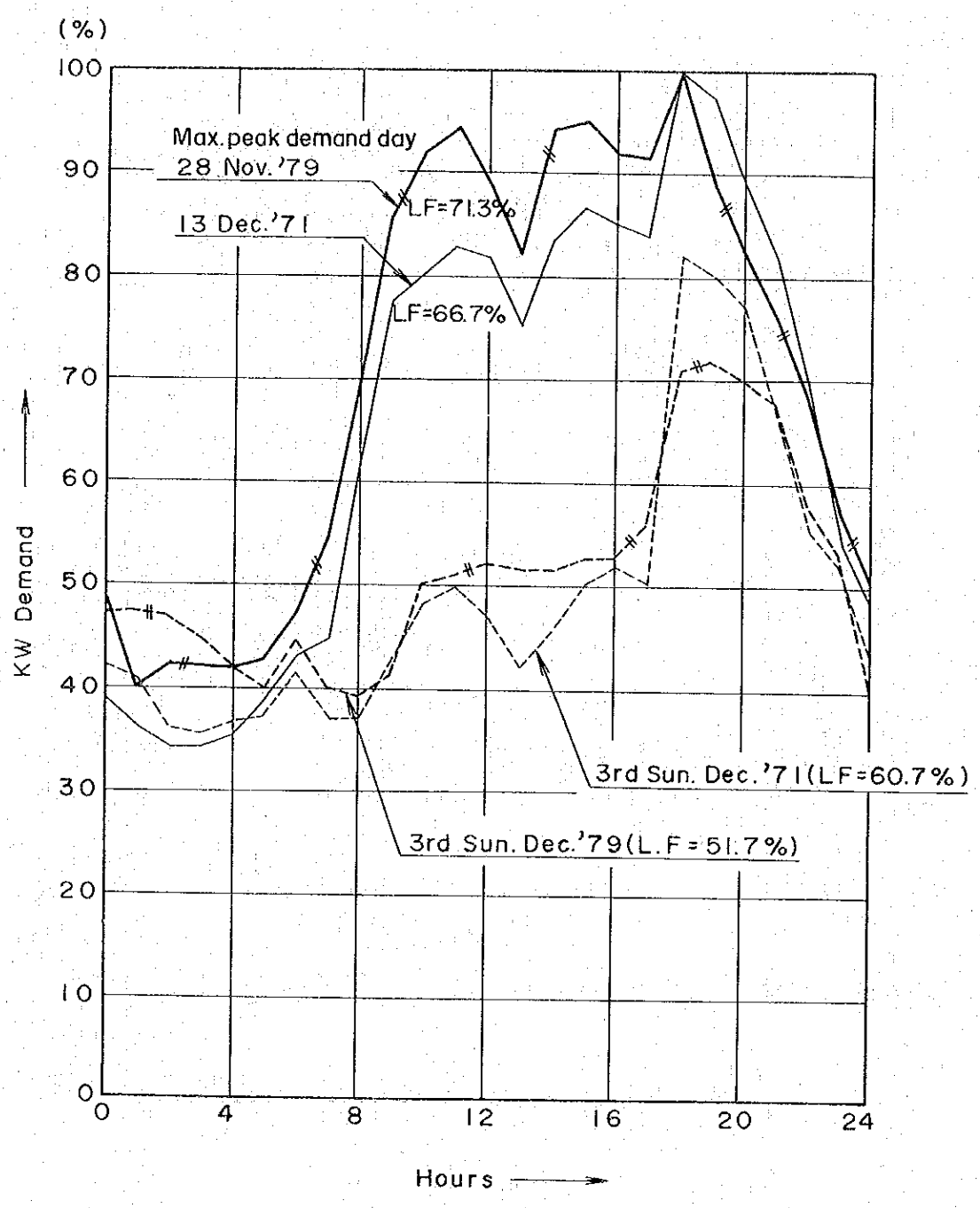
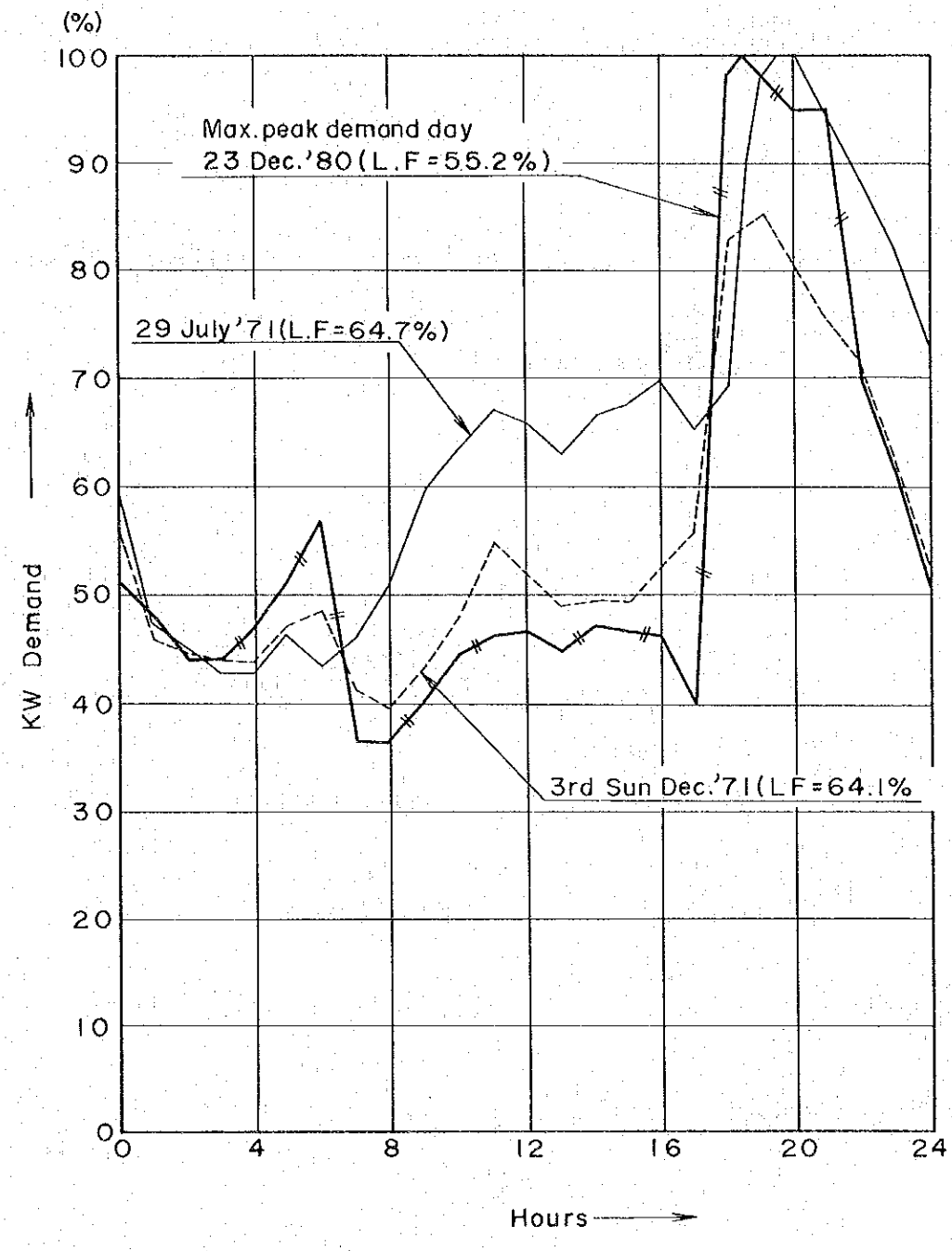


Fig. A-2-(4) Daily Load Curves of DORELCO
(Tacloban City)



A-3　電力系統解析

Table A-3-(1) Expansion Program for Generating Facilities

Year	Island	Power plant	No x MW	Available energy (GWh)
1979	Negros	Amlan Hydro	2 x 0.4	5
	Negros	Amlan Diesel	2 x 5.5	67
	Bohol	Loboc Hydro	3 x 0.4	7
	Bohol	Tagbilaran D.	2 x 5.5	67
	Cebu	Cebu Diesel	6 x 7.3	270
	Leyte	Tongonan Geo.	1 x 3	20
	Cebu	VECO Diesel	49.3	281
	Panay	Dingle Diesel	1 x 7.3	45
	Panay	Dingle Diesel	1 x 7.3	45
		Total		
1980	Panay	Panitan Diesel	11	67
	Negros	Talisay Diesel	14.6	89
	Negros	Bacolod Diesel	22.45	118
	Panay	Dingle Diesel	2 x 7.3	90
	Cebu	Rehab. of VECO. T.	10	61
	Cebu	Rehab. of Cebu D.	7.3	45
		Total		
1981	Cebu	Naga Thermal I	1 x 55	337
	Cebu	Cebu Diesel II	1 x 18	110
	Cebu	Retire VECO D.	(-9)	(-51)
	Cebu	Cebu Diesel II	1 x 18	110
	Negros	Palimpinon Geo.	2 x 1.5	20
	Cebu	Power Barge I	4 x 8	196
	Negros	Power Barge II	4 x 8	196
	Cebu	Cebu Diesel II	1 x 8	110
		Total		
1982	Negros	Sipalay Diesel	2 x 18	220
	Leyte	Tongonan Geo. 1	1 x 37.5	245
	Leyte	Tongonan Geo. 2	1 x 37.5	245
		Total		
1983	Cebu	Retire VECO. D.	(-13.5)	(-77)
	Negros	Palimpinon Geo.	1 x 37.5	245
	Negros	Palimpinon Geo.	2 x 37.5	490
	Leyte	Tongonan Geo. 3	1 x 37.5	245
		Total		

Islands	Type of power plant							
	Hydro (GWh)	Geothermal (GWh)	Coal (GWh)	Sub-total (GWh)	Diesel (GWh)	Power barge (GWh)	Sub-total (GWh)	Total (GWh)
1979								
Panay	0	0	0	0	90	0	90	90
Negros	5	0	0	5	67	0	67	72
Cebu	0	0	0	0	551	0	551	551
Leyte	0	20	0	20	0	0	0	20
Samar	0	0	0	0	0	0	0	0
Bohol	7	0	0	7	67	0	67	74
Total	12	20	0	32	775	0	775	807
1980								
Panay	0	0	0	0	157	0	157	157
Negros	0	0	0	0	207	0	207	207
Cebu	0	0	61	61	45	0	45	106
Leyte	0	0	0	0	0	0	0	0
Samar	0	0	0	0	0	0	0	0
Bohol	0	0	0	0	0	0	0	0
Total	0	0	61	61	409	0	409	470
1891								
Panay	0	0	0	0	0	0	0	0
Negros	0	20	0	20	0	196	196	216
Cebu	0	0	337	337	279	196	475	812
Leyte	0	0	0	0	0	0	0	0
Samar	0	0	0	0	0	0	0	0
Bohol	0	0	0	0	0	0	0	0
Total	0	20	337	357	279	392	671	1,028
1982								
Panay	0	0	0	0	0	0	0	0
Negros	0	0	0	0	220	0	220	220
Cebu	0	0	0	0	0	0	0	0
Leyte	0	490	0	490	0	0	0	490
Samar	0	0	0	0	0	0	0	0
Bohol	0	0	0	0	0	0	0	0
Total	0	490	0	490	220	0	220	710
1983								
Negros	0	735	0	735	0	0	0	735
Cebu	0	0	0	0	(-77)	0	(-77)	(-77)
Leyte	0	245	0	245	0	0	0	245
Total	0	980	0	980	(-77)	0	(-77)	903

Table A-3-(2) Expansion Program for Generating Facilities

Year	Island	Power plant	No x MW	Available energy (GWh)
1984	Cebu	Naga Thermal	1 x 55	337
	Leyte	Tongonan Geo.	2 x 37.5	490
	Negros	Retire Bacolod D.	(-9)	(-47)
		Total		
1985	Negros	Negros Thermal I	1 x 55	337
	Leyte	Tongonan Geo.	1 x 37.5	245
		Total		
1986	Panay	Panay Thermal I	1 x 55	337
	Leyte	Tongonan Geo.	1 x 37.5	245
		Total		
1987	Negros	Bago HE	60	110
	Leyte	Tongonan Geo.	1 x 37.5	245
	Samar	Catubig HE	2 x 15	131
		Total		
1988	Negros	Negros Thermal II	1 x 55	337
	Cebu	Retire VECO D.	(-1.5)	(-86)
	Leyte	Tongonan Geo.	1 x 37.5	245
	Bohol	Upper Loboc HE	1 x 17.5	51
		Total		
1989	Negros	Mambucal Geo.	1 x 37.5	245
	Leyte	Tongonan Geo	1 x 37.5	245
		Total		
1990	Panay	Aklan HE	20	44
	Negros	Mambucal Geo.	1 x 37.5	245
	Leyte	Tongonan Geo.	1 x 37.5	245
	Negros	Retire Bacolod D.	(-8)	(-42)
		Total		

Islands	Type of power plant							
	Hydro (GWh)	Geothermal (GWh)	Coal (GWh)	Sub-total (GWh)	Diesel (GWh)	Power barge (GWh)	Sub-total (GWh)	Total (GWh)
1984								
Negros	0	0	0	0	(-47)	0	(-47)	(-47)
Cebu	0	0	337	337	0	0	0	337
Leyte	0	490	0	490	0	0	0	490
Total	0	490	337	827	(-47)	0	(-47)	780
1985								
Negros	0	0	337	337	0	0	0	337
Leyte	0	245	0	245	0	0	0	245
Total	0	245	337	582	0	0	0	582
1986								
Panay	0	0	337	337	0	0	0	337
Leyte	0	245	0	245	0	0	0	245
Total	0	245	337	582	0	0	0	582
1987								
Negros	110	0	0	110	0	0	0	110
Leyte	0	245	0	245	0	0	0	245
Samar	131	0	0	131	0	0	0	131
Total	241	245	0	486	0	0	0	486
1988								
Negros	0	0	337	337	0	0	0	337
Cebu	0	0	0	0	(-86)	0	(-86)	(-86)
Leyte	0	245	0	245	0	0	0	245
Bohol	51	0	0	51	0	0	0	51
Total	51	245	337	633	(-86)	0	(-86)	547
1989								
Negros	0	245	0	245	0	0	0	245
Leyte	0	245	0	245	0	0	0	245
Total	0	490	0	490	0	0	0	490
1990								
Panay	44	0	0	44	0	0	0	44
Negros	0	245	0	245	(-42)	0	(-42)	203
Leyte	0	245	0	245	0	0	0	245
Total	44	490	0	534	(-42)	0	(-42)	492

Table A-3-(2) Generator and Transformer Constants on Machine Base

		Po/Pg (MVA/MW)	M (sec)	Pf (%)	xd (%)	xd' (%)	xd'' (%)	Pt (MVA)	Xt (%)
CEBU-Is									
Naga	(T)	65/55	6.0	85	155	30	17.3	65	12.0
	"	65/55	6.0	85	"	"	"	65	"
	(D)	9.1/7.3	3.88	80	141	41.3	30.2		
	"	9.1/7.3	"	"	"	"	"		
	"	9.1/7.3	"	"	"	"	"		
	"	9.1/7.3	"	"	"	"	"	38x2	12.57
	"	9.1/7.3	"	"	"	"	"		
	"	9.1/7.3	"	"	"	"	"		
	"	9.1/7.3	"	"	"	"	"		
	(P.B)	10/8	1.78	80	170	31.5	19.0		
	"	"	"	80	"	"	"		
	"	"	"	80	"	"	"	42x1	10.75
	"	"	"	80	"	"	"		
Talavera	(D)	22.5/18	2.67	80	170	22.0	16.3	22.0	12.0
	"	"	"	"	"	"	"	"	"
	"	"	"	"	"	"	"	"	"
VECO	(D)	6.3/5	2.67	80	170	22.0	16.3		
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
	"	4.3/3.4	"	"	"	"	"	30x2	12.0
	"	"	"	"	"	"	"		
	(T)	5.9/5	6.0	85	170	22.0	16.3		
	"	"	"	"	"	"	"		

		Po/Pg (MVA/MW)	M (sec)	Pf (%)	xd (%)	xd' (%)	xd'' (%)	Pt (MVA)	Xt (%)
NEGROS-Is									
Amlan	(D)	6.9/5.5	2.67	80	115.4	32	23.8	10	9.0
	"	"	"	"	"	"	"	2.5	9.0
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
					(xq=60)				
	(L)	0.5/0.4	5.8	80	96.6	32.6	22.8	1 x 1	9.0
	"	"	"	"	"	"	"		
Palimpinon	(G)	1.9/1.5	6.0	80	170	22.0	16.3	1.9	9.0
	"	"	"	"	"	"	"	"	"
	(G)	46.9/37.5	6.0	80	170	22.0	16.3	46.9	12.0
	"	"	"	"	"	"	"	"	"
	"	"	"	"	"	"	"	"	"
Kabangkalan	(T)	64.7/55	6.0	85	170	22.0	16.3	64.7	12.0
Sipalay	(D)	22.5/18	2.67	80	170	22.0	16.3	50x1	9.0
	"	"	"	"	"	"	"		
Bacolod	(P.B)	10/8	1.78	80	170	31.5	19.0	42x1	10.75
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
Talisay	(D)	6.9/5.5	2.67	80	115.4	33	23.8	6.9	9.0
		"	"	"	"	"	"	"	"
		4.5/3.1	"	"	170	22	16.3	4.5	"
					(xq=60)				
Bago	(H)	12.5/10	5.8	80	96.6	32.6	22.8	12.5	12.0
	"	62.5/50	"	"	"	"	"	62.5	"
Mambucal	(G)	46.9/39.5	6.0	80	170	22	16.3	46.9	12.0
	"	"	"	"	"	"	"	"	"
Negros II	(T)	64.9/55	6.0	85	170	22	16.3	64.7	12.0

		Po/Pg (MVA/MW)	M (sec)	Pf (%)	xd (%)	xd' (%)	xd'' (%)	Pt (MVA)	Xt (%)
PANAY-Is									
Dingle	(D)	9.3/7.3	3.88	80	144	40.4	30	28x2	12.0
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
Panitan	(D)	6.9/5.5	2.67	80	115.4	33	23.8	10x1	9.0
	"	"	"	"	"	"	"		
					(xq=60)				
Aklan	(H)	12.5/10	5.8	80	96.6	32.6	22.8	12.5	9.0
	"	"	"	"	"	"	"	"	"
Panay	(T)	64.7/55	6.0	85	170	22	16.3	64.7	12.0

Note : (T) ; Coal Fire Thermal
(D) ; Diesel
(P.B) ; Power Berge
(H) ; Hydro
(G) ; Geothermal
Po ; Capacity of unit
Pg ; Output of unit
Pf ; Power factor
Pt ; Capacity of transformer

		Po/Pg (MVA/MW)	M (sec)	Pf (%)	xd (%)	xd' (%)	xd'' (%)	Pt (MVA)	Xt (%)
LEYTE-Is									
Bantigue	(P.B)	10/8	1.78	80	170	31.5	19.0	42x1	10.75
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
	"	"	"	"	"	"	"		
Tongonan	(G)	3.8/3	6.0	80	170	22	16.3	3.8	12.0
	"	46.9/37.5	6.0	80	170	22	16.3	46.9	12.0
	"	"	"	"	"	"	"	"	"
	"	"	"	"	"	"	"	"	"
	"	"	"	"	"	"	"	"	"
	"	"	"	"	"	"	"	"	"
	"	"	"	"	"	"	"	"	"
SAMAR-Is									
					(xq=60)				
Catubig	(H)	18.8/15	5.8	80	96.6	32.6	22.8	18.8	9.0
	"	"	"	"	"	"	"	"	"

Note : (P.B) ; Power Berge
(G) ; Geothermal
(H) ; Hydro
Po ; Capacity of unit
Pg ; Output of unit
Pf ; Power factor
Pt ; Capacity of transformer

Table A−3−(3) 無効電力バランス

無効電力バランスは，パナイーネグロスーセブ電力系統１９９０年のピーク時を例にとるとTable A − 3 −(3)のようになっている。

Table A-3-(3) Reactive Power Balance

Unit: (MVar)

	Equipment	Reactive power
Production	Transmission line 138 kV	71
	" 69 kV	26
	Generator	230 *1
	Total	327
Consumption	Load	275 *2
	Transmission line 138 kV	66
	" 69 kV	60
	Transfomer	100
	Total	501

Note: *1 Supply capability at power factor of 0.9

*2 Power factor of load = 0.9

Fig. A-3-(1) Static Stability in 1985

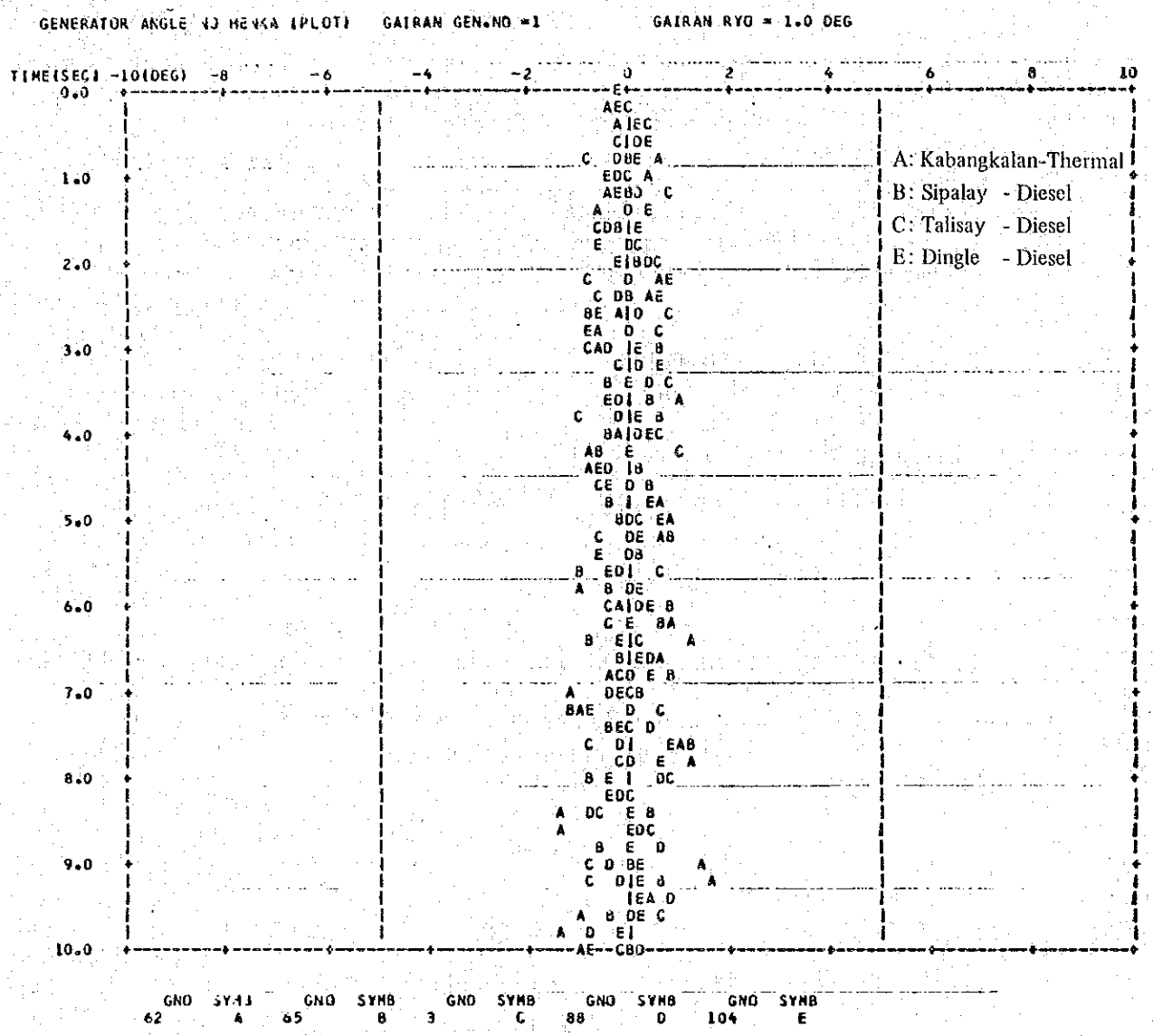


Fig. A-3-(2) Static Stability Peak in 1990

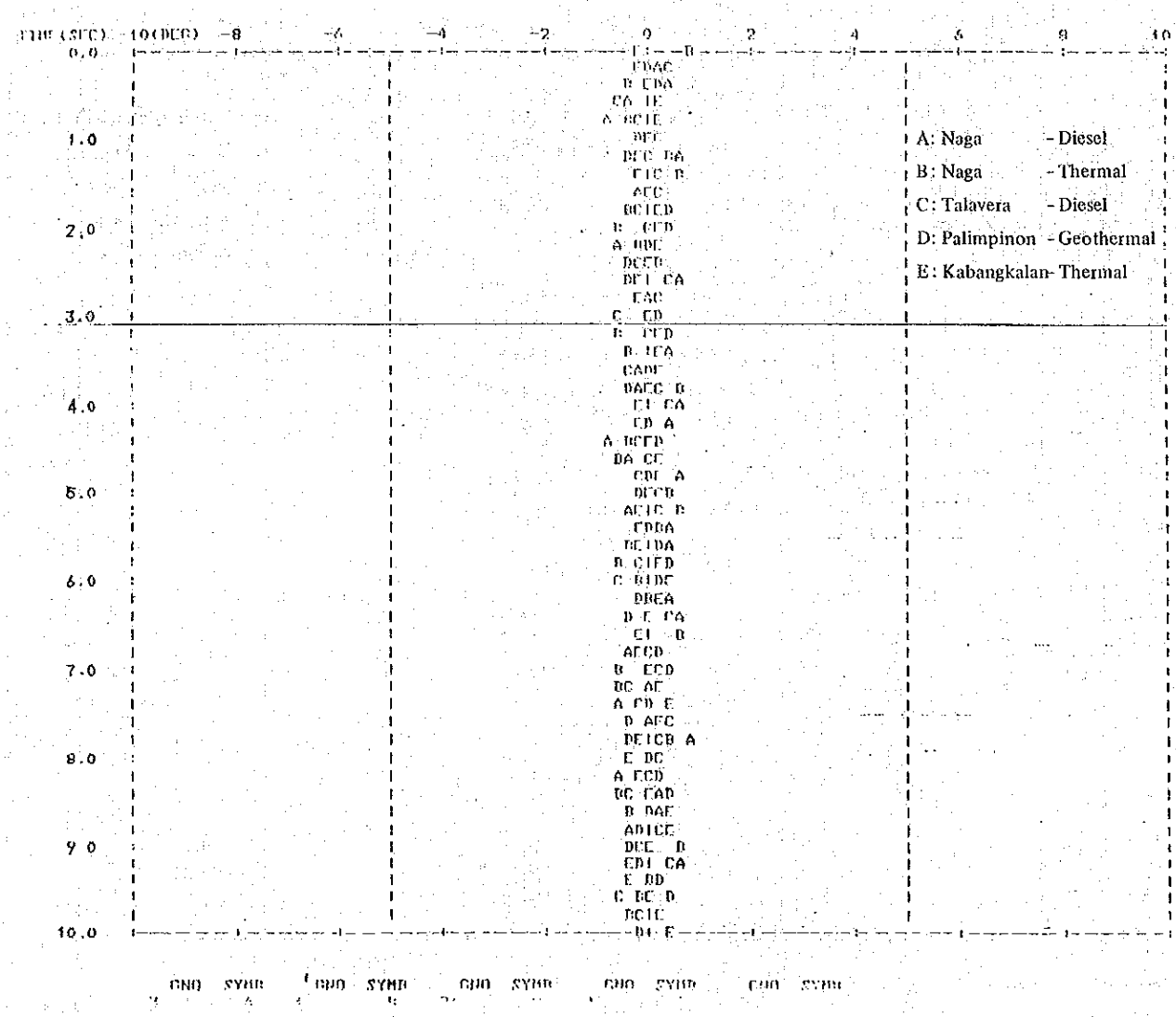


Fig. A-3-(3) Static Stability in 1990 (Base+100MW)

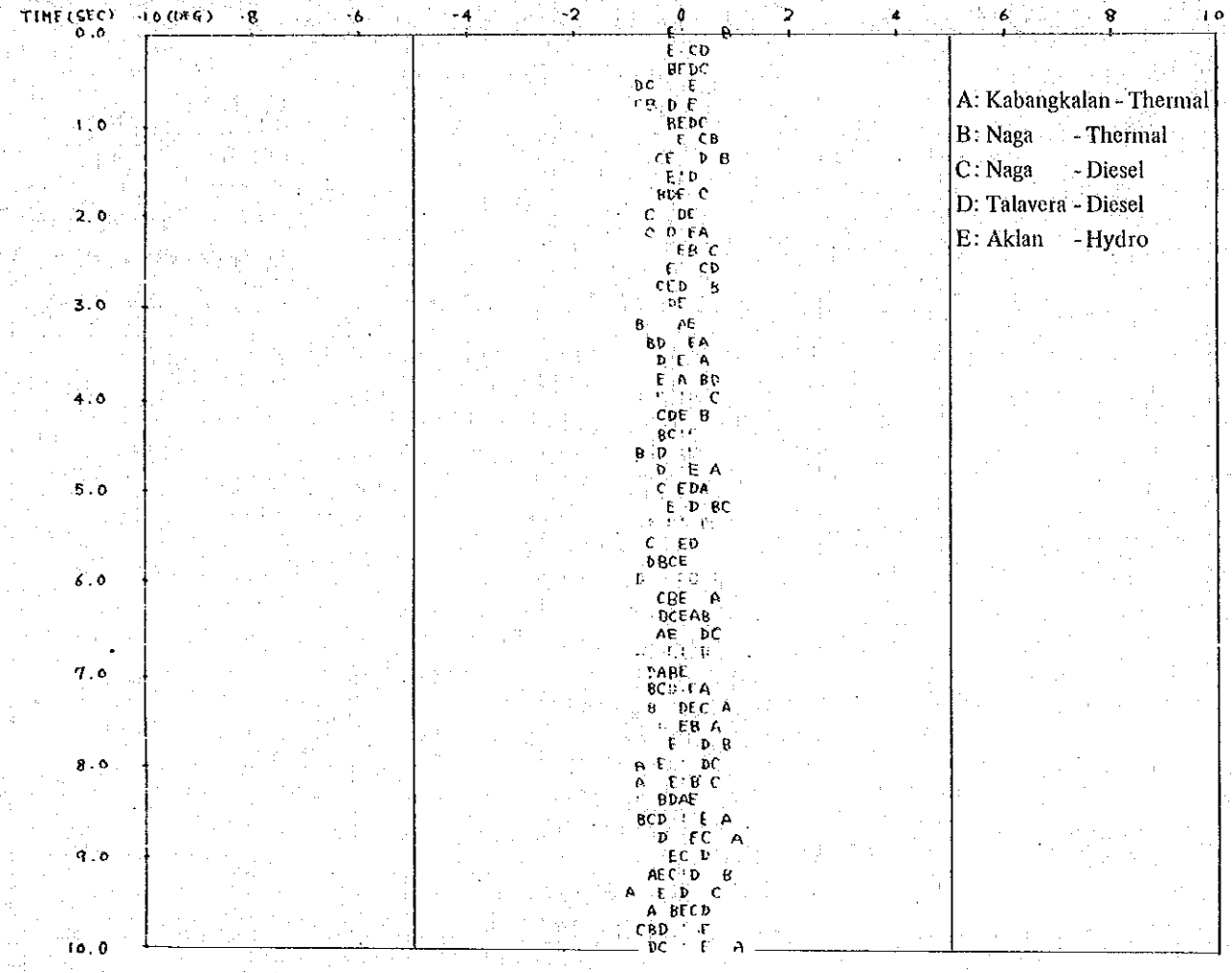


Fig. A-3-(4) Transient Stability in 1985

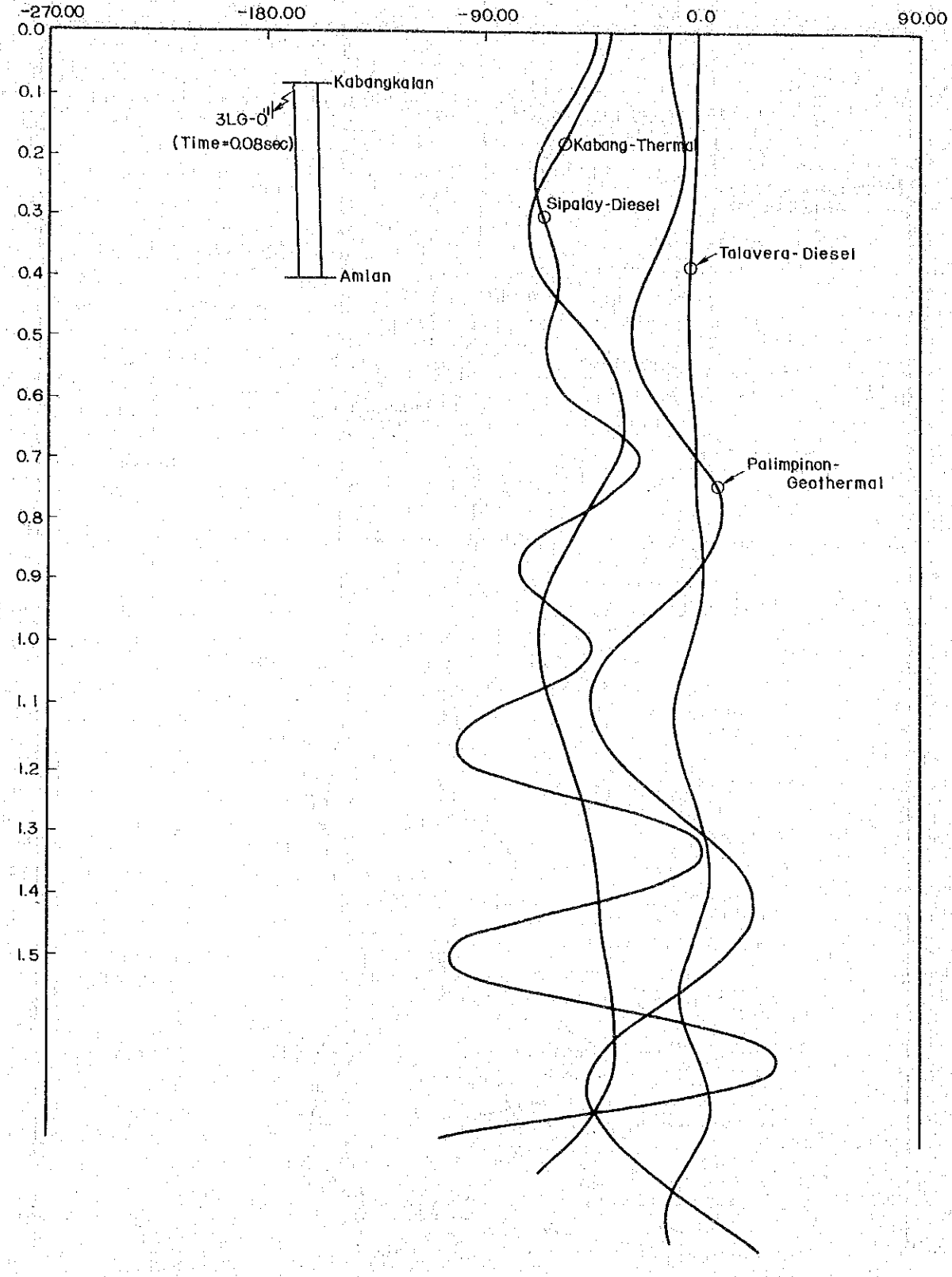


Fig. A-3-(5) Transient Stability Peak Time in 1985

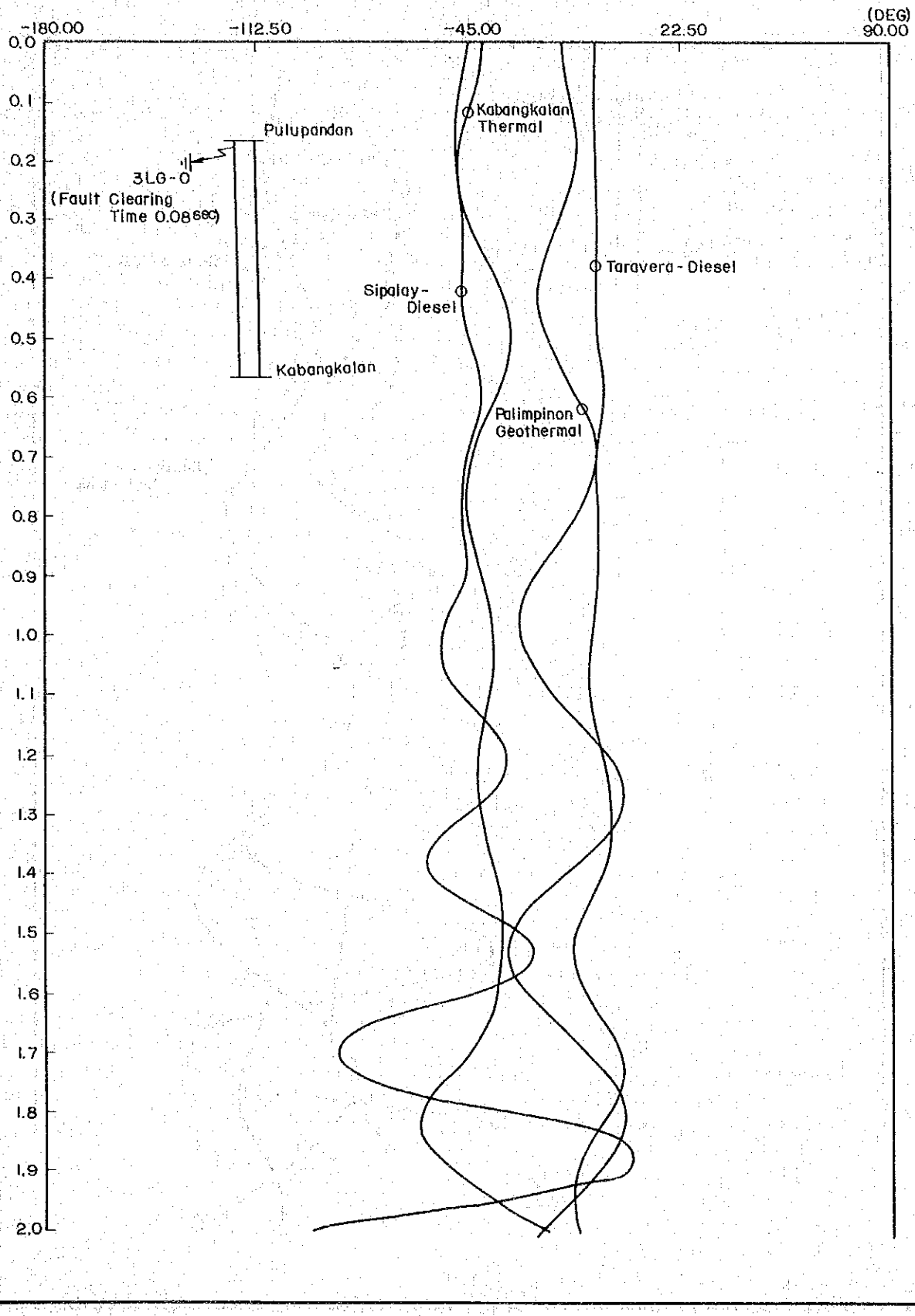


Fig. A-3-(6) Transient Stability in 1990

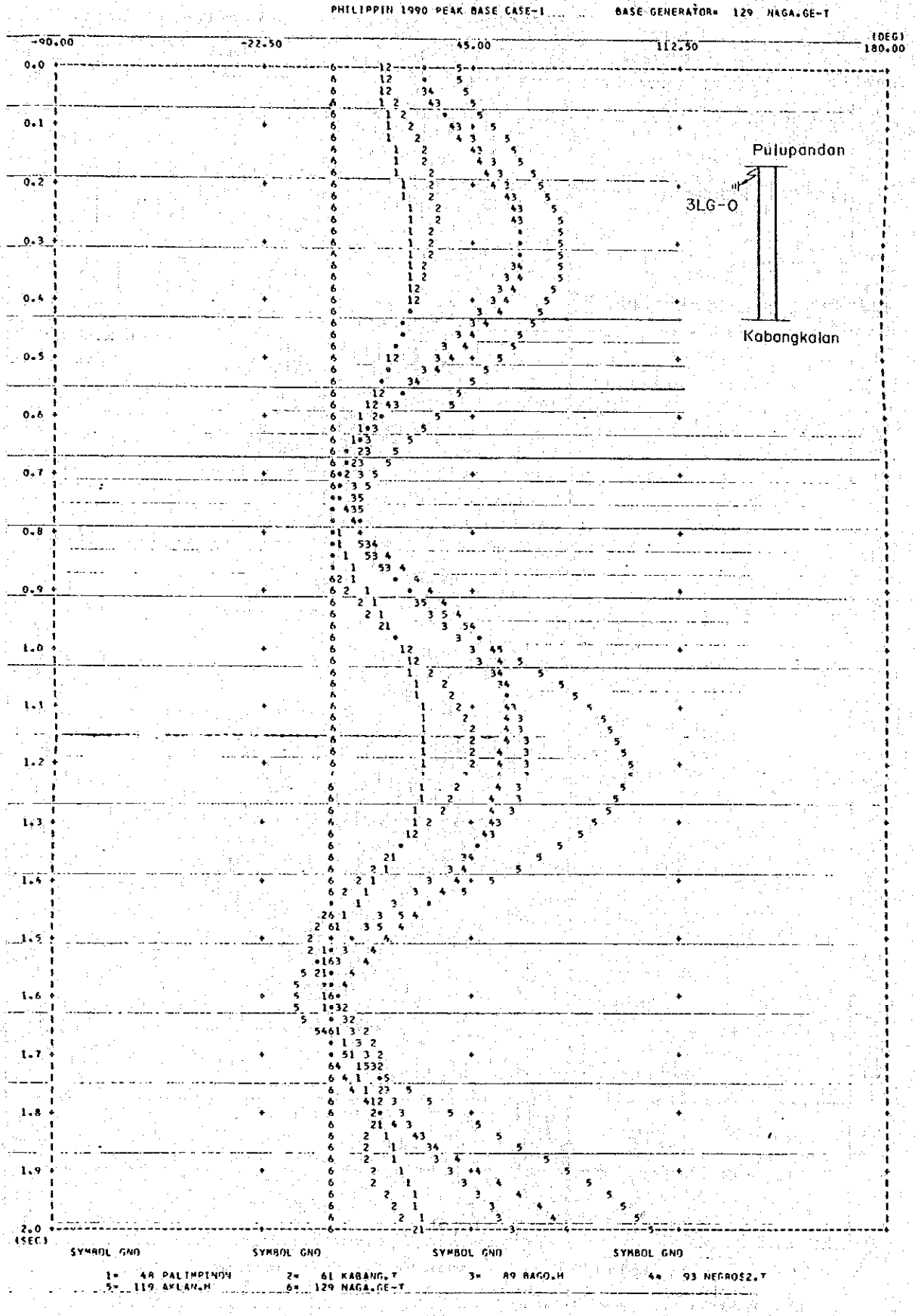


Fig. A-3-(7) Transient Stability in 1990 (Base+100MW)

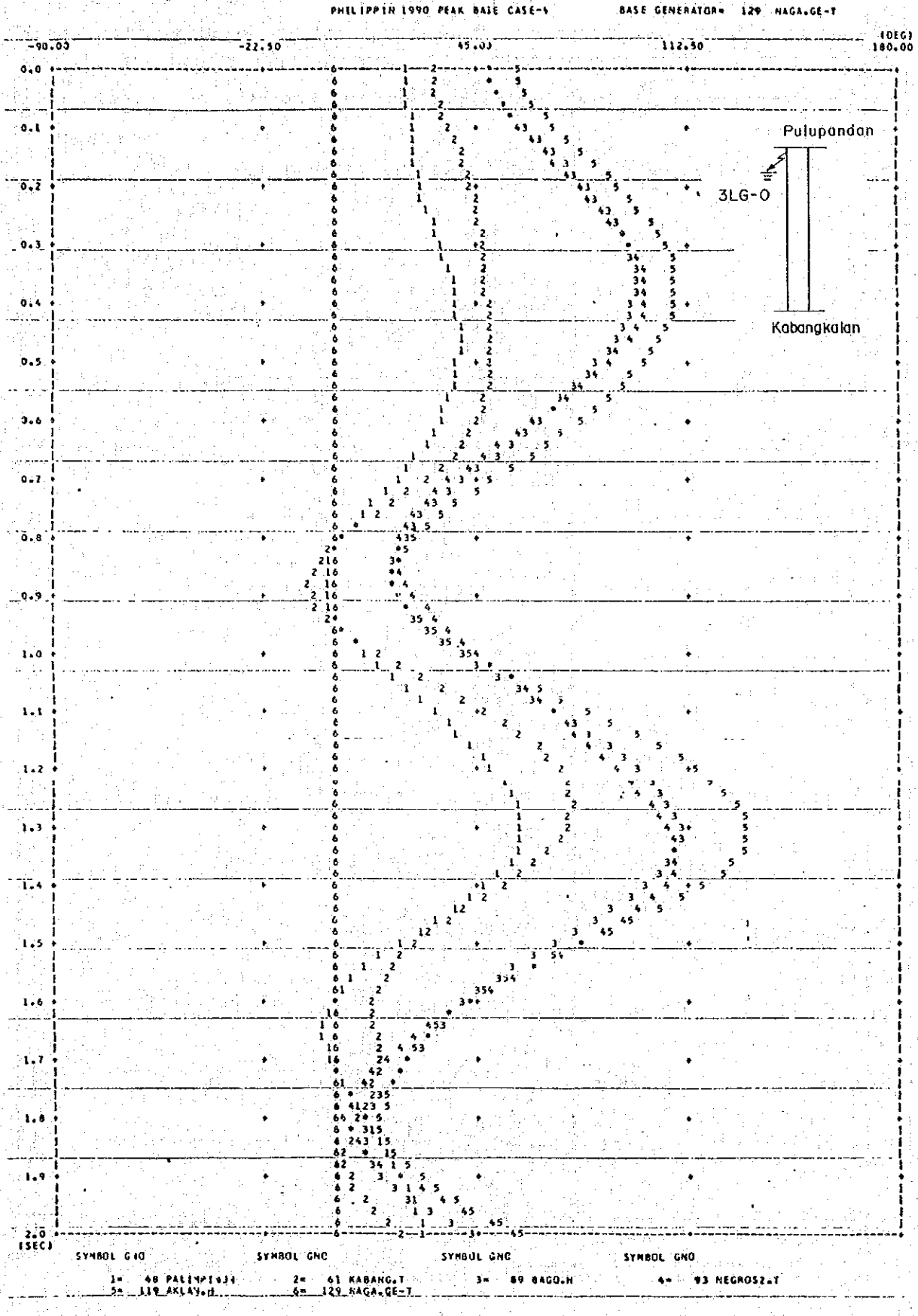


Fig. A-3-(8) Transient Stability Peak Time in 1990

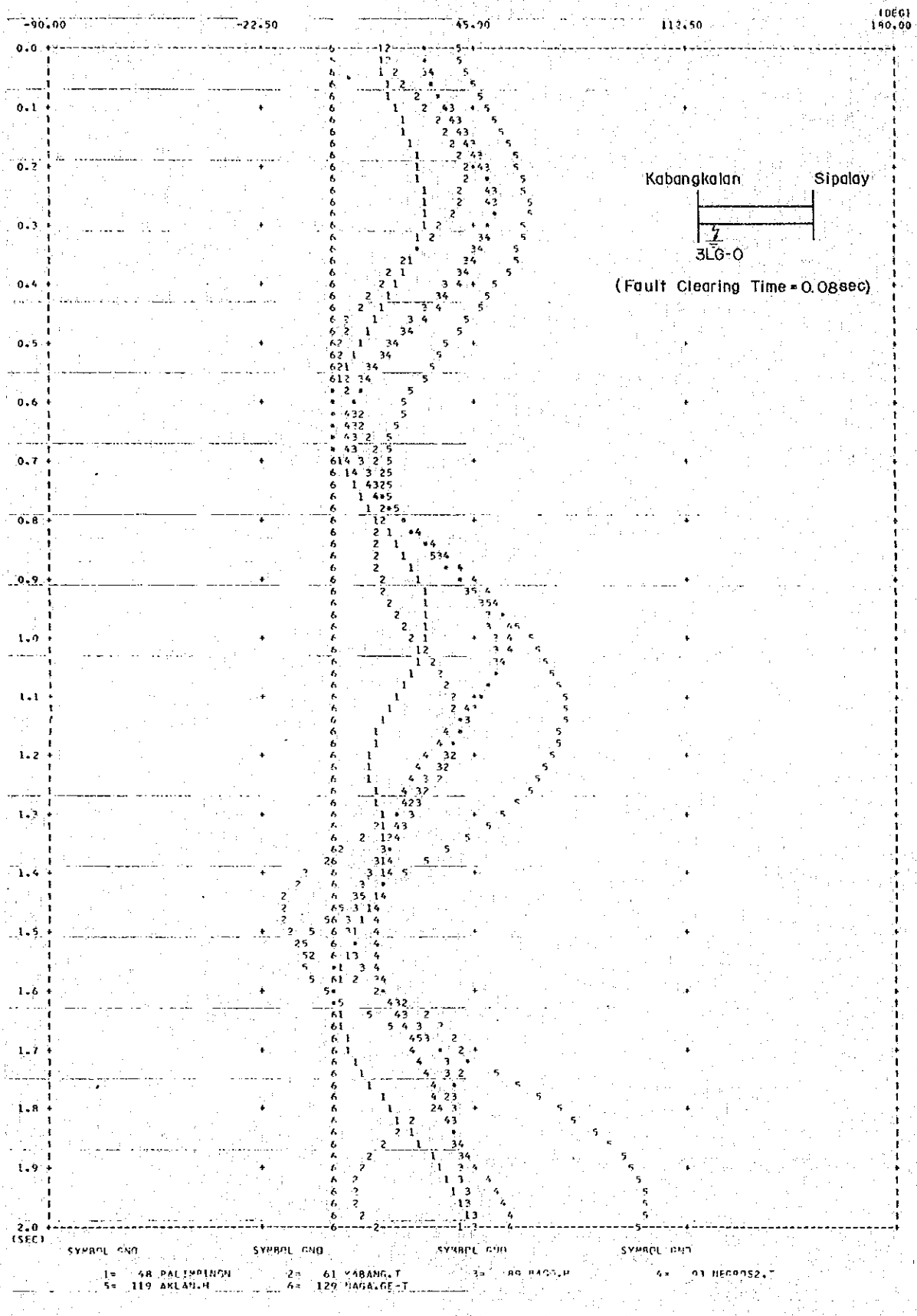


Fig. A-3-(9) Transient Stability Peak Time in 1990

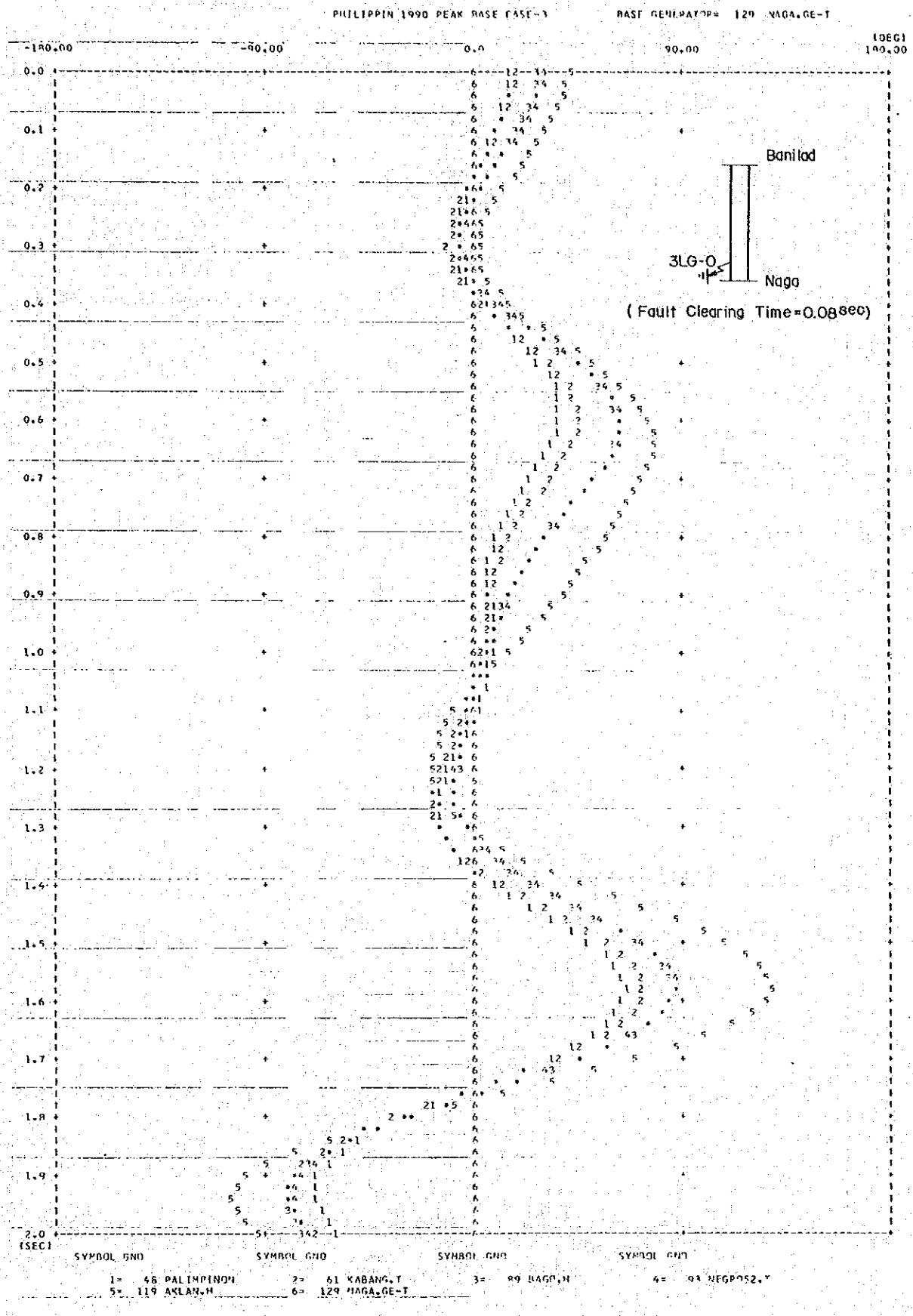


Fig. A-3-(10) Transient Stability Peak Time in 1990 (Base+100MW)

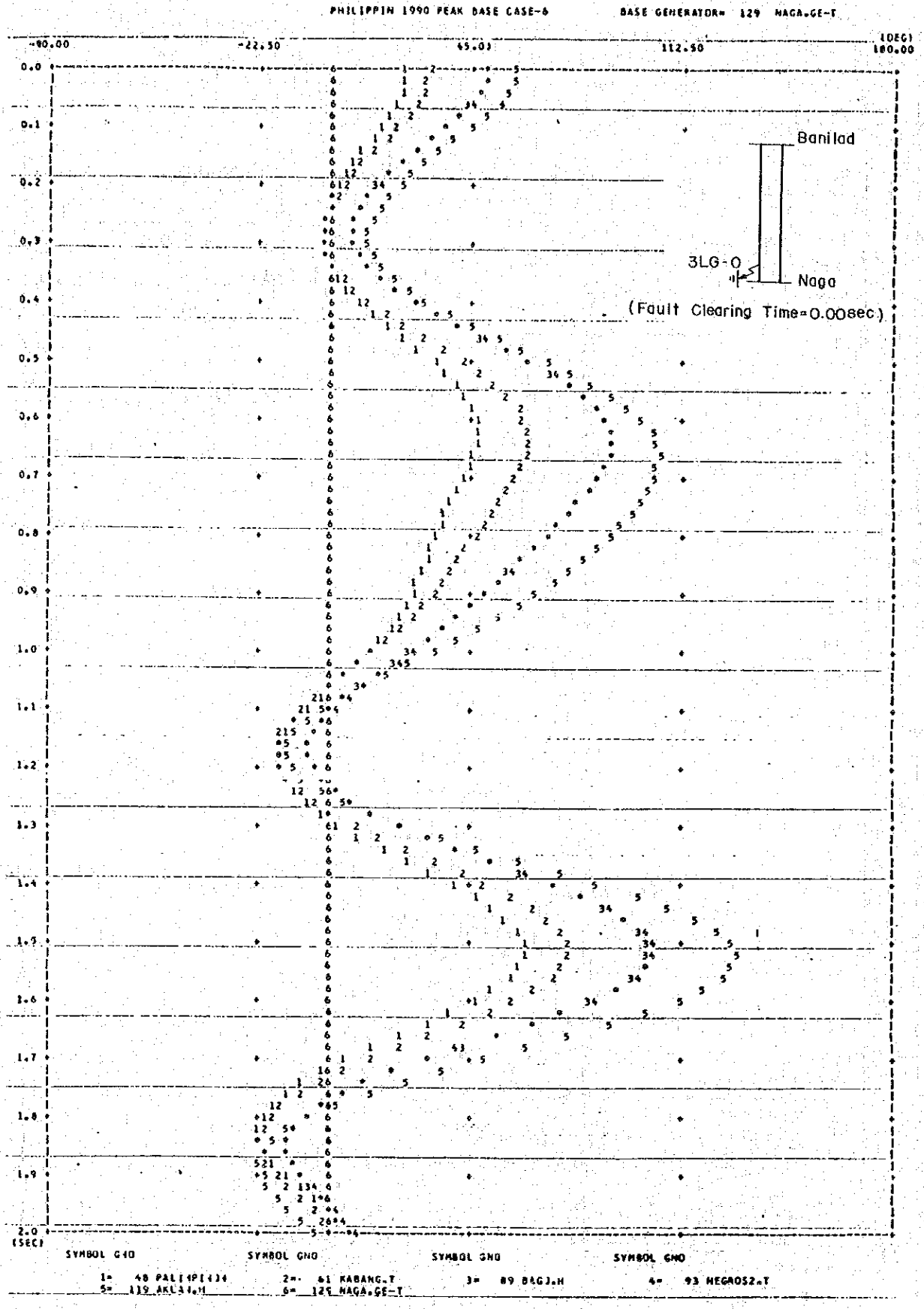


Fig. A-3-(11) Transient Stability Peak Time in 1990 (Base+100MW)

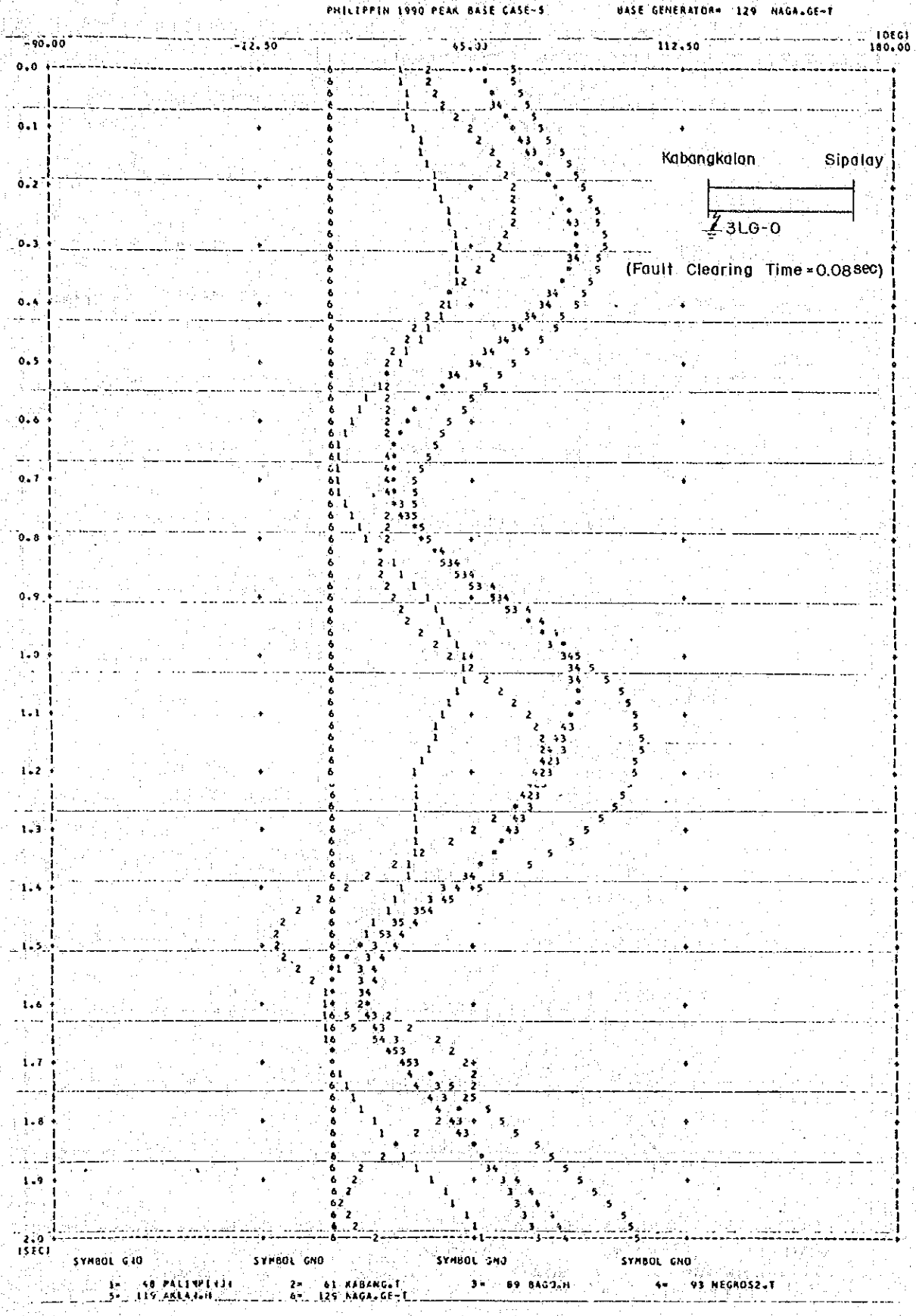


Fig. A-3-(12) Transient Stability in 1990
(Base)

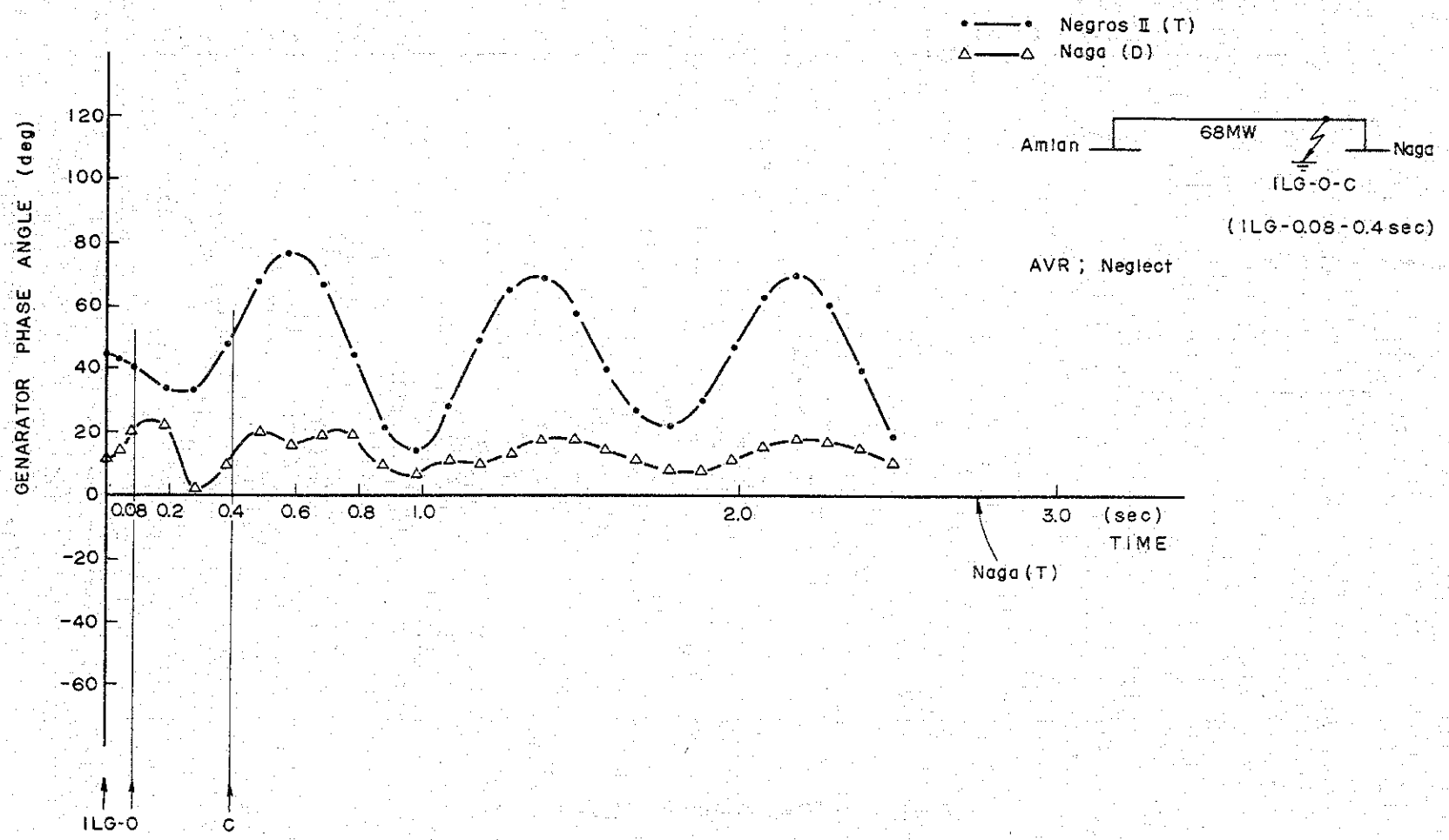


Fig. A-3-(13) Transient Stability in 1990

(Base + 100MW)

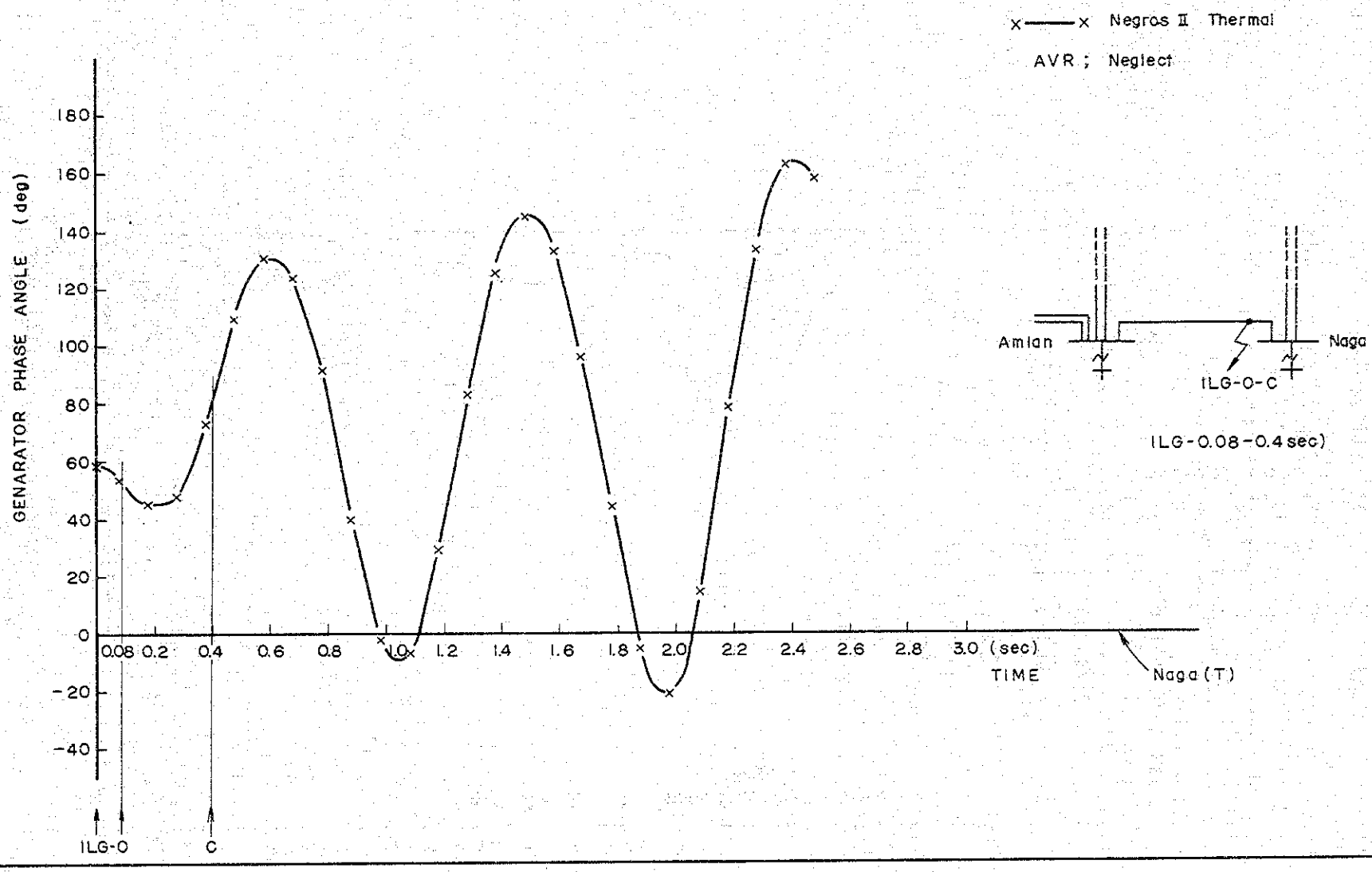
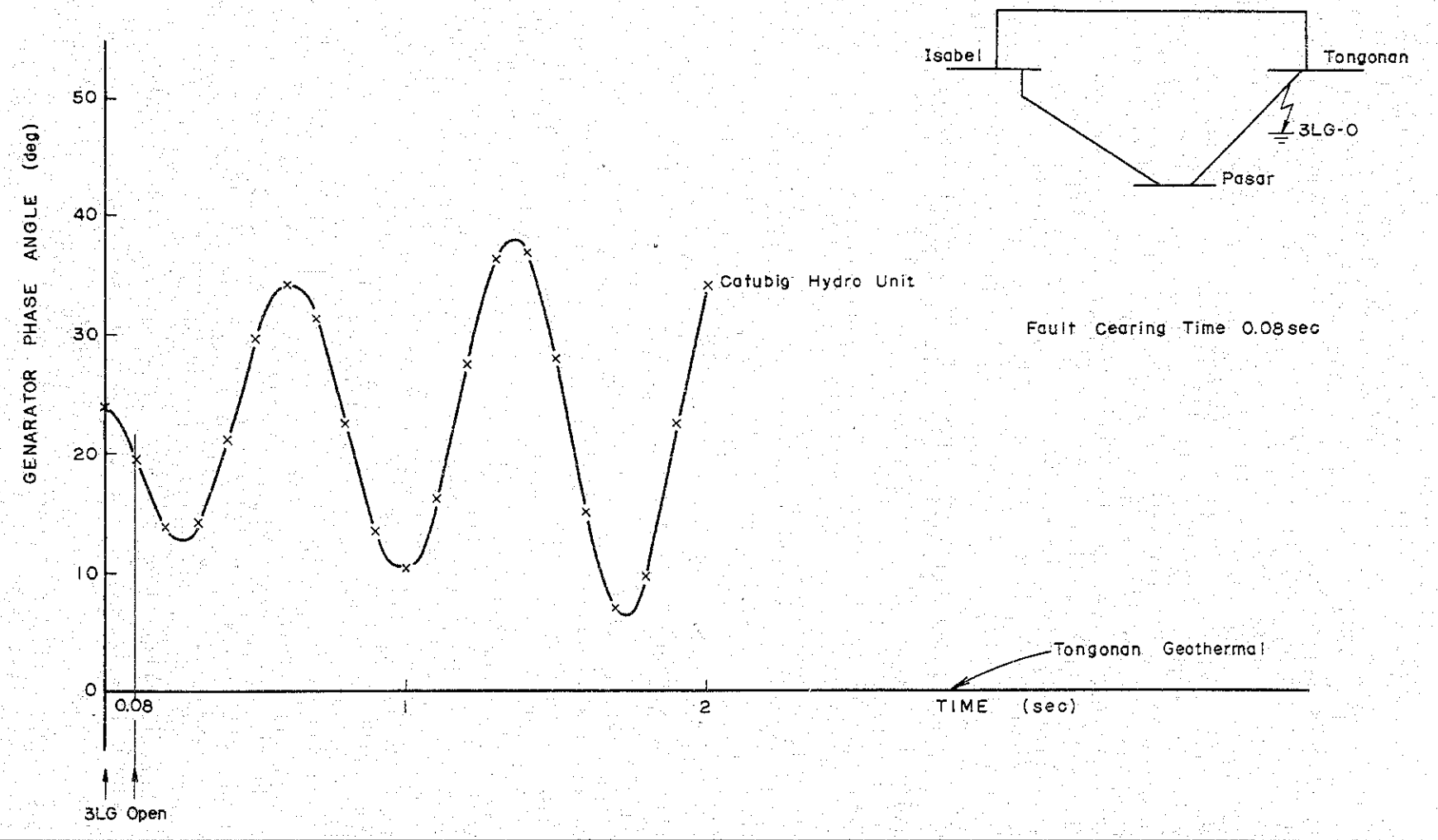


Fig. A-3-(14) Transient Stability in 1990
Leyte - Samar System (Peak)



A-4　資金計画および財務分析

Table A-4-(1) Investment Schedule for Generation Projects

	Installed capacity (MW)	Completion Year	Direct const. cost			Foreign currency					Local currency					Type of Plant	Economic life (Years)	Depreciation cost (10^3US$)
			F.C. (10^6US$)	L.C. (10^6US$)	Total (10^6US$)	1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)	1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)			
Panay																		
Panay Diesel	29.2	1979	14.1	5.2	19.3	4.2	9.9	-	-	14.1	1.6	3.6	-	-	5.2	Diesel	18	1,072
Panay Thermal I	55.0	1986	40.1	17.3	57.4	10.0	20.1	10.0	-	40.1	4.3	8.7	4.3	-	17.3	Coal	30	1,913
Aklan Hydro	20.0	1990	13.0	8.8	21.8	3.3	3.3	3.9	2.5	13.0	2.2	2.2	2.6	1.8	8.8	Hydro	50	436
Panay Thermal I	55.0	1992	35.2	12.1	47.3	8.8	17.6	8.8	-	35.2	3.0	6.1	3.0	-	12.1	Coal	30	1,577
Sub-total	159.2		102.4	43.4	145.8	26.3	50.9	22.7	2.5	102.4	11.7	20.6	9.9	1.8	43.4			
Negros																		
Amlan Diesel	11.0	1977	4.4	1.2	5.6	1.3	3.1	-	-	4.4	0.4	0.8	-	-	1.2	Diesel	18	311
Palimpinon Geothermal	3.0	1981	8.5	0.8	9.3	2.1	4.3	2.1	-	8.5	0.2	0.4	0.2	-	0.8	Geother.	20	465
Power Barge	32.0	1981	16.7	0.9	17.6	5.0	11.7	-	-	16.7	0.3	0.6	-	-	0.9	Diesel	18	978
Sipalay Diesel	36.0	1983	14.9	5.0	19.9	4.5	10.4	-	-	14.9	1.5	3.5	-	-	5.0	Diesel	18	1,106
Palimpinon Geothermal	112.5	1984	63.5	23.1	86.6	15.9	31.7	15.9	-	63.5	5.8	11.5	5.8	-	23.1	Geother.	20	4,330
Negros Thermal I	55.0	1985	40.1	17.3	57.4	10.0	20.1	10.0	-	40.1	4.3	8.7	4.3	-	17.3	Coal	30	1,913
Bago Hydro	60.0	1987	29.4	24.2	53.6	7.4	7.4	8.8	5.8	29.4	6.1	6.1	7.3	4.7	24.2	Hydro	50	1,072
Negros Thermal II	55.0	1988	40.1	17.3	57.4	10.0	20.1	10.0	-	40.1	4.3	8.7	4.3	-	17.3	Coal	30	1,913
Mambucal Geothermal	112.5	1991	63.5	23.1	86.6	15.9	31.7	15.9	-	63.5	5.8	11.5	5.8	-	23.1	Geother.	20	4,330
Sub-total	477.0		281.1	112.9	394.0	72.1	140.5	62.7	5.8	281.1	28.7	51.8	27.7	4.7	112.9			
Cebu																		
Cebu Diesel I	51.1	1979	17.5	5.5	23.0	5.3	12.2	-	-	17.5	1.7	3.8	-	-	5.5	Diesel	18	1,278
Cebu Thermal I	55.0	1981	42.7	24.7	67.4	10.7	21.3	10.7	-	42.7	6.2	12.3	6.2	-	24.7	Coal	30	2,247
Cebu Diesel II	54.0	1981	22.4	7.5	29.9	6.7	15.7	-	-	22.4	2.3	5.2	-	-	7.5	Diesel	18	1,661
Power Barge	32.0	1981	16.7	0.9	17.6	5.0	11.7	-	-	16.7	0.3	0.6	-	-	0.9	Diesel	18	978
Cebu Thermal II	55.0	1984	35.2	12.1	47.3	8.8	17.6	8.8	-	35.2	3.0	6.1	3.0	-	12.1	Coal	30	1,577
Cebu Thermal III	55.0	1993	40.1	17.3	57.4	10.0	20.1	10.0	-	40.1	4.3	8.7	4.3	-	17.3	Coal	30	1,913
Sub-total	302.1		174.6	68.0	242.6	46.5	98.6	29.5		174.6	17.8	36.7	13.5	-	68.0			
Leyte-Samar																		
Tongonan Geothermal	3.0	1977	8.5	0.8	9.3	2.1	4.3	2.1	-	8.5	0.2	0.4	0.2	-	0.8	Geother.	20	465
Tongonan Geothermal	112.5	1983	63.5	23.1	86.6	15.9	31.7	15.9	-	63.5	5.8	11.5	5.8	-	23.1	Geother.	20	4,330
Catubig Hydro	30.0	1987	16.5	20.0	36.5	4.1	4.1	4.9	3.4	16.5	5.0	5.0	6.0	4.0	20.0	Hydro	50	730
Tongonan Geothermal	112.5	1993	63.5	23.1	86.6	15.9	31.7	15.9	-	63.5	5.8	11.5	5.8	-	23.1	Geother.	20	4,330
Sub-total	258.0		152.0	67.0	219.0	38.0	71.8	38.8	3.4	152.0	16.8	28.4	17.8	4.0	67.0			
Bohol																		
Tagbilaran Diesel	11.0	1977	4.4	1.2	5.6	1.3	3.1	-	-	4.4	0 4	0 8	-	-	1.2	Diesel	18	311
Upper Loboc Hydro	35.0	1988	27.7	20.9	48.6	6.9	6.9	8.3	5.6	27.7	5.2	5.2	6.3	4.2	20.9	Hydro	50	972
Sub-total	46.0		32.1	22.1	54.2	8.2	10.0	8.3	5.6	32.1	5.6	6.0	6.3	4.2	22.1			
Total	1,242.3		742.2	313.4	1,055.6	191.1	371.8	162.0	17.3	742.2	80.0	143.5	75.2	14.7	313.4			

Table A-4-(2) Investment Schedule for Transmission Line Projects

	Length (kV)/(km)	Completion Year	Direct const. cost F.C. (10^6US$)	L.C. (10^6US$)	Total (10^6US$)	Foreign currency 1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)	Local currency 1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)	Type of structure	Economic life (Years)	Depreciation cost (10^3US$)
Panay																		
Dingle - Panitan	138/57	1979	0.9	1.3	2.2	0.3	0.6	-	-	0.9	0.4	0.9	-	-	1.3	Wooden	30	73
Dingle - Potoan	69/11	1980	0.1	0.1	0.2	0	0.1	-	-	0.1	0	0.1	0	0	0.1	"	30	7
Dingle - Sta. Barbara	138/23	1979	0.3	0.5	0.8	0.1	0.2	-	-	0.3	0.2	0.3	-	-	0.5	"	30	27
Sta. Barbar - La Paz	69/15	1979	0.2	0.2	0.4	0.1	0.1	-	-	0.2	0.1	0.1	-	-	0.2	"	30	13
Sta. Barbara - Tigbauan	69/30	1980	0.3	0.4	0.7	0.1	0.2	-	-	0.3	0.1	0.3	-	-	0.4	"	30	23
Dingle - Banate	69/18	1981	0.2	0.2	0.4	0.1	0.1	-	-	0.2	0.1	0.1	-	-	0.2	"	30	13
Banate - Sara	69/40	1982	0.4	0.5	0.9	0.1	0.3	-	-	0.4	0.2	0.3	-	-	0.5	"	30	30
Dingle -Calinog	69/40	1982	0.2	0.3	0.5	0.1	0.1	-	-	0.2	0.1	0.2	-	-	0.3	"	30	17
* Sta. Barbara - Pulupandan	138/49	1985	11.7	0.7	12.4	2.3	5.9	3.5	-	11.7	0.1	0.4	0.2	-	0.7	Steel	50	248
Kalibo - Nabas	69/35	1983	0.4	0.4	0.8	0.1	0.3	-	-	0.4	0.1	0.3	-	-	0.4	Wooden	30	27
Altavas - Culasi	69/45	1983	0.5	0.5	1.0	2.2	0.3	-	-	0.5	0.2	0.3	-	-	0.5	"	30	33
Kalibo - Panitan	138/60	1986	0.9	1.3	2.2	0.3	0.6	-	-	0.9	0.4	0.9	-	-	1.3	"	30	73
Sub-total	/404		16.1	6.4	22.5	3.8	8.8	3.5		16.1	2.0	4.2	0.2		6.4			
Negros																		
Amlan - Dumaguete	69/25	1977	0.3	0.3	0.6	0.1	0.2	-	-	0.3	0.1	0.2	-	-	0.3	Wooden	30	20
Amlan - Bindoy	69/50	1981	0.6	0.6	1.2	0.2	0.4	-	-	0.6	0.2	0.4	-	-	0.6	"	30	40
Palimpinon - Dumaguete	69/16	1981	0.2	0.2	0.4	0.1	0.1	-	-	0.2	0.1	0.1	-	-	0.2	"	30	13
Palimpinon - Amlan	138/21	1983	0.3	0.5	0.8	0.1	0.2	-	-	0.3	0.2	0.3	-	-	0.5	"	30	27
* Amlan - Kabangkalan - Pulu.	138/148	1985	8.1	4.0	12.1	1.6	4.1	2.4	-	8.1	0.8	2.0	1.2	-	4.0	Steel	50	242
Kabangkalan - Sipalay	138/40	1983	0.6	0.9	1.5	0.2	0.4	-	-	0.6	0.3	0.6	-	-	0.9	Wooden	30	50
Kabangkalan-Negros Ther.I	138/30	1983	0.5	0.7	1.2	0.2	0.3	-	-	0.5	0.2	0.5	-	-	0.7	"	30	40
Sipalay - CDCP	69/46	1982	0.5	0.6	1.1	0.2	0.3	-	-	0.5	0.2	0.4	-	-	0.6	"	30	37
Sipalay - MMIC	69/10	1982	0.1	0.1	0.2	0	0.1	-	-	0.1	0	0.1	0	0	0.1	"	30	7
Sipalay - LCMC	69/12	1982	0.1	0.1	0.2	0	0.1	-	-	0.1	0	0.1	0	0	0.1	"	30	7
Pulupandan - Bago	138/39	1987	0.6	0.9	1.5	0.2	0.4	-	-	0.6	0.3	0.6	-	-	0.9	"	30	50
Bago - Negros Thermal I	138/61	1988	0.9	1.3	2.2	0.3	0.6	-	-	0.9	0.4	0.9	-	-	1.3	"	30	73
Pulupandan - Bacolod	69/27	1985	0.3	0.3	0.6	0.1	0.2	-	-	0.3	0.1	0.2	-	-	0.3	"	30	20
Bacolod - San Enrique	69/35	1981	0.4	0.4	0.8	0.1	0.3	-	-	0.4	0.1	0.3	-	-	0.4	"	30	27
CDCP - Bayawan	69/42	1983	0.5	0.5	1.0	0.2	0.3	-	-	0.5	0.2	0.3	-	-	0.5	"	30	33
Tap - Mabinai	69/25	1983	0.3	0.3	0.6	0.1	0.2	-	-	0.3	0.1	0.2	-	-	0.3	"	30	20
Talisay - San Carlos	69/60	1982	0.7	0.7	1.4	0.2	0.5	-	-	0.7	0.2	0.5	-	-	0.7	"	30	47
Mambucal Geo - Bago	138/5	1989	0.1	0.1	0.2	0	0.1	-	-	0.1	0	0.1	-	-	0.1	"	30	7
Sub-total	/692		15.1	12.5	27.6	3.9	8.8	2.4		15.1	3.5	7.8	1.2		12.5			
Cebu																		
Naga - Sigpit	138/18	1978	0.3	0.4	0.7	0.1	0.2			0.3	0.1	0.3			0.4	Wooden	30	23
Naga - Banilad (No. 1)	138/27	1979	0.4	0.6	1.0	0.1	0.3			0.4	0.2	0.4			0.6	"	30	33
Naga - Sibonga - Dumanjug	69/50	1980	0.6	0.6	1.2	0.2	0.4			0.6	0.2	0.4			0.6	"	30	40
Talavera - Sigpit	138/10	1981	0.2	0.2	0.4	0.1	0.1			0.2	0.1	0.1			0.2	"	30	13
Banilad - Mactan	69/6	1978	0.1	0.1	0.2	0	0.1			0.1	0	0.1			0.1	"	30	7
Banilad - Danao	69/27	1978	0.3	0.3	0.6	0.1	0.2			0.3	0.1	0.2			0.3	"	30	20

Note : * Project proposed by JICA.

Table A-4-(3) Investment Schedule for Transmission Line Project

	Length (kV)/(km)	Completion year	Direct const. cost F.C. (10^6US$)	L.C. (10^6US$)	Total (10^6US$)	Foreign currency 1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)	Local currency 1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)	Type of structure	Economic life (Years)	Depreciation cost (10^3US$)
Toledo - Talavera - Asturias	69/25	1981	0.3	0.3	0.6	0.1	0.2			0.3	0.1	0.2			0.3	Wooden	30	20
Naga - Banilad (No. 2)	138/27	1981	0.4	0.6	1.0	0.1	0.3			0.4	0.2	0.4			0.6	"	30	33
Danao - Sogod - Bogo	69/56	1980	0.6	0.7	1.3	0.2	0.4			0.6	0.2	0.5			0.7	"	30	43
Tap - Alegria	69/18	1982	0.2	0.2	0.4	0.1	0.1			0.2	0.1	0.1			0.2	"	30	13
Sibonga - Boljoon	69/47	1980	0.5	0.6	1.1	0.2	0.3			0.5	0.2	0.4			0.6	"	30	37
* Naga - Liloan Point	138/106	1985	4.0	2.3	6.3	0.8	2.0	1.2		4.0	0.5	1.2	0.6		2.3	Steel	50	126
* Liloan Point - Amlan	138/7	1985	3.0	1.8	4.8	0.6	1.5	0.9		3.0	0.4	0.9	0.5		1.8	"	50	96
Asturias - Tuburan	69/20	1983	0.2	0.2	0.4	0.1	0.1			0.2	0.1	0.1			0.2	Wooden	30	13
Sub-total	/444		11.1	8.9	20.0	2.8	6.2	2.1		11.1	2.5	5.3	1.1		8.9			
Leyte - Samar																		
Tongonan - Ormoc	69/20	1977	0.2	0.2	0.4	0.1	0.1			0.2	0.1	0.1			0.2	Wooden	30	13
Tongonan - Tunga	69/46	1981	0.5	0.6	1.1	0.2	0.3			0.5	0.2	0.4			0.6	"	30	37
Tongonan - Isabel	138/36	1981	0.5	0.8	1.3	0.2	0.3			0.5	0.2	0.6			0.8	"	30	43
Power Barge - Isabel	69/10	1981	0.1	0.1	0.2	0	0.1			0.1	0	0.1			0.1	"	30	7
Calbayog - Catarman	69/50	1981	0.6	0.7	1.3	0.2	0.4			0.6	0.2	0.5			0.7	"	30	43
Isabel - Palompon	69/15	1981	0.2	0.2	0.4	0.1	0.1			0.2	0.1	0.1			0.2	"	30	13
Tongonan - Pasar	138/51	1982	0.8	1.1	1.9	0.2	0.6			0.8	0.3	0.8			1.1	"	30	63
Isabel - Pasar	138/15	1982	0.2	0.3	0.5	0.1	0.1			0.2	0.1	0.2			0.3	"	30	17
Ormoc - Baybay	69/45	1982	0.5	0.5	1.0	0.2	0.3			0.5	0.2	0.3			0.5	"	30	33
Tongonan - Naval	69/75	1982	0.8	0.9	1.7	0.2	0.6			0.8	0.3	0.6			0.9	"	30	57
(*) Tongonan - Wright	138/113	1983	1.7	1.0	2.7	0.5	1.2			1.7	0.3	0.7			1.0	"	30	90
Wright - Sta. Rita	69/60	1983	0.7	0.8	1.5	0.2	0.5			0.7	0.2	0.6			0.8	"	30	50
Catanman - Allen	69/35	1983	0.4	0 4	0.8	0.1	0.3			0.4	0.1	0.3			0.4	"	30	27
Taft - Oras	69/30	1983	0.3	0.3	0.6	0.1	0.2			0.3	0.1	0.2			0.3	"	30	20
Borongan - Quinapundan	69/55	1983	0.6	0.7	1.3	0.2	0.4			0.6	0 2	0.5			0.7	"	30	43
Tap - Tabango	69/20	1983	0.2	0.2	0.4	0.1	0.1			0.2	0.1	0.1			0.2	"	30	13
Tap - St. Bernardo	69/40	1984	0.4	0.4	0.8	0.1	0.3			0.4	0.1	0.3			0.4	"	30	27
Catubig - Catarman	69/50	1987	0.6	0.7	1.3	0.2	0.4			0.6	0.2	0.5			0.7	"	30	43
Sub-total	/766		9.3	9.9	19.2	3.0	6.3			9.3	3.0	6.9			9.9			
Bohol																		
Tagbilaran - G. Hernandez	69/51	1978	0.6	0.7	1.3	0.2	0.4			0.6	0.2	0.5			0.7	Wooden	30	43
Tagbilaran - Tubigon	69/40	1978	0.4	0.4	0.8	0.1	0.3			0.4	0.1	0.3			0.4	"	30	27
G. Hernandez - Alicia	69/45	1981	0.5	0.5	1.0	0.2	0.3			0.5	0.2	0.3			0.5	"	30	33
Tubigon - Talibon	69/58	1981	0.7	0.8	1.5	0.2	0.5			0.7	0.2	0.6			0.8	"	30	50
Tap - Carmen	69/25	1983	0.3	0.3	0.6	0.1	0.2			0.3	0.1	0.2			0.3	"	30	20
Upper Loboc - Tagbilaran	69/22	1988	0.2	0.2	0.4	0.1	0.1			0.2	0.1	0.1			0.2	"	30	13
Sub-total	/241		2.7	2.9	5.6	0.9	1.8			2.7	0.9	2.0			2.9			
Total	/2,547		54.3	40.6	94.9	14.4	31.9	8.0	0	54.3	11.9	26.2	2.5	0	40.6			

Note : * Project proposed by JICA. (*) Project financed by OECF.

Table A-4-(4) Investment Schedule for Transmission Projects

	Installed capacity (MVA)	Completion year	Direct const. cost			Foreign currency					Local currency					Economic life (Years)	Depreciation cost (10^3US$)
			F.C. (10^6US$)	L.C. (10^6US$)	Total (10^6US$)	1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)	1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)		
Panay																	
La Paz S.S.	5	1979	0.1	0	0.1	-	0.1	-	-	0.1	-	-	-	-	0	25	4
Panitan S.S.	30	1980	0.6	0.6	1.2	0.2	0.4	-	-	0.6	0.2	0.4	-	-	0.6	25	48
Sta. Barbara S.S.	50	1980	1.1	0.9	2.0	0.3	0.8	-	-	1.1	0.3	0.6	-	-	0.9	25	80
Pototan S.S.	5	1980	0.1	0	0.1	-	0.1	-	-	0.1	-	0	-	-	0	25	4
Panay Diesel		1980	0.3	0.1	0.4	0.3	-	-	-	0.3	0.1	-	-	-	0.1	25	16
Panay Diesel		1982	0.2	0	0.2	0.2	-	-	-	0.2	0	-	-	-	0	25	8
* Sta. Barbara S.S.		1985	0.3	0	0.3	0.3	-	-	-	0.3	0	-	-	-	0	25	12
Panitan S.S.		1986	0.5	0.1	0.6	0.5	-	-	-	0.5	0.1	-	-	-	0.1	25	24
Altavas Switching Sta.		1990	0.6	0.1	0.7	0.6	-	-	-	0.6	0.1	-	-	-	0.1	25	28
Sub-total	90		3.8	1.8	5.6	2.4	1.4	-	-	3.8	0.8	1.0	-	-	1.8	-	224
Negros																	
Dumaguete S.S.	10	1978	0.5	0.2	0.7	0.2	0.3	-	-	0.5	0.1	0.1	-	-	0.2	25	28
Bacolod S.S.	20	1981	0.7	0.1	0.8	0.2	0.5	-	-	0.7	-	0.1	-	-	0.1	25	32
Dumaguete S.S.		1981	0.2	0	0.2	0.1	0.1	-	-	0.2	-	-	-	-	0	25	8
* Amlan S.S.	30	1985	1.7	0.5	2.2	0.5	1.2	-	-	1.7	0.2	0.3	-	-	0.5	25	88
* Kabangkalan S.S.	10	1985	2.8	0.8	3.6	0.8	2.0	-	-	2.8	0.2	0.6	-	-	0.8	25	144
Sipalay S.S.	50	1985	0.8	0.8	1.6	0.2	0.6	-	-	0.8	0.2	0.6	-	-	0.8	25	64
* Pulupandan S.S.	30	1985	1.6	0.4	2.0	0.5	1.1	-	-	1.6	0.1	0.3	-	-	0.4	25	80
Bacolod S.S.	40	1990	1.1	0.9	2.0	0.3	0.8	-	-	1.1	0.3	0.6	-	-	0.9	25	80
Kabangkalan S.S.		1987	0.5	0.1	0.6	0.5	-	-	-	0.5	0.1	-	-	-	0.1	25	24
Pulupandan S.S.		1987	0.5	0.1	0.6	0.5	-	-	-	0.5	0.1	-	-	-	0.1	25	24
Bago Hydro		1988	0.3	0.1	0.4	0.3	-	-	-	0.3	0.1	-	-	-	0.1	25	16
Bago Hydro		1989	0.2	0	0.2	0.2	-	-	-	0.2	-	-	-	-	0	25	8
Sub-total	190		10.9	4.0	14.9	4.3	6.6	-	-	10.9	1.4	2.6	-	-	4.0	-	596
Cebu																	
Banilad S.S.	97.7	1979	1.5	1.3	2.8	0.5	1.0	-	-	1.5	0.4	0.9	-	-	1.3	25	112
Mactan S.S.	10	1979	0.4	0.1	0.5	0.1	0.3	-	-	0.4	0	0.1	-	-	0.1	25	20
Sibonga S.S.	5	1979	0.3	0.1	0.4	0.1	0.2	-	-	0.3	0	0.1	-	-	0.1	25	16
Sigpit Switching Sta.		1979	0.1	0	0.1	-	0.1	-	-	0.1	-	0	-	-	0	25	4
Danao S.S.	5	1980	0.2	0	0.2	0.1	0.1	-	-	0.2	-	0	-	-	0	25	8
Sogod S.S.	5	1980	0.2	0.1	0.3	0.1	0.1	-	-	0.2	-	0.1	-	-	0.1	25	12
Bogo S.S.	5	1980	0.2	0	0.2	0.1	0.1	-	-	0.2	-	0	-	-	0	25	8
Boljoon S.S.	5	1980	0.2	0.1	0.3	0.1	0.1	-	-	0.2	-	0.1	-	-	0.1	25	12
Banilad S.S.		1981	0.2	0	0.2	0.2	-	-	-	0.2	-	-	-	-	0	25	8
Naga Switching Sta.		1982	0.5	0.1	0.6	0.5	-	-	-	0.5	0.1	-	-	-	0.1	25	24
Sigpit Switching Sta.		1983	0.5	0.1	0.6	0.5	-	-	-	0.5	0.1	-	-	-	0.1	25	24

Note : * Project proposed by JICA.

Table A-4-(5) Investment Schedule for Transmission Projects

	Installed capacity (MVA)	Completion year	Direct const. cost			Foreign currency					Local currency					Economic life (Years)	Depreciation cost (10^3US$)
			F.C. (10^6US$)	L.C. (10^6US$)	Total (10^6US$)	1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)	1st yr. (10^6US$)	2nd yr. (10^6US$)	3rd yr. (10^6US$)	4th yr. (10^6US$)	Total (10^6US$)		
Talavera S.S.	30	1981	1.4	0.2	1.6	0.4	1.0	-	-	1.4	0.1	0.1	-	-	0.2	25	64
Toledo S.S.	5	1981	0.2	0	0.2	0.1	0.1	-	-	0.2	-	-	-	-	0	25	8
Naga Switching Sta.		1982	0.3	0.1	0.4	0.3	-	-	-	0.3	0.1	-	-	-	0.1	25	16
Sigpit Switching Sta.		1983	0.2	0.1	0.3	0.2	-	-	-	0.2	0.1	-	-	-	0.1	25	12
Banilad S.S.		1983	0.2	0	0.2	0.2	-	-	-	0.2	0	-	-	-	0	25	8
Naga Switching Sta.		1983	1.4	0.1	1.5	1.4	-	-	-	1.4	0.1	-	-	-	0.1	25	60
* Naga Switching Sta.		1985	0.5	0	0.5	0.5	-	-	-	0.5	0	-	-	-	0	25	20
Sub-total	167.7		8.5	2.4	10.9	5.4	3.1	-	-	8.5	1.0	1.4	-	-	2.4	-	436
Leyte - Samar																	
Isabel S.S.	40	1981	1.5	0.7	2.2	0.5	1.0	-	-	1.5	0.2	0.5	-	-	0.7	25	88
Wright S.S.	30	1983	1.2	0.5	1.7	0.4	0.8	-	-	1.2	0.2	0.3	-	-	0.5	25	68
Tongonan S.S.	50	1983	1.4	0.9	2.3	0.4	1.0	-	-	1.4	0.3	0.6	-	-	0.9	25	92
Catarman S.S.		1987	0.6	0.1	0.7	0.6	-	-	-	0.6	0.1	-	-	-	0.1	25	28
Sub-total	120		4.7	2.2	6.9	1.9	2.8	-	-	4.7	0.8	1.4	-	-	2.2	-	276
Bohol																	
G. Hernandez S.S.	5	1978	0.3	0.1	0.4	0.1	0.2	-	-	0.3	-	0.1	-	-	0.1	25	16
Total	572.7		28.2	10.5	38.7	14.1	14.1			28.2	4.0	6.5			10.5	-	1,548

Note : * Project proposed by JICA

A-5　現地調査入手資料リスト