10. 添付資料

10－1　ＮＥＡ　組織図

10－2　発電、送電、変電設備一覧

10－3　送電系統図

10－4　発電及び販売電力量

10－5　LAINCHOUR S/S 等の負荷状況

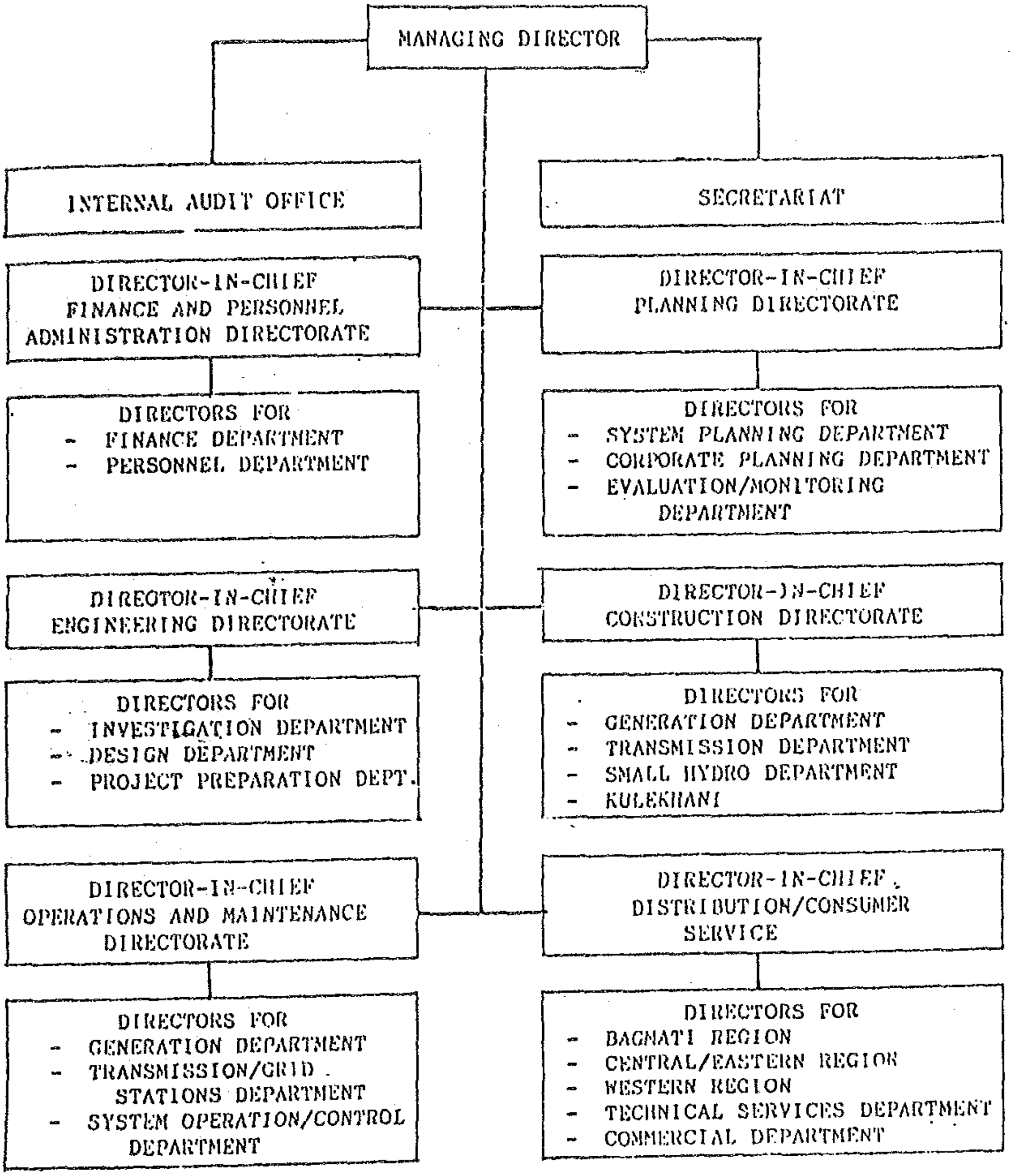
10－6　料金制度

10－7　世銀プロジェクト関係資料

10－8　要 請 書

10－1　ＮＥＡ組織図

NEPAL ELECTRICITY AUTHORITY ORGANIZATION CHART



10－2　発電、送電、変電設備一覧

EXISTING GENERATION PLANTS ON THE INTERCONNECTED SYSTEM

Name	Date in Service	Number of Units and Size MW	Installed Capacity MW	Firm Capacity MW	Firm Energy GWh/yr
Hydro Electric					
Trisuli	1962	7 x 3.0	21.0	18.0 1/	114.6
Sunkosi	1973	3 x 3.35	10.1	5.8 2/	56.7
Gandak	1979	3 x 5.0	15.0	9.4 3/	43.8
Kulekhani I	1982	2 x 30.0	60.0	60.0 1/	154.7
Devighat	1983	3 x 4.7	14.1	14.1 1/	89.7
Kulekhani II	1986	2 x 16.0	32.0	32.0 1/	95.0
Marsyangdi	1990	3 x 23	69.0	66.0 4/	312.0
Subtotal-Hydro			221.2	205.3	866.5
Misc. Small Hydro			6.0	6.0	23.2
Total Hydro - Interconnected System			227.21	211.3	889.7
Diesel: 5/					
Hetauda		4 x 2.5	10.0	10.0	21.9
Misc. Diesel			15.0	7.0	15.3
Subtotal-Diesel			25.0	17.0	37.2
TOTAL PLANT INSTALLED			252.3	228.3	926.9

1/ Kulekhani I and II share a common hydraulic system and can only be operated in "tandem" as (30 + 16) - 46 MW units. Similarly, unit outages at Trisuli require reductions at Devighat. The flow limitation at Trisuli applies during all months of the year, because it is designed to have only six units operating at any one time, resulting in some spillage of water.

2/ Seasonal variation in hydrology reduces firm capacity to 5.8 MW.

3/ Gandak system has no spillway resulting in that only a maximum of 2 units may be operated safely to avoid danger of flooding the power house.

4/ Dependable output in summer months is designed to be 66 MW, but in winter this may be increased to 69 MW.

5/ Diesel firm capacity reflects the operating state of existing units.

EXISTING POWER FACILITIES OUTSIDE INTEGRATED SYSTEM

Name	Type	Installed Capacity (MW)	Available Capacity (MW)	In-Service Date	Region
Dhankuta	Hydro	2x0.12 - 0.24	0.16	1973	Eastern
Surkhet	Hydro	3x0.12 - 0.36	0.12	1978	Mid & FW 1/
Banglung	Hydro	1x0.18 - 0.18	-	1981	Western
Phidim	Hydro	2x0.13 - 0.26	-	1981	Eastern
Jomsom	Hydro	2x0.13 - 0.26	-	1982	Western
Jumla	Hydro	2x0.10 - 0.20	-	1982	M & FW
Doti	Hydro	2x0.10 - 0.20	-	1982	M & FW
Gorkha	Hydro	2x0.03 - 0.06	-	1982	Eastern
Dhading	Hydro	1x0.03 - 0.03	-	1982	Central
Syangja	Hydro	2x0.04 - 0.08	-	1984	Western
Helambu	Hydro	1x0.05 - 0.05	-	1985	Central
Sub-total I		1.92			
Janakpur	Diesel	3units - 0.83	0.60	1961	Central
Bharatpur	Diesel	2x0.26 - 0.52	0.50	1961	Central
Bhairawa	Diesel	2x0.26 - 0.52	0.50	1961	Western
Illam	Diesel	2x0.10 - 0.20	0.16	61/73	Eastern
Bhadrapur	Diesel	1x0.34 - 0.34	0.24	1975	Eastern
Ghorahi	Diesel	2x0.05 - 0.10	0.10	56/82	M & FW
Tulsipur	Diesel	2units - 0.07	0.05	1956	M & FW
Nepalgunj	Diesel	2x0.26 - 0.52	0.50	1960	M & FW
Sub-total II			3.10	4.27	
TOTAL I & II			5.02		

1/ Mid and FW: Mid- and Far-Western Regions.

EXISTING GRID SUBSTATIONS (132 AND 66 KV)

Name	Voltage (kV)	Unit Capacity (MVA)	No. of Units	Total Capacity (MVA)	Region
Butwal	132/33	10.0	2	20.0	Western
Dumkibas	132/33	5.0	1	5.0	Western
Shivpur	132/33	5.0	1	5.0	Western
Lamahi	132/33	5.0	1	5.0	Western
Kohalpur	132/33	5.0	1	5.0	Western
Gandaki	(6.6/131)	(10.0)	2	(20.0)	Western
Bharatpur	132/11	10.0	1	10.0	Central
Pokhara	132/11	6.0	1	6.0	Western
Delkebar	132/33	10.0	1	10.0	Central
Biratnagar	132/11	15.0	2	30.0	Eastern
Hetauda	132/66	20.0	1	20.0	Central
	132/66	10.0	1	10.0	
	66/11	6.0	2	12.0	
Kulekhani IIA	(11/132)	(18.0)	2	(36.0)	Central
IIB	66/11	3.6	1	3.6	
Kulekhani	(11/66)	30.0	2 a/	(70.0)	
Siuchatar	132/66	40.0	1	40.0	Central
Baneswar	66/11	3.0	1	3.0	Central
Birgung	66/11	1.5	1	1.5	Central
	66/11	3.15	1	3.15	
Parwanipur	66/11	1.5	2	3.0	Central
	66/11	3.15	1	3.15	
Trishuli	(6.6/66)	(3.75)	2 a/	(7.5)	Central
Balaju I	66/11	3.75	2 a/	7.5	Central
Sunkosi	(6.6/66)	(5.6)	2	(11.2)	Central
Patan	66/11	6.0	2	12.0	Central
Siuchatar I	66/11	6.0	6	36.0	Central
N. Patan	66/11	6.0	2 a/	12.0	Central
Devighat	(6.6/66)	6.3	3	(18.9)	Central
N. Chabel	66/11	6.3	3	18.9	Central
Amlekjung	66/11	1.5	1	1.5	Central
Simra	66/11	1.5	1	1.5	Central
Lainchour	66/11	10.0	2	20.0	Central

TOTAL TRANSFORMER CAPACITY
(1) Grid Substations = 309.8
(2) Generator Step-up Substations = 163.6
473.4

Notes: (a) Bank of single phase transformers.
(b) Transformers at power station substations shown in parenthesis.

Source: NEA

EXISTING TRANSMISSION LINES IN NEPAL 1989 - INTERCONNECTED SYSTEM

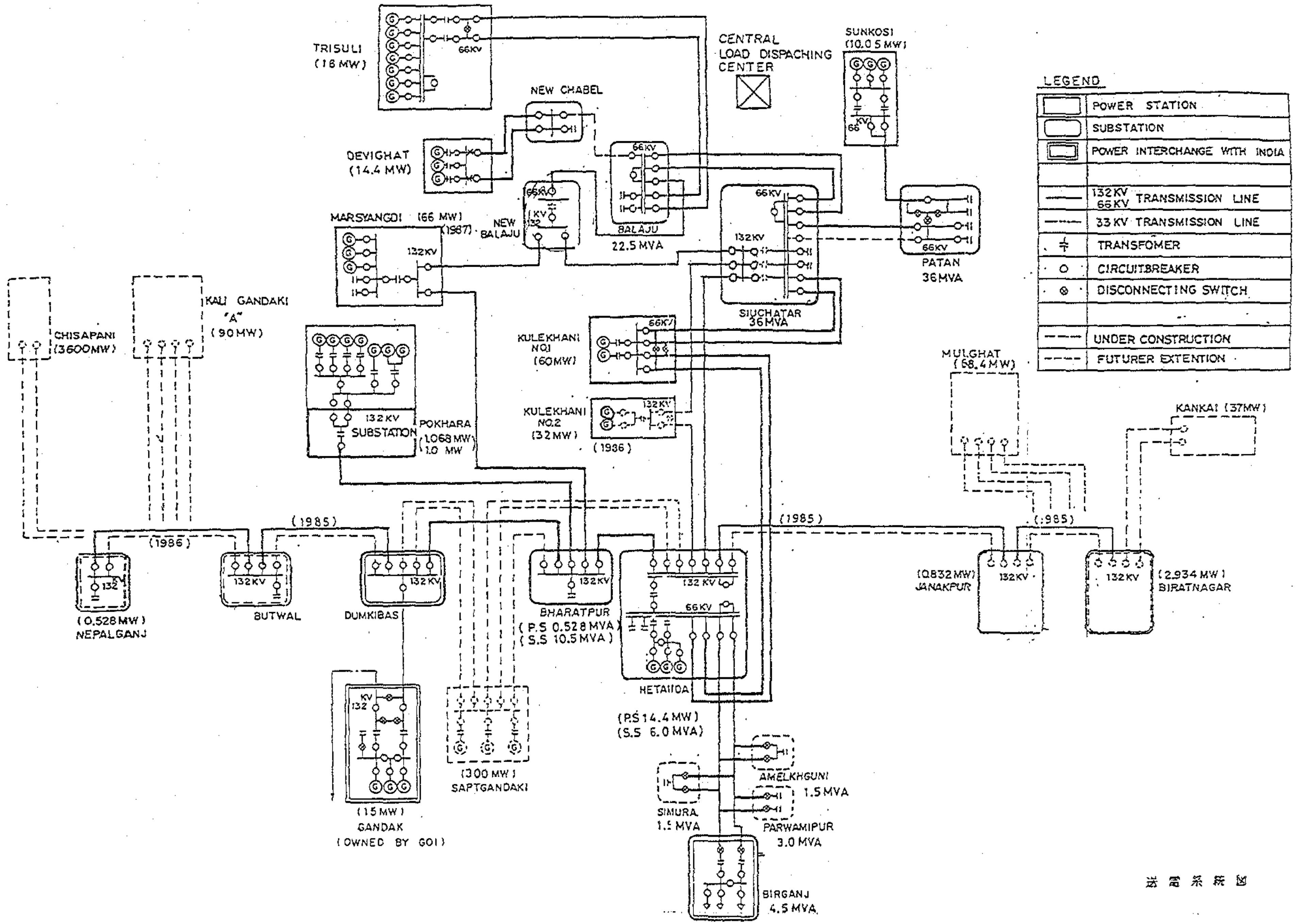
S. No.	From	To	Circuit	VOLTAGE (KV)	LENGTH (KM)	Conductor Type
	132 kV Lines					
1	Bharatpur	Pokhara	SC	132	95	Wolf
2	Bharatpur	Hetauda	SC	132	90	Panther
3	Bharatpur	Dumkibas	SC	132	52	Panther
4	Dumkibas	Butwal	SC#	132	45	Bear
5	Dumkibas	Gandak	SC	132	32	Panther
6	Hetauda	Kule-2	SC#	132	8	Bear
7	Hetauda	Janakpur	SC#	132	137	Bear
8	Janakpur	Biratnagar	SC#	132	146	Bear
9	Kule-2	Siuchatar	SC#	132	34	Bear
10	Butwal	Shivpur	SC#	132	61	Bear
11	Shivpur	Lamahi	SC#	132	51	Bear
12	Lamahi	Kohalpur	SC#	132	96	Bear
13	Marsyangdi	Balaju	SC	132	85	ACSR
14	Marsyangdi	Bharatpur	SC	132	25	ACSR
	66 kV Lines					
1	Trisuli	Balaju	DC	66	29	Wolf
2	Balaju	Siuchatar	DC	66	7	Wolf
3	Siuchatar	N. Patan	SC#	66	4	Wolf
4	Siuchatar	Kule-2	DC	66	29	Wolf
5	Kule-1	Hetauda	DC	66	16	160 **2
6	Hetauda	Amlekhgunj	DC	66	16	Wolf
7	Amlekhgunj	Simra	DC	66	10	Wolf
8	Simra	Parwanipur	DC	66	9	Wolf
9	Parwanipur	Birgunj	DC	66	9	Wolf
10	Sunkosi	Patan	SC	66	57	160 ** 2
11	Devighat	N. Chabel	DC	66	33	Wolf
12	Balaju	Lainchour	SC	66	1	
	11 kV Lines (Kathmandu Valley Ring)					
1	Balaju	Maharajgunj	SC	11	4.5	0.2 sq. in
2	Balaju	Chabel	SC	11	9	0.2 sq. in
3	Balaju	Lainchour	DC	11	1.2	0.2 sq. in
4	Balaju	Teku	DC	11	4	0.2 sq. in
5	Teku	Siuchatar	DC.	11	3	0.2 sq. in
6	Teku	N. Patan	DC	11	4.5	0.2 sq. in
7	N. Patan	Kat-2	DC	11	4.9	0.2 sq. in
8	Kat-2	R. Palace	SC	11	1	0.2 sq. in
9	Kat-2	Lainchour	SC	11	1.7	0.2 sq. in
10	Lainchour	R. Palace	SC	11	0.7	0.2 sq. in.
11	Maharajgunj	Chabel	SC	11	2.6	0.2 sq. in
12	Chabel	N. Chabel	DC	11	1	0.2 sq. in
13	N. Chabel	Shaktapur	DC	11	9.6	0.2 sq. in
14	Shaktapur	Thimi	DC	11	3.2	0.2 sq. in
15	Thimi	Patan	DC	11	7.9	0.2 sq. in
16	Patan	N. Patan	Cable	11	0.05	0.1 sq. in

Note : 1. Transmission Conductor Sizes
- Wolf 0.15 sq. in
- Panther 0.20 sq. in.
- Bear 0.25 sq. in

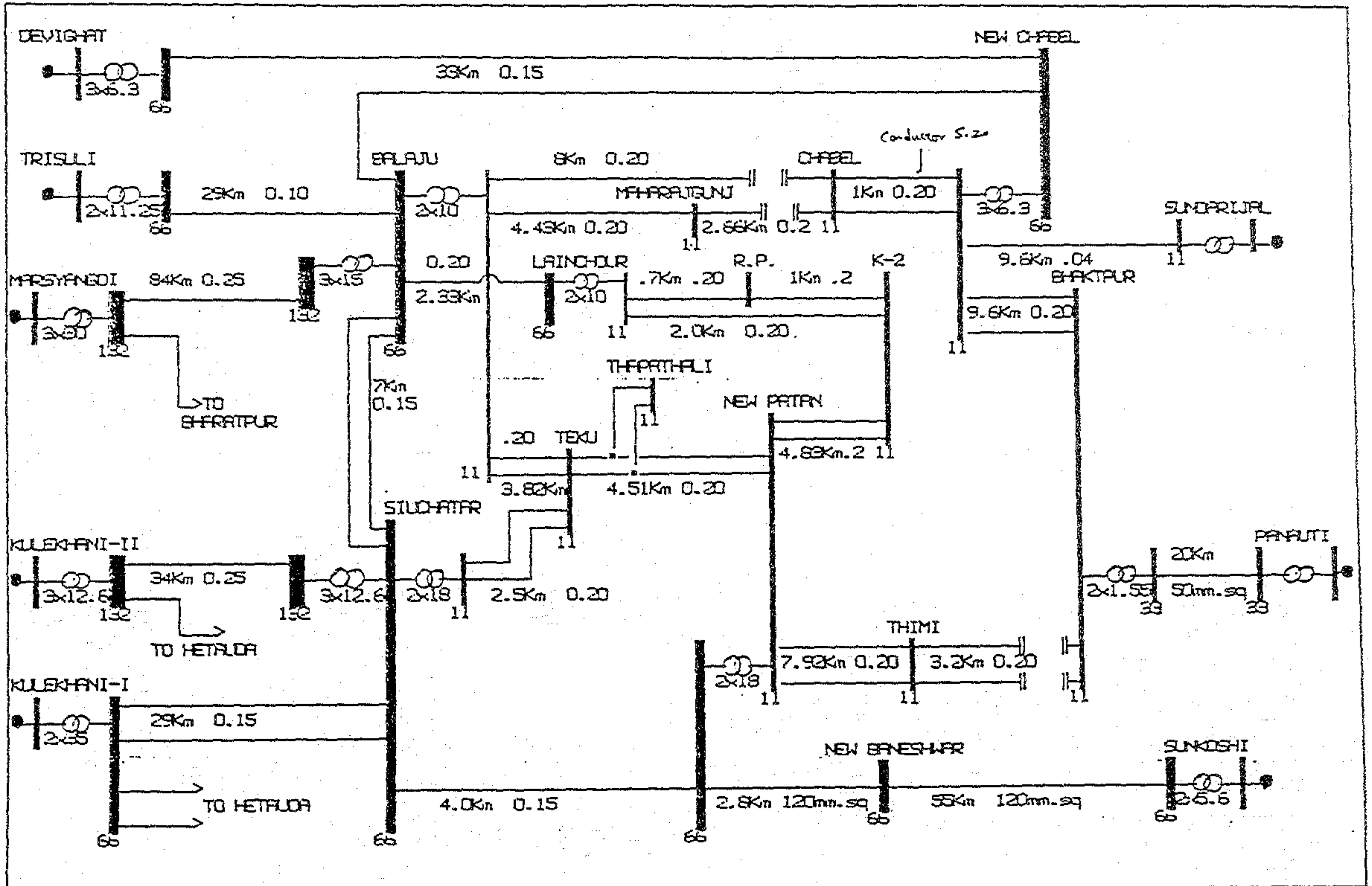
2. SC# Single circuit line on double circuit tower.

Source: NEA

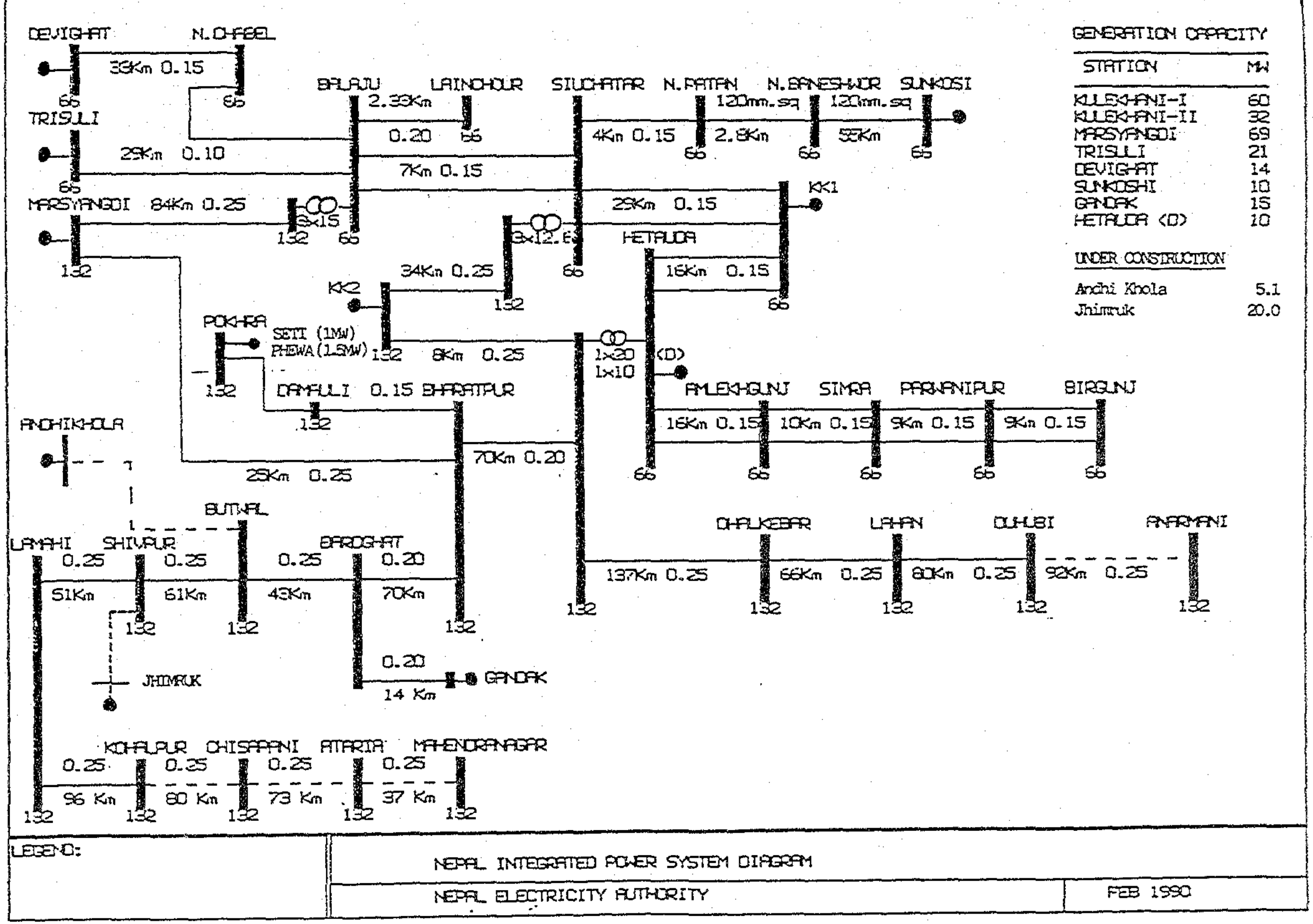
10－3　送電系統図


LEGEND
POWER STATION
SUBSTATION
POWER INTERCHANGE WITH INDIA
132 KV 66 KV TRANSMISSION LINE
33 KV TRANSMISSION LINE
TRANSFOMER
CIRCUITBREAKER
DISCONNECTING SWITCH
UNDER CONSTRUCTION
FUTURER EXTENTION
TRISULI (16 MW)
66KV
CENTRAL LOAD DISPACHING CENTER
SUNKOSI (10.05 MW)
NEW CHABEL
DEVIGHAT (14.4 MW)
66KV
BALAJU
22.5 MVA
NEW BALAJU
MARSYANGDI (66 MW) (1987)
132KV
66KV
SIUCHATAR 36 MVA
PATAN 36 MVA
KALI GANDAKI "A" (90 MW)
CHISAPANI (3600 MW)
POKHARA (1.068 MW) 1.0 MW
132 KV SUBSTATION
KULEKHANI NO.1 (60 MW)
KULEKHANI NO.2 (32 MW)
(1986)
MULGHAT (68.4 MW)
KANKAI (37 MW)
(1985)
(1986)
(0.528 MW) NEPALGANJ
BUTWAL
DUMKIBAS
BHARATPUR (P.S 0.528 MVA) (S.S 10.5 MVA)
HETAUDA
(P.S 14.4 MW) (S.S 6.0 MVA)
(0.832 MW) JANAKPUR
(2.934 MW) BIRATNAGAR
(15 MW) GANDAK (OWNED BY GOI)
(300 MW) SAPTGANDAKI
SIMURA 1.5 MVA
AMELKHGUNI 1.5 MVA
PARWAMIPUR 3.0 MVA
BIRGANJ 4.5 MVA

送電系統図



LEGEND:	KATHMANDU VALLEY POWER SYSTEM DIAGRAM AFTER BALAJU-NEW CHABEL 66kV CONNECTION	
	NEPAL ELECTRICITY AUTHORITY	15 JAN 1990



GENERATION CAPACITY

STATION	MW
KULEKHANI-I	60
KULEKHANI-II	32
MARSYANGDI	69
TRISULI	21
DEVIGHAT	14
SUNKOSHI	10
GANDAK	15
HETAUDA (D)	10

UNDER CONSTRUCTION

Andhi Khola	5.1
Jhimruk	20.0

10－4　発電及び販売電力量

Existing Electricity Supply System

(a) Generation

Nepal's interconnected power system has an installed generating capacity of 183 MW, of which 158 MW (86 per cent), is hydroelectric plant and 25 MW (14 per cent) is diesel plant. As 107 MW of the total hydro capacity was installed in the period 1981 to 1987, there has been a significant change in the mix of plant, with the hydro proportion increasing from 67 per cent in FY1980/1981 to 86 per cent in FY1987/88. The two main hydro projects commissioned were Kulekhani I (60 MW) in 1982 and Kulekhani II (32 MW) in 1986. Details of plant installed are given in Appendix 3 and supply statistics are given in the Attachment-4(1/2) All hydro plants are of the run-of-river type except for Kulekhani I, which has seasonal storage. Outside the interconnected power system NEA operates a number of small isolated hydroelectric plants with a total installed capacity of 1.92 MW and small diesel plants with a total installed capacity of 3.1 MW.

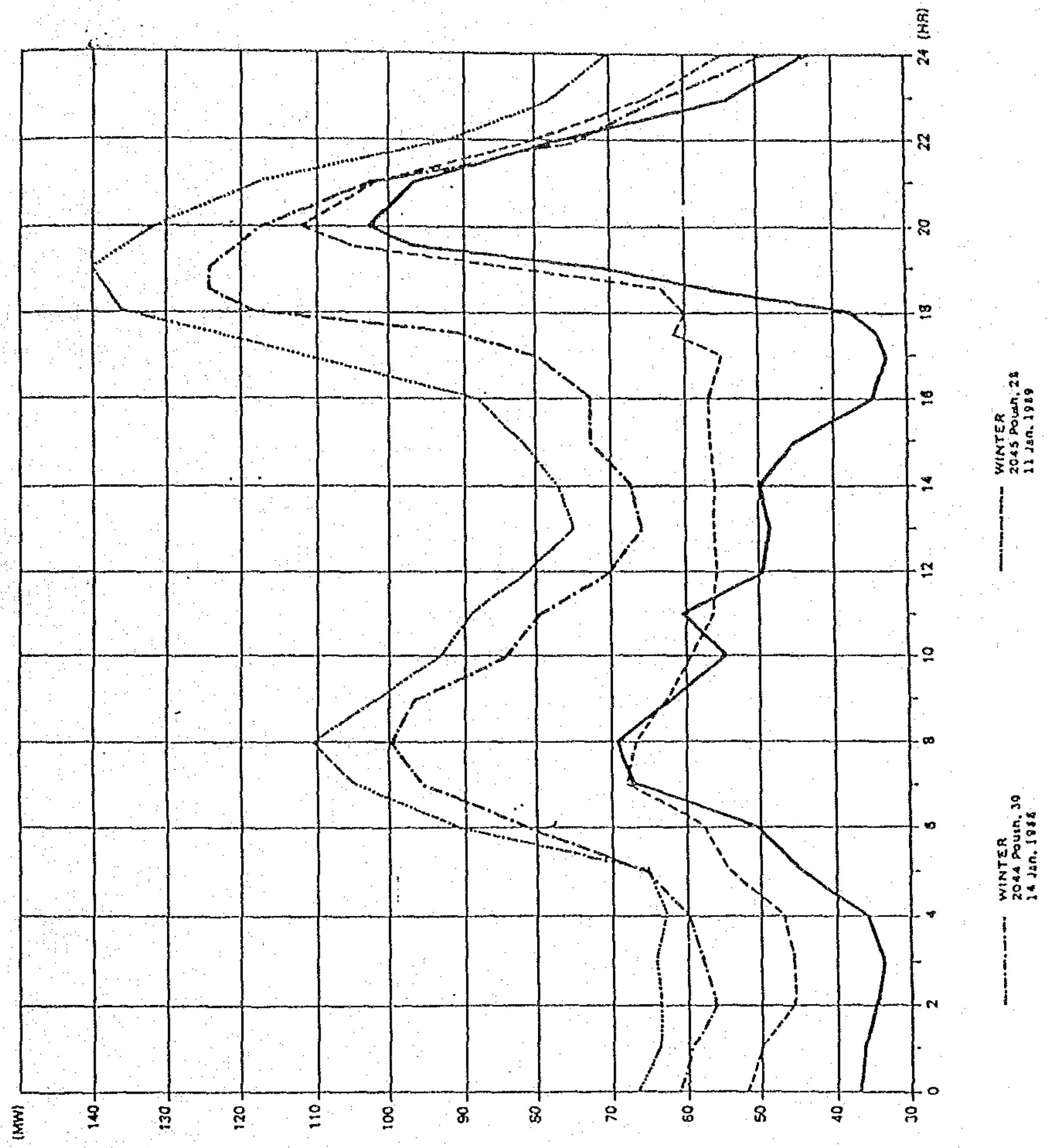
Attachment-4

NEPAL SUPPLY STATISTICS

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	Average Growt Rate (1980/81-1987/8
Maximum Demand MW	44.5	56.5	66	76	79.7	103	123.8	129.8	16.5
Installed (and available capacity) MW	76(50)	136(110)	136(110)	150(124)	150(124)	151(125)	183(162)	183(162)	
Of Which: Hydro	51(33)	111(93)	111(93)	125(107)	125(107)	126(108)	158(145)	158(145)	
Diesel	25(17)	25(17)	25(17)	25(17)	25(17)	25(17)	25(17)	25(17)	
Plant Margin									
Capacity MW, installed (and available)	32(5.5)	79(53.5)	70(54)	74(48)	57(31)	48(22)	59(38)	53(32)	
Plant Margin as % of installed (and available)	42(11)	58(48.6)	51(49)	49(39)	38(25)	29(14)	32(23)	29(20)	
Generation GWh									
Hydro	176	208	286	314	335	421	537	563	
Diesel	14	9	5	3	4	4	1	1	
Imports from India	45	57	63	66	82	52	33	65	
Total Energy Supplied	235	274	354	383	421	477	571	629	15.1
Sales GWh									
To Nepal	163	184	231	246	288	320	389	443	15.6
To India	4	7	9	10	11	21	21	16	21.9
Total Sales	167	191	240	256	299	341	410	459	15.8
Losses GWh	69	83	114	127	122	136	161	170	
% Losses	29.4	30.2	32.2	33.1	29.0	28.5	28.2	27.0	

Notes: Firm plant capacity is given in parenthesis.
Losses include NEA's self consumption.

DAILY LOAD CURVES FOR NEA



10－5　LAINCHOUR S/S 等の負荷状況

LAINCHOUR S/S (2x10 MVA)

VOLTAGE LEVEL : 66 KV

17th PAUSH 2046 — January 01, 1990

TIME	CURRENT in Amp TR.61	TR.62	TOTAL	MVA
17.00	51	51	102	11.66
17.30	70	70	140	16.00
18.00	83	83	166	18.98
18.30	85	85	170	19.43
19.00	84	84	168	19.20
19.30	78	78	~~156~~	~~17.83~~
20.00	72	72	144	16.46
20.30	62	62	124	14.18
21.00	59	59	118	13.49
21.30	56	56	112	12.80
22.00	45	45	90	10.29

18th PAUSH 2046 — January 02, 1990

TIME	CURRENT in Amp TR.61	TR.62	TOTAL	MVA
17.00	53	53	106	12.12
17.30	68	68	136	15.55
18.00	80	80	160	18.29
18.30	82	82	164	18.75
19.00	80	80	160	18.29
19.30	77	77	154	17.60
20.00	70	70	140	16.00
20.30	65	65	130	14.86
21.00	61	61	122	13.95
21.30	55	55	110	12.57
22.00	48	48	96	10.97

19th PAUSH 2046 — January 03, 1990

TIME	CURRENT in Amp TR.61	TR.62	TOTAL	MVA
17.00	50	50	100	11.43
17.30	65	65	130	14.86
18.00	80	80	160	18.29
18.30	83	83	166	18.98
19.00	80	80	160	18.29
19.30	77	77	154	17.60
20.00	70	70	140	16.00
20.30	66	66	132	15.09
21.00	62	62	124	14.18
21.30	59	59	118	13.49
22.00	52	52	104	11.89

20th PAUSH 2046 — January 04, 1990

TIME	CURRENT in Amp TR.61	TR.62	TOTAL	MVA
17.00	56	56	112	12.80
17.30	64	64	128	14.63
18.00	78	78	156	17.83
18.30	80	80	160	18.29
19.00	78	78	156	17.83
19.30	72	72	144	16.46
20.00	69	69	138	15.78
20.30	64	64	128	14.63
21.00	60	60	120	13.72
21.30	55	55	110	12.57
22.00	46	46	92	10.52

21st PAUSH 2046 — January 05, 1990

TIME	CURRENT in Amp TR.61	TR.62	TOTAL	MVA
17.00	48	48	96	10.97
17.30	62	62	124	14.18
18.00	81	81	162	18.52
18.30	87	87	174	19.89
19.00	85	85	170	19.43
19.30	80	80	160	18.29
20.00	75	75	150	17.15
20.30	62	62	124	14.18
21.00	57	57	114	13.03
21.30	53	53	106	12.12
22.00	42	42	84	9.60

22nd PAUSH 2046 — January 06, 1990

TIME	CURRENT in Amp TR.61	TR.62	TOTAL	MVA
17.00	35	35	70	8.00
17.30	50	50	100	11.43
18.00	65	65	130	14.86
18.30	68	68	136	15.55
19.00	67	67	134	15.32
19.30	64	64	128	14.63
20.00	60	60	120	13.72
20.30	54	54	108	12.35
21.00	57	57	114	13.03
21.30	53	53	106	12.12
22.00	47	47	94	10.75

23rd PAUSH 2046 January 07, 1990

TIME	CURRENT in Amp			MVA
	TR.61	TR.62	TOTAL	
17.00	51	51	102	11.66
17.30	62	62	124	14.18
18.00	76	76	152	17.38
18.30	76	76	152	17.38
19.00	76	76	152	17.38
19.30	72	72	144	16.46
20.00	70	70	140	16.00
20.30	64	64	128	14.63
21.00	60	60	120	13.72
21.30	54	54	108	12.35
22.00	48	48	96	10.97

BANESHOR S/S (1x18 MVA)

VOLTAGE LEVEL : 66 KV   17th PAUSH 2046   January 01, 1990

TIME	SUNKOSI	PATAN	TOTAL	MVA
	CURRENT in Amp			
17.00	30	48	78	8.92
17.30	28	72	100	11.43
18.00	40	80	120	13.72
18.30	45	75	120	13.72
19.00	40	70	110	12.57
19.30	40	65	105	12.00
20.00	40	55	95	10.86
20.30	32	45	77	8.80
21.00	30	50	80	9.15
21.30	25	48	73	8.35
22.00	22	40	62	7.09

18th PAUSH 2046   January 02, 1990

TIME	SUNKOSI	PATAN	TOTAL	MVA
	CURRENT in Amp			
17.00	30	48	78	8.92
17.30	30	72	102	11.66
18.00	30	92	122	13.95
18.30	42	78	120	13.72
19.00	40	75	115	13.15
19.30	38	70	108	12.35
20.00	32	68	100	11.43
20.30	32	58	90	10.29
21.00	30	50	80	9.15
21.30	30	42	72	8.23
22.00	30	30	60	6.86

19th PAUSH 2046   January 03, 1990

TIME	SUNKOSI	PATAN	TOTAL	MVA
	CURRENT in Amp			
17.00	50	20	70	8.00
17.30	45	50	95	10.86
18.00	40	75	115	13.15
18.30	40	80	120	13.72
19.00	32	80	112	12.80
19.30	32	70	102	11.66
20.00	25	68	93	10.63
20.30	25	65	90	10.29
21.00	28	52	80	9.15
21.30	30	45	75	8.57
22.00	25	42	67	7.66

20th PAUSH 2046 — January '04, 1990

	CURRENT in Amp			
TIME	SUNKOSI	PATAN	TOTAL	MVA
17.00	30	45	75	8.57
17.30	28	70	98	11.20
18.00	40	80	120	13.72
18.30	32	90	122	13.95
19.00	38	75	113	12.92
19.30	38	72	110	12.57
20.00	35	68	103	11.77
20.30	35	52	87	9.95
21.00	32	50	82	9.37
21.30	30	50	80	9.15
22.00	30	35	65	7.43

21st PAUSH 2046 — January 05, 1990

	CURRENT in Amp			
TIME	SUNKOSI	PATAN	TOTAL	MVA
17.00	20	50	70	8.00
17.30	22	70	92	10.52
18.00	30	88	118	13.49
18.30	38	82	120	13.72
19.00	40	75	115	13.15
19.30	46	60	106	12.12
20.00	40	58	98	11.20
20.30	40	50	90	10.29
21.00	35	45	80	9.15
21.30	32	38	70	8.00
22.00	28	20	48	5.49

22nd PAUSH 2046 — January 06, 1990

	CURRENT in Amp			
TIME	SUNKOSI	PATAN	TOTAL	MVA
17.00	27	35	62	7.09
17.30	30	60	90	10.29
18.00	25	90	115	13.15
18.30	40	80	120	13.72
19.00	40	75	115	13.15
19.30	35	65	100	11.43
20.00	35	55	90	10.29
20.30	40	45	85	9.72
21.00	30	50	80	9.15
21.30	32	45	77	8.80
22.00	32	30	62	7.09

	CURRENT in Amp			
TIME	SUNKOSI	PATAN	TOTAL	MVA
17.00	30	45	75	8.57
17.30	32	60	92	10.52
18.00	40	82	122	13.95
18.30	40	85	125	14.29
19.00	40	75	115	13.15
19.30	40	70	110	12.57
20.00	40	65	105	12.00
20.30	40	45	85	9.72
21.00	40	45	85	9.72
21.30	28	45	73	8.35
22.00	28	35	63	7.20

NEW-CHABEL S/S (3x6 MVA)

VOLTAGE LEVEL : 66 KV

8th FALGUN 2046 February 19, 1

TIME	CURRENT in Amp TR.1	TR.2	TR.3	TOTAL	MVA	REMARKS
17.00	19	23	24	66	7.54	After 66 KV
18.00	39	40	40	119	13.60	Connection
19.00	57	55	56	168	19.20	at Raniban
20.00	46	40	52	138	15.78	
21.00	36	34	34	104	11.89	
22.00	30	39	29	98	11.20	

9th FALGUN 2046 February 20, 1

TIME	CURRENT in Amp TR.1	TR.2	TR.3	TOTAL	MVA	REMARKS
17.00	46	44	45	135	15.43	After 66 KV
18.00	40	41	42	123	14.06	Connection
19.00	52	52	52	156	17.83	at Raniban
20.00	48	50	48	146	16.69	
21.00	35	36	36	107	12.23	
22.00	26	25	28	79	9.03	

10th FALGUN 2046 February 21, 1

TIME	CURRENT in Amp TR.1	TR.2	TR.3	TOTAL	MVA	REMARKS
17.00	26	27	28	81	9.26	After 66 KV
18.00	43	43	43	129	14.75	Connection
19.00	56	58	59	173	~~19.78~~	at Raniban
20.00	53	55	67	175	20.01	
21.00	32	32	36	100	11.43	
22.00	32	27	27	86	9.83	

11th FALGUN 2046 **February 22, 1990**

TIME	CURRENT in Amp TR.1	TR.2	TR.3	TOTAL	MVA	REMARKS
17.00	30	30	30	90	10.29	After 66 KV
18.00	47	47	47	141	16.12	Connection
19.00	62	62	62	186	21.26	at Raniban
20.00	51	51	51	153	17.49	
21.00	43	43	43	129	14.75	
22.00	33	34	34	101	11.55	

12th FALGUN 2046 **February 23, 1990**

TIME	CURRENT in Amp TR.1	TR.2	TR.3	TOTAL	MVA	REMARKS
17.00	27	28	29	84	9.60	After 66 KV
18.00	49	48	49	146	16.69	Connection
19.00	56	55	56	167	19.09	at Raniban
20.00	50	51	51	152	17.38	
21.00	43	42	42	127	14.52	
22.00	30	31	31	92	10.52	

10－6　料　金　制　度

Tariffs

The NEA is authorized by its Act to recommend electricity tariffs for Government approval. Within NEA, the Director, Corporate Planning has been responsible for preparing recommendations on tariffs in close consultation with staff in Systems Planning, Distribution and Consumer Services and Finance and Administration. When the new Commercial Department is fully operational, the Commercial Director will be responsible for tariffs. After approval of tariff proposals by NEA's Board, they are submitted to the Ministry of Water Resources, where they proceed to the Ministry of Finance, the Cabinet and finally, His Majesty the King.

Since 1980, there have been three major tariff increases: 45 per cent in 1983, 44 per cent in 1985, and 18 per cent in 1988. These increases were also accompanied by significant changes in the tariff structure. The present tariff effected in May 1988 corrected some of the deficiencies found in the previous tariff structure following extensive discussions. The present tariff structure comprises ten consumer categories and the rates within each of the main consumer categories are consistent with the supply voltage level. The largest category in terms of numbers of consumers and sales is the domestic category. This category accounts for about 40 per cent of consumption and incorporates a lifeline rate for consumers whose consumption is below 25 kWh per month, followed by three consumption blocks with increasing rates. By incorporating a minimum charge related to the ampere rating of the consumer's meter in the domestic tariff, the benefit of the lifeline rate is confined to the poorest group of consumers. For industrial, commercial, water supply, irrigation, noncommercial, and transportation consumers, the tariff includes a demand charge in addition to the energy charge. The present tariff rates are about 60 per cent of the long-run marginal cost of supply.

PAST AND PRESENT NEA TARIFFS

(Monthly Rates)

		Effective 02.11.80	Effective 01.11.83	Effective 08.11.83	Effective 01.11.85	Effective 03.11.85	Effective 05.11.88: Meter	Meter Rent	Minimum Charge: kWh Allowance	Minimum Charge: Charge Rs	Minimum Charge: Average Charge
DOMESTIC							2.5A	2	0 - 25	9	0.53
							15 A	5	0 - 25	30	1.2
							30 A	10	0 - 60	60	1.2
							60 A	10	0 - 90	90	1.2
							100 A	10	0 - 100	122.5	1.22
	Minimum charge, upto 25 kWh: Rs	6.25	12.00	11.00	11.00	11.00					
	From 25 kWh to 100 kWh: Rs/kWh	0.60	0.70	0.66	0.90	1.10			25 - 75		1.2
	From 100 kWh to 300 kWh: Rs/kWh	0.55	0.80	0.80	0.90	1.10			75 - 300		1.3
	Over 300 kWh: Rs/kWh	0.70	0.90	0.90	1.10	1.10			over 300		1.6
	Meter Rent: Rs				2.00	2.00					
INDUSTRIAL											
Rural/Cottage	maximum power:								12		
	Fixed charge :								20		
	Energy charge: Rs/kWh								1.2		
Small:	maximum power: kW	100	60	550	80	80			50		
(From 05.11.88 400/220V Supply)	Voltage level: volt				400	400			400/220		
	Demand charge: Rs/kW	12.00	20.00	18.00	20.50	25.00			35		
	Energy rates : Rs/kWh	0.36	0.55	0.55	0.75	0.90			1.15		
Medium: (From 05.11.88 11 kV Supply)	maximum power: kW		500	500	5,000	5,000			-		
	Voltage level: kV				11.00	11.00			11		
	Demand charge: Rs/kW	30.00	45.00	45.00	61.25	75.00			71		
	Energy rates : Rs/kWh	0.30	0.52	0.52	0.70	0.85			1.1		
(A) Supply at 33 kV	Demand charge: Rs/kW	-	-	-	-	-			65		
	Energy rates : Rs/kWh	-	-	-	-	-			1.1		
Large:	maximum power: kW		>500	>600	>5000	>5000			-		
	Voltage level: kV				>=66	>=66			66 kV		
	Demand charge: Rs/kVA	30.00	50.00	50.00	51.25	62.50			60		
	Energy rates : Rs/kWh	0.30	0.50	0.50					0.95		
	kWh corresponding to LF<0.50: Rs/kWh				0.57	0.70					
	kWh corresp. 0.60 < LF <0.70: Rs/kWh				0.53	0.65					
	kWh corresponding to LF>0.70: Rs/kWh				0.50	0.60					
Supply at 132 kV	Demand charge: Rs/kW	-	-	-	-	-			50		
	Energy rates : Rs/kWh	-	-	-	-	-			0.85		
COMMERCIAL											
a) Supply at 400/220V	Demand charge: Rs/kW	-	-	-	-	-			108		
	Energy rates : Rs/kWh	-	-	-	-	-			1.6		
b) From 05.11.88, supply at 11 kV and above, previously all starred hotels:	Demand charge: Rs/kVA	30.00	50.00	50.00	67.50	82.50			100		
	Energy rates : Rs/kWh	0.61	0.70	0.70	0.95	1.25			1.5		
c) Others:	Demand charge: Rs/kVA	30.00	40.00	40.00	54.00	66.00			80 (for supplies below 25 kW		
	Energy rates : Rs/kWh	0.61	0.66	0.66	0.90	1.10			1.65		

PAST AND PRESENT NEA TARIFFS

(Monthly Rates)

		Effective 02.11.80	Effective 04.11.83	Effective 08.12.83	Effective 04.11.85	Effective 09.12.85	Effective 05.11.88
NON-COMMERCIAL (per month)							
Minimum charge, upto 25 kWh:	Rs		41.00	41.00	61.00	75.00	100.00
Energy rates, above 50 kWh :	Rs/kWh		0.85	0.85	1.20	1.50	1.30
Large:							
Voltage level:	volt		11,000	11,000	11,000	11,000	-
Or minimum power:	kW				10.00	10.00	-
Demand charge:	Rs/kW	25.00	40.00	40.00	54.00	66.00	-
Energy rates :	Rs/kWh	0.25	0.35	0.35	0.50	0.60	-
IRRIGATION CATEGORY							
(a) Small: (10 kVA and 400/220 Volt Supply)							
Fixed charge :	Rs/kW						20.00
Energy charge:	Rs/kWh						0.80
(b) According to Supply Voltage							
(1) At 400 Volt (Above 10 up to 25 kVA)							
Demand charge:	Rs/kW						45.00
Energy charge:	Rs/kWh						0.80
(2) at 11 kV							
Demand charge:	Rs/kW						40.00
Energy charge:	Rs/kWh						0.70
(3) at 33 kV							
Demand charge:	Rs/kW						33.00
Energy charge:	Rs/kWh						0.65
WATER SUPPLY							
(a) at 400 Volt							
Demand charge:	Rs/kW						57.00
Energy charge:	Rs/kWh						0.70
(b) at 11 kV and above							
Demand charge:	Rs/kW						50.00
Energy charge:	Rs/kWh						0.65
TRANSPORTATION							
Demand charge:	Rs/kVA	25.00	40.00	40.00	54.00	66.00	66.00
Energy rates :	Rs/kWh	0.30	0.40	0.40	0.55	0.65	0.65
TEMPLE							
Fixed Charge :	Rs						10.00
Energy Charge above 25 kWh :	Rs/kWh						1.10
STREET LIGHTS CATEGORY							
(a) Supply through meter							
Energy rates :	Rs/kWh						1.25
(b) Supply without meter							
Energy rates :	Rs						0.5 per watt
TEMPORARY SUPPLY							
(a) Metered							
Energy rates :	Rs/kWh	1.00	1.60	1.60	2.06	2.65	3.10
(b) Unmetered							
Energy rates :	Rs/kWh	0.45	0.72	0.72	1.00	1.20	1.75
EXPORT TO INDIA							
Energy rates :	IRs/kWh	0.14	0.14	0.14	0.14	0.14	0.60
(*) :	Rs/kWh	0.24	0.24	0.24	0.24	0.24	1.01

(*) On the basis of IRs 1.00 = Rs 1.68.
Source: NEA forecast study, draft report.

3. Interest Rate

Relending Rate	:	10.25%/year
Gracing Period	:	5 years
Repayment Period	:	20 years including 5 years of Gracing Period

5. Import Duties

- Customs Duties & Import Licence Fee will be imposed 1% each on C.I.F. value.

- Local Taxes

  It may be imposed by panchayats.

4. Price Escalation

Current World Bank price escalation rates (adjusted for Nepal's fiscal year) are used: the exchange rate for the Rs. is assumed to depreciate at a rate equal to the difference between the international and domestic price escalation rates. The exchange rate for FY1989/90 is US$ = Rs. 27.0 as of 15 May 1989.

Fiscal Year	Escalation (%) Foreign	Local	Exchange Rate US$1 = Rs.
1988/90 (handwritten: 89)	5.3	9.5	25.2
1989/90	5.3	8.7	27.0
1990/91	5.0	8.0	27.9
1991/92	4.1	8.0	28.8
1992/93	4.1	8.0	30.0
1993/94	4.1	8.0	31.2
1994/95	4.1	8.0	32.4
1995/96	4.0	8.0	33.7
1996/97	4.1	8.0	35.0

10－7　世銀プロジェクト関係資料

NEPAL ELECTRICITY AUTHORITY

Indicative Terms of Reference for Developing a Ten-Year Transmission and Distribution Plan

Background

1. The Nepal Electricity Authority (NEA) has identified a set of priority investments in transmission and distribution (T & D) in conjunction with the preparation of a corporate investment plan for the period 1986/87-1995/96. However, although the approach was generally satisfactory for determining a time-slice of NEA's T & D investment program, it was not sufficient for detailed project justification work nor for minimizing system losses.

Objectives

2. The objectives of the study are:

   (i) develop planning criteria and design standards for transmission and distribution systems in Nepal;

   (ii) determine the least cost T & D expansion plan for the Nepal interconnected system to meet the anticipated load growth for the period 1987/88-1996/97; and

   (iii) design a system control and communication system consonant with the increasing complexity of the Nepal interconnected system.

Scope

3. The scope of this study includes:

   (a) reviewing with NEA existing planning reliability standards in generation, transmission and distribution in the Nepal interconnected system and, where appropriate, developing modifications in these standards in the context of optimizing system losses, frequency fluctuations, reactive power requirements and loss of load probability. Special emphasis should be put on developing distribution, design and equipment standards that are appropriate for Nepal;

(b) reviewing the development of the power market for the period 1982-87 in terms of the pattern and trend of monthly peak (kW) and energy (kWh) demands by region and any unsatisfied demand, peak and/or energy because of overloaded transmission facilities should be estimated;

(c) reviewing/updating the existing data base concerning the "base" case load forecast, (disaggregated by area, including imports/exports from India in addition to the planned exports from the Arun-3 project), the existing and committed and planned extensions to the generation, transmission and distribution system. A review/update should also be made of the possible impact of the existing/planned system loss reduction program;

(d) developing the medium-term transmission/distribution expansion plan to optimize system losses and extend the service to new consumers at least cost that is consistent with the recent least cost generation expansion plan. Alternatives of configuration and/or voltages should be considered to identify the most beneficial configurations. The plan would identify the priority investments, their cost (in local currency and foreign exchange) and their sequence of implementation. In particular, the study should indicate the most economical substation layout, conductor size (including use of bundled conductors if required) and the requirements and location of reactor compensation. In conjunction with this exercise, the consultants should undertake computer-based network analysis (including load flow stability, and short-circuit analysis) to determine the level of the next high voltage transmission (the present highest voltage is 132 kV) and to ensure that the resulting solution is technically acceptable. All inputs (capital and operation and management costs) should be costed in economic terms using border prices plus appropriate shadow pricing for local cost components. At a minimum, the capital costs should be distributed by transmission/distribution lines and substations and separated by civil works, equipment supply, transport and erection, engineering, administration and physical contingencies.

(e) the robustness of the optimum solution should be tested by conducting sensitivity analysis fc changes in the load forecast, the opportunity cost of capital, the in estment;

(f) reviewing the current system lc d dispatch center facilities and determining, under a phased prc ram; (i) the medium- and long-term requirements in supervisi g control and data acquisition facilities (SCADA) to include al power stations and 220/132 kV, where appropriate, substations; nd (ii) reliable communication facilities with relevant Indian Load Dispatch Centers, where appropriate. Cost estimates for ese facilities should be prepared to the level of detail discussed in);

(g) identifying the manpower and/ training requirements for the preparation, implementation, operation, maintenance and management of the facilities; and

(h) identifying the sources of fina ing for the local and foreign exchange components of the T & investment program.

4. It is anticipated that the preparation f the ten-year transmission and distribution plan will require about 0 staff months spread over approximately 18 calendar months.

Other

5. The study should be coordinated wit the ongoing studies on power evacuation from the Arun-3 Project an the ten-year plan for rural electrification.

6. A special feature of this study will be to explore the T & D requirements of exporting secondary energy to India, especially during off-peak hours and during the monsoon season.

7. The consultant will be required to make a presentation during various phases of the work and get the general consensus of the senior managers of the NEA.

Schedule of Deliverables	Month
Inception Report	3
Disaggregated Load Forecast (Draft)	8
Disaggregated Load Forecast (Final)	9
Medium-Term Transmission Expansion Plan (Draft)	14
Medium-Term Transmission Expansion Plan (Final)	15
Medium-Term Distribution Expansion Plan (Draft)	16
Medium-Term Distribution Expansion Plan (Final)	17
Review of SCADA and Communication Needs (Draft)	17
Review of SCADA and Communication Needs	18

301SHPLA

SHORT TERM TRANSMISSION NETWORK REINFORCEMENT PLAN

Power Sector Efficiency Project

This note presents a plan for network reinforcement. This plan is to be launched immediately and carried out during the next 3 coming years in order to secure NEA needs until the year 1995.

1 INTRODUCTION

After the commissioning of MARSYANGDI power station, the generation means are satisfactory but the transportation and distribution equipment is in many places overloaded. During the winter 1989/1990 the conditions of distribution have been very critical. Most of the equipments were utilized very closed to their limit and even frequently overloaded. In some places, unwarranted load shedding was unavoidable. In most of the places the lack of operation margin shrinked the capacity to face the consequences of technical incident even of minor magnitude. The quality of service was severely affected.

The proposed reinforcements have a two fold objective:

- the first and basic objective is to maintain the minimum capacity necessary to meet the increasing demand of all the customers of the utility.

- the second objective is to restore a better quality of service and for that purpose to increase the operation margin and the guarantee of supply.

The reinforcements are classified in three categories:

- H.V./11kV transformation capacity.
- Kathmandu Valley transmission equipment at 66 and 132kV.
- Transmission facilities outside Kathmandu Valley.

The proposed reinforcements are geared as primary steps towards the target network under preparation within the framework of the TYTDP project.

1 AUGMENTATION OF H.V./11 kV TRANSFORMATION CAPACITY

The H.V. transformation may be augmented in two manners:

- -replacing transformers by bigger ones in existing source substation.
- -erecting new substations.

Only replacement of transformers by bigger ones is considered in the présent section, creation of new substation will be discussed latterly with transmission equipment.

The transformation capacity is already fully utilized in the three following substations:

- -in LAINCHOUR at 102 %
- -in NEW CHABEL at 97 %
- -in NEW BANESWAR at 98 %

The transformation capacity in these 3 substations have to be immediately augmented. The plan proposes:

- -in LAINCHOUR to replace the 2 x 10 MVA by 2 x 18 MVA.
- -in NEW CHABEL to replace the 3 x 6 MVA by 2 x 18 MVA.
- -in BANESWAR to add a second 18 MVA.

2 KATHMANDU VALLEY TRANSMISSION REINFORCEMENT

The transmission reinforcement schemes are considered in the present order:

- new source substations and related equipment.
- lines reinforcements.
- H.V. transformation reinforcement.

2.1 New source substations

Two new source substations are proposed: one in the vicinity of BAKTAPUR and one in the site of TEKU. The detailed technical and economical justifications of these creations are developed in an intermediate report untitled "Kathmandu Valley Distribution Study" of the TYTDP project. The basic rationale is the following:

BAKTAPUR SUBSTATION

The main justification of this substation is the increase of the local load and the voltage drop due to the distance from the nearest existing sources. The voltage drop can not be avoided if the supply of BAKTAPUR is not secured by a H.V. link.

The new substation is to be build in the vicinity of BAKATAPUR. The SUNKOSI - NEW BANESWAR line will be interrupted and connected to this new substation. In addition a new line is to be built to connect the new substation to NEW CHABEL substation.

It is not yet known what should be the best design for this line in the future. The target network is not yet decided. Between NEW CHABEL and BAKTAPUR two solutions are foreseen in the long term: a double circuit 66 kV line or a single circuit 132 kV line. Presently the 132 kV scheme seems the most probable. Two designs are acceptable for the line:

- Line designed for 132 kV but operated at 66 kV in a first stage
- Line with convertible towers.

The towers are adaptable and designed for both possible use: one circuit at 132 kV or 2 circuits at 66 kV. I the first stage, one 66 kV circuit only will be strung in a second stage it will be replaced by a 132 kV or a second 66 kV circuit according to the plan.

The second solution will be preferred if not more expensive than the first one.

In NEW CHABEL the new line for BAKTAPUR will be connected on the circuit breaker being made free when replacing the 3 transformers by 2 bigger ones.

TEKU SUBSTATION

For TEKU, it is mainly a question of load. The increase of the load of Kathmandu center requires increased injections of power. These injections should be as close as possible to the center of the town but bringing power in the very center is not possible with an overhead line. TEKU is one of the places where it is possible to bring a 66 kV overhead line.

The substation will be an indoor compact substation. This technique has to be chosen because of the urban environment.

The energy will be supplied from SIUCHATAR with a 66 kV overhead line. One circuit will be sufficient for the beginning but a second circuit will be necessary latter on. The line must be built with provision for a second circuit. Due to urban environment, the line has to be built with aesthetic consideration: single foot tower or pole will be required.

2.2 Line reinforcements

2.2.1 SIUCHATAR - PATAN second circuit

The stringing of the second circuit was planned when the first was established. The tower are erected for two circuits. This new circuit will help to release the constraint on the first circuit already almost at full load during peak time.

2.2.2 Closing the loop MARSYANGDI-BHARATPUR-HETAUDA-SIUCHATAR

To avoid the permanent risk of cascade tripping by overload in case of the loss of the line BHARATPUR - MARSYANGDI it is necessary to close the 132 kV loop between BALAJU and SIUCHATAR. This will require too move the existing 132 kV GIS switchgear of BALAJU which, unfortunately, does not offer any provision for extension. The new layout of BALAJU substation must take into account provision for extensions of the two switchyards 132 kV and 66 kV as well.

2.3 Linking DEVIGHAT AND TRISULI evacuation lines.

During the month of January 1990, NEA established a 30 meters connection between one circuit of the BALAJU - TRISULI 66 kv double circuit line and one circuit of, the NEW CHABEL - DEVIGHAT 66 kv double circuit line.

This connection provided an immediate double improvement to NEA power system:

- -the supply of NEW CHABEL was drastically increased and load shedding was avoided.
- -the stability of DEVIGHAT generators was notably improved. Before the connection was established, the generators of DEVIGHAT were connected to the main Nepali Integrated System through the 11 kV of Kathmandu. Reducing the impedance between DEVIGHAT generators and the other generators of NEA improved the stability and thus mollify a cause of frequent incidents.

The careful examination of the flows expected on the network in the future shows that the connection made in January has to made permanent and has to be completed by a second connection of the same type some km northward as described in the electrical diagram presented in the appendix. These two connections will provide to NEA a convenient 66 kV loop between the 4 substations of TRISULI, DEVIGHAT, NEW CHABEL and BALAJU.

Theses two connections has to be made firm and definitive.

2.4 Refurbishment of TRISULI switchyard.
(to be coupled with the refurbishment of the power station)

The foreseen connections between DEVIGHAT and TRISULI evacuation 66 kV line will modify the mode of operations. The 66 kV lines will be operated within a loop linking BALAJU, TRISULI, DEVIGHAT and NEW CHABEL. For safe operations, the lines must equipped with appropriate circuit breakers and distance protections. Presently the lines have no circuit breakers in TRISULI. This has to be modified. The refurbishment of the switchyard has to be planned to take place during the foreseen refurbishment of the power station. Due to lack of space, it might be necessary to install a compact indoor type switchgear. But GIS is not recommended because incident, even very improbable, the interruption of service might last months because.

3 REINFORCEMENTS OUTSIDE KATHMANDU VALLEY

3.1 Increase of transformation capacity.

The BIRGANJ 66/11 kV transformer has reached its maximum capacity, the capacity transformation has to be increased immediately.

3.2 Scheme to alleviate voltage drop in DUHUBI.

Due to the increase of the load and the length of this section of 132kV transmission, there is a severe voltage drop problem at DUHUBI. Two measures have to be taken:

3.2.1 Capacitor in DUHUBI

In a first stage a capacitor of 20 MVAR has to be installed in DUHUBI.

3.2.2 Second 132 kV circuit

In a second stage, the second circuit has to be strung between HETAUDA and DUHUBI. This second circuit has to be commissioned for the year 1996, it might be anticipated if the load growth was quicker than forecasted.

4 COST EVALUATION

4.1 Principles

The cost evaluation is presented in the enclosed appendix. The estimation has been made on the basis of usual EDF planning unit costs. Corrections based on NEA system planning reference costs have been applied in order to scale these costs to International Competitive Bidding level.

The following technical assumptions were made:
-all sites involved in reinforcements are easily accessible.
-costs of land is not included.
-costs are expressed in 1990 US$.

4.2 Evaluation

The costs of reinforcements is the following:

Transformer reinforcements:		2,012,000
Kathmandu Valley reinforcements:		7,223,000
Reinforcement outside Kathmandu:		7,065,000
total	US$	16,300,000

TRAFORE
3/3/90

H.V./11 kV TRANSFORMER REINFORCEMENTS

ITEM NAME	QUANT	UNIT COST in $1000	TOTAL COST in $1000
IN LAINCHOUR S/S			
Trans 66/11 18 MVA	2	282	564
IN NEW CHABEL S/S			
Trans 66/11 18 MVA	2	282	564
IN NEW BANESWAR S/S			
Trans 66/11 18 MVA	1	282	282
Cir. Break 66 kV	1	140	140
Cir. Break 11 kV	1	20	20
IN BIRGANJ S/S			
Trans 66/11 18 MVA	1	282	282
Cir. Break 66 kV	1	140	140
Cir. Break 11 kV	1	20	20
		T O T A L	2012

KAVTERE
3/3/90

KATHMANDU VALLEY TRANSMISSION EQUIPMENT REINFORCEMENT (1st page)

ITEM NAME	QUANT	UNIT COST in $1000	TOTAL COST in $1000
NEW BAKTAPUR 66 kV SUBSTATION			
Trafo 66/11 10 MVA	2	97.0	194.0
Saving for re-use	2	-25.5	-51.0
of LAIN. trafo		0.0	
Cir. Break 66 kV	5	140.0	700.0
Cir. Break 11 kV	8	20.0	160.0
(one bank of 8)		.	
General equipement	1	470.0	470.0
66 kV OHL Line SC/	10	42.0	420.0
66 kV OHL Line DC	1	67.0	67.0
NEW TEKU 66 kV SUBSTATION			
Trafo 66/11 18 MVA	1	282.0	282.0
Cir. B 66 kV (GIS)	5	210.0	1050.0
Cir. Break 11 kV	8	20.0	160.0
(one bank of 8)			
General equipement	1	470.0	470.0
66kV OHL (1st cir)	3	51.0	153.0
In SIUCHATAR			
Cir. Break 66 kV	1	140.0	140.0
2ND 66 kV CIRCVUIT SIUCHATAR - PATAN			
OHL 2nd cable	4	10.5	42.0
Cir. Break 66 kV	2	140.0	280.0
TOTAL (1st page)			4537

KATHMANDU VALLEY TRANSMISSION EQUIPMENT REINFORCEMENT (2nd page)

ITEM NAME	QUANT	UNIT COST in $1000	TOTAL COST in $1000
CARRY form 1 st page			4537
CONNECTION TRISULI AND DEVIGHAT EVACU LINES			
OHL connection	2	10.0	20.0
REFURBISHEMENT OF TRISULI SWITCHYARD			
C. B. 66 kV (GIS)	4	210.0	840.0
Reinstall of trafo	2	68.0	136.0
General equipement	1	470.0	470.0
SIUCHATAR - BALAJU 132 kV			
OHL (1st circuit)	6	70.0	420.0
Circ. Breaker	1	200.0	200.0
Circ. Break (GIS)	2	300.0	600.0
T O T A L			7223.0

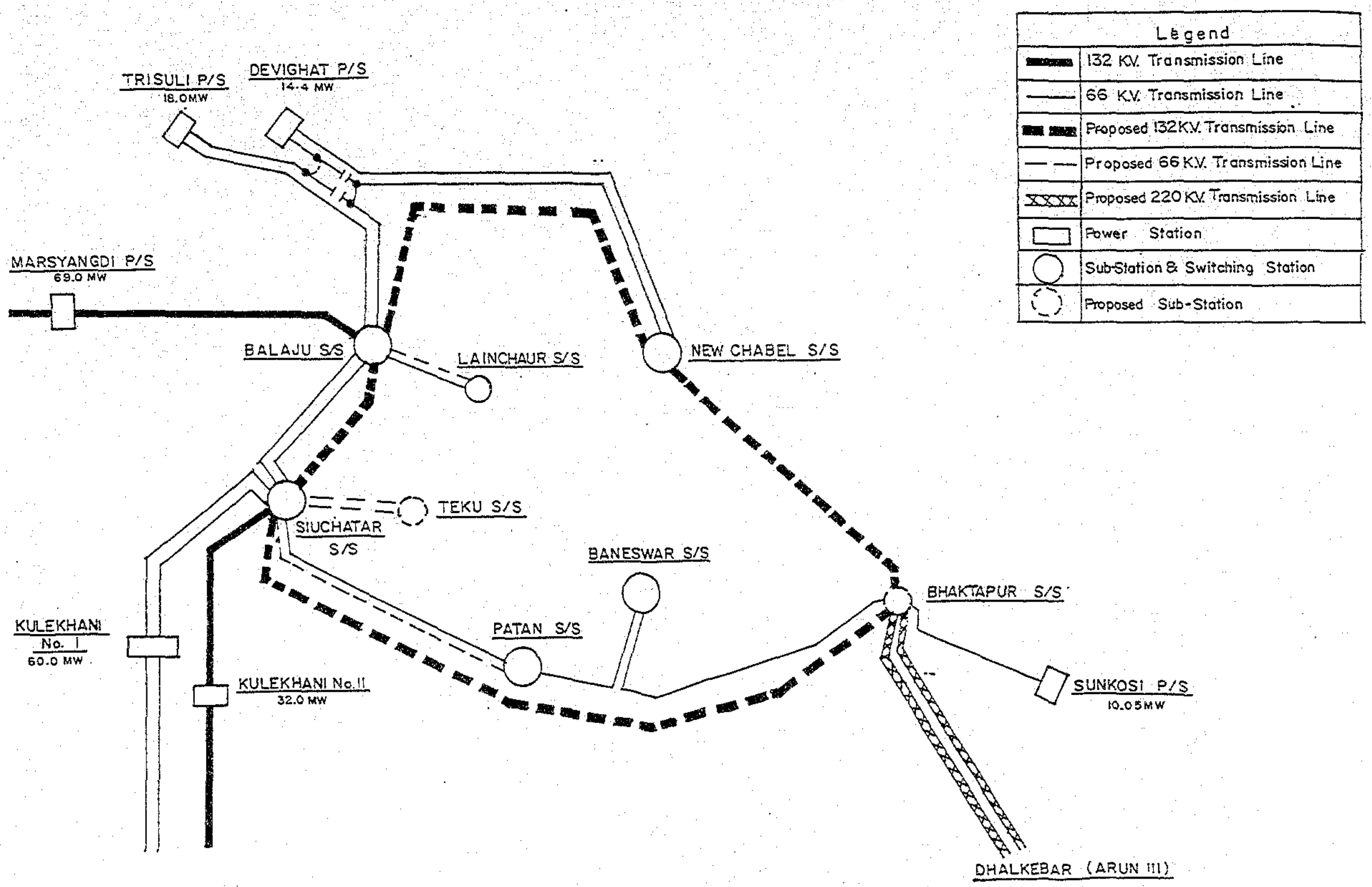
Appendix 3

TFOKURE
3/5/90

TRANSMISSION EQUIPMENT OUTSIDE KATHMANDU

ITEM NAME	QUANT	UNIT COST in $1000	TOTAL COST in $1000
IN DUHUBI S/S			
10 MVAR capacitor	20	17.00	340.0
C.B. 132 kV	1	200.00	200.0
2ND 132 kV CIRCUIT FROM HETAUDA TO DUHUBI			
second circuit	283	15.00	4245.0
Circuit Breakers	6	200.00	1200.0
Generation Overcos (18000MWh)	18000	0.06	1080.0
		T O T A L	7065.0

KATHMANDU ELECTRICAL NETWORK
Reinforcement With 66/132 K.V. Ring



10－8　要　請　書

NEPAL ELECTRICITY AUTHORITY
(HIS MAJESTY'S GOVERNMENT OF NEPAL UNDERTAKING)

MASTER PLAN STUDY
AND
FEASIBILITY STUDY OF URGENT WORKS
FOR
EXTENSION & REINFORCEMENT OF POWER TRANSMISSION AND DISTRIBUTION SYSTEM IN KATHMANDU VALLEY

OCTOBER, 1989

CONTENTS

MASTER PLAN STUDY
AND
FEASIBILITY STUDY OF URGENT WORKS
FOR
EXTENSION & REINFORCEMENT
OF
POWER TRANSMISSION AND DISTRIBUTION SYSTEM
IN
KATHMANDU VALLEY

Foreword

The power situation in the Kathmandu Valley in the late 1970's and early 1980's was characterized by frequent power blackouts and unavoidable load shedding due to the inadequate transmission and distribution network and shortage of power supply in the Integrated Nepal Power System (INPS).

Under the Grant Aid Projects financed by the Government of Japan over three phases in 1980, 1982 and 1986, the network in the Valley has been effectively and rapidly improved by the timely implementation of the reinforcement and rehabilitations works. On the other hand, new hydropower stations have also been developed at Kulekhani No.1 and No.2 sites. Kulekhani No. 1 was co-financed by the Government of Japan while Kulekhani No.2 was fully financed by them.

It has been greatly appreciated by His Majesty's Government of Nepal (HMGN) that the completion of these projects has much improved the power situation in the Valley and the reliable power supply has contributed towards social welfare and economic development in the Valley, particularly the establishment of new industries.

The transmission and distribution system in the Valley has been reinforced and extended with the objective to have capability to supply power for the load demand in 1990/91. However, referring to the actual demand in 1983 to 1986 as shown in the following table, it is seen that the recent power demand in the Valley has sharply increased.

Years	Forecasted (Valley) (1) MW	Actual Demand (INPS) (2) MW	Estimated Demand (Except Valley) (3) MW	Actual Demand (Valley) (4)=(2)-(3) MW	Ratio (4)/(1)
1983/84	54.6	76.0	19.0	57.0	104 %
1984/85	58.6	79.7	19.9	59.8	102 %
1985/86	64.6	103.0	25.8	77.2	120 %
1986/87	71.2	123.5	30.9	92.6	130 %
1987/88	78.6	141.0	35.3	105.7	134 %

In order to prevent the retrogressive situation of the network in the Valley under such a rapid demand increase and to improve the power supply for rural areas, HMGN has felt the need for providing proper power supply facilities for those increased demand based on the medium and long term power system development program. For identifying the urgently required power supply facilities, HMGN intends to formulate the Master Plan for medium and long terms extension and reinforcement of the power transmission and distribution system in the Valley and to provide the feasibility study for urgently required transmission and distribution facilities identified in the Master Plan.

In the study of the Master Plan, the following main issues have to be carefully examined to establish the future system expansion:

(1) review of the existing power market and power network,
(2) formulation of the integrated system development plan,
(3) phased development plan and project evaluation, and
(4) identify the urgently required power system facilities.

The HMGN intends to engage the experienced expatriate experts for this combined Master Plan Study and Feasibility Study for Urgent Works. The required period and man-months for both the studies are estimated to be 13 months and 47 man-months. The cost is estimated at Japanese Yen 170 million and Nepalese Rupees 0.15 million.

It is the intention of the HMGN to request the technical assistance under the Grant Aid from the Government of Japan for these studies.

1. Background

1.1 General

The Kathmandu Valley is the center of Nepal in all respects of its life, be it in politics, administration, economics, finance, cultures, etc. encompassing the capital of the country, Kathmandu. However, the power supply in the Kathmandu Valley in the late 1970's and early 1980's was in the worse condition and people's daily life was considerably hindered by frequent power black-outs as well as large voltage drops due to insufficient power generating capacity and lack of the transmission and distribution network.

Under such situations, the Government of Japan conducted the feasibility study in 1978 on the reinforcement of the transmission and distribution system in the Kathmandu Valley and establishment of a load dispatching center taking into account the demand increase up to the year 1990/91. On the basis of this study, the reinforcement projects of the transmission and distribution network were implemented under the grant aid from the Government of Japan in 1980, 1982 and 1986.

After completion of the reinforcement projects of the system and generating facilities such as Kulekhani No.1 and No.2 power stations, power supply in the Kathmandu Valley has remarkably improved with reliable and quality power supply.

Though the power supply system has improved under the reinforcement projects, the improved system will be over-loaded soon, because the power demand is increasing at a higher growth rate than those forecasted under the feasibility study.

Under such circumstances, the Nepal Electricity Authority (NEA) shall provide urgently proper transmission, distribution and substation facilities to meet such demand increase taking into account the medium and long term development of the system. To identify the urgently required power system facilities in the Kathmandu Valley, it is essential to formulate a Master Plan for medium and long term development program of the reinforcement and extension of the power system.

The NEA is, therefore, intending to conduct the following two studies together;

a. Master Plan study for medium and long term development program of the reinforcement and extension of the power system to meet the future power demand in the Kathmandu Valley

b. Feasibility Study of the urgently required power system facilities identified in the Master Plan

1.2 Executing Agency

The electric power supply activities in Nepal were managed by two organizations under the Ministry of Water Resources, i.e. Electricity Department responsible for planning and execution of the electric power development projects and Nepal Electricity Corporation for operation of power facilities and electricity supply to the public. However, in 1985, both the organizations were amalgamated into the present NEA.

The maintenance of the distribution network in the Kathmandu Valley is currently undertaken by Distribution and Consumer Service Directorate of NEA. The maintenance organization for the distribution lines of the Valley is divided into Kathmandu, Patan and Bhaktapur in accordance with the administrative divisions of the Valley. However, all transmission lines (66 kV and above) and associated substations in the Valley are maintained by Operation and Maintenance Directorate.

1.3 Power Market

The existing electrical facilities in the Kathmandu Valley are summarized hereunder. The transmission system and locations of the lines and substations are referred to in the attached Fig-1 and Fig-2.

a. Generating Facilities

The existing generating facilities in INPS are mostly hydro-power with total installed capacity of about 168 MW. The details of the generating facilities are as shown below;

Kulekhani No.1	60 MW
Kulekhani No.2	32 MW
Trisuli	21 MW
Devighat	14 MW
Sunkosi	10 MW
Gandak	15 MW
Misc. Small Hydro	6 MW
Hetauda Diesel	10 MW
Total	168 MW

A new hydropower generating facility at Marsyandi with output of 69 MW will be completed at the end of 1989 and this power station will be connected with the INPS.

b. Transmission Facilities

The transmission lines in Nepal are composed of 132 kV, 66 kV and 33 kV lines. The transmission system in the Valley is mainly 66 kV lines. Details of the lines are as below:

132 kV Line	Kulekhani No.2 P/S - Siuchatar S/S	34 km
	Marsyangdi P/S - Balaju S/S	85 km
Total 132 kV Line		119 km
66 kV Line	Trisuli P/S - Balaju S/S	29 km
	Balaju S/S - Siuchatar S/S	7 km
	Sunkosi P/S - Patan S/S	57 km
	Kulekhani No.1 P/S - Siuchatar S/S	29 km
	Siuchatar S/S - Patan S/S	4 km
	Devighat P/S - Chabel S/S	33 km
	Baneswar S/S Loop	3 km
	Balaju S/S - Lainchour S/S	1 km
Total 66 kV Line		163 km
Total length including 132 kV line		282 km

c. Substation Facilities

Six major substations are located in the Valley. Transformer capacities of those substations are shown below:

132/66 kV S/S	Siuchatar S/S	39.0 MVA
	Balaju S/S	45.0 MVA
Total 132/66 kV S/S		84.0 MVA
66/11 kV S/S	Balaju S/S	42.5 MVA
	Siuchatar S/S	36.0 MVA
	Patan S/S	48.6 MVA
	Chabel S/S	18.9 MVA
	Baneswar S/S	18.0 MVA
	Lainchour	20.0 MVA
Total capacity of 66/11 kV S/S		184.0 MVA

The power for the Kathmandu Valley is supplied from these 66/11 kV substations through 11kV distribution lines via switching stations located in the city.

d. Distribution Facilities

The Distribution system in Nepal consists of 11 kV, 3.3 kV and 400/230 V lines. The distribution network in the Kathmandu Valley was reinforced in three phases under the Japanese Grant Aid in 1980, 1982 and 1986. The total length of distribution lines and the total capacity of distribution transformers installed in the Valley are as summarized below;

	1978	1st Phase 1980	2nd Phase 1982	3rd Phase 1986
11 kV Lines (km)	250	342	422	450
3.3 kV (km)	64	39	20	0
Total	314	381	442	450
Distribution Transformer *				
11/0.4-0.23kV(MVA)	31.64	57.26	84.33	93.23
3.3/0.4-0.23 kV(MVA)	8.82	4.00	2.00	2.00
Total (MVA)	40.46	61.26	86.33	93.23

All distribution lines of 3.3 kV were upgraded into 11 kV lines under the reinforcement projects.

Note: * Transformers installed by NEA which drop voltage from 66 kV and transformers installed by consumers such as hospitals and small industries are not included.

e. Historical Load Demand

The records of electrical energy generation, maximum demand and energy consumption of the Integrated Nepal Power System (INPS) for the last twelve years are summarized as below;

Years	Energy Production (GWh)	Growth Rate (%)	Max. Demand (MW)	Growth Rate (%)	Energy* Consump. (MW)	Growth Rate (%)
1976/77	129.3	3.6	34.7	8.8	119.6	11.5
1977/78	144.2	11.5	37.9	9.2	129.6	8.4
1978/79	160.6	11.4	38.1	0.5	148.1	14.3
1979/80	179.2	11.6	42.5	11.5	161.2	8.8
1980/81	177.6	-0.9	44.5	4.7	163.9	1.7
1981/82	205.0	15.5	56.5	27.0	184.8	12.8
1982/83	273.7	33.4	66.0	16.8	232.3	25.7
1983/84	325.0	18.7	76.0	15.2	244.6	5.3
1984/85	351.9	8.3	79.7	4.9	286.6	17.2
1985/86	473.3	34.5	103.0	29.2	341.3	19.1
1986/87	571.0	20.6	123.5	19.9	402.0	17.8
1987/88	627.0	9.8	141.0	14.2	459.0	14.2
Average growth(%)		14.8		13.5		13.1

Note: * Sales Energy

The table shows that the average growth of energy consumption was 13.1 % per annum over the period, although its growth until the year 1980/81 was constrained by serious shortages of generation in the system and unreliable supply. High growth rate in the year 1982/83 has resulted from the completion of Kulekhani No.1 hydropower plant.

Of the total electricity consumption, the domestic sector still accounts for largest share of 40 %, the consumption of the industrial sector has grown up to 35 % and the others 25%.

f. Power Demand Forecast

The power demand forecast for the Kathmandu Valley as made in the feasibility study is produced below;

Year	Energy Consump. (GWh)	Max. Demand (MW)	Load Factor (%)	Growth Rate (%)
1983/84	215.8	54.6	45.1	
1984/85	233.1	58.6	45.4	7.3
1985/86	258.7	64.6	45.7	10.2
1986/87	287.1	71.2	46.0	10.2
1987/88	318.7	78.6	46.3	10.4
1988/89	353.8	86.7	46.6	10.3
1989/90	392.7	95.6	46.9	10.3
1990/91	435.9	105.4	47.2	10.3

The actual demand growth in the Valley (Actual demand for Integrated Nepal Power System minus assumed demand outside the Valley) in 1983 to 1988 is about 20 to 40 % over the forecasted demand as shown below;

Years	Forecasted (Valley) (1) MW	Actual Demand (CNP) (2) MW	Estimated# Demand (Except Valley) (3) MW	Actual Demand (Valley) (4)=(2)-(3) MW	Ratio (4)/(1)
1983/84	54.6	76.0	19.0	7.0	104 %
1984/85	58.6	79.7	19.9	59.8	102 %
1985/86	64.6	103.0	25.8	77.2	120 %
1986/87	71.2	123.5	30.9	92.6	130 %
1987/88	78.6	141.0	35.3	105.7	134 %

Note#:Actual demand out side the Valley under Ingegrated Nepal Power System was assumed to be about 25 % of the total demand in INPS.

This high demand increase has resulted from the improvement of reliable power supply facilities such as improved distribution facilities in the Valley and additional generating facilities.

2. Objective of the Study

2.1 Master Plan Study

As aforementioned, the power transmission and distribution system in the Valley has been significantly improved due to the three reinforcement projects under the Japanese Grant Aid and it is satisfactorily functioning for short-term demand increase as planned in the basic design report for the third phase project.

However, there is no certain and integrated plan of medium and long term extension and reinforcement of the power transmission and distribution system in the Valley, though several fragmented plans and/or recommendation for improvement and reinforcement of the system have been formulated or proposed by NEA under difference studies.

Under these circumstances, NEA is intending to study and to establish a Master Plan for the medium and long term extension and reinforcement of power transmission and distribution system and to identify urgently required power supply facilities to meet sharp demand increase and to establish the priority of the development plan for facilities to meet the requirement of the demand increase in the Valley.

The following items are to be taken into account for the study;

a. Power Demand Forecast

The power demand forecast up to 1990/91 was made under the feasibility study on the reinforcement of the transmission and distribution system in the Kathmandu Valley in 1978. The system in the Kathmandu Valley has been reinforced and extended to meet the demand in 1990/91. The power demand forecast after 1990/91 will have to be studied for further reinforcement and extension of the system in the Kathmandu Valley.

The Kathmandu Valley are split into about 100 Panchayats (small administrative areas), the areawise demand forecast for designing the individual distribution line for these small areas will have to be carried out.

b. Review of System Voltage

The existing standard transmission and distribution line voltages under NEA are 11 kV, 33 kV, 66 kV, and 132 kV. Taking account of the power demand, applied location such as town, rural area, length of line, future extension, the most suitable system voltage will have to be studied.

c. 66 kV New substation

In compliance with the completion of the aforementioned reinforcement projects for the transmission and distribution system in the Valley and Kulekhani No. 2 power station, the demand has remarkably increased beyond the forecasted demand especially eastern area of the Valley establishing a hospital, a TV assembly factory and other small industries. Further reinforcement and extension of the transmission and distribution system, therefore, is required to meet those sharp demand increase. The proposed location of the new substation is referred to in Fig-2.

d. 66 kV Ring System

To improve 66 kV system operation and for reliable power sharing, it will be required to establish a 66 kV ring system in the Valley. For establishing the ring system, the following matters are to be taken into consideration;

Additional Stringing of the Existing 66 kV Line

An additional stringing on the existing 66kV transmission line designed with double circuits between Siuchatar and Patan seems to be required to increase transmission capacity to meet the demand at the eastern area of the Valley.

Connection of Devighat - Chabel Line to 66 kV System

The 66 kV line from Devighat to Chabel is isolated from the 66 kV system in the Valley. This line will be required to be connected at a common 66 kV bus with the 66 kV Trisuli - Balaju line to improve its reliable operation. A new 66 kV switching station may be required.

Connection of Sunkosi 66 kV line to new 66 kV substation

The existing 66 kV Sunkosi line which passes near Thimi and Bhaktapur, where a new substation is proposed, will be required to be connected with the new substation.

Connection of Chabel 66 kV substation to the new 66 kV substation

The existing Chabel 66 kV substation will be required to be connected by a new 66 kV line to the proposed new substation near Thimi to complete the 66 kV ring system. This new line will be designed for easy future upgrading to 132 kV.

In addition to the above, a direct line from Chabel to Baneswar is also proposed for the study of the ring system as an alternative plan.

When the above four works are completed, the proposed 66 kV ring system will be established.

e. Branch of 132 kV Marsyandi line

The 132 kV transmission line is constructed from Marsyandi power station to Balaju substation in the Valley, the line passes near 132 kV Siuchatar substation. It will be studied to branch the line to Siuchatar substation to improve transmission reliability and system operation flexibility.

f. Expansion of Switching Stations

In relation to the demand increase in Kathmandu, reinforcement of the existing switching stations, construction of new switching stations/substations will have to be considered. In addition, upgrading of suitable existing 11 kV substation with associated transmission line to 66 kV will also have to be considered. The breaking capacity of the old type circuit breakers will also be reviewed for the necessity of the replacement of the old switches by new to meet the expanded power system.

g. Application of Underground and Overhead Insulated Distribution Lines

Roads in some areas in the Kathmandu city are very narrow and houses are built close to the roads and then no sufficient spacing between line conductors and houses can be kept. Taking account of the safety of the public, those overhead lines close with houses will have to be changed to underground cable or overhead insulated conductors.

h. Rehabilitation of existing LV lines in the city core areas

The low voltage distribution lines in the city core areas was constructed 20 years ago, more consumers in these areas are changing to electricity for cooking instead of other fuels and the demand is increasing accordingly. The rehabilitation of the existing low voltage lines in the city core area will be required to supply reliable electric power.

i. Reliability of Distribution Lines in Kathmandu

Though the reliability of the distribution lines in Kathmandu has improved after completion of the reinforcement project, however, alternate power supply for the important substations or switching station will be studied for improving reliability of the power supply.

j. Extension of Rural Distribution Lines

The extension and reinforcement of the distribution lines in the rural area was implemented under the first phase reinforcement project under the Japanese Grant Aid, but limited extension to cover rural area has been made due to shortage of the fund. However, further electrification of the rural area in the Valley is required not only to improve the life of people there but also to develop small scale industries in these areas. The extension and reinforcement plan of the rural distribution lines system,therefore, is to be formulated.

2.2 Feasibility Study for Facilities Urgently Required

Some small scale industries such as TV assembly factory etc.have been established at the suburb of Kathmandu, the extension of the transmission and distribution lines will be required to meet the demand for such new consumers. On the basis of the study results of the Master Plan, the Feasibility Study for the urgent works will be required to provide power for the waiting consumers. The detailed site survey to find the scale of the transmission and distribution lines with associated substations/switching stations to be extended and reinforced will be necessary. The basic design of the distribution lines is to be made referring to the results of the site survey and design conditions of the existing distribution lines constructed under the past three projects.

3. Plan of Operation

3.1 Study for the Works

In the study of the Master Plan, the following items will have to be reviewed, analyzed and established clearly:

a. Effects of the past three reinforcement projects implemented under the Japanese Grant Aid

b. Present and future issues of the existing power transmission and distribution system

c. Actual power demand in the Valley and its tendency in future
d. Power and energy balance in the Valley and power flow
e. Cost estimate of each development plan for economic and financial evaluation
f. Development plans and its priority for implementation
g. Recommendation of action programs
h. Recommendation for extension and reinforcement of the power system facilities urgently required in the Valley

In the feasibility study, the following items shall be made referring to the results of the study of the Master Plan for the facilities urgently required;

a. Detailed site survey at the recommended areas
b. Review of the demand forecast for the areas
c. Study for the present issues for the existing facilities in the areas
d. Study and analysis of the power system for reinforcement of the existing facilities and new facilities
e. Cost estimate for the facilities
f. Basic design

3.2 Schedule of the Reports

It is envisaged that the following reports will be provided under the study in the following steps;

a. Inception Report: Within one (1) month after the commencement of the study
b. Interim Report: Within seven (7) months after commencement of the study
c. Draft Final Report: Within eleven (11) months after commencement of the study
d. Final Report: Within one (1) month after review and comments on the draft final report by NEA

3.3 Required Man-Month

For executing the study, the following foreign experts will be required;

a. Master plan study

Team Leader
System Engineer
Distribution Engineer
Transmission Engineer
Economist

b. Feasibility study

Team Leader (Same Leader as Master plan study)
Distribution Engineer
Transmission Engineer
Substation Engineer
Economist (Same Economist as Master plan study)

The required man-month for the study is estimated to be 47 M/M in total i.e., 13.5 M/M in the field and 33.5 M/M at home office.
The details for the plan of operation is referred to the attached ANNEX.

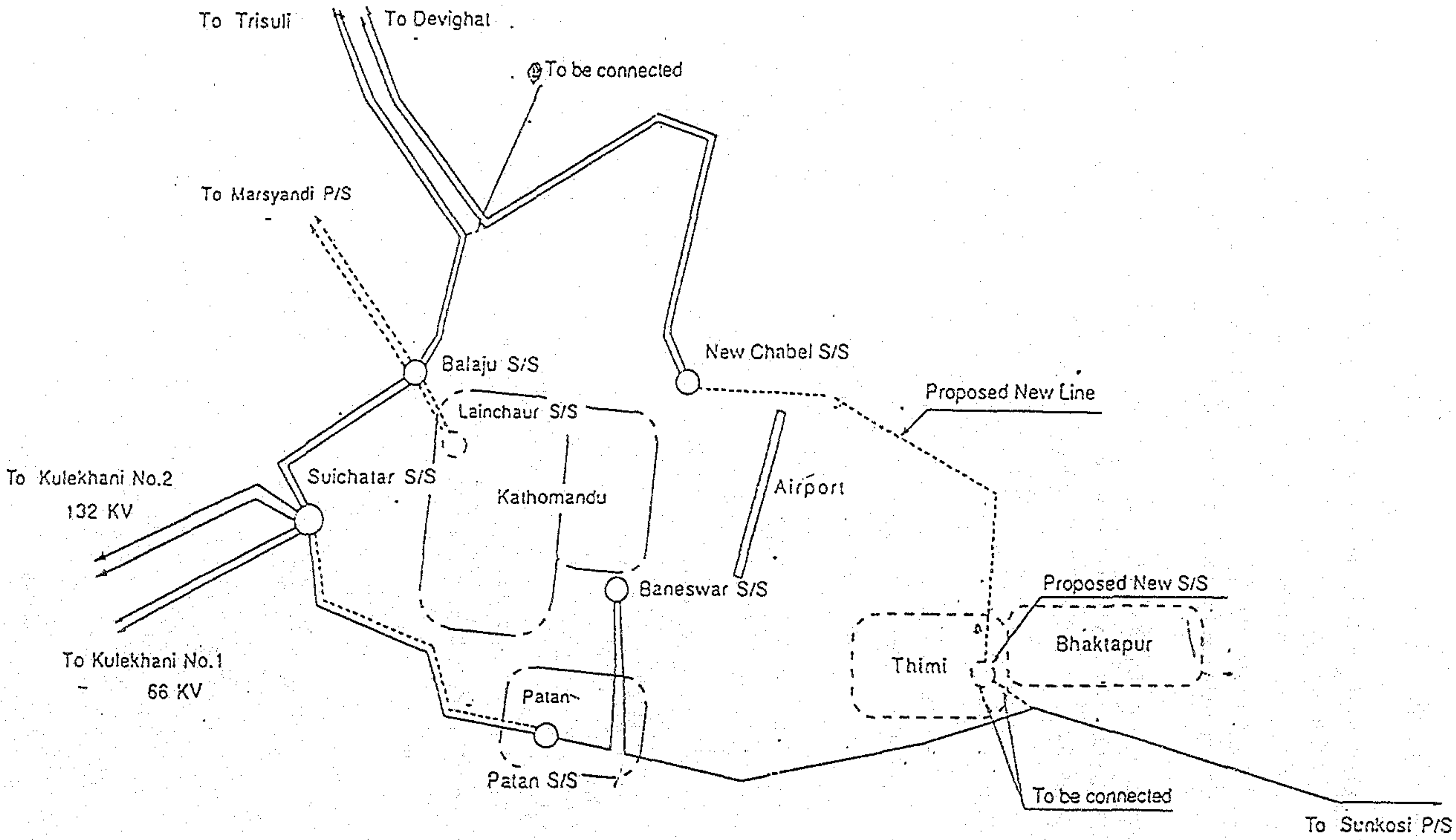


Fig-2 LOCATIONS OF T/L & S/S

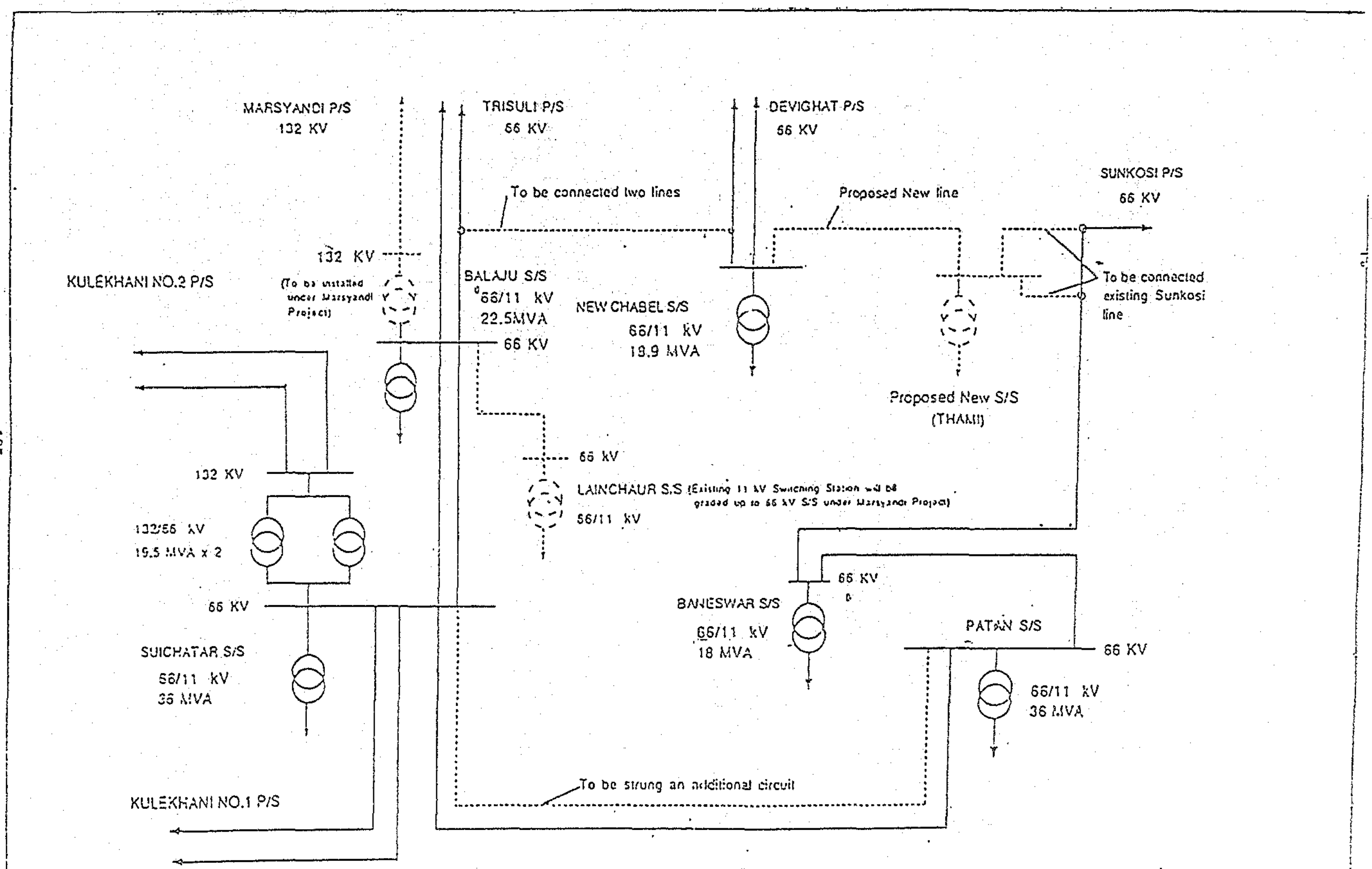


Fig-1. KATHOMANDU TRANSMISSION SYSTEM

NEPAL ELECTRICITY AUTHORITY
(HIS MAJESTY'S GOVERNMENT OF NEPAL UNDERTAKING)

ANNEX

TERMS OF REFERENCE

MASTER PLAN STUDY
AND
FEASIBILITY STUDY OF URGENT WORKS
FOR
EXTENSION & REINFORCEMENT OF POWER TRANSMISSION AND DISTRIBUTION SYSTEM IN KATHMANDU VALLEY

TERMS OF REFERENCE

MASTER PLAN STUDY
AND
FEASIBILITY STUDY OF URGENT WORKS
FOR
EXTENSION & REINFORCEMENT
OF
POWER TRANSMISSION AND DISTRIBUTION SYSTEM
IN
KATHMANDU VALLEY

1. Objective

The main objectives of Consulting Services are to establish the medium and long term overall Master Plan for the extension and reinforcement of the power transmission and distribution system in the Kathmandu Valley taking account of the reinforcement projects urgently needed for the system, and to provide the Feasibility Study for the power supply facilities urgently required.

2. Scope of the Study

The study will be broadly divided into, two parts; (i) Master Plan Study and (ii) Feasibility Study.

In the course of the study, the transfer of technology shall be provided to the NEA staff and counterpart personnel by foreign experts of the Study Team in the field and the home office.

The study shall include the following items:

2.1 Master Plan Study

(1) Power Demand Forecast

a) Collection and review of the existing data, information and previous documents related to the study

b) Survey of the existing power supply system in addition to the power transmission and distribution system in the Kathmandu Valley

c) Survey of the present power market in the Valley including power and energy balance, power demand, load curves, load density, etc

d) Collection and review of the existing data related to power demand forecast including forecast made by NEA and/or other consultants, waiting customers, extension plan of public, irrigation and/or industrial sectors. etc.

e) Study and analysis of the overall power demand forecast and micro-area in the Valley, and making clear its tendency of load density

f) Socio-economic survey including analysis of socio-economic data such as national and regional development plan, general economic indicators, population, etc.

(2) System Study

a) Review and evaluation of the past reinforcement projects undertaken by the Government of Japan Grant Aid programs and other planned/on going Projects
b) Study and analysis of the existing power supply system and discussion of present issues on the existing power transmission and distribution system
d) Study and analysis of power transmission and distribution system in the Valley on the basis of the demand forecast and power development program by NEA, and making clear its bottleneck for supply of steady power to the consumers
e) Power flow study and fault calculation for the system

(3) Development plans for the extension and reinforcement of the power transmission system

a) Establishment of an adequate transmission line system for the Kathmandu Valley
b) Study of new 66 kV substation in the eastern area of the Kathmandu Valley
c) Upgrading of suitable 11 kV substation to 66 kV

(4) Development plans for the extension and reinforcement of the power distribution system

a) Adaption of underground cable system or insulated conductors for HV and LV distribution system in the central area
b) Reinforcement and extension of power distribution system in new residential and industrial areas
c) Extension of power distribution system to the rural area in the Valley
d) Study for alternate power supply for the congested area in Kathmandu
e) Detailed study for selection of suitable distribution voltages such as 11 kV, 22 kV and 33 kV in rural area
f) Review of the methodology for designing distribution lines

(5) Cost estimate for the development plans, economic and financial evaluation, and its priority study
(6) Recommendation of action program in the medium term (about 10 years) and long term (about 20 years)
(7) Recommendation for the power supply facilities urgently required in the Valley

2.2 Feasibility Study for the Urgent Reinforcement Project

Following the detailed study and the present issues of the transmission and distribution system (item (2), (b) of 2.1 above) under the Master Plan, the following study shall be done:

(1) Study of development plans for countermeasures of the present issues to be solved urgently
(2) Cost estimate for selected countermeasures for reinforcement of the existing system
(3) Evaluation of urgency and necessity of the present issues to be improved and priority of the development plans
(4) Economic and financial evaluation of alternative plans
(5) Recommendation for the facilities to be provided urgently

2.3 Basic Design for the Urgent Reinforcement Project

Referring to the recommendation of the Master Plan for the facilities urgently required, the following study shall be made:

(1) Detailed site survey to confirm consumers in the recommended areas
(2) Review of the demand forecast for those areas
(3) Study for the present problems/issues for the existing system and review of the existing facilities in those areas
(4) Study and analysis of the power supply system for reinforcement of the existing facilities and new facilities
(5) Cost estimate for the facilities to be reinforced and extended

2.4 Transfer of Technology

In the course of the study, transfer of technology shall be provided to the NEA staff and counterpart personnel by the foreign experts in the following field:

(1) Collection and reinforcement of relevant system data
(2) Methodology of power demand forecast
(3) Planning and design of transmission and distribution network
(4) Planning and design of protection system of power transmission and distribution system
(5) Introduction of new technology of transmission and distribution system

The above transfer of technology shall be carried out in the form of on-the-job training and seminar. Overseas training also will be provided.

2.5 Executing Agency

Nepal Electricity Authority (NEA) will act as an Executing Agency of the HMGN for the study.

3. Schedule of the Study and Reports

The total period required for the study shall be within thirteen (13) months as shown in Fig-1.

In the course of the study, the following reports shall be prepared and submitted by the specified time.

(1) Inception report to be submitted within one (1) month after the commencement of the study, which will contain plan of operation and methodology, work schedule, preliminary findings and others.

(2) Interim report to be submitted within seven (7) months after the commencement of the study, which covers the results of the field survey, present issues of the system, evaluated results of the past reinforcement projects, urgently required facilities to be taken up for the Feasibility Study.

(3) Draft final report to be submitted within eleven (11) months after the commencement of the study.

(4) Final report to be submitted within one (1) month after receiving comments on the draft final report from NEA.

4. External Input

For executing the study, the following foreign experts will be required.

a. Master plan study

- Team Leader
- System Engineer
- Distribution Engineer
- Transmission Engineer
- Economist

b. Feasibility study

- Team Leader (Same Leader as Master plan study)
- Distribution Engineer
- Transmission Engineer
- Substation Engineer
- Economist (Same Economist as Master plan study)

The required man-month of foreign experts for the works is to be 13.5 M/M for the field and 33.5 M/M for the home works.

5 Undertaking of the Government

In order to facilitate a smooth and effective execution of the study, NEA on behalf of HMGN will undertake the following items as necessary.

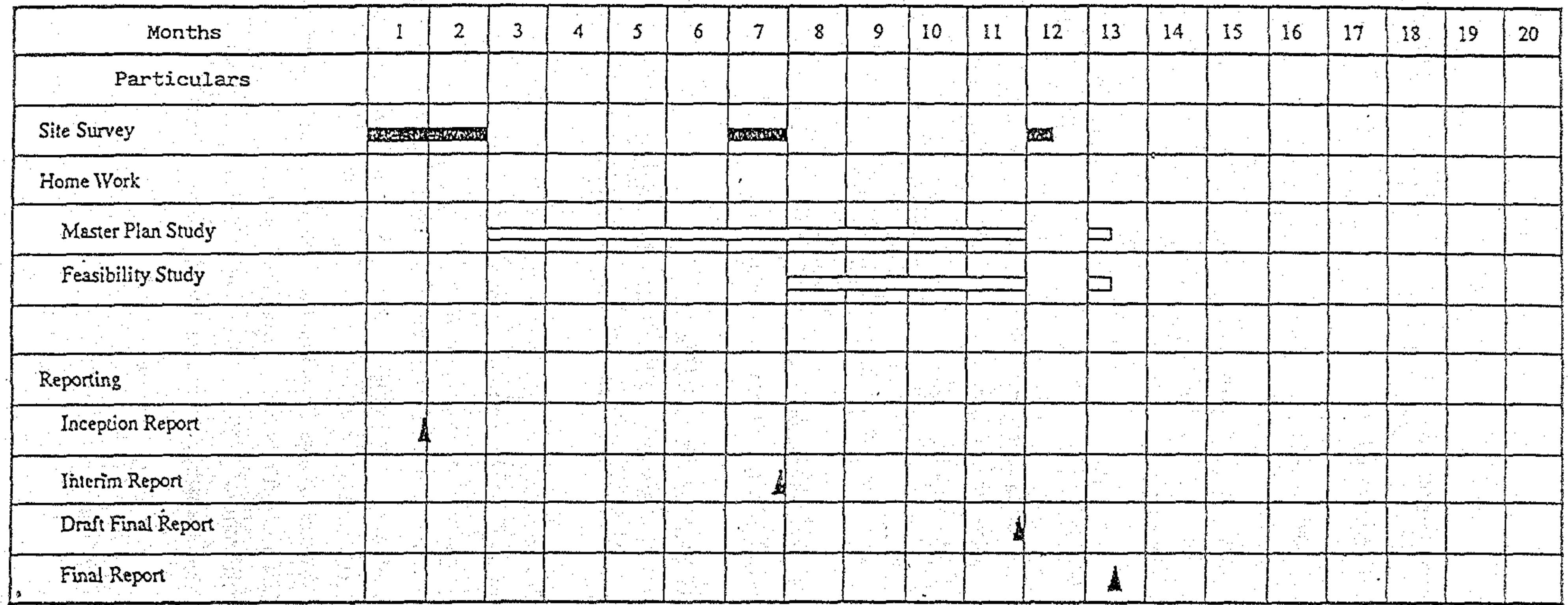
(1) Provision of a counterpart group to assist the Study Team to collect data and information related to the study, including settlement of any trouble arising throughout the field survey period.

(2) Arrangement for exemption from import duties imposed on instrument and equipment to be brought into Nepal by the Study Team for the study as per prevalent HMGN's rules.

(3) Provision of a sufficient and suitable office with appurtenant furnitures and facilities in Kathmandu during the field survey.

(4) Provision of available data and information such as reports, documents, maps, statistics, etc. needed for execution of the study.

Fig-1 Work Schedule



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