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PRELIMINARY STUDY
OF
**UPPER NAM PONG BASIN
HYDRO - ELECTRIC PROJECT**

THAILAND

APPENDIX
(FIGURES & TABLES)

August 1966

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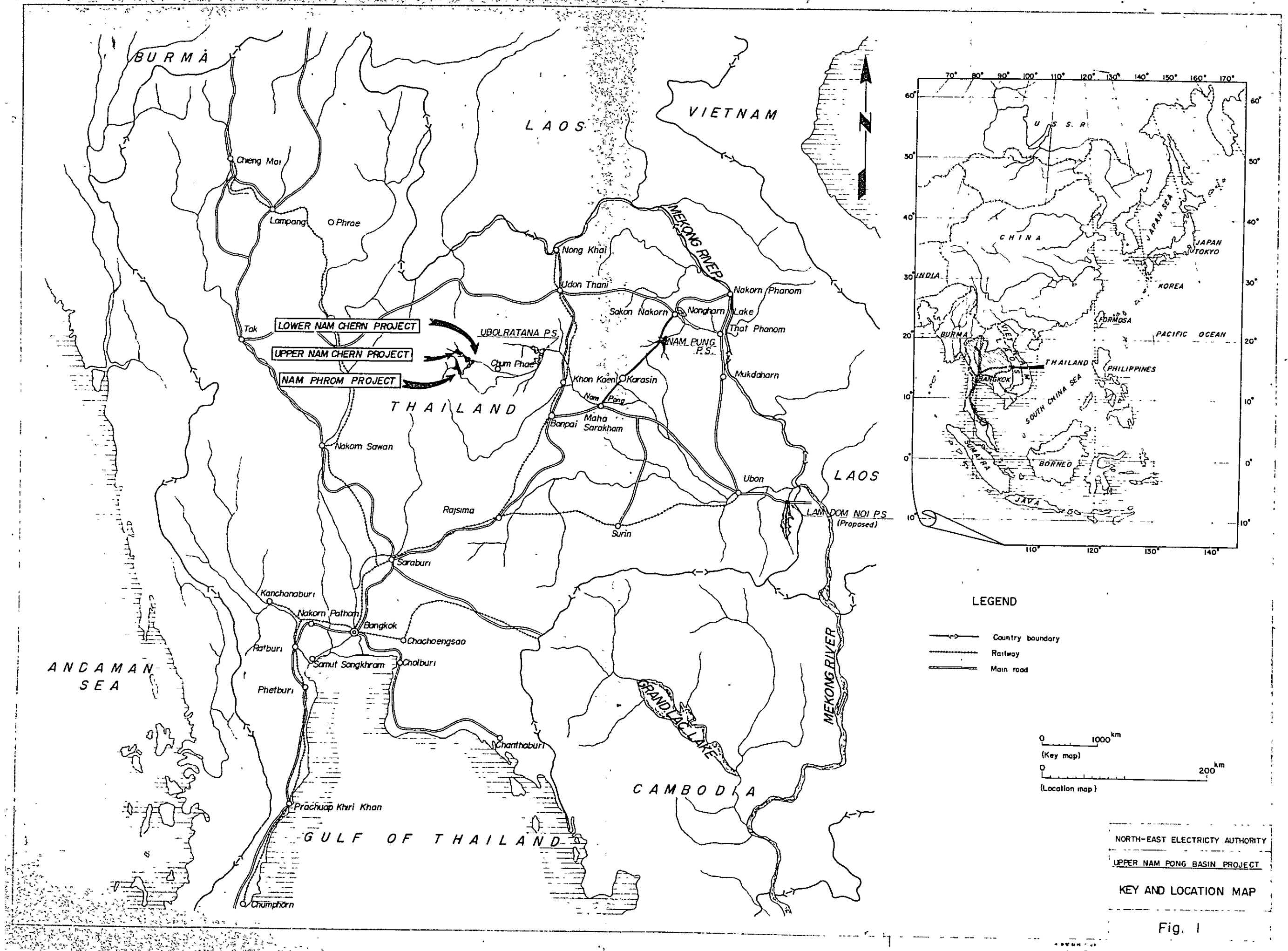
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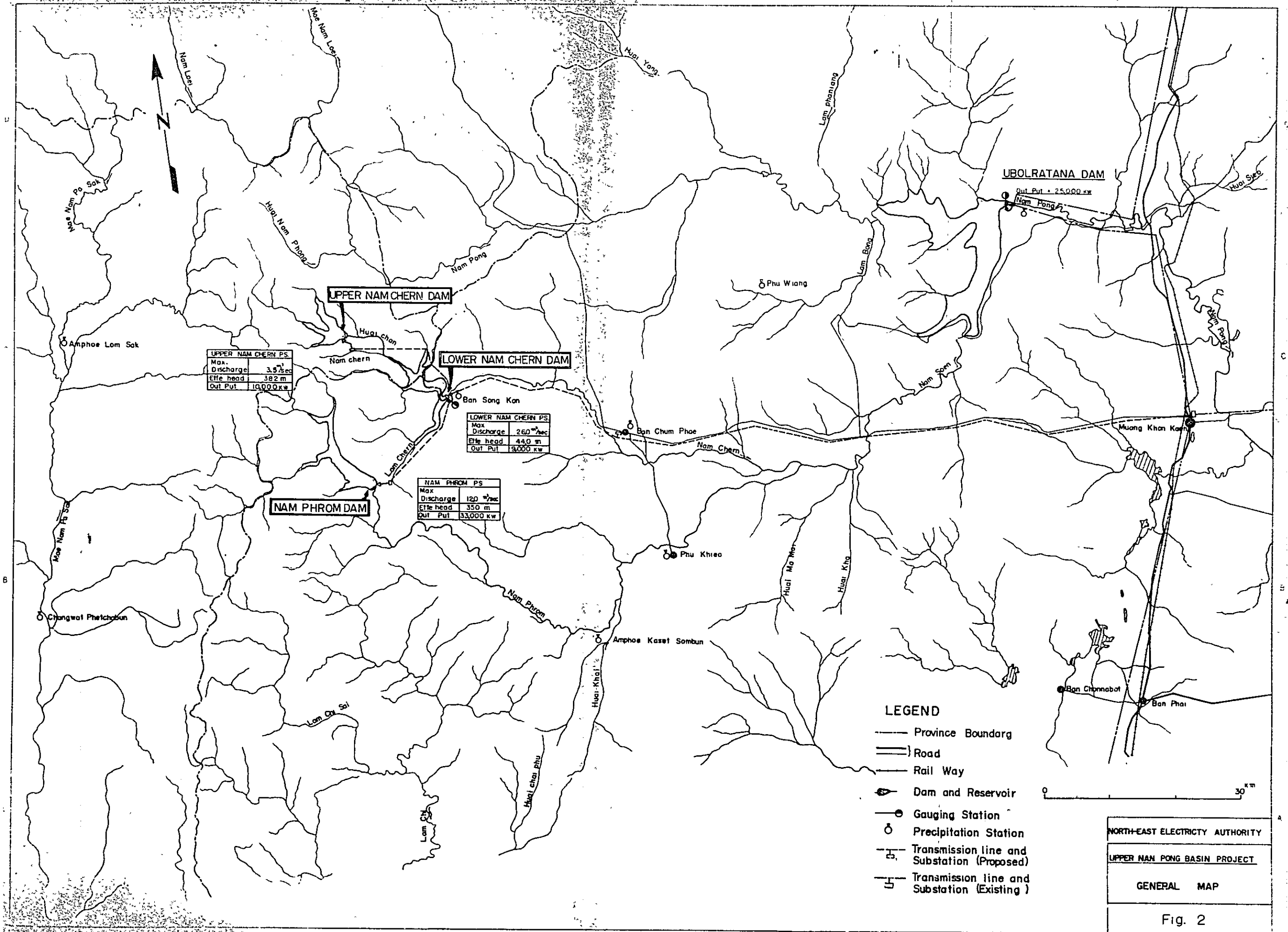
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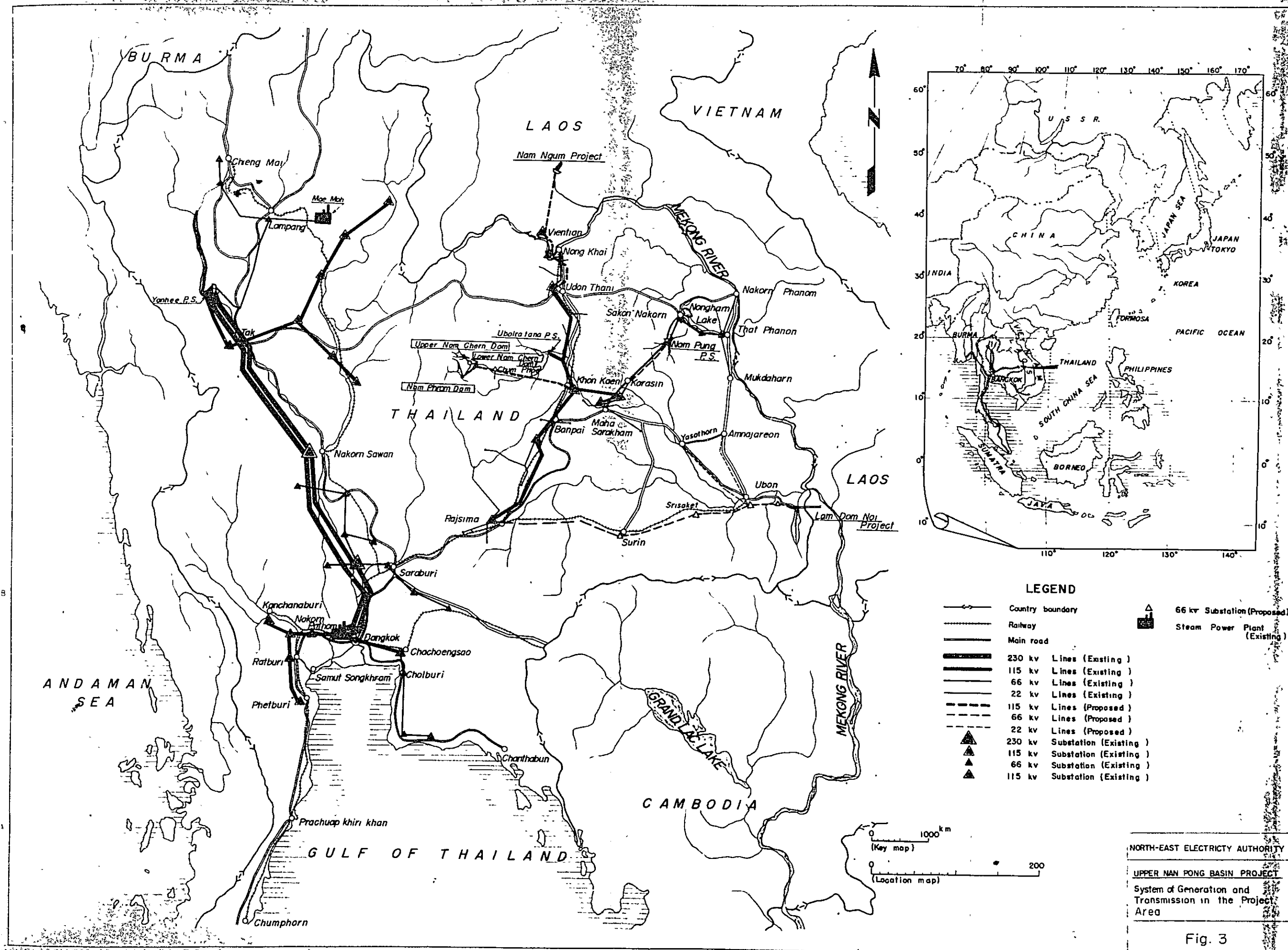
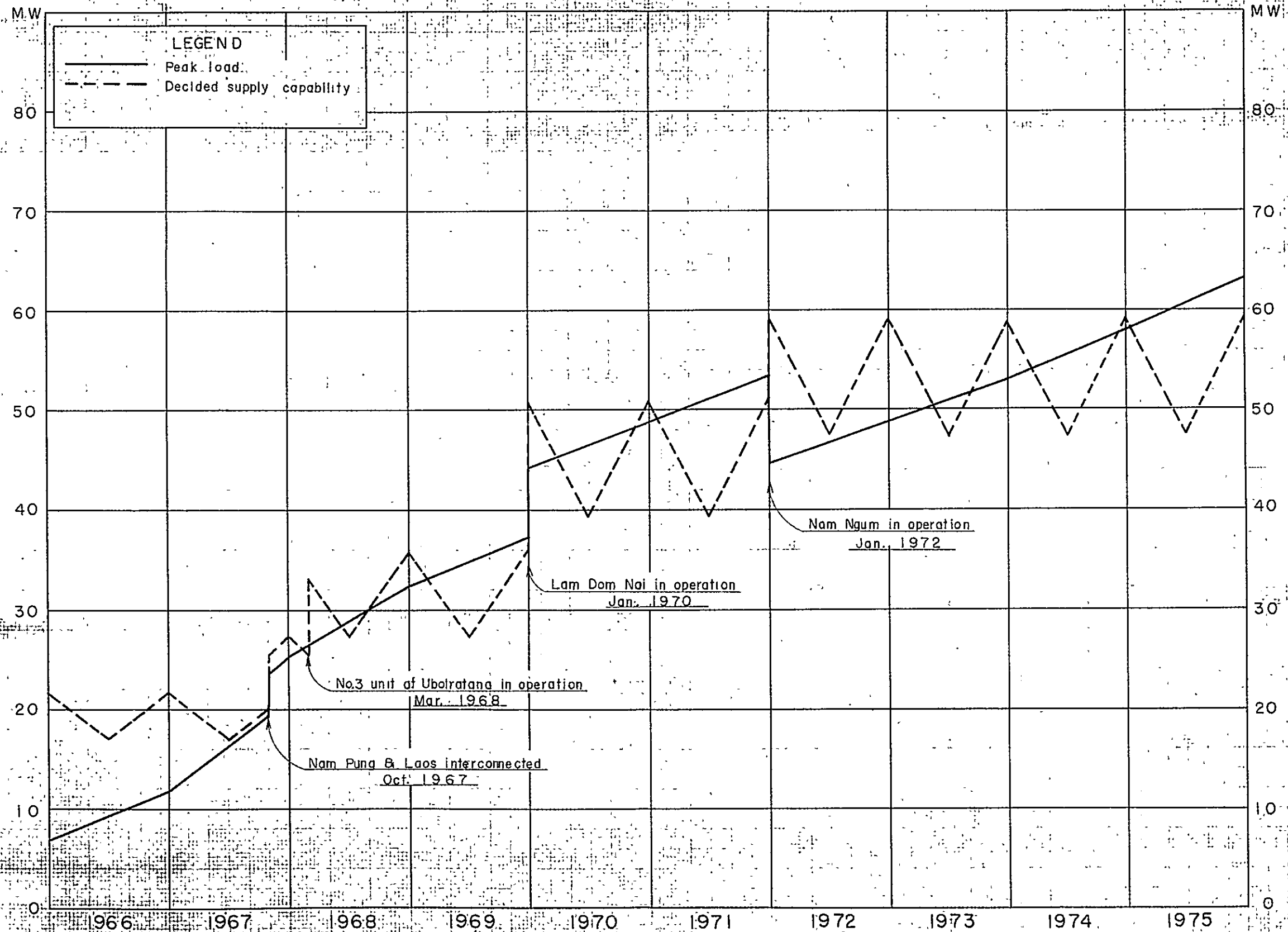


Fig 4-1

Peak Load Balance



Energy Balance

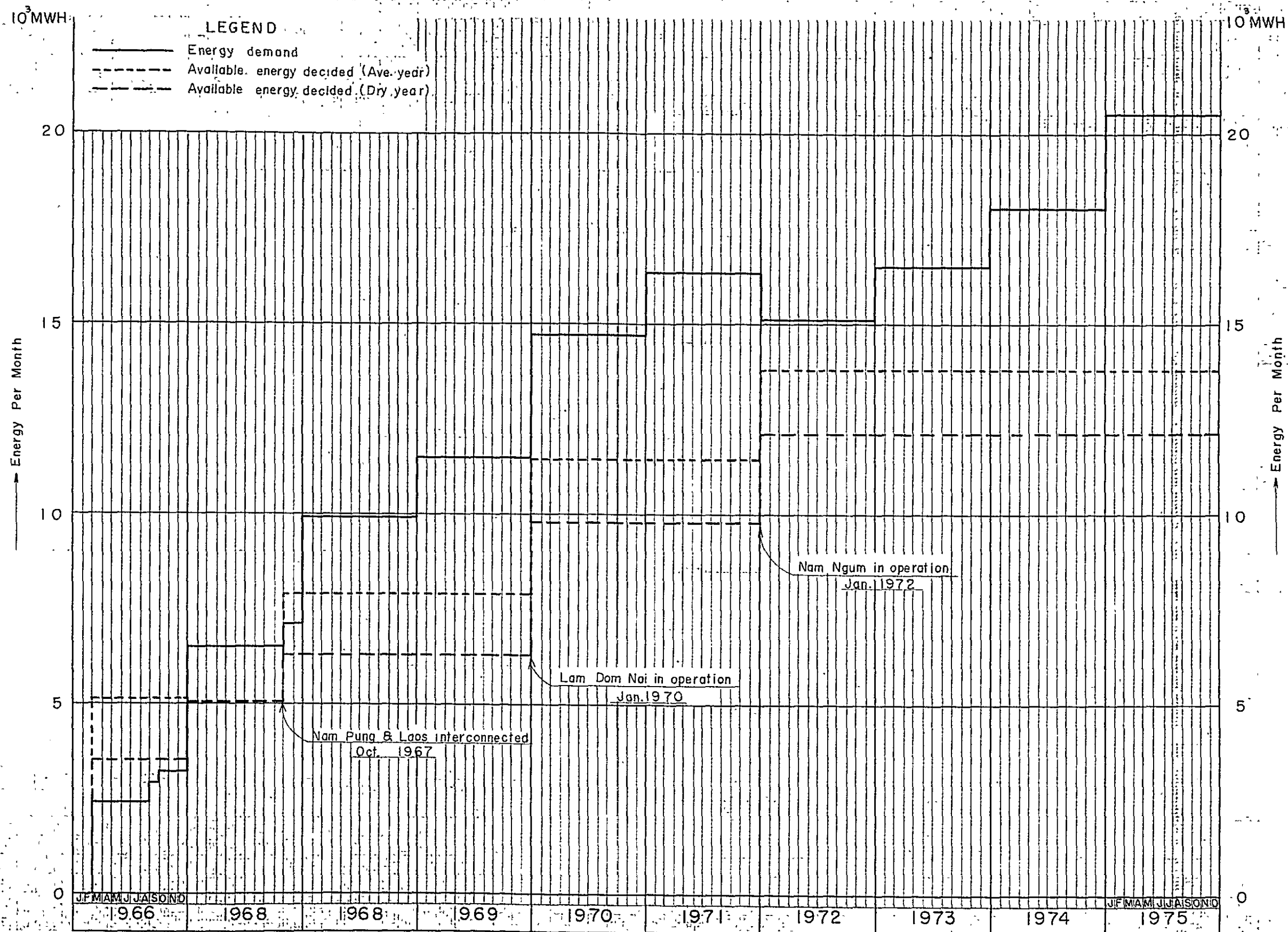


Fig 5—1

Peak Load Balance

(In case that Nam Phrom is developed firstly)

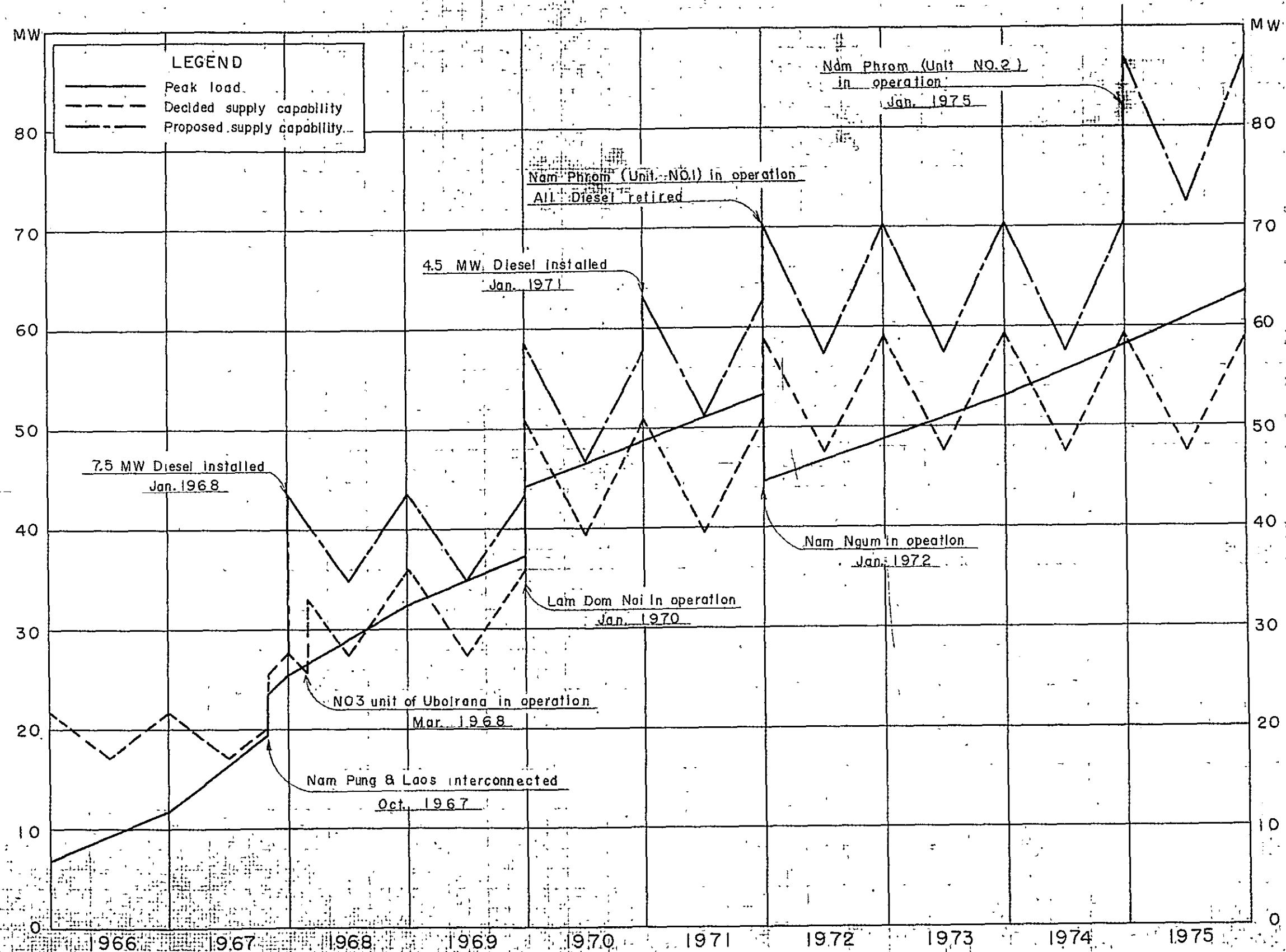


Fig. 5—2

Energy Balance

(In case that Nam Phrom is developed firstly)

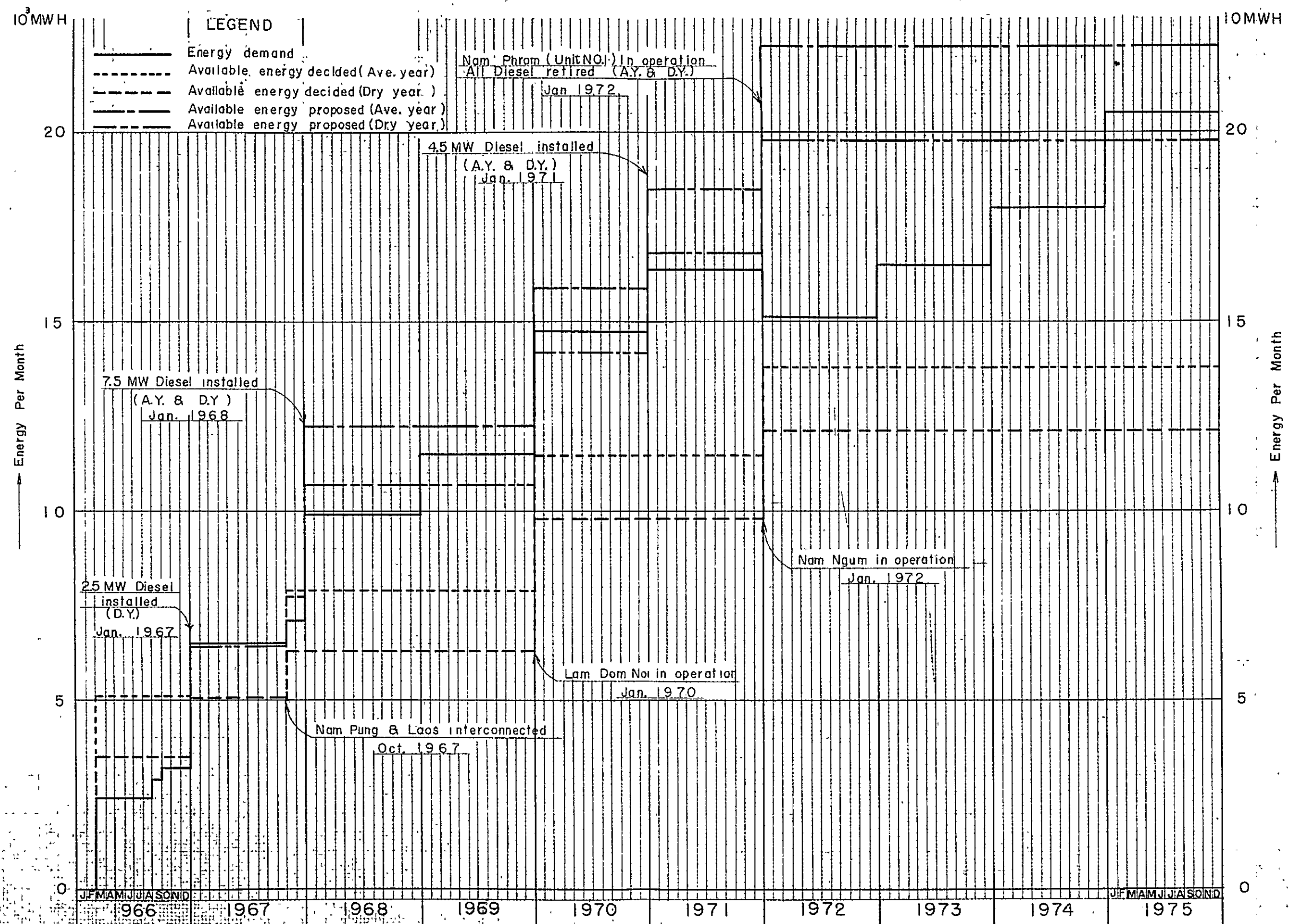


Fig 5-3

Peak Load Balance

(In case that Upper Nam chern is developed firstly.)

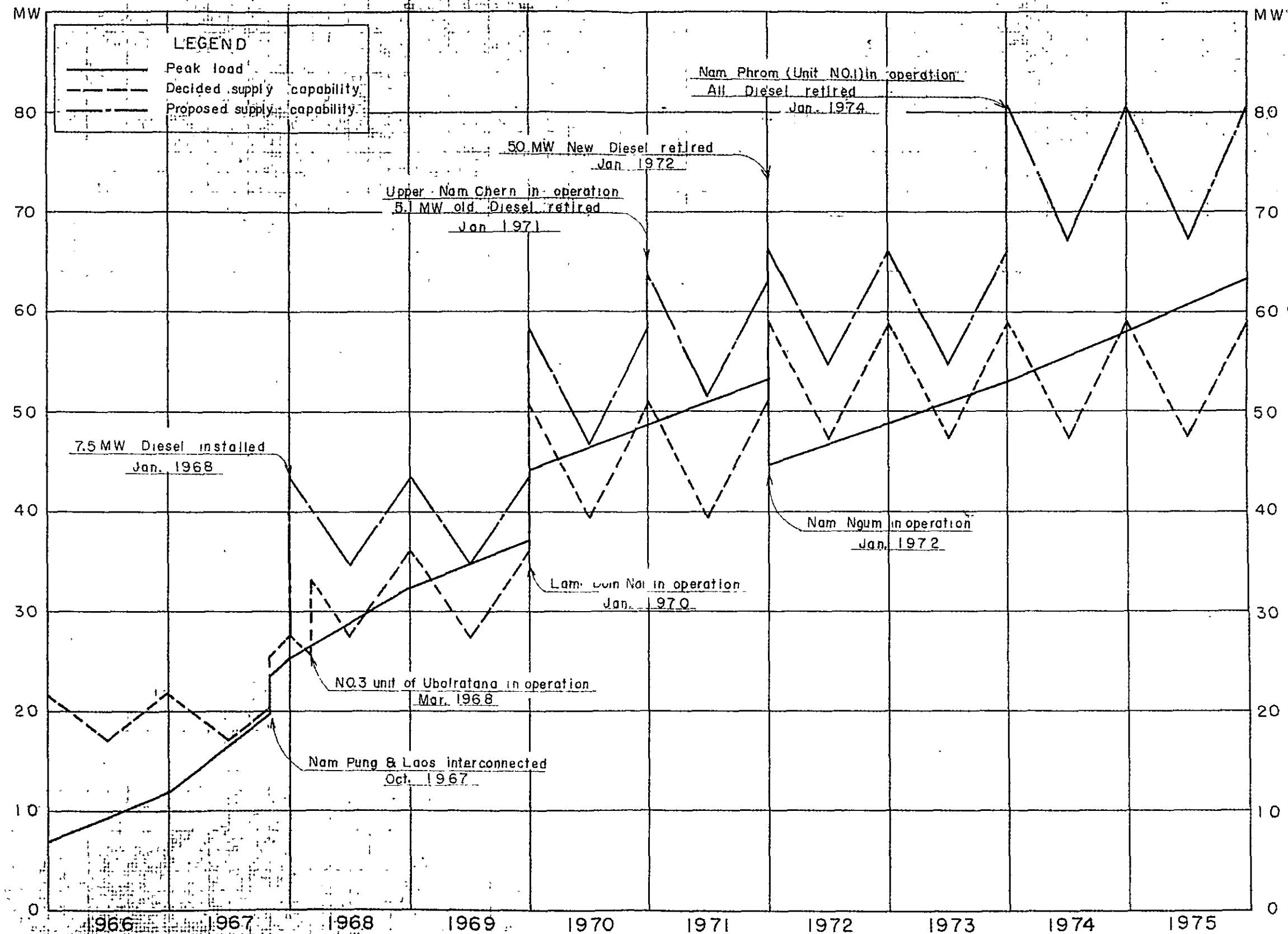


Fig. 5-4

Energy Balance

(In case that Upper Nam chern is developed firstly)

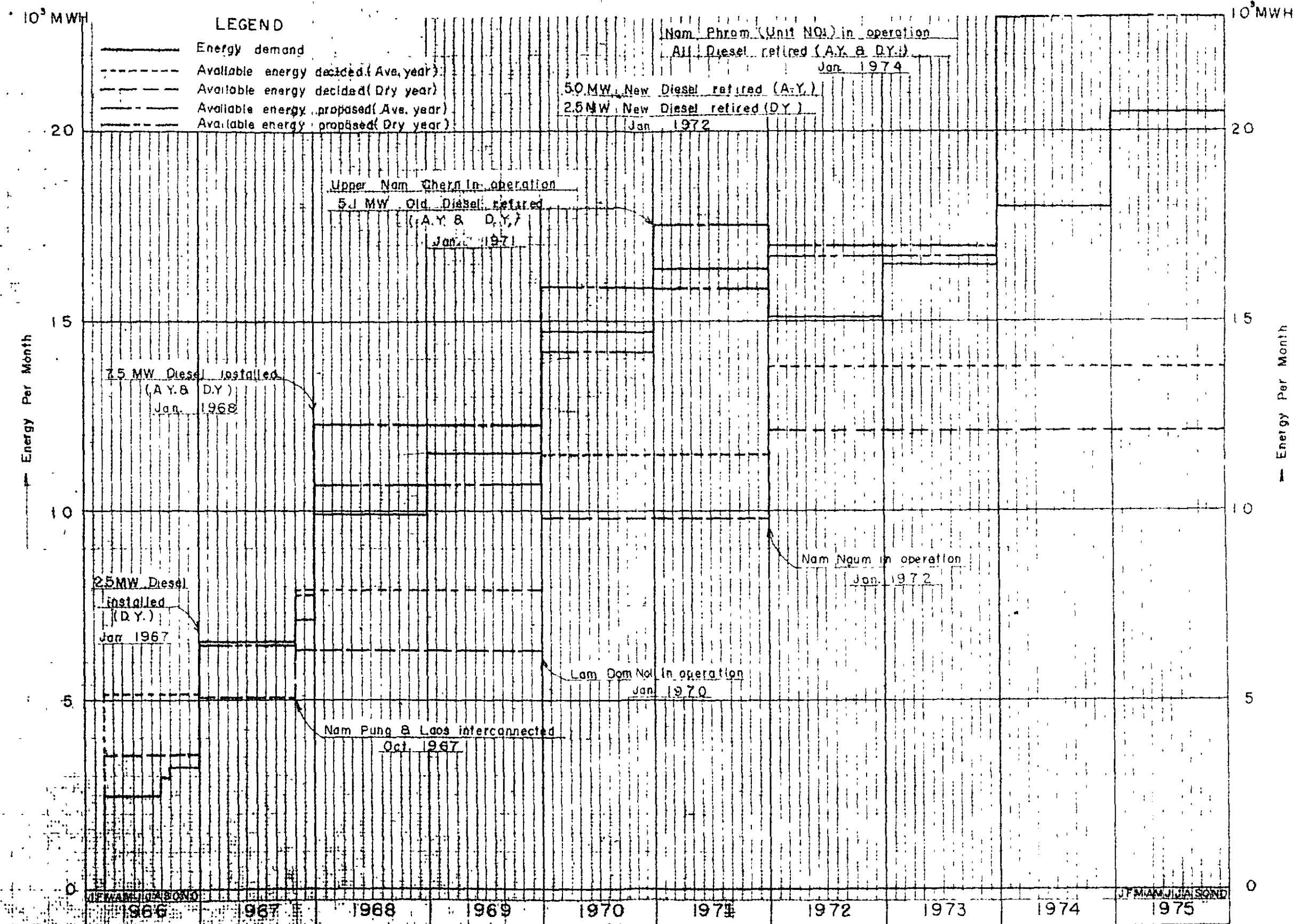


Fig. 6-1 Daily Load Curve at Ubolratana Power Plant

15 June 1966

Peak Load: 850 MW Average Load: 440 MW Load Factor: 53%

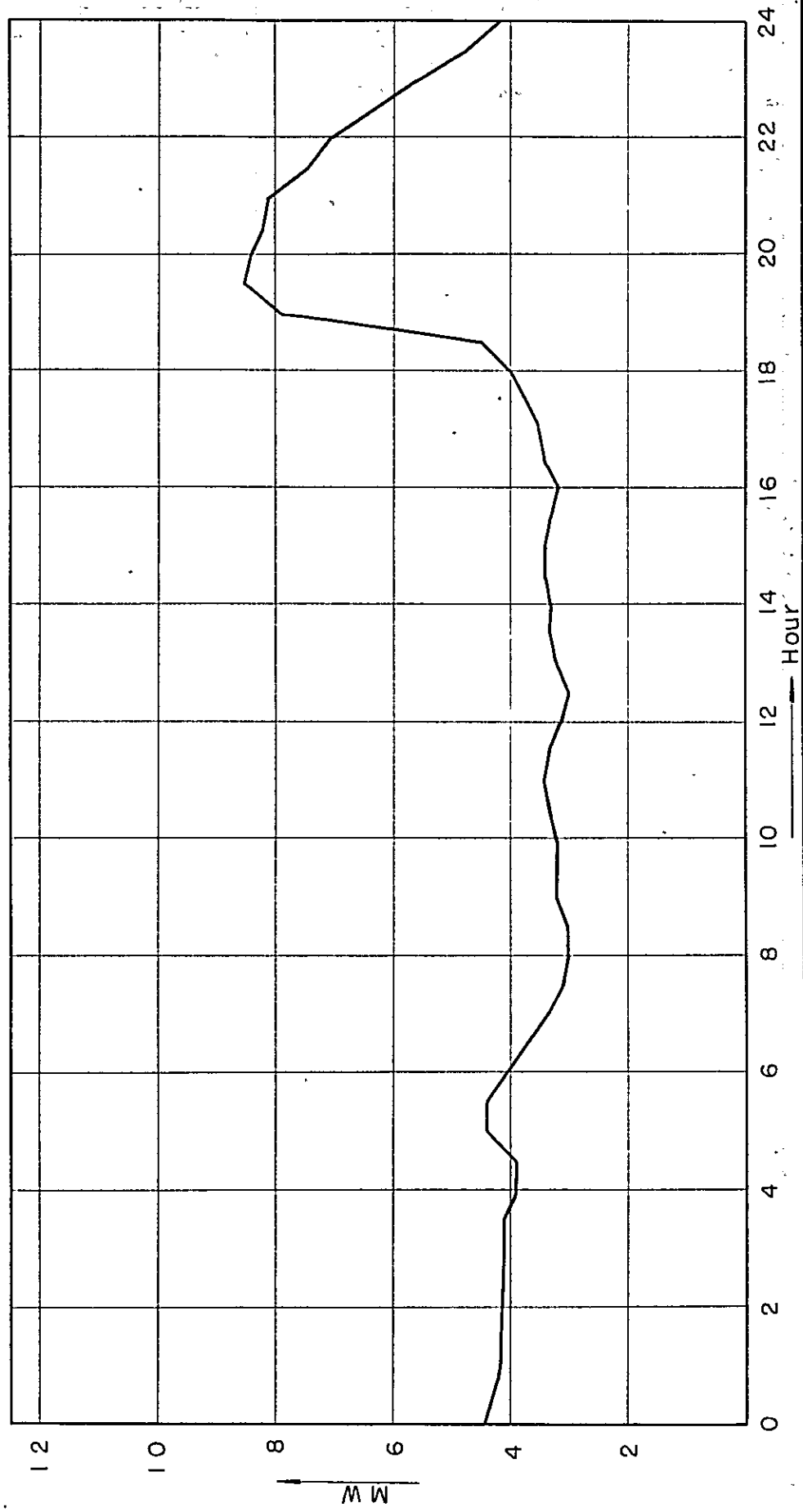


Fig. 6-2 Daily Load Curve at Ubolratana Power Plant

16 June 1966

Load Factor: 49 %

Average Load: 4.33 M W

Peak Load: 8.80 M W

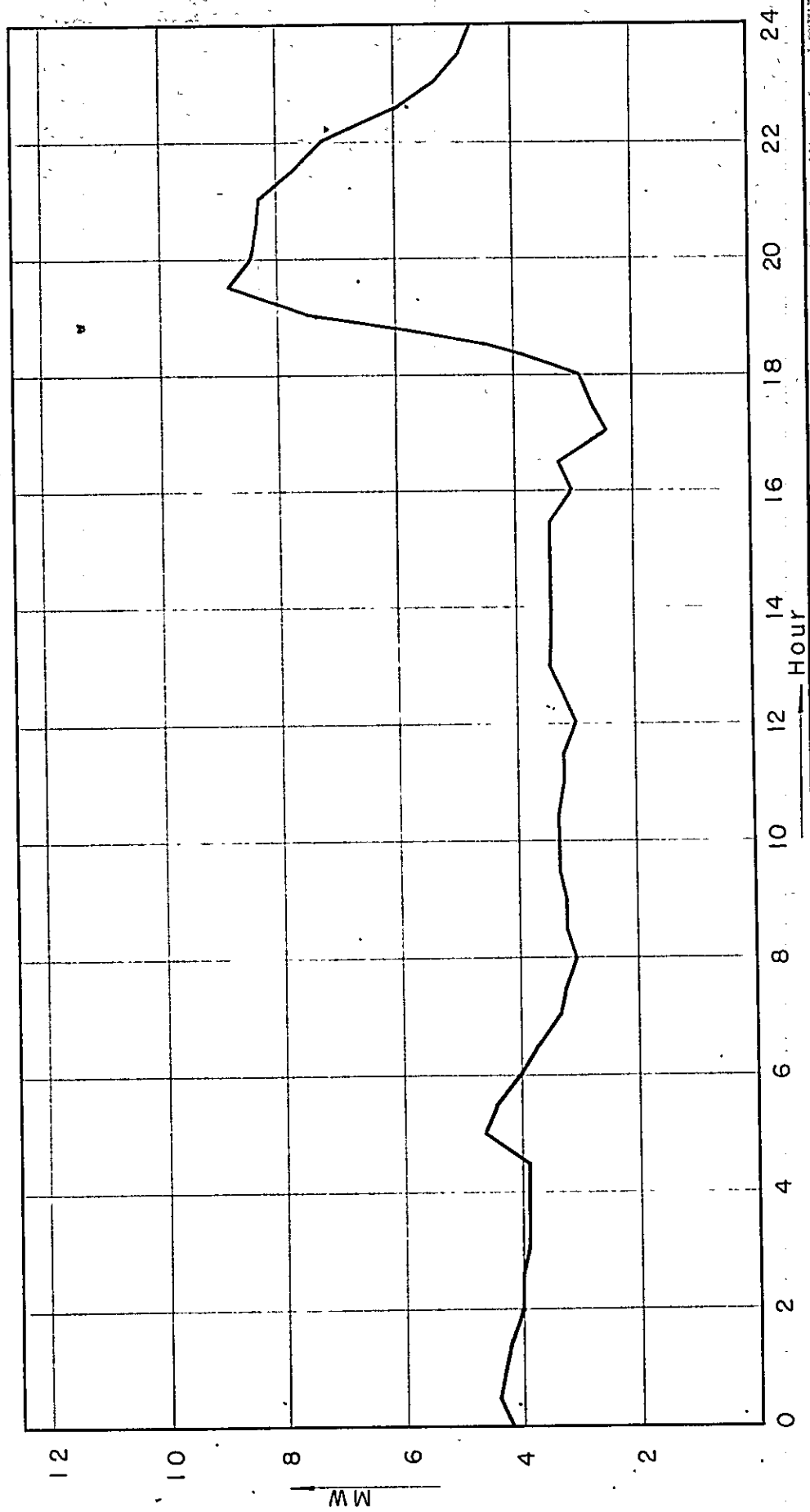


Fig. 6—3 Daily Load Curve at Ubolratana Power Plant

29 June 1966

Peak Load: 8.50 MW Average Load: 4.40 MW Load Factor: 52 %

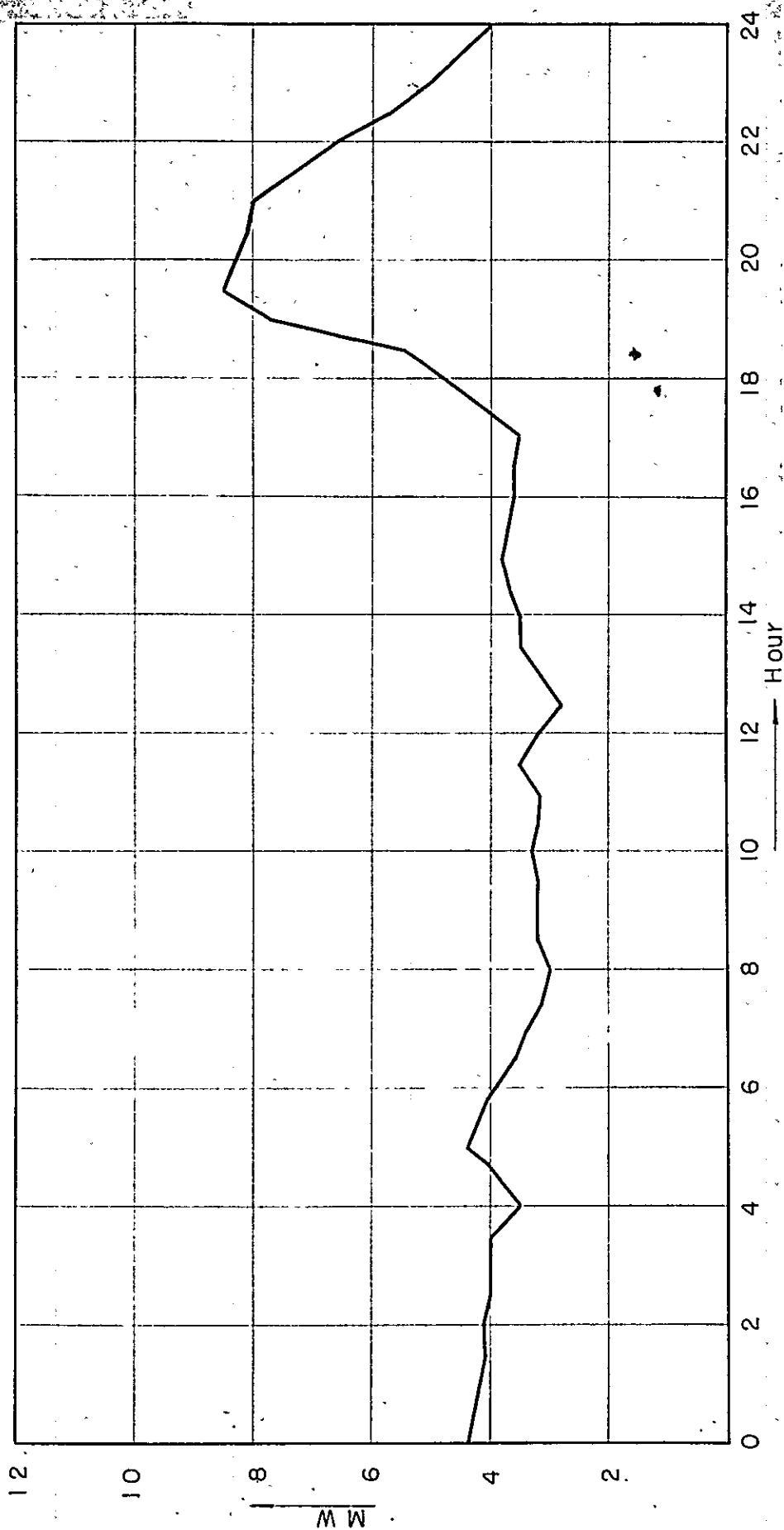


Fig. 6-4 Daily Load Curve at Khon Kaen Substation

27 May 1966

Peak Load: 1.41 MW

Average Load: 0.73 MW

Load Factor: 42 %

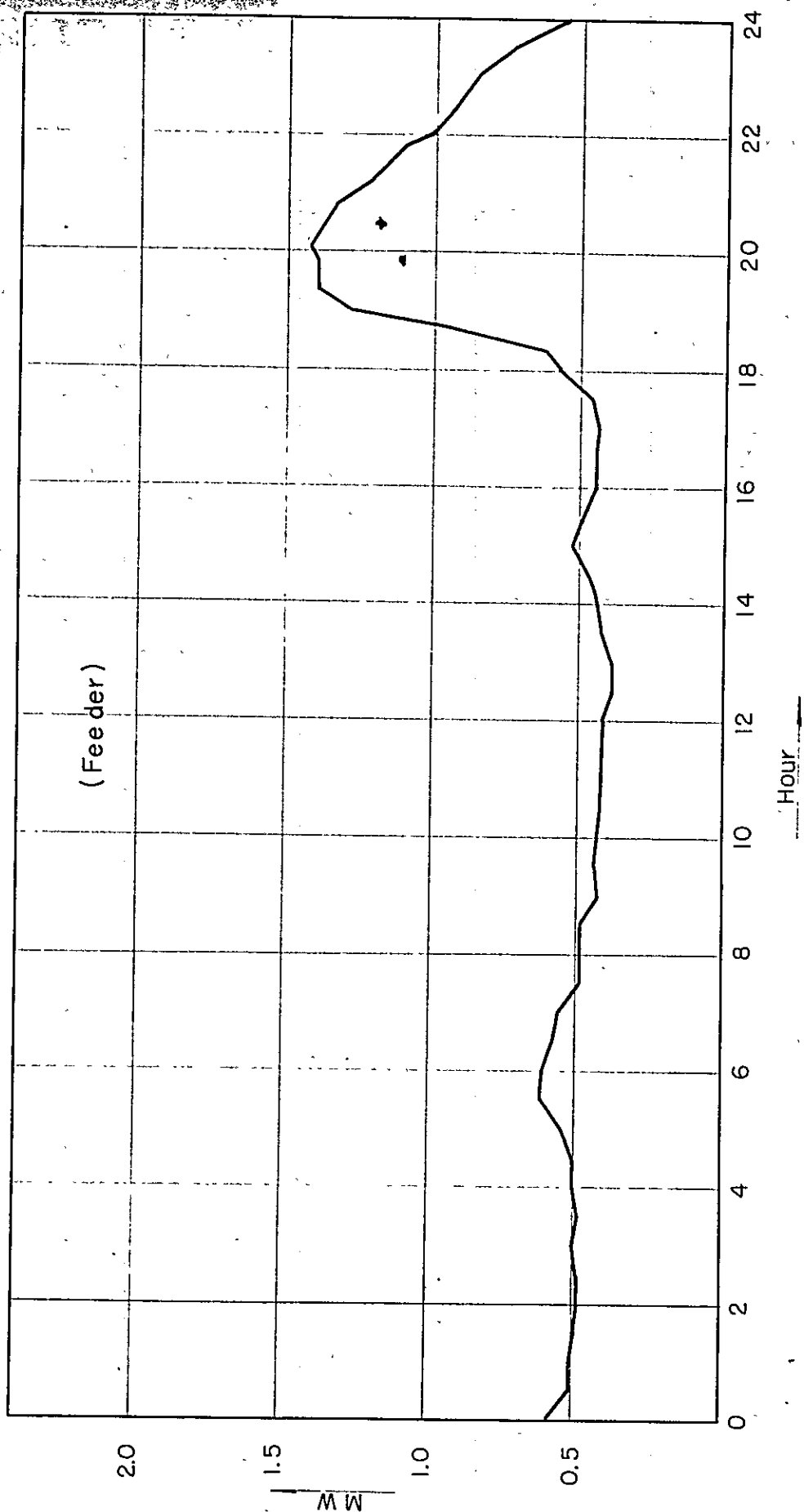


Fig. 6-5 Daily Load Curve at Nakorn Ratsima Substation

27 May 1966

Peak Load: 3.50 MW

Average Load: 1.85 MW

Load Factor: 53 %

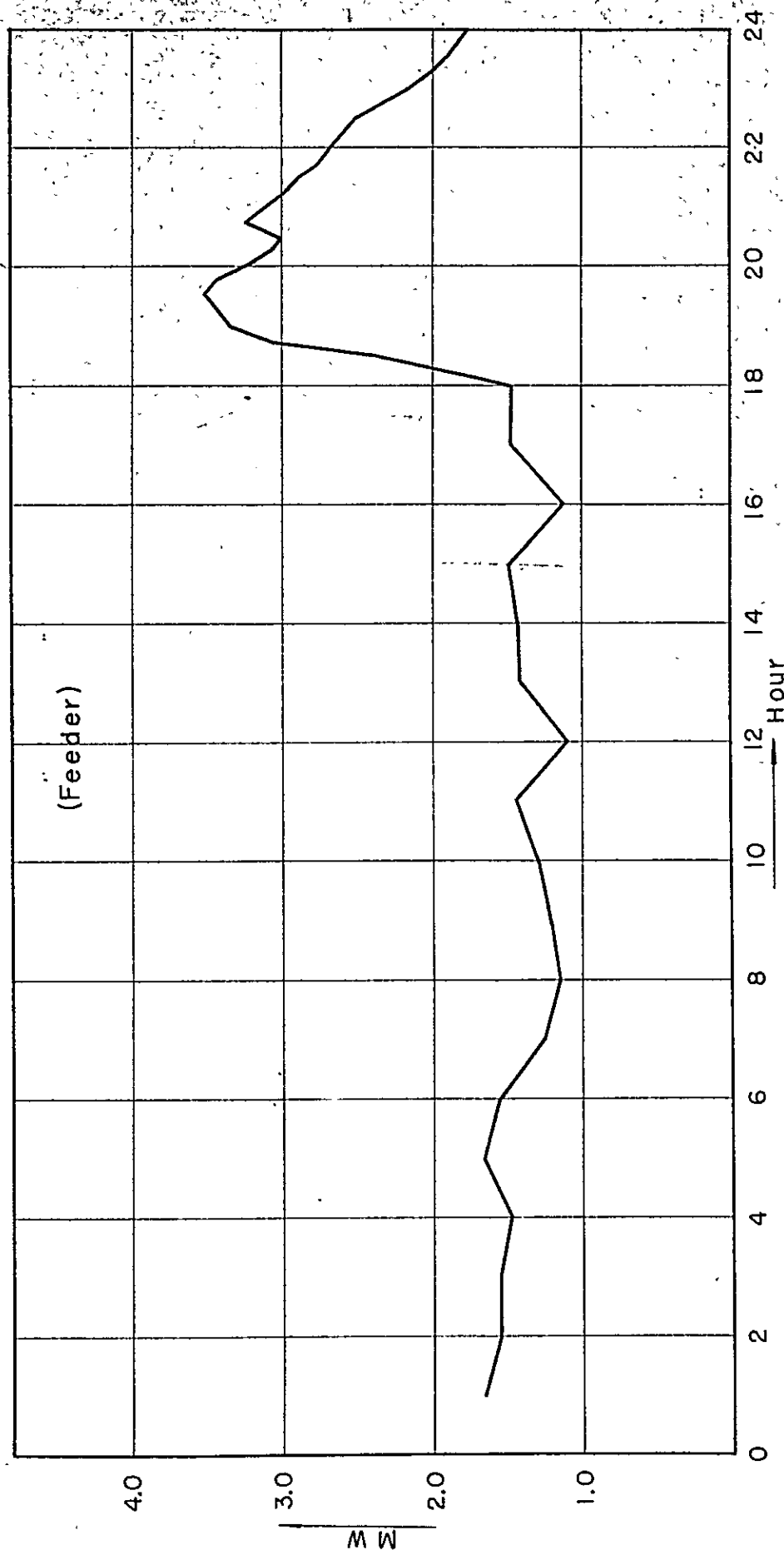


Fig. 6-6 Daily Load Curve at Udon Thani Substation

27 May 1966

Peak Load: 2.02 MW

Average Load: 1.04 MW

Load Factor: 51 %

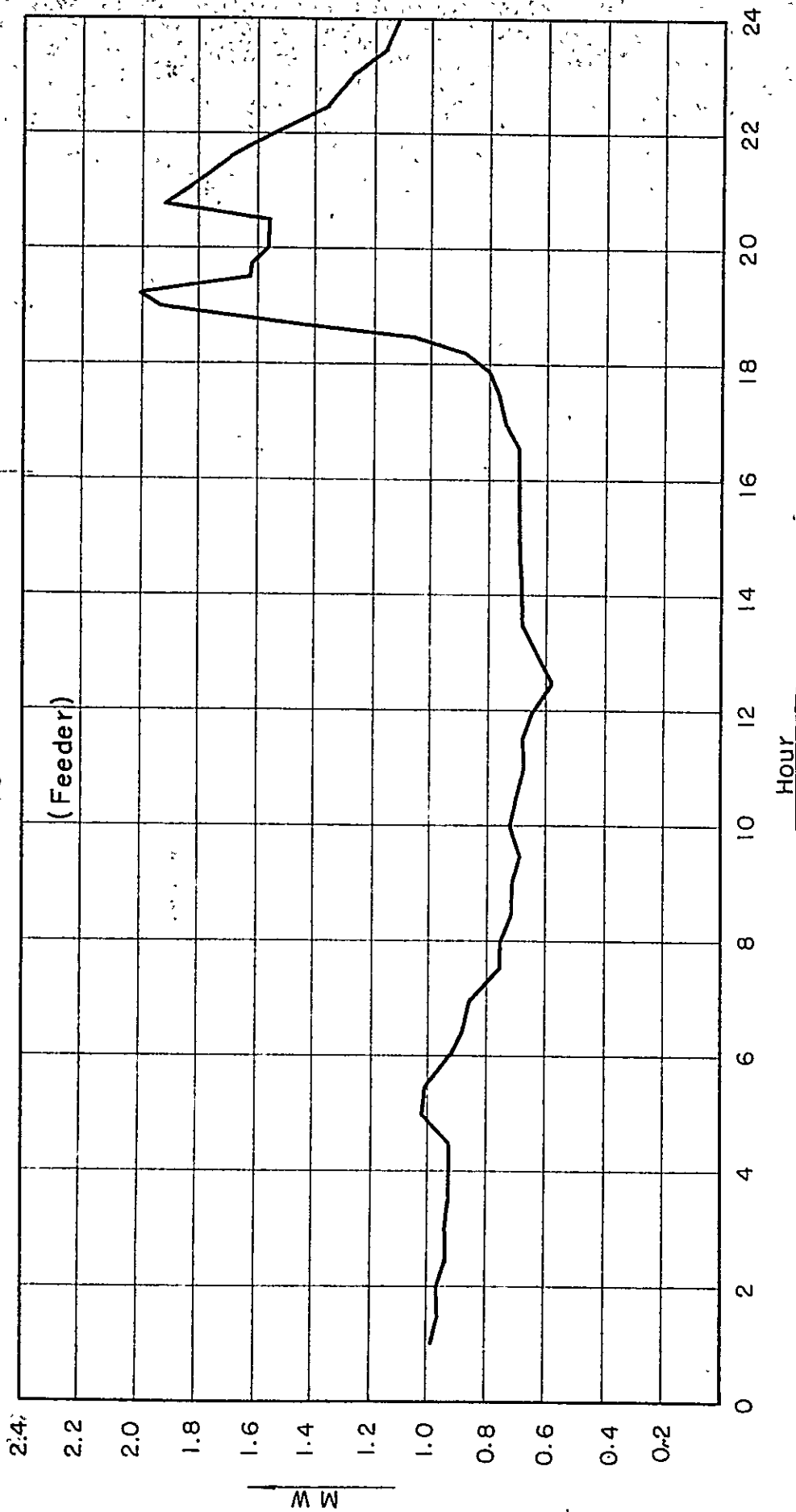


Fig. 6—7 Daily Load Curve at Phol Substation

27 May 1966

Peak Load: 0.16 MW

Average Load: 0.07 MW

Load Factor: 41 %

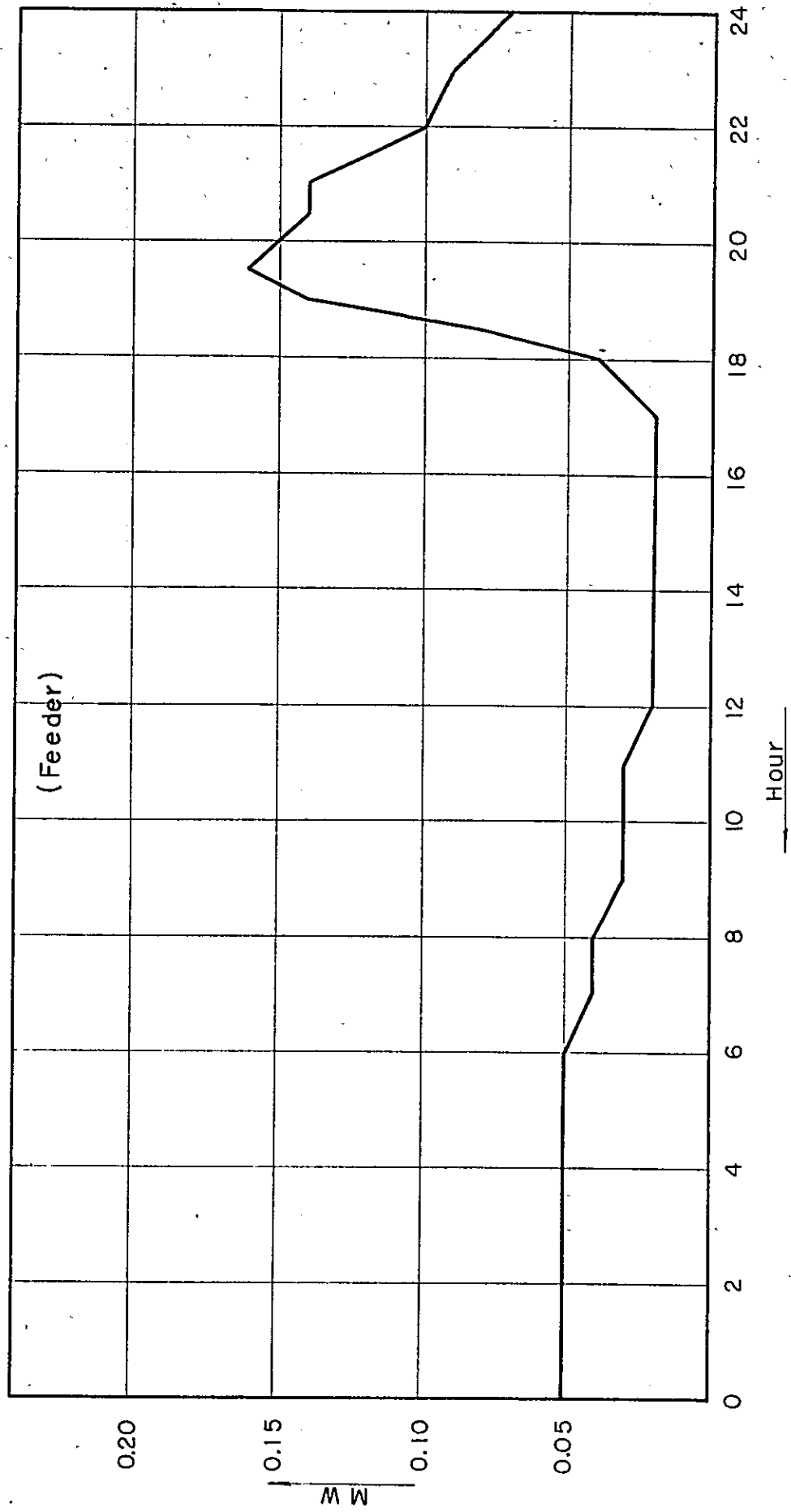


Fig. 6-8 Daily Load Curve at Maharakham Substation

27 May 1966

Peak Load: 0.57 MW

Average Load: 0.22 MW

Load Factor: 39 %

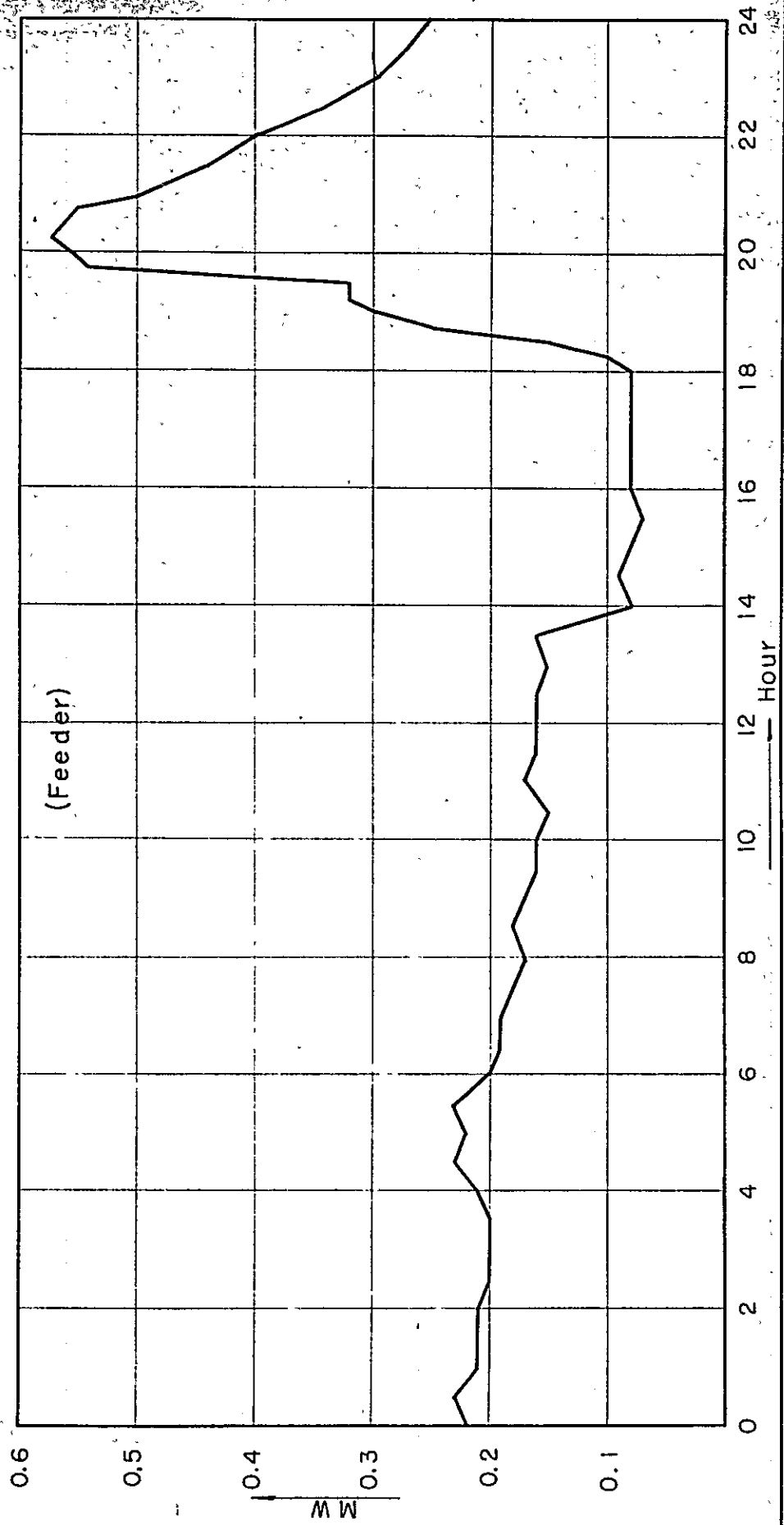


Fig. 7-1 CONSTRUCTION SCHEDULE OF NAM PHROM PROJECT

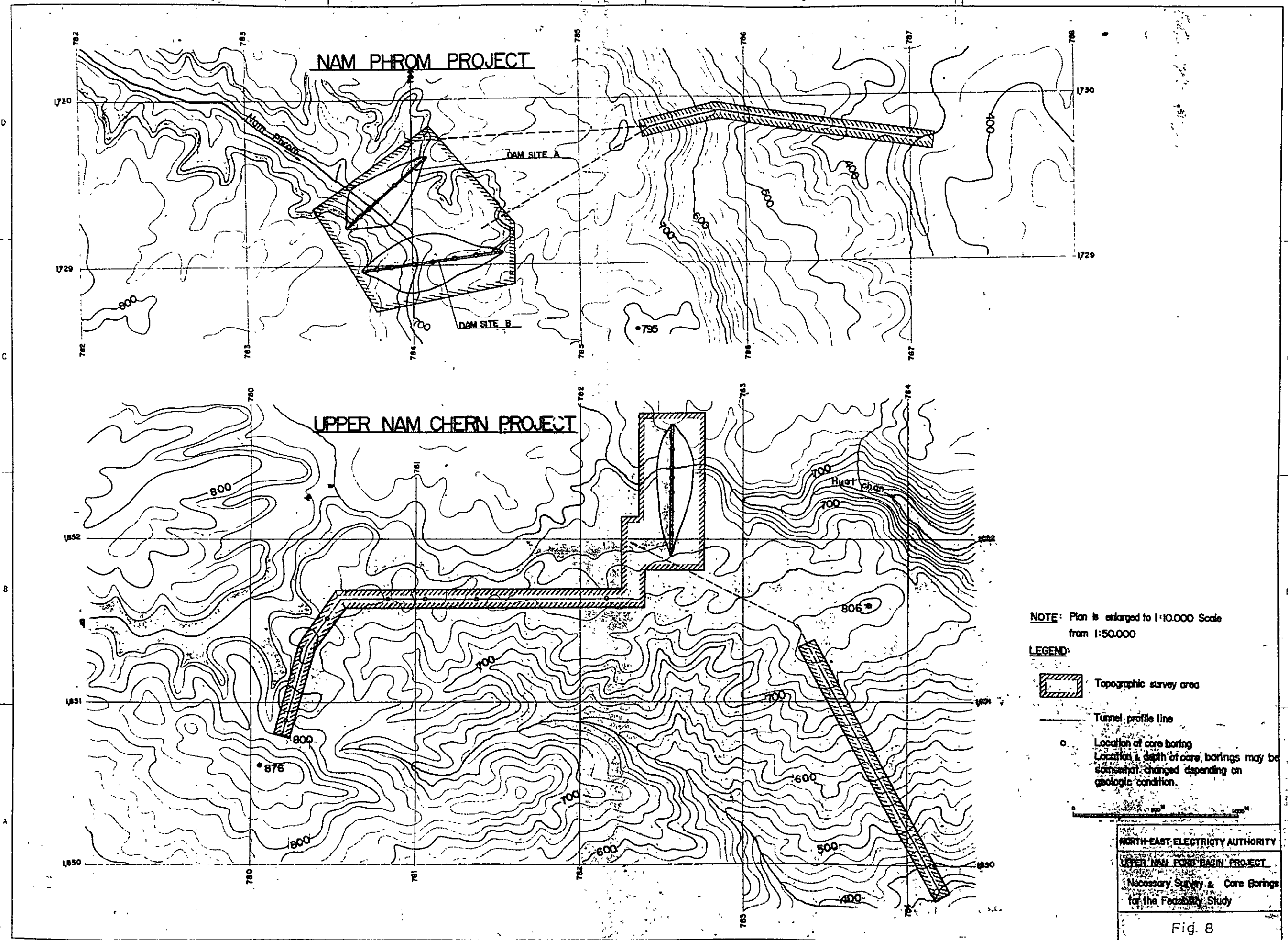
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Note : It is assumed that the access road is completed before the end of 1968.

Fig. 7-2 CONSTRUCTION SCHEDULE OF UPPER NAM CHERN

	1968												1969												1970												1971											
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ELECTRICAL EQUIPMENT																																																
TRANSMISSION LINE & SUBSTATION																																																

Note: It is assumed that the access road is completed before the end of 1968.



TABLES

Table-1 Population Data (1964)

Changwad	Total Population	Approximate Population in Towns	Presumptive Population in Towns and their Suburbs
(1) Nam Pong Service Area			
Khon Kaen	925,967	55,000	100,000
Nakorn Ratsima	1,143,260	61,700	100,000
Udon Thani	802,737	41,000	150,000
Chaiya Phum	575,501	12,000	50,000
Mahasarakham	543,689	18,200	30,000
Loi-et	724,724	24,700	50,000
Kala-sin	526,538	12,600	30,000
Nong Khai	289,686	25,300	50,000
Subtotal	5,532,102	250,500 (4.5%)	560,000 (10.1%)
(2) Nam Pung Service Area			
Sakon Nakhon	451,384	15,200	30,000
That Phanom	485,611	13,200	28,000
Subtotal	936,995	28,400 (3.0%)	58,000 (6.2%)
(3) Lam Dom Noi Service Area			
Ubol Rat Thani	1,249,790	33,000	85,000
Sri Saket	679,458	14,000	30,000
Su-rin	622,296	14,000	30,000
Subtotal	2,551,544	61,000 (2.4%)	145,000 (5.7%)
(4) Total	9,020,641	339,900 (3.8%)	763,000 (8.5%)

Table-2 Existing Power Plants and Other Projects
in Northeastern Region

	Installed Capacity MW	Dependable Capacity MW	Annual Energy Generation		Remarks
			Average Year 103 MWH	Dry Year 103 MWH	
Ubolratana Hydro-power Plant (Nam Pong)	(16.6(*1)) 25.0(*2)	(12.0(*1)) 18.0(*2)	62.0	43.0	(*1) 2 units (*2) 3 units Unit No. 3 will be in operation in Mar. 1968.
Nam Pung Hydro-power Plant	6.0	4.2	15.0	15.0	
Lam Dom Noi Hydro-power P.	15.0	12.0	43.0	42.0	Expected to be in operation in Jan. 1970.
Diesel Power Plants	6.0	5.1	17.9	17.9	L.F. = 40%
Total	52.0	39.3	137.9	117.9	

Table-3 Annual Mean Rate of Load Growth in KW (Unit:%)

(1) Residential and Commercial Consumers

Areas	Years	1966	'67	'68	'69	'70	'71	'72	'73	'74	'75
<u>Nam Pong Service Area</u>											
Khon Kaen			16	14	12						12
Nakorn Ratsima			16	14	12						12
Udon Thani			16	14	12						12
Phol & Ban Phai				12	10						10
Chalya Phum				14	12	10					10
Manasarakham			16	12	10						10
Loi-et			16	12	10						10
Kala-sin			16	12	10						10
Nong Khai				12	10						10
<u>Nam Pung Service Area</u>											
Sakon Nakhon				12	10						10
Nakae				12	10						10
That Phanom				12	10						10
<u>Lam Dom Noi Service Area</u>											
Ubol Rat Thani							16	14	12		12
Sri Saket							14	12	10		10
Su-rin							14	12	10		10
<u>Laos</u>											
Vientian					20	20					

(2) Cooperative Demand

Areas	Years	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
<u>Nam Pong Service Area</u>											
Udon Thani						10					10
Nong Khai						10					10

Table-4-1 Estimated Load Factor

(Unit: %)

(1) Residential and Commercial Consumers

Areas \ Years	1966	'67	'68	'69	'70	'71	'72	'73	'74	'75
<u>Nam Pong Service Area</u>										
Khon Kaen	44		44	45						45
Nakorn Ratsima	44		44	45						45
Udon Thani	44		44	45						45
Phol	36		36	38						38
Maharakham	36		36	38						38
Nong Khai	36		36	38						38
<u>Nam Pung Service Area</u>										
Sakon Naknon	34	36	36	38						38
Nakae	34	36	36	38						38
That Phanom	34	36	36	38						38
<u>Iam Dom Noi Service Area</u>										
Udai Rat Thani	-	-	-	-	40	44	44	45		45
Sri Saket	-	-	-	-	34	36	36	38		38
Su-rin	-	-	-	-	34	36	36	38		38
<u>Laos</u>										
at										
Vientian (Nong Khai)	-	40								40
Nam Ngum (")	-	40								40

Table-4-2 Estimated Load Factor

(Unit: %)

(2) Military Base

Areas \ Years	1966	'67	'68	'69	'70	'71	'72	'73	'74	'75
<u>Nam Pong Service Area</u>										
Khon Kaen	44		44	45						45
Nakorn Ratsima	44		44	45						45
Udon Thani	44		44	45						45
<u>Lam Dom Noi Service Area</u>										
Ubol Rat Thani					40	44	44	45		45

(3) Cooperative Demand

Areas \ Years	1966	'67	'68	'69	'70	'71	'72	'73	'74	'75
<u>Nam Pong Service Area</u>										
Udon Thani		25								25
Nong Khai		25								25

(4) Laotian Demand

Areas \ Years	1966	'67	'68	'69	'70	'71	'72	'73	'74	'75
<u>Nam Ngum Service Area</u>										
Vientian		40				40				
Nam Ngum			40			40				

Table-5-1 Load Forecast in MW and MWH for the Year 1967 - 1975

			1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		Remarks
			MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	
Nam Pong Service Area																							
Koen Kaen	Res. & Com.		1.70	4.91	1.79	7.58	2.25	8.66	2.52	9.92	2.82	11.10	3.16	12.45	3.54	13.95	3.96	15.60	4.43	17.49	4.96	19.54	From Mar. 1966 From Mar. 1966
	Military Base		-	-	2.00	7.70	3.50	13.47	3.50	13.80	3.50	13.80	3.50	13.80	3.50	13.80	3.50	13.80	3.50	13.80	3.50	13.80	
	Subtotal		1.70	4.91	3.97	15.28	5.75	22.13	6.02	23.72	6.32	24.90	6.66	26.25	7.04	27.75	7.46	29.40	7.93	31.29	8.46	33.34	
Korn Ratsima	Res. & Com.		4.00	11.55	4.62	17.78	5.26	21.65	5.89	23.20	6.60	26.00	7.39	29.10	8.27	32.60	9.25	36.50	10.36	40.80	11.61	45.80	From Mar. 1966 From Sept. 1966
	Military Base		1.00	1.25	2.50	9.63	3.00	11.54	3.00	11.82	3.00	11.82	3.00	11.82	3.00	11.82	3.00	11.82	3.00	11.82	3.00	11.82	
	Subtotal		5.00	12.80	7.12	27.41	8.26	33.19	8.89	35.02	9.60	37.82	10.39	40.92	11.27	44.42	12.25	48.32	13.36	52.62	14.61	57.62	
Kien Thani	Res. & Com.		2.20	6.19	2.55	9.82	2.91	11.20	3.26	12.86	3.65	14.40	4.09	16.12	4.58	18.05	5.13	20.20	5.74	22.60	6.43	25.34	From Mar. 1966 From Mar. 1966 30% of load demanded in peak time.
	Military Base		0.50	0.63	2.50	9.63	2.50	9.63	2.50	9.85	2.50	9.85	2.50	9.85	2.50	9.85	2.50	9.85	2.50	9.85	2.50	9.85	
	Cooperative D.		-	-	(0.50)	1.10	(0.75)	1.64	(1.00)	2.19	(1.10)	2.41	(1.21)	2.65	(1.33)	2.91	(1.46)	3.20	(1.61)	3.53	(1.77)	3.88	
	Subtotal		2.70	6.82	5.22	20.55	5.66	22.47	6.09	24.90	6.52	26.66	6.99	28.62	7.52	30.81	8.12	33.25	8.78	35.98	9.52	39.07	
Phol	Phol & Ban	Res. & Com.	0.45	0.83	0.90	2.84	1.01	3.18	1.11	3.69	1.22	4.06	1.34	4.46	1.48	4.92	1.62	5.39	1.79	5.96	1.97	6.55	From Mar. 1966
	Phai	Res. & Com.	-	-	0.60	1.89	0.69	2.18	0.77	2.56	0.85	2.83	0.94	3.13	1.03	3.43	1.13	3.76	1.24	4.17	1.36	4.53	
	Chaiya Phum	Subtotal	0.45	0.83	1.50	4.73	1.70	5.36	1.88	6.25	2.07	6.89	2.28	7.59	2.51	8.35	2.75	9.15	3.03	10.13	3.33	11.08	
Mahasarakham	Mahasarakham	Res. & Com.	0.30	0.63	0.35	1.10	0.39	1.23	0.43	1.43	0.47	1.56	0.52	1.73	0.57	1.90	0.63	2.10	0.69	2.30	0.76	2.53	From Mar. 1966 From Oct. 1966 From Oct. 1966
	Loi-et	Res. & Com.	0.25	0.20	0.29	0.91	0.33	1.04	0.36	1.20	0.40	1.33	0.44	1.46	0.48	1.60	0.53	1.76	0.58	1.93	0.64	2.13	
	Kala-sin	Res. & Com.	0.20	0.16	0.23	0.73	0.26	0.82	0.29	0.97	0.31	1.03	0.35	1.17	0.38	1.27	0.42	1.40	0.46	1.53	0.51	1.70	
	Subtotal		0.75	0.99	0.87	2.74	0.98	3.09	1.08	3.60	1.18	3.92	1.31	4.36	1.43	4.77	1.58	5.26	1.73	5.76	1.91	6.36	
Khai	Res. & Com.		0.70	0.50	1.00	3.15	1.12	3.53	1.23	4.09	1.35	4.48	1.49	4.95	1.64	5.45	1.80	5.98	1.98	6.59	2.18	7.25	From Oct. 1966 30% of load demanded in peak time
	Cooperative D.		-	-	(0.50)	1.10	(1.50)	3.28	(2.50)	5.48	(2.75)	6.02	(3.03)	6.63	(3.33)	7.29	(3.66)	8.01	(4.02)	8.81	(4.42)	9.70	
	Subtotal		0.70	0.50	1.17	4.25	1.62	6.81	2.06	9.57	2.27	10.50	2.50	11.58	2.75	12.74	3.02	13.99	3.32	15.40	3.65	16.95	
Total Load at Substations			11.30	26.85	19.85	74.96	23.97	93.05	26.02	103.06	27.96	110.69	30.13	119.32	32.52	128.84	35.18	139.37	38.15	151.18	41.48	164.42	
Losses in the System (%)			4.0	2.2	6.0	3.3	6.7	3.7	7.0	3.9	7.5	4.1	8.0	4.4	8.5	4.7	9.0	4.9	9.5	5.2	10.0	5.5	
Total load at Sending End			11.80	27.50	21.10	77.50	25.50	96.60	27.90	107.20	30.10	115.20	32.60	124.80	35.30	135.00	38.30	146.20	41.80	159.20	45.60	173.80	

Table-5-2 Load Forecast in MW and MWH for the Year 1966 - 1975

		1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		Remarks
		MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	
Nam Pung Service Area																						Intercon- nection between Nam Pong S.A. and Nam Pung S.A. will be completed in October 1967
Nakhon	Res. & Com.	(0.52)	(1.55)	0.70	(2.21) 0.37 (0.47)	0.78	2.46	0.86	2.86	0.95	3.16	1.05	3.49	1.16	3.86	1.28	4.26	1.41	4.69	1.55	5.16	
	Res. & Com.	(0.03)	(0.09)	0.15	0.08	0.17	0.54	0.19	0.63	0.21	0.70	0.23	0.77	0.25	0.83	0.28	0.93	0.31	1.03	0.34	1.13	
Phanom	Res. & Com.	(0.94)	(2.70)	1.20	(3.79) 0.63 (6.47)	1.34	4.23	1.47	4.89	1.62	5.39	1.78	5.93	1.96	6.52	2.16	7.19	2.38	7.92	2.62	8.72	
Load at Substations		(1.49)	(4.34)	2.05	1.08	2.29	7.23	2.52	8.38	2.78	9.25	3.06	10.19	3.37	11.21	3.72	12.38	4.10	13.64	4.51	15.01	
Loss in the System (%)		4.0	2.2	4.0	2.2	4.0	2.2	4.0	2.2	4.5	2.5	4.5	2.5	5.0	2.8	5.0	2.8	5.5	3.0	5.5	3.0	
Load at Sending End		(1.55)	(4.44)	2.13	(6.62) 1.11	2.38	7.40	2.62	8.57	2.91	9.48	3.20	10.44	3.54	11.52	3.91	12.71	4.33	14.05	4.76	15.48	
Lam Dom Noi Service Area (Laos)																						
Rat Thani	Res. & Com.	-	-	-	-	-	-	(2.80)	(9.81)	3.30	11.55	3.82	14.72	4.35	16.77	4.87	19.20	5.46	21.50	6.12	24.10	Lam Dom Noi will be in operation at the beginning of 1970.
	Military Base	-	-	-	-	-	-	(2.00)	(7.00)	2.00	7.00	2.00	7.70	2.00	7.70	2.00	7.88	2.00	7.88	2.00	7.88	
	Subtotal	-	-	-	-	-	-	(4.80)	(16.81)	5.30	18.55	5.82	22.42	6.35	24.47	6.87	27.08	7.46	29.38	8.12	31.98	
Saket	Res. & Com.	-	-	-	-	-	-	(0.70)	(2.09)	0.83	2.48	0.95	2.99	1.07	3.38	1.18	3.93	1.30	4.33	1.43	4.76	
in	Res. & Com.	-	-	-	-	-	-	(1.30)	(3.87)	1.58	4.71	1.80	5.68	2.02	6.37	2.22	7.39	2.44	8.12	2.68	8.92	
Load at Substations		-	-	-	-	-	-	(6.80)	(22.77)	7.71	25.74	8.57	31.09	9.44	34.22	10.27	38.40	11.20	41.83	12.23	45.66	
Loss in the System (%)		-	-	-	-	-	-	5.0	2.8	5.0	2.8	5.0	2.8	6.0	3.3	6.0	3.3	7.0	3.9	7.0	3.9	
Load at Sending End		-	-	-	-	-	-	(7.14)	(23.40)	8.20	26.50	9.00	32.00	10.00	35.40	10.90	39.70	12.00	43.50	13.10	47.50	

Table-5-3 Load Forecast in MW and MWH for the Year 1966 - 1975

	1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		Remarks
	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	MW	10 ³ MWH	
(4) Nam Ngum Service Area																					Interconnection between Nam Pong S.A. and Nam Ngum S.A. will be completed in Oct. 1967. Nam Ngum P.P. will be in operation at the beginning of 1972.
Vientian Res. & Com.	-	-	2.00	1.17	3.50	12.26	4.20	14.70	5.05	17.70	6.05	21.20	-	-	-	-	-	-	-	-	
Nam Ngum Res. & Com.	-	-	-	-	0.70	2.45	2.00	7.00	2.00	7.00	2.00	7.00	-	-	-	-	-	-	-	-	
Total Load at Substation (Nong Khai)	-	-	2.00	1.17	4.20	14.71	6.20	21.70	7.05	24.70	8.05	28.20	-	-	-	-	-	-	-	-	
Loss in the System	-	-	6.0	3.3	7.0	3.9	7.0	3.9	7.5	4.1	8.0	4.4	-	-	-	-	-	-	-	-	
Total Load at Sending End	-	-	2.12	1.21	4.50	15.30	6.63	22.50	7.59	25.70	8.70	29.50	-	-	-	-	-	-	-	-	
(5) Total Load (at sending end) for the Area to be Considered																					
Nam Pong Service Area	11.80	27.50	21.10	77.50	25.50	96.60	27.90	107.20	30.10	115.20	32.60	124.80	35.30	135.00	38.30	146.20	41.80	159.20	45.60	173.80	
Nam Pung Service Area	-	-	2.13	1.11	2.38	7.40	2.62	8.57	2.91	9.48	3.20	10.44	3.54	11.52	3.91	12.71	4.33	14.05	4.76	15.48	
Iam Dom Noi Service Area	-	-	-	-	-	-	-	-	8.20	26.50	9.00	32.00	10.00	35.40	10.90	39.70	12.00	43.50	13.10	47.50	
Nam Ngum Service Area	-	-	2.12	1.21	4.50	15.30	6.63	22.50	7.59	25.70	8.70	29.50	-	-	-	-	-	-	-	-	
Total	11.80	27.50	25.35	79.82	32.38	119.30	37.15	138.27	48.80	176.88	53.50	196.74	48.84	181.92	53.11	198.61	58.13	216.75	63.46	236.78	

Table 6-1. Peak Load Balance

(Unit: MW)

	1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		Remarks
	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	
(1) Peak Load																					
Nam Pong Service Area	-	11.80	16.45	21.10	23.30	25.50	26.70	27.90	29.00	30.10	31.35	32.60	33.95	35.30	36.80	38.30	40.05	41.80	43.70	45.60	
Nam Pung Service Area	-	-	-	2.13	2.26	2.38	2.50	2.62	2.77	2.91	3.06	3.20	3.37	3.54	3.73	3.91	4.12	4.33	4.55	4.76	
Lam Dom Noi Service Area	-	-	-	-	-	-	-	-	7.67	8.20	8.60	9.00	9.50	10.00	10.45	10.90	11.45	12.00	12.55	13.10	
Nam Ngum Service Area (Laos)	-	-	-	2.12	3.31	4.50	5.57	6.63	7.11	7.59	8.14	8.70	-	-	-	-	-	-	-	-	
Total Peak Load	-	11.80	16.45	25.35	28.87	32.38	34.77	37.15	46.55	48.80	51.15	53.50	46.82	48.84	50.98	53.11	55.62	58.13	60.80	63.46	
(2) Dependable Capability																					
Ubolratana Power Plant	12.00	16.60	12.00	16.60	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	No.3 Unit will be in operation in Mar. 1968. From Nov. 1967
Nam Pung P.P.	-	-	-	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	
Existing Diesel P.P.	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	
Lam Dom Noi P.P.	-	-	-	-	-	-	-	-	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	From Jan. 1970.
Expected Power from Nam Ngum P.P.	-	-	-	-	-	-	-	-	-	-	-	-	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	From Jan. 1972
Total Dependable Capability	17.10	21.70	17.10	27.70	27.30	36.10	27.30	36.10	39.30	51.10	39.30	51.10	47.30	59.10	47.30	59.10	47.30	59.10	47.30	59.10	
(3) Required Capability in MW	-	-	-	-	1.57	-	7.47	1.05	7.25	-	11.85	2.40	-	-	3.68	-	8.32	-	13.50	4.36	(1) - (2)

Table-6-2 Annual Energy Balance

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Remarks
(1) Energy Demand											
Nam Pong Service Area	27.50	77.50	96.60	107.20	115.20	124.80	135.00	146.20	159.20	173.80	
Nam Pong Service Area	-	1.11(*1)	7.40	8.57	9.48	10.44	11.52	12.71	14.05	15.48	(*1) 2 months
Lam Dom Noi Service Area	-	-	-	-	26.50	32.00	35.40	39.70	43.50	47.50	
Nam Ngum Service Area (Laos)	-	1.21	15.30	22.50	25.70	29.50	-	-	-	-	
Total Energy Demand per Year (Energy Demand per Month)	24.70:26.60:27.50 (2.47:2.95:3.25)	78.71:79.82 (6.56:7.12)	119.30 (9.94)	138.27 (11.52)	176.88 (14.74)	196.74 (16.39)	181.92 (15.16)	198.61 (16.55)	216.75 (18.06)	236.78 (20.56)	
(2) Available Energy	Dry Year	Average Year	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	
Ubolratana Power Plant	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	
Num Pung P.P.	-	-	- 15.0	- 15.0	15.0	15.0	15.0	15.0	15.0	15.0	
Existing Diesel P.P.	-	-	17.9:17.9	16.7:2.8	17.9	17.9	17.9	17.9	17.9	17.9	L.F=40%
Lam Dom Noi P.P.	-	-	-	-	-	-	42.0	43.0	42.0	43.0	
Expected Energy from Nam Ngum	-	-	-	-	-	-	-	-	28.0	28.0	
Total Available Energy per year (Available Energy per Month)	43.0 (3.58)	62.0 (5.17)	60.9:75.9 (5.08:6.32)	78.7:79.8 (6.56:7.12)	75.9 (6.32)	94.9 (7.91)	75.9 (6.32)	94.9 (7.91)	117.9 (9.82)	137.9 (11.49)	
(3) Required Capability in MWH	-	-	17.8:3.9	-	43.4	24.4	62.4	43.4	59.0	39.0	(1) - (2)

Table-7-1 Peak Load Balance
(In case that Nam Phrom is developed firstly)

(Unit: MW)

	1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		Remarks
	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	
(1) Peak Load																					
Nam Pong Service Area	-	11.80	16.45	21.10	23.30	25.50	26.70	27.90	29.00	30.10	31.35	32.60	33.95	35.30	36.80	38.30	40.05	41.80	43.70	45.60	
Nam Pung Service Area	-	-	-	2.13	2.26	2.38	2.50	2.62	2.77	2.91	3.06	3.20	3.37	3.54	3.73	3.91	4.12	4.33	4.55	4.76	
Lam Dom Noi Service Area	-	-	-	-	-	-	-	-	7.67	8.20	8.60	9.00	9.50	10.00	10.45	10.90	11.45	12.00	12.55	13.10	
Nam Ngum Service Area (Laos)	-	-	-	2.12	3.31	4.50	5.57	6.63	7.11	7.59	8.14	8.70	-	-	-	-	-	-	-	-	
Total Peak Load	-	11.80	16.45	25.35	28.87	32.38	34.77	37.15	46.55	48.80	51.15	53.50	46.82	48.84	50.98	53.11	55.62	58.13	60.80	63.46	
(2) Dependable Capability																					
Ubolratana Power Plant	12.00	16.60	12.00	16.60	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	No.3 Unit will be in operation in Mar. 1968.
Nam Pung P.P.	-	-	-	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.20	From Nov. 1967.
Existing Diesel P.P.	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	
Lam Dom Noi P.P.	-	-	-	-	-	-	-	-	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	From Jan. 1970.
Expected Power from Nam Ngum P.P.	-	-	-	-	-	-	-	-	-	-	-	-	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	From Jan. 1972.
Total Dependable Capability	17.10	21.70	17.10	27.70	27.30	36.10	27.30	36.10	39.30	51.10	39.30	51.10	47.30	59.10	47.30	59.10	47.30	59.10	47.30	59.10	
(3) Required Capability in MW	-	-	-	-	1.57	-	7.47	1.05	7.25	-	11.85	2.40	-	-	3.68	-	8.32	-	13.50	4.36	(1) - (2)
(4) Expected New Capability																					
Diesel P.P.	-	-	A -	-	7.50	7.50	7.50	7.50	7.50	7.50	12.00	12.00	-	-	-	-	-	-	-	-	A: Average year
Nam Phrom (Unit No.1)	-	-	D 2.50	2.50	-	-	-	-	-	-	-	-	15.00	16.50	15.00	16.50	15.00	16.50	30.00	33.00	D: Dry year
Total Expected Capability	-	-	A -	-	7.50	7.50	7.50	7.50	7.50	7.50	12.00	12.00	15.00	16.50	15.00	16.50	15.00	16.50	30.00	33.00	
			D 2.50	2.50	7.50	7.50	7.50	7.50	7.50	7.50	12.00	12.00	15.00	16.50	15.00	16.50	15.00	16.50	30.00	33.00	
(5) Retired Old Diesel P.P.	-	-	-	-	-	-	-	-	-	-	-	-	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	
(6) = (2) + (4) - (5)			A 17.10	27.70	34.80	43.60	34.80	43.60	46.80	58.60	51.30	63.10	57.20	70.50	57.20	70.50	57.20	70.50	72.20	87.00	(2) + (4) - (5)
			D 19.50	30.20	34.80	43.60	34.80	43.60	46.80	58.60	51.30	63.10	57.20	70.50	57.20	70.50	57.20	70.50	72.20	87.00	
(7) Peak Load Balance			A 0.65	2.35	5.93	11.22	0.03	6.45	0.25	9.80	0.15	9.60	10.38	21.66	6.22	17.39	1.58	12.37	11.40	23.54	
			D 3.05	4.85	5.93	11.22	0.03	6.45	0.25	9.80	0.15	9.60	10.38	21.66	6.22	17.39	1.58	12.37	11.40	23.54	

Table-7-2 Annual Energy Balance
(In case that Nam Phrom is developed firstly)

(Unit:10³MWH)

	1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		Remarks
(1) Energy Demand																					
Nam Pong Service Area	27.50		77.50		96.60		107.20		115.20		124.80		135.00		146.20		159.20		173.80		(*1) 2 months
Nam Pung Service Area	-		1.11(*1)		7.40		8.57		9.48		10.44		11.52		12.71		14.05		15.48		
Lam Dom Noi Service Area	-		-		-		-		26.50		32.00		35.40		39.70		43.50		47.50		
Nam Ngum Service Area (Laos)	-		1.21		15.30		22.50		25.70		29.50		-		-		-		-		
Total Energy Demand per Year	24.70:26.60:27.50		78.71:79.82		119.30		138.27		176.88		196.74		181.92		198.61		216.75		236.78		
(Energy Demand per Month)	(2.47:2.95:3.25)		(6.56:7.12)		(9.94)		(11.52)		(14.74)		(16.39)		(15.16)		(16.55)		(18.06)		(20.56)		
(2) Available Energy	Dry Year	Average Year	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	
Ubolratana Power Plant	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	L.F.=40%
Nam Pung P.P.	-	-	- 15.0	- 15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	
Existing Diesel P.P.	-	-	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	
Lam Dom Noi P.P.	-	-	-	-	-	-	-	-	42.0	43.0	42.0	43.0	42.0	43.0	42.0	43.0	42.0	43.0	42.0	43.0	
Expected Energy from Nam Ngum	-	-	-	-	-	-	-	-	-	-	-	-	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	
Total Available Energy per year	43.0	62.0	60.9:75.9	79.9:94.9	75.9	94.9	75.9	94.9	117.9	137.9	117.9	137.9	145.9	165.9	145.9	165.9	145.9	165.9	145.9	165.9	
(Available Energy per Month)	(3.58)	(5.17)	(5.08:6.32)	(6.63:7.90)	(6.32)	(7.91)	(6.32)	(7.91)	(9.82)	(11.49)	(9.82)	(11.49)	(12.16)	(13.82)	(12.16)	(13.82)	(12.16)	(13.82)	(12.16)	(13.82)	
(3) Required Capability - in MWH	-	-	17.8:3.9	-	43.4	24.4	62.4	43.4	59.0	39.0	78.8	58.8	36.0	16.0	52.7	32.7	70.9	50.9	90.9	70.9	(1)-(2)
(4) Expected New Capability			2.5MW		7.5MW	7.5MW					12.0MW	12.0MW									L.F=80%
Diesel P.P.	-	-	17.5	-	52.5	52.5	52.5	52.5	52.5	52.5	84.1	84.1	-	-	-	-	-	-	-	-	
Nam Phrom (Unit No.1)	-	-	-	-	-	-	-	-	-	-	-	-	110.0	120.0	110.0	120.0	110.0	120.0	110.0	120.0	
Total Expected Capability	-	-	17.5	-	52.5	52.5	52.5	52.5	52.5	52.5	84.1	84.1	110.0	120.0	110.0	120.0	110.0	120.0	110.0	120.0	
(5) Retired Old Diesel - P.P.	-	-	-	-	-	-	-	-	-	-	-	-	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	
(6) Definitely Available Energy (Energy per Month)	43.0	62.0	78.4:93.4	94.9	128.4	147.4	128.4	147.4	170.4	190.4	202.0	222.0	238.0	268.0	238.0	268.0	238.0	268.0	238.0	268.0	(2)+(4)-(5)
	(3.58)	(5.17)	(6.53)(7.78)	(7.91)	(10.70)	(12.29)	(10.70)	(12.29)	14.20	(15.88)	(16.83)	(18.50)	(19.83)	(22.32)	(19.83)	(22.32)	(19.83)	(22.32)	(19.83)	(22.32)	
(7) Annual Energy Balance	15.5	34.5	40.3:13.6	15.1	9.1	28.1	49.9	9.1	46.5	13.5	5.3	25.3	56.1	86.1	39.4	69.4	21.2	51.2	1.2	31.2	

Table-7-3 Peak Load Balance

(In case that Upper Nam-Chern is developed firstly)

(Unit:MW)

	1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		Remarks
	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	
(1) Peak Load																					
Nam Pong Service Area	-	11.80	16.45	21.10	23.30	25.50	26.70	27.90	29.00	30.10	31.35	32.60	33.95	35.30	36.80	38.30	40.05	41.80	43.70	45.60	
Nam Pung Service Area	-	-	-	2.13	2.26	2.38	2.50	2.62	2.77	2.91	3.06	3.20	3.37	3.54	3.73	3.91	4.12	4.33	4.55	4.76	
Lam Dom Noi Service Area	-	-	-	-	-	-	-	-	7.67	8.20	8.60	9.00	9.50	10.00	10.45	10.90	11.45	12.00	12.55	13.10	
Nam Ngum Service Area (Laos)	-	-	-	2.12	3.31	4.50	5.57	6.63	7.11	7.59	8.14	8.70	-	-	-	-	-	-	-	-	
Total Peak Load	-	11.80	16.45	25.35	28.87	32.38	34.77	37.15	46.55	48.80	51.15	53.50	46.82	48.84	50.98	53.11	55.62	58.13	60.80	63.46	
(2) Dependable Capability																					
Ubolratana Power Plant	12.00	16.60	12.00	16.60	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	18.00	25.00	No.3 Unit will be in operation in Mar. 1968.
Nam Pung P.P.	-	-	-	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	4.20	6.00	From Nov. 1967.
Existing Diesel P.P.	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	
Lam Dom Noi P.P.	-	-	-	-	-	-	-	-	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	12.00	15.00	From Jan. 1967.
Expected Power from Nam Ngum P.P.	-	-	-	-	-	-	-	-	-	-	-	-	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	From Jan. 1972.
Total Dependable Capability	17.10	21.70	17.10	27.70	27.30	36.10	27.30	36.10	39.30	51.10	39.30	51.10	47.30	59.10	47.30	59.10	47.30	59.10	47.30	59.10	
(3) Required Capability in MW	-	-	-	-	1.57	-	7.47	1.05	7.25	-	11.85	2.40	-	-	3.68	-	8.32	-	13.50	4.36	(1) - (2)
(4) Expected New Capability																					
Diesel P.P.	-	-	A - D 2.50	- 2.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	A2.50 D5.00	2.50 5.00	A2.50 D5.00	2.50 5.00	(Retired)	-	-	-	A:Average year D:Dry year
Upper Nam Chern	-	-	-	-	-	-	-	-	-	-	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
Nam Phrom	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.00	16.50	15.00	16.50	
Total Expected Capability			A - D2.50	- 2.50	7.50	7.50	7.50	7.50	7.50	7.50	17.50	17.50	A12.50 D15.00	12.50 15.00	12.50 15.00	12.50 15.00	25.00	26.50	25.00	26.50	
(5) Retired Old Diesel P.P.	-	-	-	-	-	-	-	-	-	-	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	
(6) = (2) + (4) - (3)			A17.10 D19.50	27.70 30.20	34.80	43.60	34.80	43.60	46.80	58.60	51.70	63.50	A54.70 D57.20	66.50 69.00	A54.70 D57.20	66.50 69.00	67.20	80.50	67.20	80.50	(2) + (4) - (5)
(7) Peak Load Balance			A0.65 D3.05	2.35 4.85	5.93	11.22	0.03	6.45	0.25	9.80	0.55	10.00	A7.88 D10.38	17.66 20.16	A3.72 D6.22	13.39 15.89	11.58	22.37	6.40	17.40	(6) - (1)

Table-7-4 Annual Energy Balance
(In case that Upper Nam Chern is developed firstly)

(Unit: 10³MWH)

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Remarks
1) Energy Demand											
am Pong Service Area	27.50	77.50	96.60	107.20	115.20	124.80	135.00	146.20	159.20	173.80	(*1) 2 months
am Pung Service Area	-	1.11(*1)	7.40	8.57	9.48	10.44	11.52	12.71	14.05	15.48	
am Dom Noi Service Area	-	-	-	-	26.50	32.00	35.40	39.70	43.50	47.50	
am Ngum Service Area (Laos)	-	1.21	15.30	22.50	25.70	29.50	-	-	-	-	
Total Energy Demand per Year (Energy Demand per Month)	24.70:26.60:27.50 (2.47:2.95:3.25)	78.71:79.82 (6.56:7.12)	119.30 (9.94)	138.27 (11.52)	176.88 (14.74)	196.74 (16.39)	181.92 (15.16)	198.61 (16.55)	216.75 (18.06)	236.78 (20.56)	
	Dry Year	Average Year	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	D.Y.	A.Y.	
2) Available Energy											
oolratana Power Plant	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	43.0	62.0	L.F.=40%
am Pung P.P.	-	-	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	
isting Diesel P.P.	-	-	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	
am Dom Noi P.P.	-	-	-	-	-	-	42.0	43.0	42.0	43.0	
Expected Energy from	-	-	-	-	-	-	28.0	28.0	28.0	28.0	
Total Available Energy per year (Available Energy per Month)	43.0 (3.58)	62.0 (5.17)	60.9:75.9 (5.08:6.32)	79.9:94.9 (6.66:7.90)	75.9 (6.32)	94.9 (7.91)	75.9 (6.32)	94.9 (7.91)	117.9 (9.82)	137.9 (11.49)	
3) Required Capability in MWH.	-	-	17.8:3.9	-	43.4	24.4	62.4	43.4	59.0	39.0	(1)-(2)
4) Expected New Capability			2.5MW		7.5MW	7.5MW			5.0MW	2.5MW	L.F.=80%
iesel P.P.	-	-	17.5	-	52.5	52.5	52.5	52.5	52.5	52.5	
pper Nam Chern	-	-	-	-	-	-	-	-	38.0	38.0	
in Phrom	-	-	-	-	-	-	-	-	38.0	38.0	
Total Expected Capability	-	-	17.5	-	52.5	52.5	52.5	52.5	90.5	90.5	
5) Retired Old Diesel P.P.	-	-	-	-	-	-	-	-	5.1MW 17.9	17.9	
6) Definitely Available Energy (Energy per Month)	43.0 (3.58)	62.0 (5.17)	78.4:93.4 (6.53:7.78)	94.9 (7.91)	128.4 (10.70)	147.4 (12.29)	128.4 (10.70)	147.4 (12.29)	170.4 (14.20)	190.4 (15.88)	(2)+(4)-(5)
7) Annual Energy Balance	15.5	34.5	Δ 0.3:13.6	15.1	9.1	28.1	Δ 9.9	9.1	Δ 6.5	13.5	(6)-(1)

Table-8 Construction Cost of Each Project

Nam Phrom Project

Item	Foreign Currency 1,000 \$	Local Currency 1,000 ₪	Total	
			Foreign Cur. 1,000 \$	Local Cur. 1,000 ₪
Access Road	403	26,167	1,711	34,222
Dam	3,158	82,723	7,295	145,890
Waterway, Penstock & Powerhouse	2,633	22,722	3,770	75,389
Electrical Equipment	2,014	8,167	2,423	48,445
Transmission Line	1,128	17,944	2,025	40,500
Substation	67	944	114	2,278
Contingency	1,153	21,334	2,219	44,389
Total Investment Cost	10,556	180,001	19,557	391,113

Upper Nam Chern Project

Item	Foreign Currency 1,000 \$	Local Currency 1,000 ₪	Total	
			Foreign Cur. 1,000 \$	Local Cur. 1,000 ₪
Access Road	358	23,056	1,511	30,222
Dam	911	23,834	2,103	42,056
Waterway, Penstock & Powerhouse	1,067	11,389	1,636	32,722
Electrical Equipment	800	3,111	955	19,111
Transmission Line	1,128	18,333	2,045	40,889
Substation	39	556	67	1,334
Contingency	419	9,167	878	17,556
Total Investment Cost	4,722	89,446	9,195	183,890

Lower Nam Chern Project

Item	Foreign Currency 1,000 \$	Local Currency 1,000 ₪	Total	
			Foreign Cur. 1,000 \$	Local Cur. 1,000 ₪
Access Road	167	10,500	692	13,833
Dam	3,245	84,556	7,471	149,446
Waterway, Penstock & Powerhouse	214	2,889	358	7,167
Electrical Equipment	950	3,778	1,139	22,778
Transmission Line	961	15,556	1,739	34,778
Substation	39	556	67	1,334
Contingency	619	14,945	1,367	27,334
Total Investment Cost	6,195	132,780	12,833	256,670

Table-9 Cost of Alternate Source

(Diesel Power Plant)

No.	Item	Unit		Remarks
1	Rated output	KW	5,000	
2	Annual availability	%	45	
3	Annual operating hours	hr.	3,940	8,760 x (2)%
4	Annual generating energy	10 ³ KWH	19,700	(1) x (3)
5	House demand	10 ³ KWH	110	(4) x 0.53% assume
6	Annual energy supply	10 ³ KWH	19,590	
7	Diesel engine cost	10 ³ ₱	16,510	3 sets x 2,500KW (1 set for spare) Customs tariff 30% 12,700₱ x 1.3
8	Erection for diesel engine	10 ³ ₱	660	
9	Generator cost	10 ³ ₱	5,500	Transportation 400 4,200 x 1,300
10	Erection for generator	10 ³ ₱	390	
11	Construction and civil cost	10 ³ ₱	1,230	
12	Miscellaneous Machine	10 ³ ₱	160	Transportation 10 120₱ x 1.30
(A)	Total investment	10 ³ ₱	24,450	(7) ~ (12)
13	Amortization of investment cost	10 ³ ₱	2,310	20 years, 7%: 0.09439
14	Municipal property tax	10 ³ ₱	490	(A) x 2%
(B)	Subtotal		2,800	
15	Operators salary	10 ³ ₱	340	12 persons x 28,000₱/year
16	Repairing expenses	10 ³ ₱	490	(A) x 2% assume
17	Miscellaneous expenses	10 ³ ₱	50	(A) x 0.2%
(C)	Subtotal		880	
18	Fuel cost	₱/kg	1	0.9₱/kg = 1₱/kg
19	Annual fuel consumption	kg/year	4,560,000	170gr/hr/HP
20	Total fuel cost	10 ³ ₱	4,560	
21	Lubricating oil cost	₱/kg	5.6	
22	Annual lubricating oil consumption	kg/year	107,200	
23	Total lubricating oil cost	10 ³ ₱	600	
(D)	Subtotal	10 ³ ₱	5,160	(20) + (23)
24	Total annual cost	10 ³ B	8,840	(B)+(C)+(D)
25	Generating cost(Generating terminal)	₱/KWH	0.449	(24)/(4)
26	Generating cost (Out coming)	₱/KWH	0.452	(24)/(6)
27	Fixed cost per KW	₱/KW	736	(B)+(C)/(1)
28	Movable cost per KWH	₱/KWH	0.264	(D)/(6)

Table-10 Comparison in Cost per KWH between Case-A and Case-B

Case	Item	Present Worth in 1968	Year								Remarks
			1968	1969	1970	1971	1972	1973	1974	1975	
A	(Annual Cost) Existing Diesel 5.1 MW (10 ³ ฿)	15,440	3,680	6,000	4,840	3,680	-	-	-	-	8 years, 7%, 0.5820 3 years, 7%, 2.624 4 years, 7%, 0.7629
	New Diesel 7.5MW (")	63,010	16,670	19,340	19,340	19,340	-	-	-	-	
	New Diesel 4.5MW (")	7,390	-	-	-	9,690	-	-	-	-	
	Nam Phrom 33.0MW (")	74,790	-	-	-	-	28,880	28,880	28,880	29,170	
	Total Present Worth in 1968(10 ³ ฿)	160,630	-	-	-	-	-	-	-	-	8 years, 7%, 0.16747
	Annual Cost (10 ³ ฿)	-	26,900							26,900	
	Salable Energy (10 ⁶ KWH)	479.3	42.3	61.3	56.9	76.7	33.9	50.6	68.8	88.8	
	Average Salable Energy (10 ⁶ KWH)	-	59.9							59.9	
B	Cost per KWH (฿/KWH)	-	0.449							0.449	≈ 0.45
	(Annual Cost) Existing Diesel 5.1MW (10 ³ ฿)	12,630	3,680	6,000	4,840	-	-	-	-	-	5 years, 7%, 4.100 3 years, 7%, 0.8163 2 years, 7%, 1.808 6 years, 7%, 0.6663
	New Diesel 7.5MW (")	60,240	16,670	19,340	19,340	15,710	-	-	-	-	
	New Diesel 2.5MW (")	4,750	-	-	-	-	1,840	5,160	-	-	
	Upper Nam Chern 10.0MW (")	47,060	-	-	-	14,060	14,060	14,060	14,060	14,060	
	Nam Phram 33.0MW (")	34,790	-	-	-	-	-	-	28,880	28,880	8 years, 7%, 0.16747
	Total Present Worth in 1968(10 ³ ฿)	159,470	-	-	-	-	-	-	-	-	
	Annual Cost (10 ³ ฿)	-	26,700							26,700	
	Salable Energy (10 ⁶ KWH)	479.3	42.3	61.3	56.9	76.7	33.9	50.6	68.8	88.8	
	Average Salable Energy (10 ⁶ KWH)	-	59.9							59.9	≈ 0.45
	Cost per KWH (฿/KWH)	-	0.446							0.446	

Table-11 Schedule of Field Investigations for the Feasibility Studies

Nam Phrom Project		Quantity	1966 Oct.	Nov.	Dec.	1967 Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.
a)	Mapping of Reservoir Area by Aerial photo	10 ^{km²}	Checking of 1/50,000 map by traverse and cross Section Survey											
b)	Topography; Dam Axis, Penstock Line, Power Plant	0.9 ^{km²}												
c)	Profile ; Tunnel Line	23 ^{km}												
d)	Core Borings for Dam Axis	270 ^m												
e)	Other Test Pits & Core Borings	150 ^m	Field Visit of EPDC Engineers for Feasibility Study											
Upper Chern Project			<div style="display: flex; justify-content: space-between;"> x Decision of the first Project by NEEA * Submit of Feasibility Report </div>											
a)	Mapping of Reservoir Area by Aerial Photo	10 ^{km²}	Checking of 1/50,000 map by traverse and cross Section Survey											
b)	Topography; Dam Axis, Penstock Line, Power Plant	0.6 ^{km²}												
c)	Profile ; Tunnel Line	1.3 ^{km}												
d)	Core Borings for Dam Axis & Right Side Ridge	Dam Axis 180 ^m Ridge 180 ^m												
e)	Topography for Right Side Ridge	0.3 ^{km²}												
f)	Other Test Pits & Core Borings	150 ^m												

