巻末 4　MEPE Annual Report（一部抜粋）

BACKGROUND HISTORY

I Date of Initial Establishment

1 Under the Electricity Supply Act 1948. Electricity Supply Board was established on the 1st October , 1951,and took over the functions of Electricity Supply Department and Hydro Electric Survey Board. The Rangoon Electric-Tramway and Supply Company Limited was nationalised on the 1st October,1953.

2 Under the Notification No.2 dated 16th March 1972 of the Ministry of Industry, Electricity Supply Board was reorganized as Electric Power Corporation.As of Notification No.2/89 dated 31st March 1989 of the Government of the Union of Myanmar, the Corporation has been constituted as Myanma Electric Power Enterprise.

II Parent Ministry & Location

1 Ministry of Electric Power

2 Myanma Electric Power Enterprise,197/199, Lower Kyimyindine Road, Yangon

III Objective and Purpose

1 Development of Electric Supply and Distribution

2 Development,Promotion and search for Hydro Electric Power Resources

3 Cheap and low cost of Electric Supply for Industrial and Commercial user

4 To provide supplies of Electricity in bulk or otherwise for consumers in the whole of Myanmar.

IV Administrative Staff

Name	Designation	Phone
U Yan Naing	Managing Director	220918
Dr San Oo	Chief Engineer	221353
U Myo Naing	Director (Finance)	221032
U Tin Aung	Dy. Chief Engineer (Operation)	220921
U Zaw Win	Dy. Chief Engineer (Planning)	221410
U Win Kyaw	Dy. Chief Engineer (Hydel Construction)	220925
U Khin Maung Kyi	Director (Material Planning)	220813
U Ye Myint Soe	Director (Administration)	220923

V Territorial Coverage.

The Whole of Myanmar.

MYANMA ELECTRIC POWER ENTERPRISE PAGE 2

ELECTRICITY TARIFFS

(Effective September 1,1994)

SR NO	CONSUMER CATEGORY	ENERGY CHARGES (PYAS PER KWH)			CAPACITY CHARGES (KYAT PER HORSE POWER)	FIXED CHARGES ie Meter Maintenance
		Govt. Dept (Pyas Per KWH)	Govt. Servants Govt.Pensioners (Pyas Per KWH)	Public (Pyas Per KWH)		
1	General Purpose	Flat Rate 50	1 - 50 Units 50 51 and above 250	Flat Rate 250	-	Single Phase K 5 Three Phase K 10
2	Domestic Power	Flat Rate 50	1 - 100 Units 50 101 and above 300	Flat Rate 300		Single Phase K 5 Three Phase K 10
3	Small Power	Flat Rate 50	Flat Rate 300	Flat Rate 300	3	Single Phase K 15 Three Phase K 25
4	Industrial	Flat Rate 50	Flat Rate 300	Flat Rate 300	3	Three Phase K 50
5	Large Industrial	Flat Rate 50	Flat Rate 300	Flat Rate 300	3	Three Phase K 50
6	Bulk	Flat Rate 50	Flat Rate 300	Flat Rate 300	3	Three Phase K 50
7	Street Light	-	-	(minimum 40 Watts) Kyats 2 Every Additional 10 Watts Kyats 4		-
8	Temporary Lighting	Flat Rate 250	Flat Rate 250	Flat Rate 300	-	-

MYANMA ELECTRIC POWER ENTERPRISE

ELECTRICITY TARIFFS

FOR ENERGY CHARGES COLLECTED IN US $

(Effective September 1,1994)

Sr No	CONSUMER CATEGORY	ENERGY CHARGES (US $ PER KWH)		CAPACITY CHARGES (US $ PER HORSE POWER)	FIXED CHARGES (METER MAINTENANCE) (US $)	
1	General Purpose	Flat Rate	0.08	-	Single Phase	1
				-	Three Phase	2
2	Domestic Power	Flat Rate	0.08	-	Single Phase	1
				-	Three Phase	2
3	Small Power	Flat Rate	0.08	0.50	Single Phase	3
					Three Phase	5
4	Industrial	Flat Rate	0.08	0.50	Three Phase	10
5	Large Industrial	Flat Rate	0.08	0.50	Three Phase	10
6	Bulk	Flat Rate	0.08	0.50	Three Phase	10
7	Temporary Lighting	Flat Rate	0.08	-	-	

MYANMA ELECTRIC POWER ENTERPRISE

PRODUCTION IN PHYSICAL QUANTITY AND COST

(KWH in Million)

(Kyats in Thousand)

Year	Electric Energy					Cost
	Hydro KWH	Thermal KWH	Diesel KWH	Gas KWH	Total KWH	Kyats
1985-86	1003.48	55.01	64.50	996.38	2119.37	385195.00
1986-87	1042.61	80.91	46.26	1075.68	2245.46	429321.00
1987-88	1023.74	61.37	25.79	1208.74	2319.64	482166.00
1988-89	934.89	39.41	23.70	1228.45	2226.45	584801.00
1989-90	1144.34	25.33	32.33	1292.44	2494.44	731070.00
1990-91	1248.45	28.11	73.89	1292.60	2643.05	812892.00
1991-92	1238.27	25.72	46.16	1365.77	2675.92	912914.00
1992-93	1529.95	24.77	49.70	1402.18	3006.60	1039087.00
1993-94	1705.16	34.05	52.83	1594.75	3386.79	1085143.00
1994-95	1658.95	79.01	41.84	1852.04	3631.84	1357693.00
1995-96	1595.46	62.49	43.21	2061.17	3762.33	1771341.00
1996-97 PA	1651.04	64.54	46.07	2183.33	3944.98	2003952.00
1997-98 RE	1655.70	198.00	41.80	2309.51	4205.01	3300894.00
1998-99 BE	1656.54	200.00	48.00	2611.00	4515.54	3660125.00

MYANMA ELECTRIC POWER ENTERPRISE PAGE 5

ELECTRIC POWER GENERATED AND CONSUMED

YEAR	INSTALLED CAPACITY MW	UNITS GENERATED (MILLION) KWH	UNITS CONSUMED (MILLION) KWH	NO.OF CONSUMERS (IN 000)	NO.OF TOWNSHIPS LIGHTED	NO.OF VILLAGES LIGHTED
1985-86	684.33	2119.37	1459.53	583.63	279	72[illegible]
1986-87	702.79	2245.46	1542.98	590.87	283	731
1987-88	705.34	2319.64	1580.09	604.62	286	74[illegible]
1988-89	706.82	2226.45	1428.21	[illegible]12.21	287	749
1989-90	792.57	2494.44	1592.6[illegible]	[illegible].97	304	78[illegible]
1990-91	803.95	2643.05	1675.20	659.21	307	838
1991-92	809.74	2675.92	1677.18	695.56	313	880
1992-93	807.14	3006.60	1831.46	741.07	314	933
1993-94	809.82	3386.79	2059.1[illegible]	775.24	314	960
1994-95	837.38	3631.84	2218.01	805.22	314	971
1995-96	982.07	3762.33	2262.37	825.82	320	1013
1996-97 PA	1030.60	3944.98	2433.80	852.63	323	105[illegible]
1997-98 RE	1207.45	4205.01	2502.35	880.69	323	1087
1998-99 BE	1207.45	4515.54	2934.79	915.92	329	1112

MYANMA ELECTRIC POWER ENTERPRISE

ELECTRICITY LOSSES

(Units in Million)

YEAR	GENERATION	CONSUMPTION BY STATION AUXILIARIES	UNITS SOLD	LOSS	
				UNIT	%
1985-86	2119.37	28.98	1459.53	630.86	29.77%
1986-87	2245.46	37.91	1542.98	664.57	29.60%
1987-88	2319.64	38.11	1580.09	701 05	30.23%
1988-89	2226.45	33.15	1428.21	765.09	34.36%
1989-90	2494.44	30.76	1592.68	871.00	34.92%
1990-91	2643.05	33.57	1675.20	934.28	35.35%
1991-92	2675.92	44.79	1677.18	953.95	35.65%
1992-93	3006.60	49.91	1831.46	1125.23	37.43%
1993-94	3386.79	56.22	2059.17	1271.40	37.54%
1994-95	3631.84	59.26	2218.01	1374.57	37.85%
1995-96	3762.33	62.75	2262.37	1437.21	38.20%
1996-97 PA	3944.98	76.80	2433.80	1434.38	36.36%
1997-98 RE	4205.01	78.50	2512.35	1624.16	38.63%
1998-99 BE	4515.54	80.01	2934.78	1500.75	33.24%

MYANMA ELECTRIC POWER ENTERPRISE

FIRM POWER AND PEAK LOAD IN NATIONAL GRID AREA

(IN MW)

Particulars	85 -86	86 -87	87 -88	88 - 89	89 -90	90 -91	91 -92	92 -93	93 -94	94 -95	95 -96	96 -97 PA	97 -98 RE	98-99 BE
Firm Power	396.28	382.38	406.91	406.91	382.76	355.50	355.50	383.50	398.50	410.50	608.50	630.50	525.50	754.50
Demand	299.00	305.60	359.21	332.00	373.00	406.84	430.00	459.55	482.50	485.00	581.00	661.00	677.00	850.00
Power Surplus or Shortage	97.28	76.78	47.70	74.91	9.76	-51.34	-74.50	-76.05	-84.00	-74.50	27.50	-30.50	-41.50	-95.50

MYANMA ELECTRIC POWER ENTERPRISE

OUT PUT AND CONSUMPTION OF ELECTRICITY

(KWH IN MILLION)

YEAR	OUT - PUT					CONSUMPTION				
	HYDEL	THERMAL	DIESEL	GAS	TOTAL	DOMESTIC	INDUSTRIAL POWER	BULK	OTHERS	TOTAL
1985 - 86	1003.48	55.01	64.50	996.38	2119.37	408.66	882.34	128.48	40.05	1459.53
1986 - 87	1042.61	80.91	46.26	1075.68	2245.46	436.95	918.75	145.96	41.32	1542.98
1987 - 88	1023.74	61.37	25.79	1208.74	2319.64	481.08	904.35	153.66	41.00	1580.09
1988 - 89	934.89	39.41	23.70	1228.45	2226.45	500.10	737.74	149.68	40.69	1428.21
1989 - 90	1144.34	25.33	32.33	1292.44	2494.44	563.42	807.48	179.69	42.09	1592.68
1990 - 91	1248.45	28.11	73.89	1292.60	2643.05	628.91	787.50	214.03	44.76	1675.20
1991 - 92	1238.27	25.72	46.16	1365.77	2675.92	672.43	727.29	228.90	48.56	1677.18
1992 - 93	1529.95	24.77	49.70	1402.18	3006.60	770.59	768.93	238.36	53.58	1831.46
1993 - 94	1705.16	34.05	52.83	1594.75	3386.79	887.89	850.89	263.03	57.36	2059.17
1994 - 95	1658.95	79.01	41.84	1852.04	3631.84	982.86	862.90	302.35	69.90	2218.01
1995 - 96	1595.46	62.49	43.21	2061.17	3762.33	972.29	875.67	340.21	74.20	2262.37
1996 - 97 PA	1651.04	64.54	46.07	2183.33	3944.98	1089.24	875.65	392.51	76.40	2433.80
1997 - 98 RE	1655.70	198.00	41.80	2309.51	4205.01	1137.95	919.40	364.97	80.03	2502.35
1998 - 99 BE	1656.54	200.00	48.00	2611.00	4515.54	1468.64	996.35	383.21	86.59	2934.79

MYANMA ELECTRIC POWER ENTERPRISE

SALES OF ELECTRICITY

(KYATS IN THOUSAND)

YEAR	DOMESTIC		INDUSTRIAL POWER		BULK		OTHER		TOTAL	
	UNITS (MILLION KWH)	VALUE KYATS	UNITS (MILLION KWH)	VALUE KYATS	UNITS (MILLION KWH)	VALUE KYATS	UNITS (MILLION KWH)	VALUE KYATS	UNITS (MILLION KWH)	VALUE KYATS
1985 - 86	408.66	175477	882.34	160508	128.48	43299	40.05	18156	1459.53	397440
1986 - 87	436.95	188674	918.75	167576	145.96	49083	41.32	18923	1542.98	424256
1987 - 88	481.08	205739	904.35	166865	153.66	51198	41.00	19008	1580.09	442810
1988 - 89	500.10	233768	737.74	221362	149.68	57258	40.69	19642	1428.21	532030
1989 - 90	563.42	298368	807.48	377355	179.69	82616	42.09	20702	1592.68	779041
1990 - 91	628.91	328514	787.50	372543	214.03	98173	44.76	22955	1675.20	822185
1991 - 92	672.43	351199	727.29	356463	228.90	105899	48.56	26245	1677.18	839806
1992 - 93	770.59	402435	768.93	374697	238.36	112133	53.58	28768	1831.46	918033
1993 - 94	887.89	462009	850.89	407858	263.03	120705	57.36	31115	2059.17	1021687
1994 - 95	982.86	1129841	862.90	639808	302.35	175491	69.90	55903	2218.01	2001043
1995 - 96	972.29	1670566	875.67	843693	340.21	235958	74.20	77077	2262.37	2827294
1996 - 97 PA	1089.24	1836291	875.65	875239	392.51	288344	76.40	86461	2433.80	3086335
1997 - 98 RE	1137.95	1983438	919.40	951390	364.97	297047	80.03	96213	2502.35	3328088
1998 - 99 BE	1468.64	[illegible]	996.35	1143827	383.21	311809	86.59	108090	2934.79	4162985

SALES OF ELECTRICITY AND OTHER INCOME IN US $ (FIGURES IN THOUSAND)

YEAR	SALES OF ELECTRICITY			OTHER INCOME		TOTAL	
	KWH	US $	KYATS EQUIVALENT	US $	KYATS EQUIVALENT	US $	KYATS EQUIVALENT
1990 - 91	4534.01	366.29	2222.51	10.99	65.95	377.28	2288.46
1991 - 92	14611.00	1158.64	7207.96	11.07	69.58	1169.71	7277.54
1992 - 93	12902.07	1022.81	6272.26	13.98	81.61	1036.79	6353.87
1993 - 94	15982.92	1243.29	7838.29	18.63	112.60	1261.92	7950.89
1994 - 95	1[illegible]07	1510.61	8865.27	179.89	1041 97	1690.50	9907.24
1995 - 96	24823.34	2080.19	11624.87	15.60	87.93	2095.79	11712.80
1996 - 97 PA	54427.54	4525.55	26792.38	14.50	83.95	4540.05	26876.33
1997 - 98 RE	54857.38	4388.59	27209.27	19.24	119.29	4407.83	27328.56
1998 - 99 BE	63348.00	5067.84	31674.00	16.48	103.00	5084.32	31777.00

ELECTRIC POWER GENERATED AND SOLD (PERCENTAGES)

(KWH IN MILLION)

YEAR	UNITS GENERATED KWH a	INCREASE OR DECREASE OVER PRECEDING YEAR %	UNITS SOLD KWH b	INCREASE OR DECREASE OVER PRECEDING YEAR %	RATIO b/a %
1985 - 86	2119.37	12.12%	1459.53	15.50%	69%
1986 - 87	2245.46	5.95%	1542.98	5.72%	69%
1987 - 88	2319.64	3.30%	1580.09	2.41%	68%
1988 - 89	2226.45	- 4.02%	1428.21	-9.61%	64%
1989 - 90	2494.44	12.04%	1592.68	11.52%	64%
1990 - 91	2643.05	5.96%	1675.20	5.18%	63%
1991 - 92	2675.92	1.24%	1677.18	0.12%	63%
1992 - 93	3006.60	12.36%	1831.46	9.20%	61%
1993 - 94	3386.79	12.65%	2059.17	12.43%	61%
1994 - 95	3631.84	7.24%	2218.01	7.71%	61%
1995 - 96	3762.33	3.59%	2262.37	2.00%	60%
1996 - 97 PA	3944.98	4.85%	2433.80	7.58%	62%
1997 - 98 RE	4205.01	6.59%	2502.35	2.82%	60%
1998 - 99 BE	4515.54	7.38%	2934.79	17.28%	65%

PURCHASE OF ELECTRICITY FROM OUTSIDE SOURCES

YEAR	NAME OF ORGANIZATION	LOCATION	NO.OF UNITS	RATE	AMOUNT (KYATS)	REMARKS
1985 - 86	M.O.G.E	Yenanchaung , Chauk , Seikpyu	4209000	0.25	1052250.00	Total Purchase Units = 22847200
	NO.(1)MINING ENTERPRISE	Lashio & Namtu	1728700	0.20	345740.00	Kyats = 4779890
	M.P.E	Tanyin	16909500	0.20	3381900.00	
1986 - 87	M.O.G.E.	Yenanchaung , Chauk , Seikpyu	4275000	0.25	1068750.00	Total Purchase Units = 14416900
	M.P.E	Tanyin	6972000	0.20	1394400.00	

YEAR	NAME OF ORGANIZATION	LOCATION	NO.OF UNITS	RATE	AMOUNT (KYATS)	REMARKS
1987-88	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	531000	0.25	132750.00	Total Purchase Units = 5438800
	NO (1) MINING ENTERPRISE	Lashio &Namtu	4907800	0.20	981560.00	Kyats =1114310
1988-89	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	394000	0.25	98500.00	Total Purchase Units =5797000
	NO (1) MINING ENTERPRISE	Lashio &Namtu	5403000	0.20	1080600.00	Kyats =1179100
1989-90	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	398000	0.50	199000.00	Total Purchase Units =7857500
	NO (1) MINING ENTERPRISE	Lashio &Namtu	7459500	0.40	2983800.00	Kyats =3182800
1990-91	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	439000	0.50	219500.00	Total Purchase Units =9383200
	NO (1) MINING ENTERPRISE	Lashio &Namtu	8944200	0.40	3577680.00	Kyats =3797180
1991-92	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	498600	0.50	249300.00	Total Purchase Units =9109800
	NO (1) MINING ENTERPRISE	Lashio &Namtu	8611200	0.40	3444480.00	Kyats =3693780

YEAR	NAME OF ORGANIZATION	LOCATION	NO.OF UNITS	RATE	AMOUNT (KYATS)	REMARKS
1992 - 93	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	574800	0.50	287400.00	Total Purchase Units = 9736900
	NO.(1)MINING ENTERPRISE	Lashio & Namtu	9162100	0.40	3664840.00	Kyats = 3952240
1993 - 94	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	858000	0.50	429000.00	Total Purchase Units = 9873200
	NO.(1)MINING ENTERPRISE	Lashio & Namtu	9015200	0.40	3606080.00	Kyats = 4035080
1994 - 95	M.O.G.E	Yenanchaung ,Chauk , Seikpyu	151000	0.50	75500.00	Total Purchase Units = 9169000
	NO.(1)MINING ENTERPRISE	Lashio & Namtu	9018000	0.50	4509000.00	Kyats = 4584500
1995 - 96	NO.(1)MINING ENTERPRISE	Lashio & Namtu	2374000	0.50	1187000.00	Total Purchase Units = 2374000 Kyats = 1187000
1996 - 97 PA	NO.(1)MINING ENTERPRISE	Lashio & Namtu	2183400	0.50	1091700.00	Total Purchase Units = 2183400 Kyats = 1091700
1997 - 98 RE	NO.(1)MINING ENTERPRISE	Lashio & Namtu	2050000	0.50	1025000.00	Total Purchase Units = 2050000 Kyats = 1025000
1998 - 99 BE	NO.(1)MINING ENTERPRISE	Lashio & Namtu	-	-	-	-

MYANMA ELECTRIC POWER ENTERPRISE

UNITS SOLD, SALES OF ELECTRICITY AND OTHER INCOME

(UNITS IN MILLION)

(KYATS IN THOUSAND)

Particulars	1985-86		1986-87		1987-88		1988-89		1989-90		1990 -91		1991 -92	
	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT
SALES OF ELECTRICITY	1459.53	397440	1542.98	424756	1580.09	442810	1428.21	532030	1592.68	779041	1675.20	822185	1677.18	839806
GENERAL PURPOSE	362.59	165444	387.99	177820	425.59	193721	445.13	216068	509.90	270510	572.96	299883	617.17	322897
DOMESTIC POWER	46.07	10033	48.96	10854	55.49	12018	54.97	17700	53.52	27158	55.95	28631	55.26	28302
INDUSTRIAL	882.34	160508	918.75	167576	904.35	166865	737.74	221362	807.49	377355	787.50	372543	727.29	356463
BULK	128.48	43299	145.96	45983	153.66	51198	149.68	57258	179.69	82616	214.03	98173	228.90	105899
STREET LIGHT	32.88	15863	30.93	15480	29.74	15042	30.12	15100	32.47	16132	34.33	17951	37.44	20335
FLAT RATE														
SPECIAL														
TEMPORARY LIGHTING	2.69	1174	3.30	1458	4.07	1809	3.41	1606	4.01	2049	5.00	2560	5.37	2802
DEPARTMENTAL	4.48	1119	7.09	1985	7.19	2157	7.16	2936	5.60	2521	5.43	2444	5.75	3108
METER RENT														
OTHERS														
OTHER INCOME		5848		8940		38283		12112		36959		38604		40369
RENT OF PROPERTIES		989		936		952		930		3877		3434		3292
SALE OF UNSERVICABLE STORES		18		893		854		157		644		608		132
SALE OF TENDER FORMS		199		4		79		144		4		11		36
INTEREST RECEIVABLE														
PROFIT & LOSS ON REALISATION OF ASSETS		537		701		499		282		6457		10787		3389
INSTALLATION FEES		2070		2434		2606		2732		3864		4247		5412
INTERNAL WIRING & SPECIAL SERVICES		794		839		757		670		1431		1672		2133
HIRE OF EQUIPMENTS		300		83		41		-63		394		126		1604
MISCELLANEOUS INCOME		941		899		1444		956		3243		2878		4980
COMPENSATION				2081		28262		1936		8196		6505		11814
SALE OF STEAM						2789		4368		8849		8336		6250
SALE OF DEMINERALIZED WATER														1327
TOTAL	1459.53	403288	1542.98	433196	1580.09	481093	1428.21	544142	1592.68	816000	1675.20	860789	1677.18	880175

Particulars	1992-93		1993-94		1994-95		1995-96		1996-97 PA		1997-98 RE		1998-99 BE	
	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT	UNIT	AMOUNT
SALES OF ELECTRICITY	1831.46	918033	2059.17	1021687	2218.01	2001043	2262.37	2827294	2433.80	3086335	2502.35	3328088	2934.79	4162985
GENERAL PURPOSE	712.27	372573	820.64	427722	913.73	1032790	903.98	1518176	1014.90	1672415	1063.65	1811297	1390.62	2418422
DOMESTIC POWER	58.32	29862	67.26	34287	69.13	97051	68.31	152390	74.34	163876	74.30	172141	78.02	180747
INDUSTRIAL	768.93	374697	850.89	407858	862.90	639808	875.67	843693	875.65	875239	919.40	951390	946.35	1143827
BULK	238.36	112133	263.03	120705	302.35	175491	340.21	235958	392.51	288344	364.97	297047	383.21	311899
STREET LIGHT	41.32	22297	41.98	23229	50.56	33011	52.17	40287	53.30	43291	59.42	45478	62.98	48207
FLAT RATE														
SPECIAL														
TEMPORARY LIGHTING	6.65	3386	9.50	4831	11.97	18404	14.27	30869	15.38	36838	13.08	44079	15.70	52894
DEPARTMENTAL	5.61	3085	5.87	3055	7.37	4488	7.76	5921	7.72	6332	7.53	6656	7.91	6989
METER RENT														
OTHERS														
OTHER INCOME		61239		47930		43023		62802		98779		70854		75191
RENT OF PROPERTIES		3517		4533		4301		4436		3751		2516		2567
SALE OF UNSERVICABLE STORES		982		2073		50		493		27		592		631
SALE OF TENDER FORMS				5		13						13		13
INTEREST RECEIVABLE														
PROFIT & LOSS ON REALISATION OF ASSETS		5469		1013		2834		3052		573				1
INSTALLATION FEES		7249		6122		7313		9657		11556		11000		11330
INTERNAL WIRING & SPECIAL SERVICES		2749		2227		1751		2441		2970		3768		3881
HIRE OF EQUIPMENTS		375		131		72		44		44				
MISCELLANEOUS INCOME		6128		3709		4866		8001		5844		6062		6239
COMPENSATION		25298		22061		12159		17237		51842		23283		24881
SALE OF STEAM		7325		5245		1859		16353		18914		19481		20066
SALE OF DEMINERALIZED WATER		2147		811		7805		1088		3258		4139		5583
TOTAL	1831.46	979272	2059.17	1069617	2218.01	2044066	2262.37	2890096	2433.79	3185114	2502.35	3398942	2934.79	4238176

MYANMA ELECTRIC POWER ENTERPRISE
CONSOLIDATED REVENUE ACCOUNTS

(Kyats in Thousand)

Particulars	1985 -86	1986 -87	1987 -88	1988 -89	1989 -90	1990 -91	1991-92	1992-93	1993 -94	1994 -95	1995 -96	1996 -97 PA	1997-98 RE	1998-99 BE
INCOME														
Sales of Electricity	397449	424256	442810	532030	779041	822185	839806	918033	1021687	2001043	2827294	3086335	3328088	4162985
Other Income	5843	8940	38283	12112	36959	38604	40369	61239	47930	43023	62802	98779	70854	75191
Total Income	403283	433196	481093	544142	816000	860789	880175	979272	1069617	2044066	2890096	3185114	3398942	4238176
GENERATION														
Salaries and Wages	8821	9200	10504	10893	23745	23280	24157	23676	30266	30705	31576	31237	42921	45066
Fuel Consumption	76279	80845	103786	163733	240063	316528	391542	447589	374121	433887	613553	597010	1572325	1717828
Purchase of Electricity	4537	3929	1174	1299	2345	1951	7431	4168	7449	4088	4043	2800	7227	7227
Depreciation	58378	81050	92166	102560	146253	137713	143744	151490	143497	193663	202889	214090	260378	277368
Maintenance,Repairs and Other Expenses	7832	7615	7527	6511	10887	12322	20926	14533	32654	27673	37591	53044	199121	247237
General Expenses:-	155847	182639	215157	284996	423293	491794	587800	641456	587987	690016	889652	898181	2081972	2294726
TRANSMISSION														
Salaries and Wages	3485	3524	3998	4043	8994	20596	21581	11707	15128	15600	15542	15060	45604	16644
Depreciation	12547	12530	16910	17209	11884	17839	20228	18526	39609	53862	54741	62917	73988	192[illegible]
Maintenance,Repairs and Other Expenses	6939	6443	6587	7564	21269	2995	3250	16357	32206	37408	43586	68322	90484	106576
Transmission Expenses:	22971	22497	27495	28816	42147	41430	45059	46590	87943	106870	113869	146299	210076	232478
DISTRIBUTION														
Salaries and Wages	10624	10432	11246	11554	26884	26806	28716	29404	39240	41047	41613	41659	58688	61623
Depreciation	11128	11205	11913	13886	21116	24512	29850	45555	49078	62959	74099	125798	91183	95930
Maintenance,Repairs and Other Expenses	5973	7268	8482	9545	17062	19855	24333	17257	12588	24412	43191	106881	191013	219882
Distribution Expenses:	27725	28905	31641	34985	65062	71173	82899	92216	100906	128418	158903	274338	340884	377435
ADMINISTRATIVE														
Salaries and Wages	26566	27925	30985	31700	58357	59117	59230	60102	80831	86824	91165	88670	105367	110635
Depreciation	7834	11238	10381	11040	10780	11895	9845	12656	13641	21573	54218	58207	54427	54538
Maintenance,Repairs and Other Expenses	17775	28168	24128	21175	35383	51222	40218	41729	60795	80530	153889	220506	196788	220642
Interest Expenses	112160	112399	125167	148599	61159	45224	44886	94490	97486	114358	120682	108175	85592	80231
Commodity and Service Tax	14317	15550	17212	23490	34889									
Commercial Tax						41037	42976	49848	56554	129104	188963	209576	225788	289440
Administrative Expenses:	178652	195280	207873	236004	200568	208495	197155	258825	309307	432389	608917	685134	667962	755486
Total Expenses: -	385195	429321	482166	584801	731070	812892	912913	1039087	1085143	1357693	1771341	2003952	3300894	3660125
Profit/Loss before Taxation and State Contribution:-	18093	3875	-1073	-40659	84930	47897	-32738	-59815	-15526	686373	1118755	1181162	98048	578000
Income Tax	-	-	-	-	-	14369	-	-	-	205912	335627	354349	29414	173415
State Contribution	5428	1162	-	-	84930	33528	-32738	-59815	-15526	480461	783128	826813	68634	404636
Profit After State Contribution	12665	2713	-1073	-40659	-	-		-		-	-	-	-	-

MYANMA ELECTRIC POWER ENTERPRISE

ELECTRICITY PRODUCTION, COST AND AVERAGE SELLING PRICE

Particulars		1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97 PA	1997-98 RE	1998-99 BE
	UNIT														
1.Units Generated	000KWH	2119372	2245464	2319640	2226448	2494442	2643050	2677500	2995990	3386790	3631840	3762310	3944980	4205013	4515540
2.Loss(a)Consumption by															
Station Auxiliaries	"	28980	37910	38500	33150	30760	33570	44450	49730	56220	39260	62750	76800	78500	80000
(b)Losses in Generation	"														
Transmission	"														
Distribution		630861	664572	701050	765091	870997	934284	955875	1114805	1271400	1374570	1437208	1434384	1624167	1500751
3.Unit Consumed		1459531	1542982	1580090	1428207	1592685	1675196	1677175	1831455	2059170	2218010	2262372	2433796	2502346	2934789
4.Total Income (Sales of Electricity)	Kyats in	397440	424256	442810	532030	779041	822185	839806	918033	1021687	2001043	2827294	3086335	3328088	4162985
5.Production Cost	Thousand														
(1)Salaries and Wages	"	49496	51081	56733	58190	117980	129799	133684	124889	165465	174176	179896	176626	252580	263968
(2)Fuel Consumption	"	76279	80845	103786	153733	240063	316528	391542	447589	374121	433887	613553	597010	1572325	1717828
(3)Purchase of Electricity	"	4537	3929	1174	1299	2345	1951	7431	4168	7449	4088	4043	2800	7227	7227
(4)Depreciation	"	89887	116023	131370	144695	190033	191959	203667	228227	245825	332057	385947	461012	479976	507094
(5)Maintenances, Repairs and Other Expenses	"	38519	49494	46724	44795	84001	86394	88728	89876	138243	170023	278257	448753	677406	794337
(6)Commodity and Service Tax	"	14317	15550	17212	23490	34339									
(7)Commercial Tax	"						41037	42976	49848	56554	129104	188963	209576	225788	289440
6.Total Production Cost (Excluding interest)	"	273035	316922	356999	435202	669911	767668	868028	944597	987657	1243336	1650659	1895777	3215302	3570894
7.Interest	"	112160	112399	125167	148599	61159	45224	44886	94490	97486	114358	120682	108175	85592	89231
8.Total Production Cost	"	385195	429321	482166	584801	731070	812892	912914	1039087	1085143	1357693	1771341	2003952	3300894	3660125
9.Cost Per Unit															
(1)Excluding Interest (6/3)	Pyas	18.71	20.54	22.59	30.54	42.06	45.82	51.75	51.58	47.96	56.06	72.96	77.89	128.49	121.98
(2)Including Interest (8/3)	"	26.39	27.82	30.52	40.95	45.90	48.52	54.43	56.74	52.70	61.21	78.30	82.34	131.91	124.72
10.Average Selling Price Per Unit (4/3)	"	27.23	27.49	28.02	37.25	48.91	49.08	50.07	50.13	49.62	90.22	124.97	126.81	133.00	141.85

MYANMA ELECTRIC POWER ENTERPRISE

GENERATORS AND INSTALLED CAPACITY(BY LOCATION)

YEAR	LAWPITA HYDEL POWER STATION		YANGON		DISTRICT TOWNS AND VILLAGES		TOTAL	
	NO OF GENERATORS	INSTALLED CAPACITY 000 K.W	NO OF GENERATORS	INSTALLED CAPACITY 000 K.W	NO OF GENERATORS	INSTALLED CAPACITY 000 K.W	NO OF GENERATORS	INSTALLED CAPACITY 000 K.W
1985 -86	6	168.00	16	106.94	619	409.39	641	684.33
1986 -87	6	168.00	18	109.14	633	425.65	657	702.79
1987 -88	6	168.00	18	109.14	644	428.20	668	705.34
1988 -89	6	168.00	18	109.94	652	429.68	676	706.82
1989 -90	6	168.00	19	163.94	661	460.63	686	792.57
1990 -91	6	168.00	19	163.94	719	472.01	744	[illegible]
1991 -92	6	168.00	19	163.94	794	477.80	819	809.74
1992 -93	8	196.00	18	163.26	538	447.88	564	[illegible]
1993 -94	8	196.00	26	164.51	542	449.31	576	809.82
1994 -95	8	196.00	21	191.92	547	449.46	578	837.38
1995 -96	8	196.00	25	315.92	588	470.15	621	982.07
1996 -97 PA	8	196.00	26	350.92	616	483.68	650	1030.60
1997 -98 RE	8	196.00	30	470.23	607	541.22	645	1207.45
1998 -99 BE	8	196.00	30	470.23	607	541.22	645	1207.45

GENERATORS AND INSTALLED CAPACITY (BY TYPE)

YEAR	HYDRO ELECTRIC		THERMAL		GAS		DIESEL		TOTAL	
	NO OF GENERATOR	INSTALLED CAPACITY 000 KW	NO OF GENERATOR	INSTALLED CAPACITY 000 KW	NO OF GENERATOR	INSTALLED CAPACITY 000 KW	NO OF GENERATOR	INSTALLED CAPACITY 000 KW	NO OF GENERATOR	INSTALLED CAPACITY 000 KW
1985 -86	19	225.50	13	80.20	29	300.07	580	78.56	641	684.33
1986 -87	24	226.72	15	92.20	31	302.27	587	81.60	657	702.79
1987 -88	34	228.58	15	92.20	31	302.27	588	82.29	668	705.34
1988 -89	40	228.85	15	92.20	31	302.27	590	83.50	676	706.82
1989 -90	45	257.86	15	92.20	32	357.07	594	85.44	686	792.57
1990 -91	44	257.76	15	92.20	32	357.07	653	96.92	744	803.95
1991 -92	56	259.95	15	92.20	32	357.07	716	100.52	819	809.74
1992 -93	64	288.39	15	92.20	28	348.35	457	78.20	564	807.14
1993 -94	68	290.91	15	92.20	28	348.35	465	78.36	576	809.82
1994 -95	70	298.81	12	61.10	26	399.45	470	78.02	578	837.38
1995 -96	75	316.74	10	61.10	29	523.45	507	80.78	621	982.07
1996 -97 PA	91	328.47	11	96.10	29	523.45	519	82.58	650	1030.60
1997 -98 RE	92	340.47	13	216.10	34	569.99	506	80.89	645	1207.45
1998 -99 BE	92	340.47	13	216.10	34	569.99	506	80.89	645	1207.45

HYDEL GENERATORS

YEAR	UP to 12500 KW Other than LAWPITA & KINDA SEDAWGYI & LAWPITA NO(1)		28000KW LAWPITA		28000KW KINDA		12500KW SEDAWGYI		14000KW LAWPITA NO(1)		TOTAL	
	NO	000KW	NO	000KW	NO	000KW	NO	000KW	NO	000KW	NO	000KW
1985-86	11	1.50	6	168	2	56					19	225.50
1986-87	16	2.72	6	168	2	56					24	226.72
1987-88	26	4.58	6	168	2	56					34	228.58
1988-89	32	4.85	6	168	2	56					40	228.85
1989-90	35	8.86	6	168	2	56	2	25			45	257.86
1990-91	34	8.76	6	168	2	56	2	25			44	257.76
1991-92	46	10.95	6	168	2	56	2	25			56	259.95
1992-93	52	11.39	6	168	2	56	2	25	2	28	64	281.39
1993-94	56	13.91	6	168	2	56	2	25	2	28	68	290.91
1994-95	58	21.81	6	168	2	56	2	25	2	28	70	298.81
1995-96	63	39.74	6	168	2	56	2	25	2	28	75	316.74
1996-97 PA	79	51.47	6	168	2	56	2	25	2	28	91	328.47
1997-98 RE	80	63.47	6	168	2	56	2	25	2	28	92	340.47
1998-99 BE	80	63.47	6	168	2	56	2	25	2	28	92	340.47

MYANMA ELECTRIC POWER ENTERPRISE

GAS GENERATORS

YEAR	1 TO 5 MW		5 MW TO OVER		TOTAL	
	NO	MW	NO	MW	NO	MW
1991-92	14	30.52	18	326.55	32	357.07
1992-93	10	21.80	18	326.55	28	348.35
1993-94	10	21.80	18	326.55	28	348.35
1994-95	6	29.35	20	370.10	26	399.45
1995-96	5	10.90	24	512.55	29	523.45
1996-97 PA	5	10.90	24	512.55	29	523.45
1997-98 RE	8	17.44	26	552.55	34	569.99
1998-99 BE	8	17.44	26	552.55	34	569.99

MYANMA ELECTRIC POWER ENTERPRISE

DIESEL GENERATORS

YEAR	50 KW		51 TO 100KW		101 TO 250 KW		251 TO 500KW		501TO 1000 KW		1001 TO 1250 KW		TOTAL	
	NO	000KW	NO	000KW	NO	000KW	NO	000KW	NO	000KW	NO	000 KW	NO	000 KW
1985-86	202	5.37	281	22.28	30	6.98	27	12.36	40	31.58			580	78.57
1986-87	183	4.30	302	23.54	30	6.98	30	13.82	42	32.95			587	81.59
1987-88	183	4.30	302	23.54	30	6.98	30	13.82	43	33.64			588	82.28
1988-89	183	4.30	302	23.54	30	6.98	30	13.82	45	34.86			590	83.50
1989-90	183	4.30	302	23.54	30	6.98	34	15.76	45	31.86			594	82.44
1990-91	226	4.34	193	12.55	139	19.68	45	20.34	50	40.02			653	96.93
1991-92	265	4.99	201	12.95	154	21.53	45	20.34	51	40.70			716	100.51
1992-93	131	2.09	119	7.55	125	16.45	39	18.09	44	34.02			458	78.20
1993-94	138	2.26	119	7.55	125	16.45	39	18.09	44	34.01			465	78.36
1994-95	135	2.16	119	7.55	125	16.45	39	18.09	44	34.02			462	78.27
1995-96	173	2.74	120	7.63	131	17.55	38	17.69	44	34.01	1	1.16	507	80.78
1996-97 PA	174	2.65	126	8.23	134	17.82	40	18.70	44	34.02	1	1.16	519	82.58
1997-98 RE	196	2.64	100	6.72	122	16.24	41	18.92	46	35.21	1	1.16	506	80.89
1998-99 BE	196	2.64	100	6.72	122	16.24	41	18.92	46	35.21	1	1.16	506	80.89

MYANMA ELECTRIC POWER ENTERPRISE

THERMAL GENERATORS

YEAR	500 TO 10000 KW		10000 KW		TOTAL	
	NO	000 KW	NO	000KW	NO	000KW
1985 -86	4	2.20	9	78.00	13	80.20
1986 -87	4	2.20	11	90.00	15	92.20
1987 -88	4	2.20	11	90.00	15	92.20
1988 -89	4	2.20	11	90.00	15	92.20
1989 -90	4	2.20	11	90.00	15	92.20
1990 -91	4	2.20	11	90.00	15	92.20
1991-92	4	2.20	11	90.00	15	92.20
1992 -93	4	2.20	11	90.00	15	92.20
1993 -94	4	2.20	11	90.00	15	92.20
1994 -95	4	1.10	8	60.00	12	61.10
1995 -96	4	1.10	6	60.00	10	61.10
1996 -97 RA	4		7	95.00	11	96.10
1997 -98 RE	4	1.10	9	215.00	13	216.10
1998 -99 BE	4	1.10	9	215.00	13	216.10

MYANMA ELECTRIC POWER ENTERPRISE

TRANSMISSION AND DISTRIBUTION LINES

(Miles)

SR NO	YEAR	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97 PA	97-98 RE	98-99 BE
1	230 KV LINE	354	449	593	593	652	652	652	652	652	652	652	652	652	758
2	132 KV LINE	522	630	630	630	790	931	931	935	935	935	935	935	915	1225
3	66 KV LINE	459	467	497	497	497	509	509	534	534	514	564	632	783	1145
4	33 KV LINE	1190	1277	1376	1443	1500	1503	1524	1562	1567	1599	1863	1978	2043	2101
5	11 KV LINE	2659	2700	2765	2897	2927	2956	3022	3213	3242	3415	3673	3694	3813	3845
6	6.6 KV LINE	497	232	503	528	535	547	548	548	557	275	472	472	472	472
7	3.3 KV LINE	13	14	13	13	13	13	13	13	13	18	18	18	18	18
8	0.4 KV LINE	4282	4283	4356	4427	4476	4531	4558	4597	4605	4504	4657	4685	4715	4745

巻末 5　Country Paper on Recent Development in the Myanmar Electric Power Sector (Oct. 1999)

THE GOVERNMENT OF THE UNION OF MYANMAR

MINISTRY OF ELECTRIC POWER

COUNTRY PAPER

ON

RECENT DEVELOPMENTS

IN

THE MYANMAR ELECTRIC POWER SECTOR

Presented by

U Zaw Win

Director General

Department of Electric Power

Yangon, Myanmar

Dated October, 1999

Country Paper
on
Recent Developments
in
The Myanmar Electric Power Sector

Introduction

1. The Ministry of Electric Power was established on 15 November 1997 for promotion and effective operation of the power sector. The Myanma Electric Power Enterprise which was previously under The Ministry of Energy has been put under The Ministry of Electric Power.

2. A new department called the Department of Electric Power was also formed which acts as a planning and policy making body and also as a secretariat to the Ministry. This new department is headed by a Director General and its sanctioned strength is (124) persons.

3. The Myanma Electric Power Enterprise (MEPE) remains as an implementing agency responsible for power generation, transmission and distribution throughout the country. The management of MEPE is headed by the Managing Director and Chief Engineer and organized with six operating departments namely:

   (1) Planning
   (2) Hydro Power Development
   (3) Operation
   (4) Finance
   (5) Administration
   (6) Material Planning

   The sanctioned strength of MEPE is (16526) persons.

4. The Head Office of MEPE is located in Yangon, and the remaining (18) Regional offices are located in the capital cities of the (7) States (7) Divisions and (3) Sub-States and Divisions of the Union of Myanmar.

Demand and Supply

5. The area of electric supply in Myanmar can be defined into two parts:-

   (i) Area of supply from National Grid System (The Interconnected System)

   (ii) Area of supply outside the Grid System.

6. The breakdown of Installed Capacity for the year 1998-99 is as follows:-

	Grid System	Isolated	Total	Percentage
Installed Capacity (MW)	973.82	173.05	1146.87	100.00 %
- Hydroelectric	307.00	33.32	340.32	29.67 %
- Gas Turbine (32units)	508.10	35.89	543.99	47.43 %
- Steam Turbines	142.5	31.10	173.6	15.13 %
- Diesel	16.22*	72.74	88.96	7.75 %

(* Stand by)

7. The breakdown of total units generated and sold for the year 1998-99 is as follows:

Units Generated (mill kWh)		Units Sold (mill kWh)	
Hydro	1458.88	Industry	962.58
Steam	226.13	Domestic	1277.11
Gas	2847.87	Bulk	520.19
Diesel	46.41	Others	88.14
Total	4579.29	Total	2848.02

8. The demand for electricity has been increasing rapidly over the last few years. Electricity generation increased from about (2117 GWh) in 1988-89 to about (4579 GWh) in 1998-99. The Peak Demand also increased from about (332 MW) in 1988-89 to (750 MW) in 1998-99. This is more than double in (10) years.

9. As shown in the attached map Annexure (1), the National Grid System (the Interconnected System) covers the Southern and Central parts of the country and the generation within this system is about 95 % of the total generation of the whole country.

Existing Power Stations

10. The following major electric power stations feed electricity into the National Grid System with 230 kV, 132 kV and 66 kV transmission lines and substations.

		Installed Capacity (MW)
I.	Hydroelectric Power Stations	307.00
	1. Baluchaung No: 2 Lawpita	168.00
	2. Kinda	56.00
	3. Sedawgyi	25.00
	4. Baluchaung No: 1	28.00
	5. Zawgyi No : 1	18.00
	6. Zawgyi No : 2	12.00
II	Gas Turbine Power Stations	650.30
	1. Kyunchaung	54.00
	2. Myanaung	67.65
	3. Shwedaung	55.35
	4. Mann	36.90
	5. Ywama	36.90
	6. Tharkayta GTCC	91.50
	7. Ahlone GTCC	154.00
	8. Hlawga GTCC	154.00
	Total :	957.30

Completed Projects

11. In 1995-96, two new gas turbine power stations with an installed capacity of (100) MW each, comprising six GE frame (6) units from GEC Alsthom of France had been installed at Ahlone and Hlawga in Yangon. The Ahlone Gas Turbine Power Station

was commissioned in April 1995 and second gas turbine power station at Hlawga was also commissioned in early 1996.

12. Addition of a Combined Cycle Plant (34.5) MW at Tharkayta Power Station which has an initial installed capacity of (57) MW was commissioned in January 1996. Similar Combined Cycle Plants (54) MW each were commissioned in May 1999 at Hlawga Power Station which has an initial installed capacity of (100) MW and also at Ahlone Power Station in September 1999 which has an installed capacity of (100) MW thereby increasing the total capacity to (399.5) MW.

13. On hydro power development, the Baluchaung No. 1 Hydroelectric Power Station with an installed capacity of 28 MW (2 No. of 14 MW units) upstream of Baluchaung No. 2 was completed and commissioned in August 1992. The Sedawgyi Hydroelectric Power Station with an installed capacity of 25 MW (2 No. of 12.5 MW units) was commissioned in June 1989 and the Zawgyi (1) power station in the Shan State with an installed capacity of 18 MW (3 No. of 6 MW units) was commissioned in July 1995. The Zawgyi (2) power station, upstream of Zawgyi (1) was completed in November 1998.

14. In order to fulfill the ever-increasing demand of electricity in the country, MEPE had tried to initiate the construction of large scale hydroelectric power projects but managed to develop small and medium hydro power projects only. The following are some of the hydro power projects which were completed within the last (10) years.

Sr. no	Project	Division / State	Installed Capacity (MW)
1	Sedawgyi	Mandalay Division	25.000
2	Zawgyi (1)	Shan State	18.000
3	Mogok	Mandalay Division	4.000
4	Kattalu (Kyunsu)	Tanintharyi Division	0.150
5	Hopin galainggyaung	Kachin State	1.260
6	Kunhing	Shan State	0.150
7	Namlat (Kyaington)	Shan State	0.480
8	Chinshwehaw	Shan State	0.100
9	Selu	Shan State	0.024
10	Maing Lar	Shan State	0.060
11	Matupi (Namlaung)	Chin State	0.200
12	Malikyun (Palaw)	Tanintharyi Division	0.192
13	Baluchaung No.1	Kayah State	28.000
14	Ching Krang Hka	Kachin State	2.520
15	Laiva	Chin State	0.600
16	Nammyao (Lashio)	Shan State	4.000
17	Namwop (Kyaington)	Shan State	3.000
18	Chinshwehaw (Extension)	Shan State	0.200
19	Kunlong (Hopan)	Shan State	0.500
20	Zi Chaung (Kalemyo)	Sagaing Division	1.260
21	Namkhamhka (Mogaung)	Kachin State	5.000

Sr. no	Project	Division / State	Installed Capacity (MW)
22	Nam saung ngaung (Kyaukme)	Shan State	4.000
23	Lahe	Sagaing Division	0.050
24	Tui Swang (Tonzang)	Chin State	0.200
25	Che Chaung (Mindat)	Chin State	0.200
26	Zawgyi Dam Power Station	Shan State	12.000
		Total	111.146

Ongoing Projects

15. The following are some of the major hydroelectric power projects which are under construction.

Sr. No	Name of Project	Location	Capacity MW	Annual Energy GWh	Remarks
1	Zaungtu Dam-L= 5896' H= 147'	Bago Division	20 (10MWx2)	76	The final stage of completion about end 1999.
2	Paunglaung Dam-L=940m H=130m V=11.6x$10^6$$m^3$	Mandalay Division	280 (70MWx4)	910	Diversion Tunnels by Kajima and NEWJEC. Project implementation signed with YMEC on 6 Oct. 1998 and 11 Nov 1998.
3	Mon Dam-L=4320' H=200'	Magwe Division	75 (25MWx3)	330	Under construction. Contract signed with CITIC on 20th Nov. 1998.
4	Thapanzeik Dam-L=22587' H=108'	Sagaing Division	30 (10MWx3)	117	Under construction. Contract signed with CITIC on 20th Nov. 1998.

Future Projects (HYDRO)

16. The territorial area of the Union of Myanmar is about 677,000 square kilometers over half of which is highland dissected by North-South mountain ranges. The topography combined with heavy rainfall from the South-west monsoon endows the country with abundant hydropower resources in the Ayeyarwady, Sittoung, Thanlwin and Chindwin River Basins. The World Bank estimates a figure of more than 100,000 MW of which only about 340 MW has been developed.
17. Baluchaung No. 2 Lawpita Power Station with an initial installed capacity of 84 MW built by Japanese war reparation fund and later increased to 168 MW and Baluchaung No.1 Hydroelectric Power Station with an installed capacity of 28 MW amounting to 196 MW is still the biggest power station in Myanmar.
18. According to preliminary studies, the hydropower resources identified up to date is about 37,000 MW, of which about 25,000 MW is of large scale and the remainder is of medium and small scale power projects. In addition to the larger scale hydro power sites, mini and micro hydropower sites are abundant throughout the country.

19. The total developed capacity of hydropower about 340 MW in comparison with the country's potential is only about 1.0 percent and therefore 99 percent of the potential still remains undeveloped.
20. The following are some of the major hydroelectric power projects to be implemented in the near future. The locations are also shown in Annexure (2).

Sr. No	Name of Project	Location	Capacity MW	Annual Energy GWh	Remarks
1	Bilin	Mon State	280 (70MWx 4)	756	A preliminary report has been completed by Nippon Koei.
2	Kun	Bago Division	84 (28MWx 3)	350	Field investigation works for feasibility study completed with China National Agricultural Machinery Export & Import Corporation (CNAMC). Project Report is delayed, to be submitted.
3	Yeywa Dam-L=610m H=120m Diversion Tunnel 600mx2 11 m ϕ	Mandalay Division	600	2815	Nippon Koei Co. Ltd; doing feasibility study. Report expected Oct 1999. MEPE plans to start diversion tunnels in 2000. Engineering Design still to complete.
4	Baluchaung 3	Kayah State	48	327	Feasibility study completed by NEWJEC.
5	Pyu	Bago Division	65	260	Preliminary study by UNDP.
6	Thaukyegat	Kayin State	150	780	Pre-design report had been completed. Feasibility study to be conducted by TEPCO.
7	Bawgata	Kayin State	160	500	Preliminary study
8	Nam Kok	Shan State	100 to 150	284	Feasibility study with Marubeni, MDX., Italian Thai developers mainly for export to Thailand. Pending
9	Hutgyi	Shan State	400	2000	Feasibility study proposed by Marubeni / NEWJEC led consortium (export to Thailand)
10	Tanintharyi	Tanintharyi Division	600	3476	Preliminary study by Nippon Koei. (export to Thailand).
11	Tasang	Shan State	3600	23000	At present lahmehyer International is finalising pre-feasibility survey as consultant to GMS Power Public Co., Ltd the developer.

Sr. No	Name of Project	Location	Capacity MW	Annual Energy GWh	Remarks
12	Shweli	Northern Shan State	200 to 300	1600	Reconnaissance survey completed. Very attractive project for rapid implementation, BOT arrangement possible. Under discussion with YMEC.
13	Tamanthi	Sagaing Division	1200		Prefeasibility. Interests from Indian Government side.

21. Among future Hydro Power Projects, Shweli, located 25 miles inside Myanmar on the Yunnan border, is the best in the country. With just a small diversion weir about 20 m high and a tunnel 4.8 km long, 300 m head and 200 MW power can be achieved.

Future Projects (GAS /COAL)

22. The Ministry of Energy is developing the Domestic off-shore gas utilization Project utilizing the 105 mmscf/day which will be available for domestic consumption. This Project consists of a pipe line from Yadana to Delta area on-shore and an approximately 300 MW Combined Cycle Plant (Hmawbi). The Ministry of Energy is concentrating on the realisation of the pipe line portion and the Ministry of Electric Power on the Power Plant.

23. Furthermore, 20 mmscf/day of natural gas will be also be available for domestic consumption at Kanbauk, the land-fall point of the pipe-line going to Thailand from Yadana. MEPE is planning to build a Gas Turbine Power Plant for supply of electricity in the Tanintharyi area.

24. The country is estimated to have a total coal resource of 200 to 230 million tons, in numerous deposits mostly of sub-bituminous rank, mainly in the northern regions. Presently there are only two mines in production where Kalewa Coal Mine, using underground mining techniques and Namma Coal Mines, using open-cut mining technique is producing about 12,900 tons per year and 25,810 tons per year respectively.

25. The Kalewa deposits are the only significant deposits for consideration for future coal development at the present time. A mine-mouth coal-fired power plant of about 200 MW could be developed according to preliminary studies. Itochu, Chiyoda and Nissho Iwai are studying the possible development of the Kalewa (100 to 200 MW) coal-fired power plant.

26. The electricity generated from this coal-fired power station could be supplied to the Copper mines in Monywa which Ivanhoe Co. is developing. The power requirement of the Copper mines is about (30) to (40) MW and the balance could be supplied to the Grid System.

Export Oriented Projects

27. Among the hydro power sites on the Thanlwin river, GMS of Thailand had started feasibility study for the Tasang (3600 MW) Project. This Project is mainly for export to Thailand .

28. There are also many promising sites on the Thanlwin River for export oriented power projects such as Ywathit (3000 MW) and Hutgyi (400 MW). However a detailed

study of the Thanlwin River Basin is required before choosing any specific sites for hydro power development on the Thanlwin River. GMS and Ital-Thai of Thailand and other companies had shown interest in carrying out the basin study for development of hydro power from the Thanlwin River.

29. However due to the current economic situation in Thailand, the power demand in Thailand had significantly slowed down and consequently the pace for development of export-oriented projects to Thailand also had slowed down.

30. On the other hand, India also renewed its interest to import power from Myanmar. In February 1999, an Indian delegation consisting of senior officials from several Indian power utilities visited Myanmar and held discussions with Myanmar officials for development of the Tamanthi hydropower project about 1200 MW capacity on the Chindwin river in the North-western part of Myanmar. The Project site is just 80 kilometres from the Indian-Myanmar border and India has expressed its keen interest for purchase of power from Tamanthi Project to its North-eastern grid which is facing acute power shortage.

Thai-Myanmar Transmission Line Interconnection

31. In July 1997, a Memorandum of Understanding was signed between Myanmar and Thailand for purchase of power from Myanmar up to 1500 MW by the year 2010. Pursuant to the MOU, each side has established a committee consisting of representatives from the relevant government departments in order to implement the power purchase program.

32. On the Thai side " The committee on the Implementation of Power Purchase Program from the Union of Myanmar" is chaired by the Governor of the Electricity Generating Authority of Thailand (EGAT) with (5) members from the National Energy Policy Council, Ministry of Foreign Affairs, Department of Energy Development and Promotion, National Economic and Social Development Board and representative from EGAT as secretary.

33. Whereas on the Myanmar side it is chaired by the Managing Director of Myanmar Electric Power Enterprise (MEPE) with (6) members from the Department of Electric Power (DEP), Energy Planning Department (EPD), Ministry of Foreign Affairs, National Planning and Economic Development, Hydro-power Implementation Department (MEPE) and Chief Engineer of MEPE as secretary.

34. At the first Committee meeting held in "Tachilek" on 29th April 1998, working committees consisting of technical experts from both countries have been formed to study in detail the possibility of connecting transmission system between the two countries.

35. Due to the current economic situation in Thailand, the power demand in Thailand has significantly slowed down and Thailand will have huge surplus power for the next few years. On the other hand, Myanmar is in need of electric power at the moment. This situation means that Thailand could be exporting electricity to Myanmar for some period of time before importing.

36. In view of this present scenario, at the second meeting of the two committees in Yangon in January 1999, the idea of early interconnection of the two grids via. Mae Sod – Myawaddy – Pa-an and Bago was discussed to import the surplus power from Thailand and to export back in future when the export-oriented power projects in Myanmar are completed.

37. Since then these committees have been working closely and has succeeded in finding five corridors linking the two countries as shown in Annexure (1).

The five possible connection points to Myanmar are :

(a) Route 1 : At Mae Sai District Chiangrai Province, 30 kilometers from the Thai-Myanmar Border close to Myanmar.

(b) Route 2 : At Mae Ai District Chiangrai Province which is 70 kilometers away from the border.

(c) Route 3 : At Muang District, Kanchanaburi Province which is 70 kilometers away from the border.

(d) Route 4 : At Mae Sot District, Tak Province, which is 10 kilometers away from the border.

(e) Route 5 : At Muang District, Mae Hong Son Province, which is 22 kilometers away from the border.

38. Both EGAT and MEPE will pursue studies on technical feasibility and economic viability of the Project. The project will help EGAT to reduce its excess generation capacity, which will soar to more than 50% in 2001. For Myanmar, purchasing surplus power from Thailand could be a quicker solution and more economical than building new power plants and firing them with diesel before the off-shore gas arrives on-shore.

Minihydro Power Projects and border area development

39. The Myanma Electric Power Enterprise has constructed more than (20) mini hydro power projects in remote areas where hydro power resources are available to uplift the social and economic standards of the rural and remote communities especially in the Mountainous border areas.

40. Electrification, normally started in these areas with small diesel generating sets, but the transportation of diesel oil in some areas is so difficult that mini - hydro provides a solution in such cases.

41. Hydro power development in such remote areas also promote agriculture, pumped water irrigation and small cottage industries for the local people thereby creating jobs and uplifting the living standards and economic development of the local communities.

42. The following are some of the small hydro power projects which are to be implemented in the near future for the development of border areas.

Sr. No.	Name of Project	Installed Capacity (KW)	Location	Objective
1.	Mepan Chaung	2000 (1000 KW x 2)	(6) miles due North-East of Mong Hsat town on Mepan Chaung in Eastern Shan State.	To supply electric power to Mong Hsat and Mong Ton towns in the Eastern Shan State.
2.	Tumpang Hka Chaung	6000 (2000 KW x 3)	(40) miles South-East of Waing-Maw town on Tumpang Hka Chaung in Kachin State.	To supply electric power to Myitkyina and Waing-Maw towns in the Kachin State.

Sr. No.	Name of Project	Installed Capacity (KW)	Location	Objective
3.	Keng Hkawng Chaung	1200 (400 KW x 3)	(8) miles South West of Mong Hkak town on Nam Hkak Chaung in Eastern Shan State.	To supply electric power to Mong Hkak and Mong Yang townships in the Eastern Shan State.
4.	Kyu Hkok Chaung	320 (160 KW x 2)	(4) miles due South-West of Kyu Hkok town on Nam Khan Chaung in North-Eastern Shan State.	To supply electric power to Kyu Hkok town and nearby villages in Muse township in the North-Eastern Shan State.
5.	Nam Mae Sai*	6000 (2000 KW x 3)	(2) miles due West of Tachileik town on Nam Mae Sai Chaung in Eastern Shan State.	To supply electric power for Tachileik town in the Eastern Shan State and also export of excess power to Thailand.

Private Sector Participation

43. In early 1994 the permission of Private Sector to participate or jointly implement in Government activities was introduced also in the power sector.

44. Since then MEPE had been discussing with several interested parties both local and foreign for private participation in various areas of the power sector. However, the low tariffs in local currency and the small amount of consumers in foreign currency have been a draw-back to the commercialization process.

45. With the promotion of the tourist industry, mining industry and the current trend of foreign investments in various sectors, an increase in the number of consumers in foreign currency is expected in the near future.

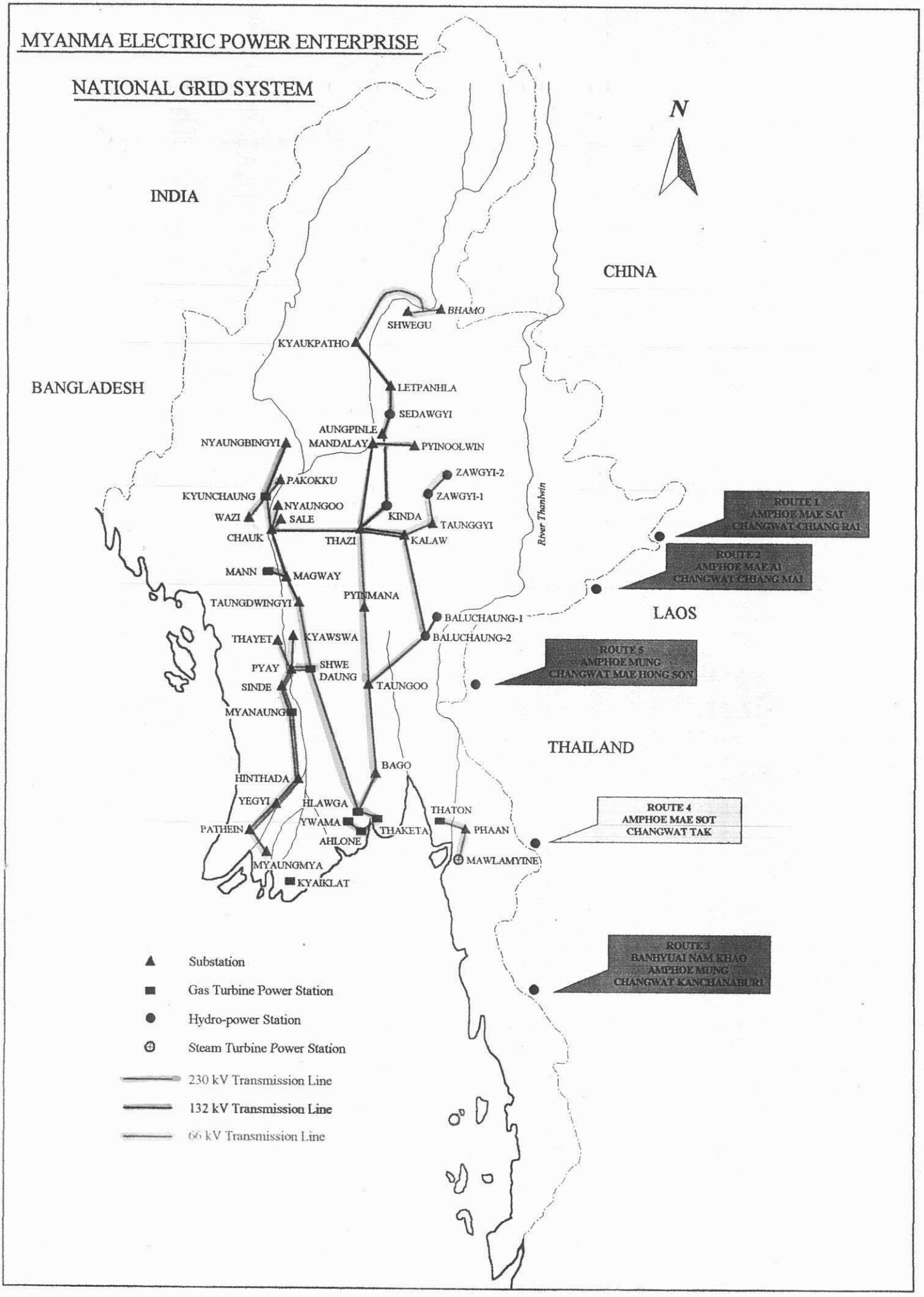
46. The tariff was increased in September 1994 for the first time in 40 years. It was raised fivefold from Kyat 0.50 to 2.5 Kyat per unit (of 1 kilowatt-hour) for domestic users and 3 Kyats per unit for commercial and industrial users. Tariff in foreign currency for foreigners, foreign and export-oriented companies is 0.08 US $ / kWh.

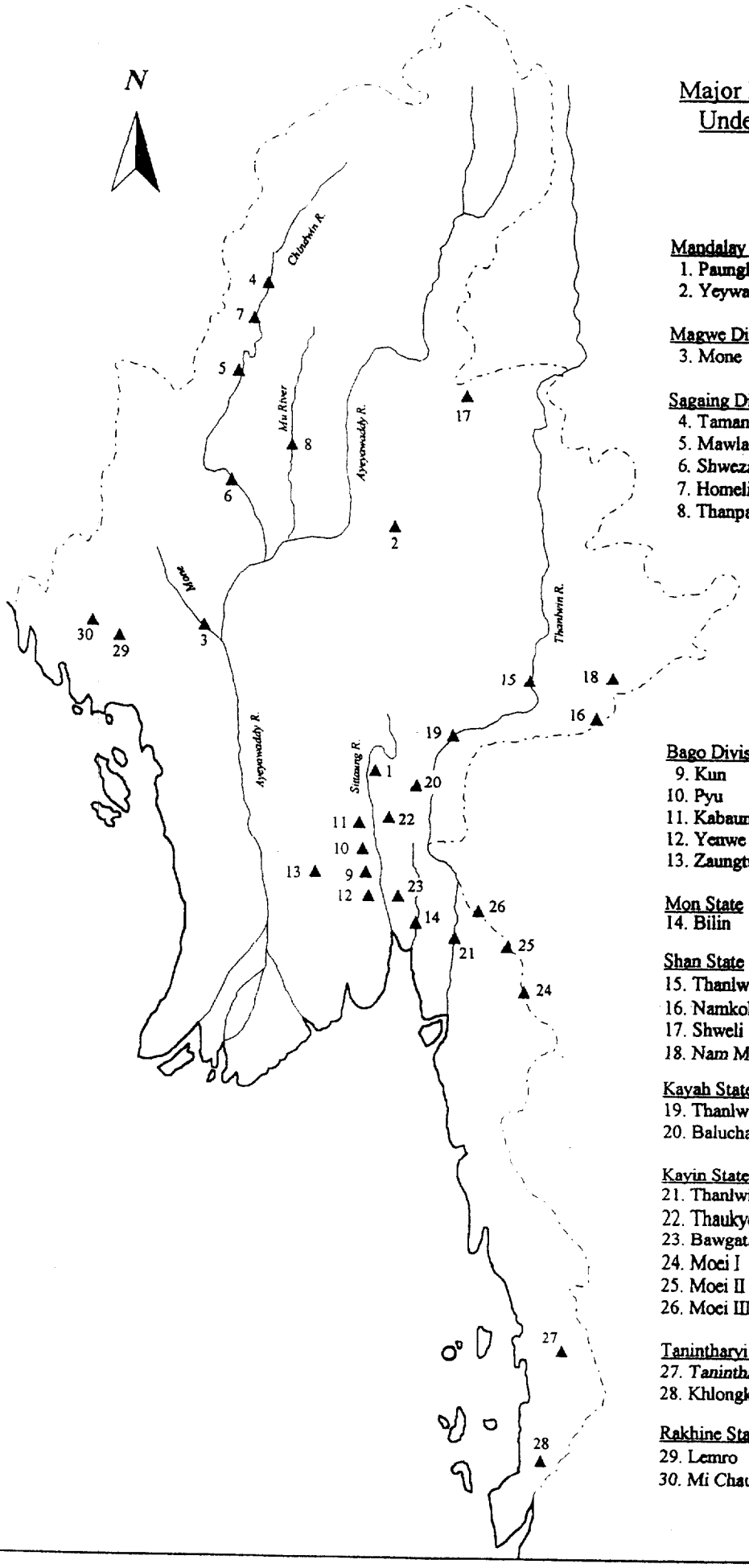
47. Even after this increase, the tariff in local currency is well below the commercial rates needed to make power generation profitable. On 1st April 1999 the tariff has been further raised from K 2.50/kWh to K25/kWh for commercial and industrial consumers and for domestic users above 200 units per month.

48. Pursuant to the increase in tariff, many of the local and foreign companies have discussed with eagerness for private participation in the power generation sector. For the time-being the Government intends to allow only the local companies for investments in the power sector.

49. The difference in official and market exchange rates and prohibition for repatriation of local currency for foreign companies at present is expected to normalize slowly to practical situation with consequent realization of commercialization and privatization process in the power sector.

50. Discussions are also underway with local companies to build new power plants and distribution facilities in Yangon industrial zones as well as in remote localities such as Sittwe of Rakhine State, Myeik and Kawthaung of Tanintharyi Division, Muse and Tachileik of Shan State and Kawkareik and Myawaddy of Kayin State.


MYANMA ELECTRIC POWER ENTERPRISE
NATIONAL GRID SYSTEM
N
INDIA
CHINA
BANGLADESH
LAOS
THAILAND
River Thanlwin
BHAMO
SHWEGU
KYAUKPATHO
LETPANHLA
SEDAWGYI
AUNGPINLE
MANDALAY
PYINOOLWIN
NYAUNGBINGYI
PAKOKKU
ZAWGYI-2
ZAWGYI-1
KYUNCHAUNG
NYAUNGOO
WAZI
SALE
KINDA
TAUNGGYI
CHAUK
THAZI
KALAW
MANN
MAGWAY
PYINMANA
TAUNGDWINGYI
BALUCHAUNG-1
BALUCHAUNG-2
THAYET
KYAWSWA
PYAY
SHWE DAUNG
TAUNGOO
SINDE
MYANAUNG
BAGO
HINTHADA
YEGYI
HLAWGA
YWAMA
AHLONE
THAKETA
THATON
PHAAN
PATHEIN
MAWLAMYINE
MYAUNGMYA
KYAIKLAT
ROUTE 1
AMPHOE MAE SAI
CHANGWAT CHIANG RAI
ROUTE 2
AMPHOE MAE AI
CHANGWAT CHIANG MAI
ROUTE 5
AMPHOE MUNG
CHANGWAT MAE HONG SON
ROUTE 4
AMPHOE MAE SOT
CHANGWAT TAK
ROUTE 3
BANHYUAI NAM KHAO
AMPHOE MUNG
CHANGWAT KANCHANABURI
Substation
Gas Turbine Power Station
Hydro-power Station
Steam Turbine Power Station
230 kV Transmission Line
132 kV Transmission Line
66 kV Transmission Line

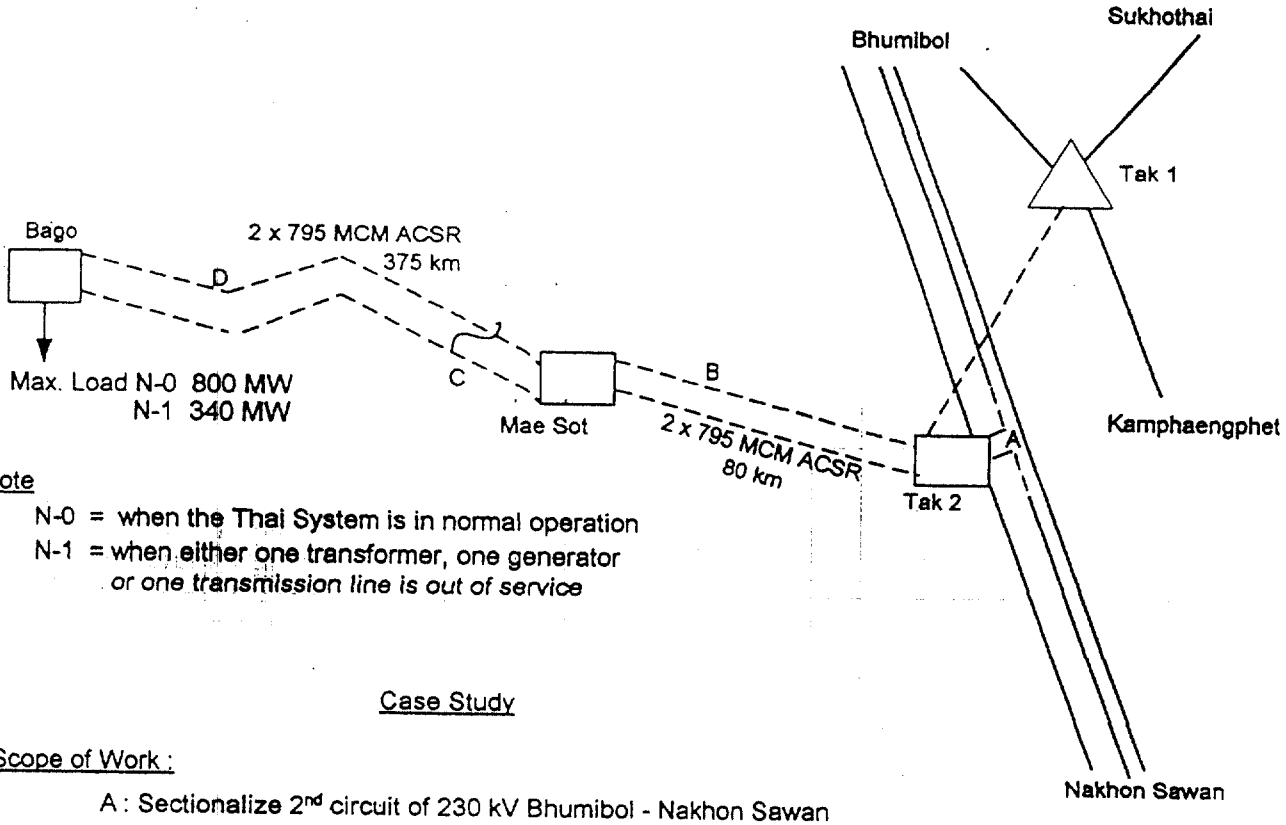


Major Hydroelectric Projects Under Implementation & Planning

Mandalay Division	
1. Paunglaung	280 MW
2. Yeywa	600 MW
Magwe Division	
3. Mone	75 MW
Sagaing Division	
4. Tamanthi	1200 MW
5. Mawlaik	400 MW
6. Shwezaye	600 MW
7. Homelin	150 MW
8. Thanpanzeik	30 MW
Bago Division	
9. Kun	84 MW
10. Pyu	65 MW
11. Kabaung	30 MW
12. Yenwe	16 MW
13. Zaungtu	20 MW
Mon State	
14. Bilin	280 MW
Shan State	
15. Thanlwin (Tasang)	3600 MW
16. Namkok	150 MW
17. Shweli	100~200 MW
18. Nam Mae Sai	6 MW
Kayah State	
19. Thanlwin (Ywathit)	3500 MW
20. Baluchaung III	48 MW
Kayin State	
21. Thanlwin (Hutkyi)	400 MW
22. Thaukyegat	150 MW
23. Bawgata	160 MW
24. Moei I	70 MW
25. Moei II	120 MW
26. Moei III	250 MW
Tanintharyi Division	
27. Tanintharyi	600 MW
28. Khlongkra	130 MW
Rakhine State	
29. Lemro	600 MW
30. Mi Chaung	200 MW

Annexure - 3

230 kV To BAGO
(2 x 795 MCM ACSR CONDUCTOR)



Note

N-0 = when the Thai System is in normal operation
N-1 = when either one transformer, one generator
or one transmission line is out of service

Case Study

Scope of Work :

A : Sectionalize 2nd circuit of 230 kV Bhumibol - Nakhon Sawan Line to Tak 2 Substation

B : Reconstruction of 115 kV Tak 1 - Mae Sot Line to be 230 kV Tak 2 - Mae Sot Double Circuit, Steel Tower, 2x795 MCM ACSR, 80 km

C : Construction of 230 kV Mae Sot - Border (Myawaddy) Double Circuit, Steel Tower, 2x795 MCM ACSR, 10 km

D : Construction of 230 kV Thai-Myanmar Border (Myawaddy) to Bago Doublele Circuit, Steel Tower, 2x795 MCM ACSR, 375 km

巻末６　先方政府からの要請書

APPLICATION FOR THE STUDY ON RURAL ELECTRIFICATION BY RENEWABLE ENERGY IN MYANMAR

1. PROJECT TITLE

"The Study on Rural Electrification by Renewable Energy in Myanmar"

2. LOCATION

States along the border areas in Myanmar.

3. EXECUTING AGENCY

Ministry of Electric Power

4. PROJECT JUSTIFICATION

(1) Background

Myanmar, having an area of 676,522 km^2, is bordered with China to the north, India and Bangladesh to the west, Thailand and Laos to the east. The population in the year 1995 was estimated at 46.4 million, and growing at the rate of 1.84 % per year. Nearly 66% of the total employment is assumed to be engaged in the agriculture, livestock, fishery and forestry sectors. The Myanmar economy has been growing at 4.6% per annum at 1996/97. Per capita GDP in 1995/96 was approximately US$250.

Due to the rapidly increasing demand of electricity, public utilities have become difficult to provide quality services on continuing basis. The disparities between rural and urban households in terms of electricity use are considerable. The electrification ratio shows high value of 97 % in urban area. However, the recent severe droughts on major reservoirs has led to serious power shortages throughout the country. Since the priority has been given to industrial and urban household use, the electrification ratio in rural area is estimated at low value of 7.4% in 1995. Electrification ratios in Kayah, Rakhine, and Chin States, for example, where the transmission line is not extended also indicate lower than 3 %. Accordingly, large number of rural population currently has little access to electricity services.

Electrification by expanding distribution grids will be not economically feasible for remote rural areas due to the small demand in dispersed supply points. Thus, dispersed energy

systems have emerged as an important alternative to cope with the small needs of the poorest sectors of such remote villages in border areas. Electric light can increase the hours available for work, education and recreation. This is especially important in poor rural communities, since both children and adults have little chance to study during the day. Therefore, providing renewable energy for the electricity will contribute to the variety of quality of life improvements to households as well as to the community as a whole, since it will simultaneously contribute to the eliminating source of pollution and a fixed cost for candles and kerosene.

(2) Objective of the Study

The objectives of the Study are to formulate appropriate development plan on renewable energy generation in the remote areas by carrying out the study of PV power, Wind power, Bio-mass power and Small/Micro hydropower projects, to provide renewable energy generating facilities as an model facilities for PV, and to train the local staffs in order to develop the further projects.

(3) Prospective Beneficiaries

The prospective beneficiaries will be principally the rural population living in the border states in Myanmar.

(4) Project Priority in National Development Plan

The Study is needed to establish the appropriate strategy for development of renewable energy in Myanmar. The Study is to be given high priority for realising stable development of renewable energy resources for economic development, improving shortage of electrical power and maintaining environmental reservation.

5. PROJECT IMPLEMENTATION SCHEDULE

The period for preparation of the Study is estimated at twenty-eight (28) months (Refer to Figure 2).

6. EXPECTED FUNDING SOURCE

Technical assistance program by the Government of Japan.

7. OTHER RELEVANT PROJECTS, IF ANY

- R&D for PV / WIND Hybrid System are being prepared by NEDO.
- Pilot project of the Solar PV Battery Charging Station for Non-electrified Remote Community Areas are being implemented through UNDP/ ENSIGN(Energy Support Income Generation) Project.

8. TERMS OF REFERENCE

The terms of reference for the Study on this project are indicated in APPENDIX-A.

9. EXPERTISE INPUTS

The following fourteen (14) experts and engineers will be required for executing the study:

(1) Team leader
(2) Rural community analysis expert
(3) New energy expert (PV power analyst)
(4) New energy expert (PV field engineer)
(5) New energy expert (Wind power)
(6) New energy expert (Bio-mass expert)
(7) New energy expert (Bio-mass generation system expert)
(8) New energy expert (Small/micro hydropower)
(9) Hydrologist
(10) Geologist
(11) Civil engineering expert
(12) Natural environmental expert
(13) Economic and financial analysis expert

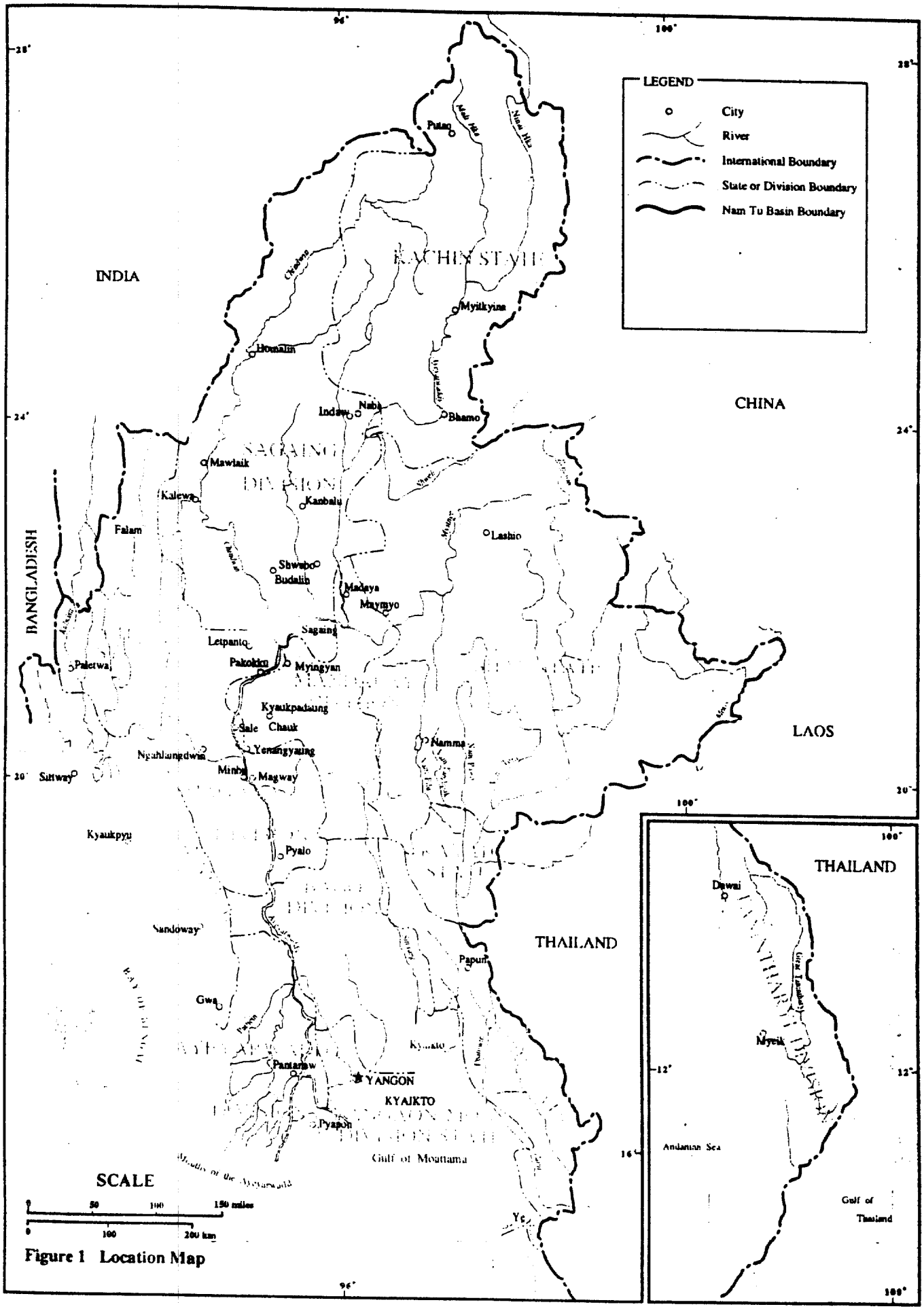
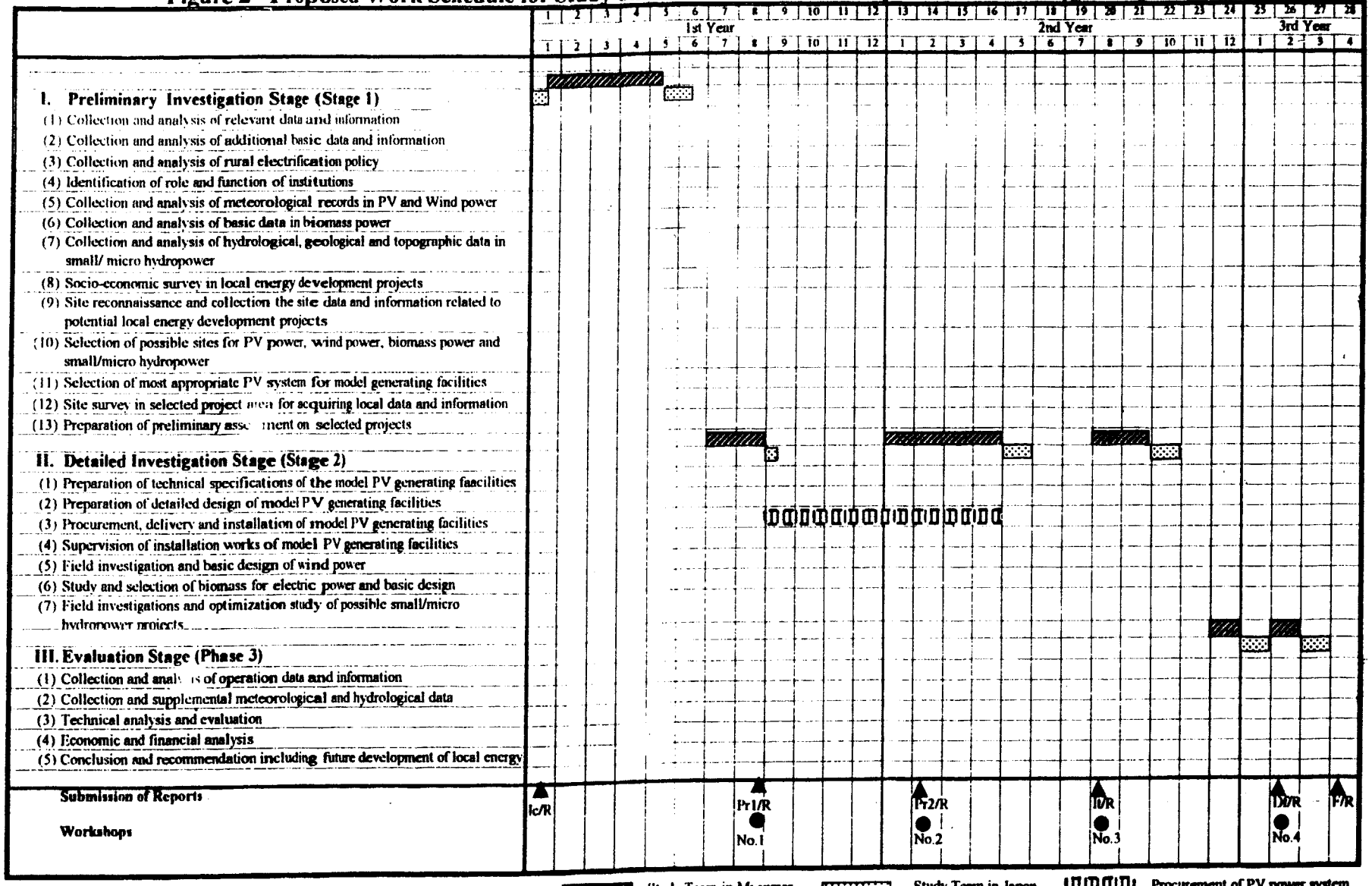


Figure 1 Location Map

Figure 2 Proposed Work Schedule for Study on Rural Electrificaation by Renewable Energy in Myanmar



ToR Schedule/R

APPENDIX-A

TERMS OF REFERENCE
FOR
THE STUDY
ON
RURAL ELECTRIFICATION BY RENEWABLE ENERGY
IN
MYANMAR

1. BACKGROUND

1.1 General Description of Power Generation in Myanmar

Myanmar, having an area of 676,522 km^2, is bordered with China to the north, India to the west, Thailand and Laos to the east. The population in the year 1995 was estimated at 44.7 million, and growing at the rate of 2 % per year. Nearly 70% of the total employment is assumed to be engaged in the agricultural sector. The Myanmar economy has been growing at 8.2 % per annum since 1992/93 and the power generation at 11.5 % per annum following the reform into market economy. Per capita GDP in 1995/96 was approximately US$250.

The existing interconnected power system has 13 major power stations. Eight gas turbine/Combined-cycle, and five hydropower stations. They have at total installed capacity of 868 MW and a total firm capacity of 680 MW in 1996/97. The total installed capacity of hydropower stations is 295 MW and 34 % of the total in the interconnected power system. There is one isolated systems: the Thaton-Mawlamyine system in Mon and Kayin States with a total capacity of 68 MW and a firm capacity of 25 MW. The power demand is forecasted to reach 1,800 MW by 2005/06 and 3,000 MW by 2010/11. This indicates that more than 150 MW of new power sources have to be developed every year to catch up with the growing economy.

The Government of Myanmar employs the short-term and long-term development policy for development of the power generation projects in order to meet the fast growing power demand.

Short-term : To install gas turbine and combined cycle plants using domestic natural gas resources

Long-term : To develop hydropower resources in full swing which are renewable, clean, and indigenous to the country and will contribute to saving foreign currency (substituting import of fuel) and environmental conservation (avoiding emission of CO_2 and others)

The supply area of the interconnected power system is limited as power distribution is confined to town areas near substations, which are generally situated apart to each other. Outside the area of the interconnected power system, necessary power is supplied by small hydro and diesel plants in hilly areas and thermal plants (steam, gas, and diesel) in flat plains. Around 720 generators, mostly diesel operated, are under operation in all the 14 Divisions and States in 1996/97. About 20 % of MEPE consumers are supplied by isolated systems.

1.2 Necessity of the Project

Due to the rapidly increasing demand of electricity, public utilities have become difficult to provide quality services on continuing basis. The disparities between rural and urban households in terms of electricity use are considerable. The electrification ratio shows high value of 97 % in urban area. However, the recent severe droughts on major reservoirs has led to serious power shortages throughout the country. Since the priority has been given to industrial and urban household use, the electrification ratio in rural area is estimated at low value of 7.4% in 1995. Electrification ratios in Kayah, Rakhine, and Chin States, for example, where the transmission line is not extended also indicate lower than 3 %. Accordingly, large number of rural population currently has little access to electricity services.

Electrification by expanding distribution grids will be not economically feasible for remote rural areas due to the small demand in dispersed supply points. Thus, dispersed energy systems have emerged as an important alternative to cope with the small needs of the poorest sectors of such remote villages in border areas. Electric light can increase the hours available for work, education and recreation. This is especially important in poor rural communities, since both children and adults have little chance to study during the day. Therefore, providing renewable energy for the electricity will contribute to the variety of quality of life improvements to households as well as to the community as a whole, since it

will simultaneously contribute to the eliminating source of pollution and a fixed cost for candles and kerosene.

2. OBJECTIVE OF THE STUDY

The objectives of the Study aims to formulate appropriate development plan on renewable energy generation in remote areas by studying the potential of Photovoltaics (PV) power, Wind power, Biomass power and Small/micro hydropower, to provide local energy generating facilities as an model facilities for PV, and to train the local staffs in development of further projects.

3. THE STUDY AREA

On formulating the framework for rural electrification, the development plan of PV power, wind power, biomass power, and small/micro hydropower are considered as significant means to any off grid areas in Myanmar. However, installation and monitoring of PV system and wind power and investigations and formulation on small/micro hydropower supply and biomass power are limited to the selected villages.

4. SCOPE OF THE STUDY

In accordance with the Objectives of the Study, the Study is broadly divided into three stages:

Stage 1 : Preliminary Investigation Stage
Stage 2 : Detailed Investigation Stage
Stage 3 : Evaluation Stage

Transfer of technology is to be carried out mainly in the form of on-the-job training from time to time during the course of the above studies. The detailed scope of the Study is itemized as follows:

4.1 Preliminary Investigation Stage (Stage 1)

Particular data and records will be required for the Study on the local energy development of PV power, wind power, biomass power, and small/micro hydropower. Some basic data for the implementation of the proposed plan may be available in the related authorities, however, additional basic data and information may be needed for the Study of the Plan. The major components of the Study at this stage will be outlined as follows:

(1) Collection and analysis of the relevant data and information including previous study reports
(2) Collection and analysis of the additional basic data and information
(3) Collection and analysis of rural electrification policy and role in Myanmar
(4) Identification of the role and function of institutions related to electric power supply in national and local level
(5) Collection and analysis of meteorological records in potential PV power and wind power
(6) Collection and analysis of basic data in potential biomass power
(7) Collection and analysis of hydrological, geological and topographic data in potential small/micro hydropower projects
(8) Socio-economic survey at potential local energy development project sites
(9) Site reconnaissance and collection of the local data and information related to the potential local energy development of PV power, wind power, biomass power, and small/micro hydropower
(10) Selection of possible sites for PV power, wind power, biomass power and small/micro hydropower
(11) Selection of most appropriate system for model PV generating facilities
(12) Site survey in the selected project areas for acquiring site data and information
(13) Preparation of the preliminary assessment on the selected projects of the local energy model generating facilities

4.2 Detailed Investigation Stage (Stage 2)

PV Power

The Study of PV power in Stage 2 is carried out as follows:

(1) Preparation of technical specifications of the model PV generating facilities
(2) Preparation of detailed design of the model PV generating facilities
(3) Procurement, delivery and installation of the model PV generating facilities
(4) Supervision of the installation works of the model PV generating facilities

Wind Power

The Study of Wind power in Stage 2 is carried out as follows:

(1) A year-round wind measurement of air speed, direction and air density at the project area
(2) Selection of an appropriate wind power generator based on the results of the

preliminary study

(3) Basic design of the appropriate wind power generating system

(4) Wind measurement of air speed, direction and air density at the possible sites

(5) Development and implementation of a program for the establishment of a regulatory body to provide a framework for the sector operations

Biomass Power

The Study of Biomass power in Stage 2 is carried out as follows:

(1) Study on the present utilization and problems of bio-mass energy in various aspects

(2) Study on the present situation and problems of bio-mass utilization for electric power

(3) Evaluation of the existing power generation by bio-mass energy

(5) Selection of the promising bio-mass for electric power

(6) Study on the amount of selected bio-mass for electric power

(7) Selection of the proposed sites for agro-processing facilities, and study on electrification situations in its surrounding area

(8) Design of the technical specifications such as electric supply system, capacity of generator, facilities

(9) Cost estimate and study on financial source for implementation

(10) Implementation agency and schedule

Small/Micro Hydropower

The Study of Small/Micro Hydropower in Stage 2 at the possible small micro hydropower project sites includes:

(1) Hydrological investigation

- Collection of daily discharge flow at the intake weir
- Establishment of stream gauging stations and rating curve at the intake weir site including installation of staff gauges
- Hydrological analysis of long-term discharge at the intake weir site
- Determination of design floods at possible intake weir and power station sites

(2) Topographic survey

- River cross sections at the intake weir site and river profile to identify the available head

- Topographic map at the intake weir and power station sites with plane table in a scale of 1: 1,000

(3) Geological investigation

- Execution of geological reconnaissance at the intake weir, waterway and power station sites
- Preparation of geological mappings

(4) Construction material survey

(5) Optimization study on the project layout and installed capacity

(6) Environmental assessment

- Identification of potential impacts of the possible small/micro hydropower project sites on the social and natural environment
- Assessment of degree of the potential impacts
- Study and recommendation of mitigation measures for negative impacts that are judged significant or serious

(7) Preliminary construction planning and cost estimate

4.3 Evaluation Stage (Stage 3)

(1) Collection and analysis of operation data and information

(2) Collection of supplemental meteorological and hydrological data

(3) Technical analysis and evaluation

(4) Economic and financial analysis

(5) Conclusion and recommendation including the future development of local energy

5. WORK SCHEDULE

The Study will be carried out in accordance with the tentative work schedule shown in Figure A1.

6. REPORTS

The Study Team will prepare and submit the following reports in English to the Government of Myanmar:

1)	Inception report	Twenty(20) copies
2)	Progress report 1	Twenty(20) copies
3)	Progress report 2	Twenty(20) copies

4) Interim report Thirty (30) copies

5) Draft final report Thirty (30) copies (main reports and summaries)

Ministry of Electric Power (hereinafter referred to as "MOEP") shall provide its comments on the draft final report within one (1) month after the submission of that report.

6) Presentation

The presentation of Draft final report shall be made to MOEP.

7) Final report Forth (40) copies (main reports and summaries)

The Study Team will submit these reports within six (6) weeks after receiving the comments of the Government of Myanmar on the draft final report.

During the field study in Myanmar, monthly meetings are held, and monthly reports are prepared and submitted to the meetings.

7. EXPERTISE REQUIREMENT

The following thirteen (13) experts and engineers will be required for executing the study:

(1) Team leader
(2) Rural community analyst
(3) New energy expert (PV power analyst)
(4) New energy expert (PV field engineer)
(5) New energy expert (Wind power)
(6) New energy expert (Biomass expert)
(7) New energy expert (Biomass generation system expert)
(8) New energy expert (Small/micro hydropower)
(9) Hydrologist
(10) Geologist
(11) Civil engineering expert
(12) Natural environmental expert
(13) Economic and financial analysis expert

8. RESPONSIBILITY OF THE GOVERNEMENT

(1) To facilitate smooth conduct of the Study, the Government of Myanmar shall take necessary measures;

1) To secure the safety of the Study Team,
2) To permit the members of the Study Team to enter, leave and sojourn in

Myanmar for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,

3) To exempt the members of the Study Team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into, and out of, Myanmar for the conduct of the Study,

4) To exempt the members of the Study Team from income taxes and charges of any kind imposed on, or in connection with, any emoluments or allowances paid to them for their services for the implementation of the Study,

5) To provide necessary facilities to the Study Team for remittance as well as utilization of the funds introduced into Myanmar from Japan in connection with the implementation of the Study,

6) To secure permission for entry into private properties or restricted areas for the implementation of the Study,

7) To secure permission for the Team to take all data and documents including maps and photographs related to the Study out of Myanmar to Japan,

8) To provide medical service as needed. Its expenses will be chargeable on members of the Study Team.

(2) The Government of Myanmar shall bear claims, if any arises, against members of the Study Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Study Team.

(3) MOEP shall act as counterpart agency to the Study Team and also as coordinating body in relation with the other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

(4) MOEP shall, at its own expense, provide the Team with the following, in cooperation with other organizations concerned;

(1) available data and information related to the Study,

(2) counterpart personnel,

(3) suitable office space with necessary equipment in Yangon,

(4) credentials or identification cards,

(5) necessary vehicles with drivers, fuel and maintenance services for carrying out the field survey.

Figure A1 Proposed Work Schedule for Study on Rural Electrificaation by Renewable Energy in Myanmar