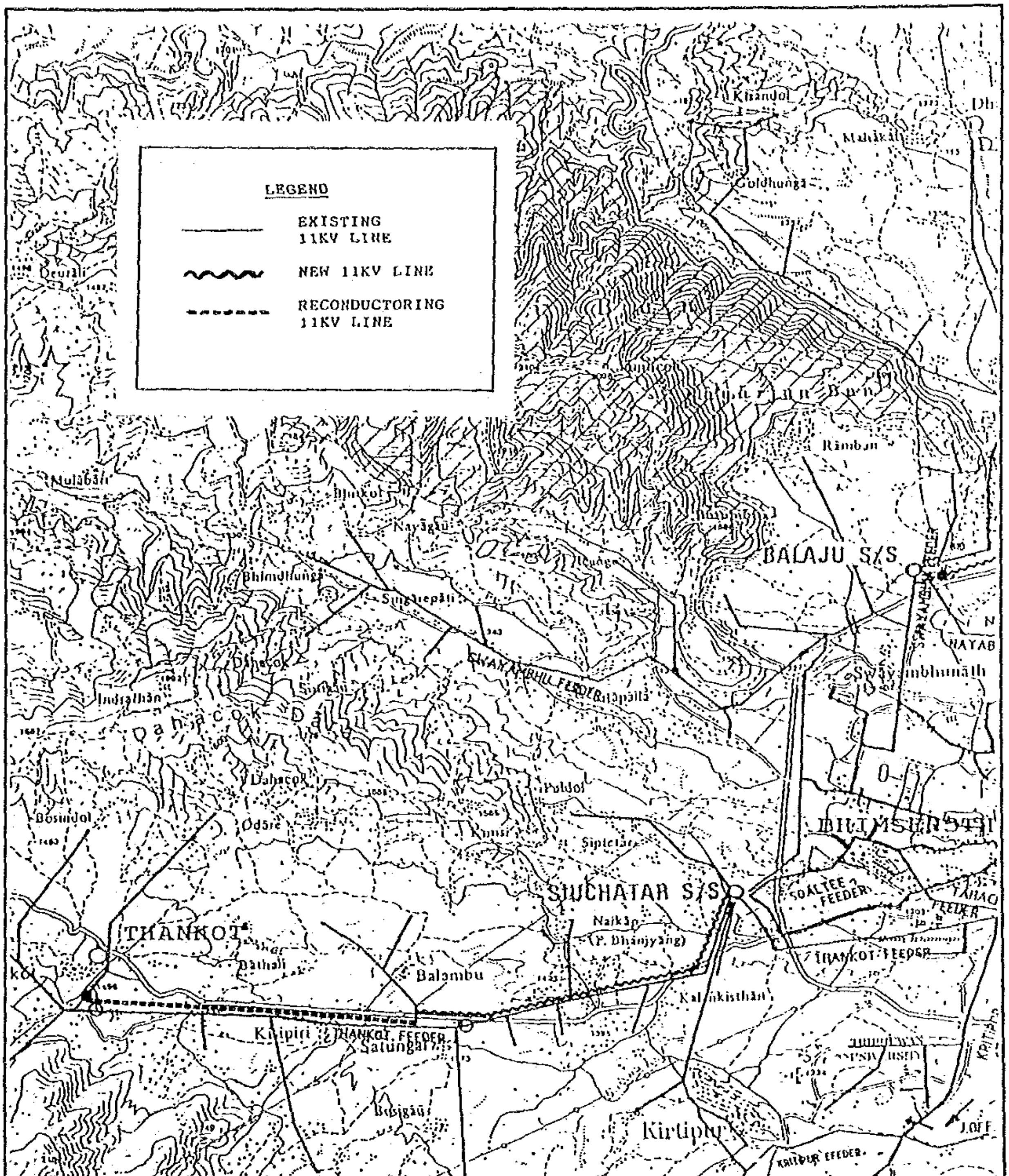
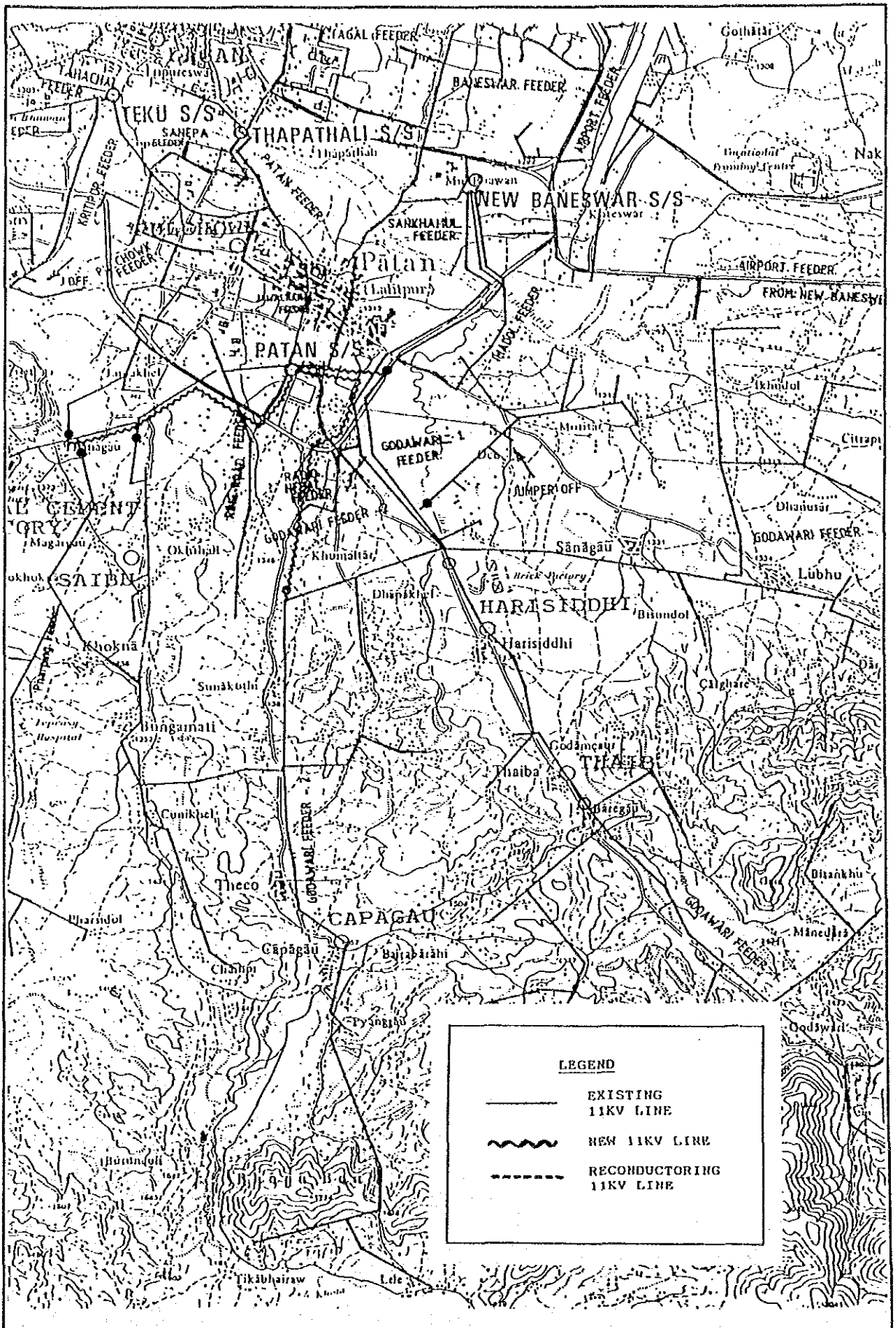
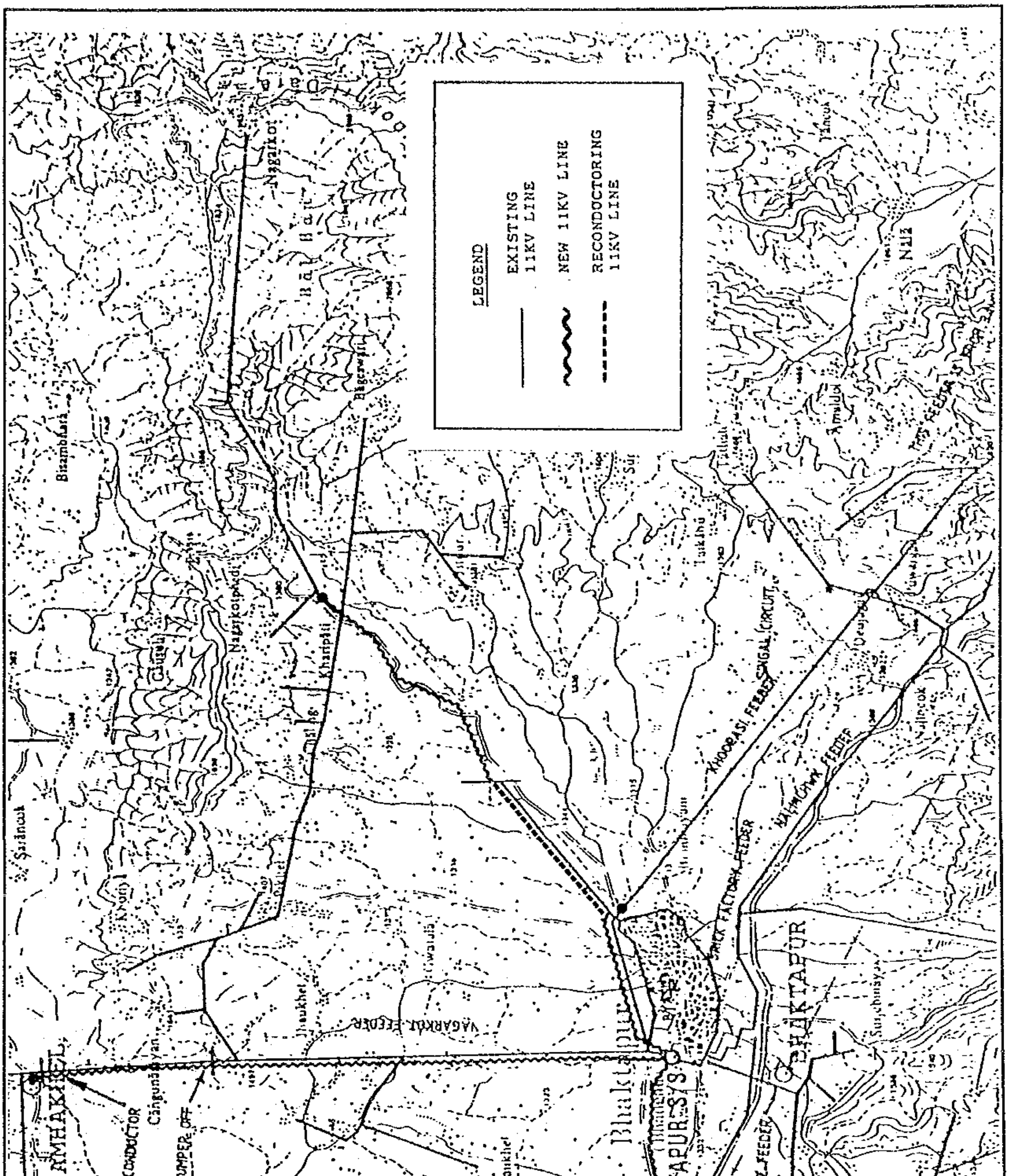
MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Fig. 12.3** **Reinforcement Plan in Kathmandu East Division**



MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY / JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Fig. 12.4 Reinforcement Plan in Kathmandu West Division



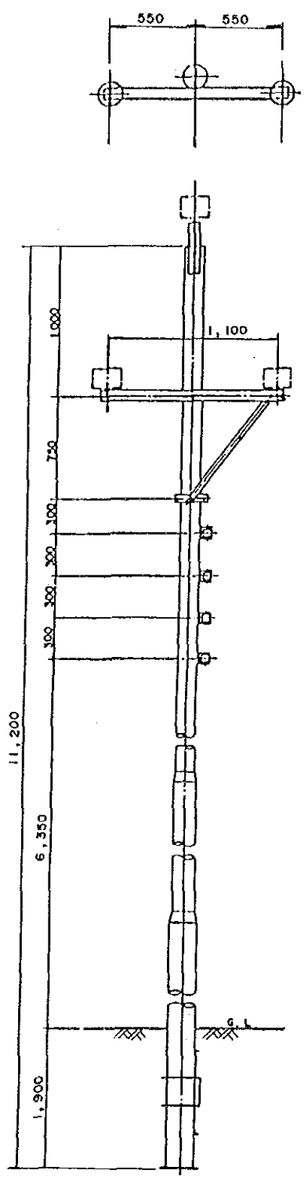
MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Fig. 12.5 Reinforcement Plan in Lalitpur Division



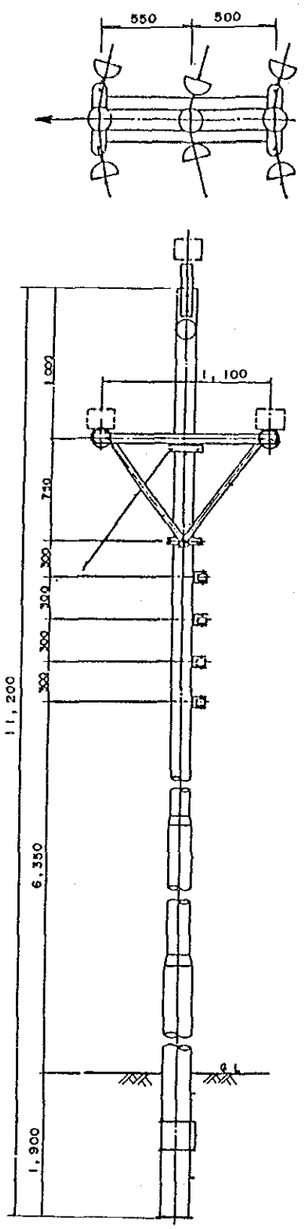
MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY / JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Fig. 12.6 Reinforcement Plan in Bhaktapur Division

(TRIANGLE ARRANGEMENT)

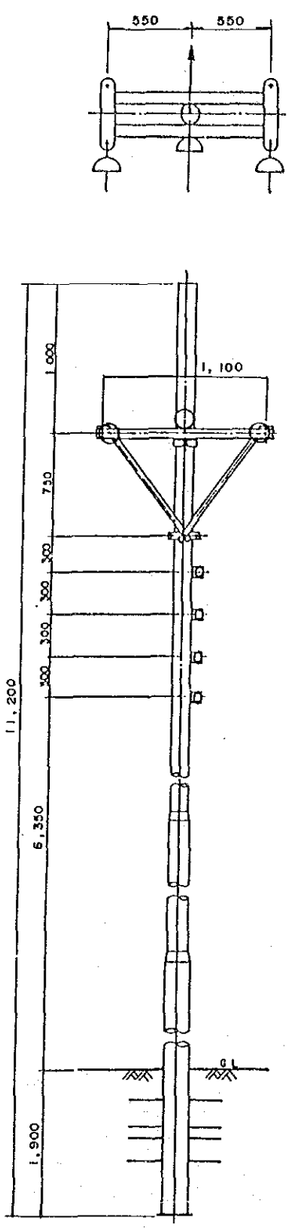
STRAIGHT TYPE POLE



ANGLE TYPE POLE

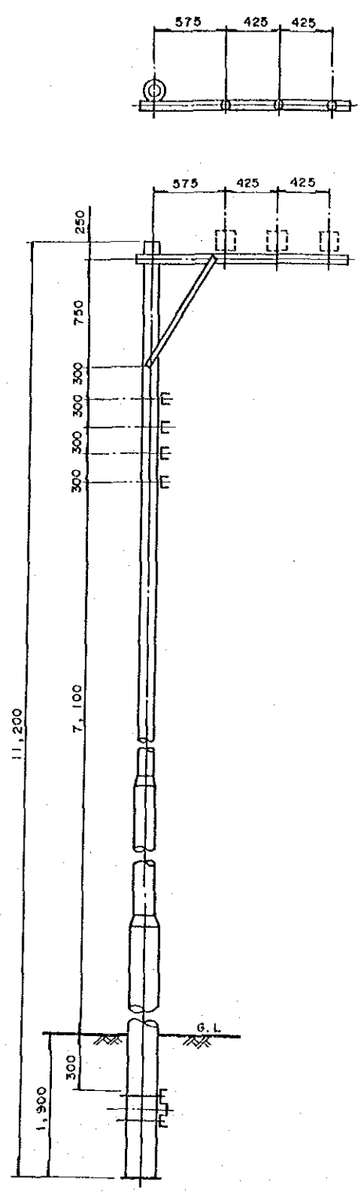


DEAD END TYPE POLE



(ONE SHOULDER ARRANGEMENT)

STRAIGHT TYPE POLE



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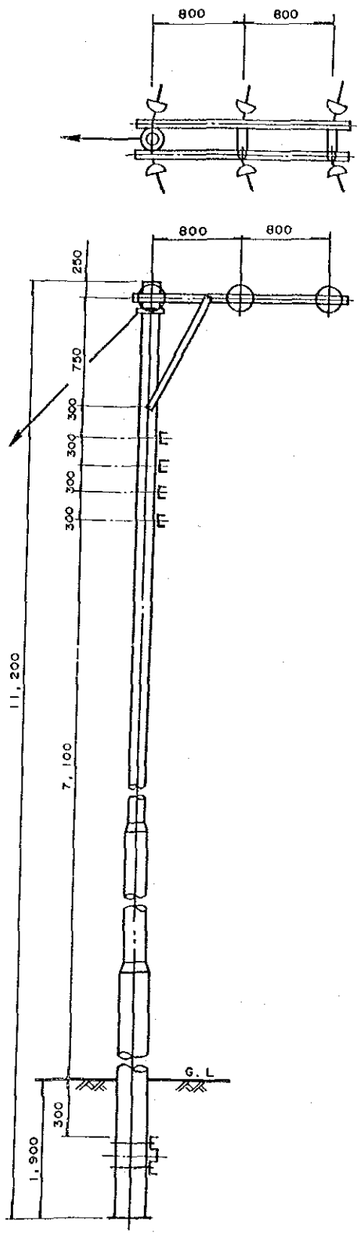
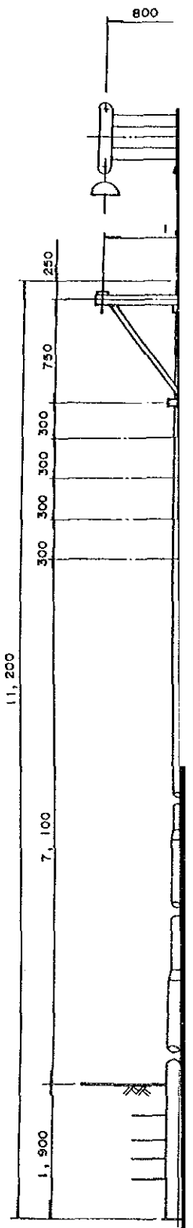


DEAD EN

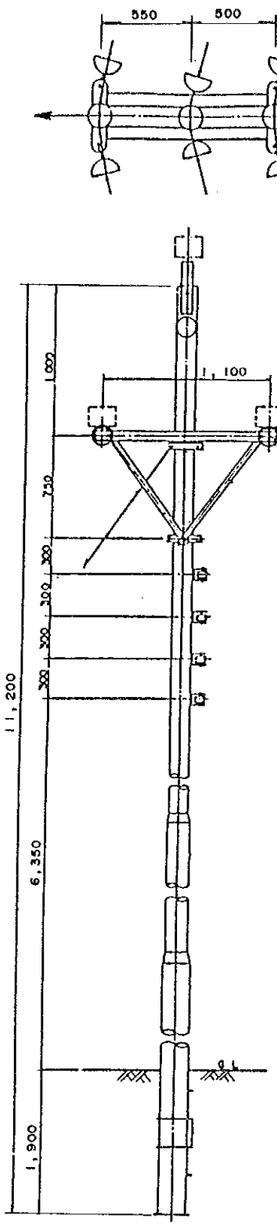


MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORIT
	JAPAN INTERNATIONAL COOPERATION AGENCY

(TRIANGLE ARRANGEMENT)

LE

ANGLE TYPE POLE



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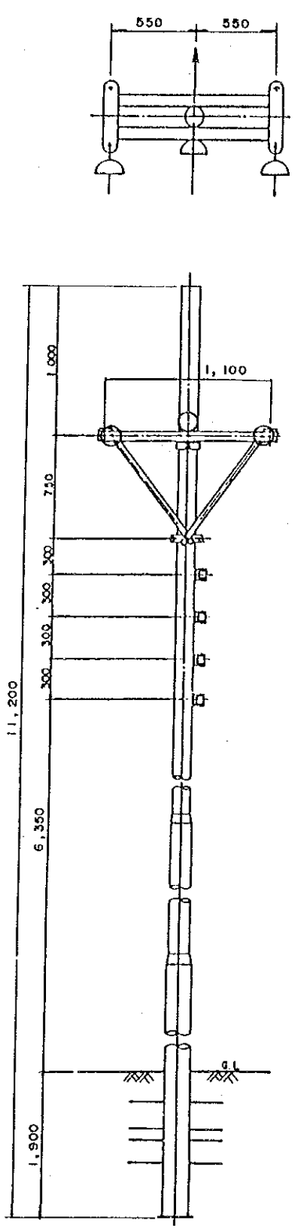
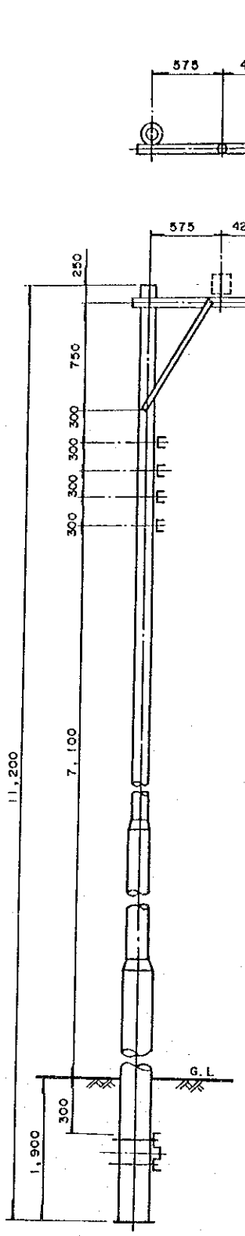
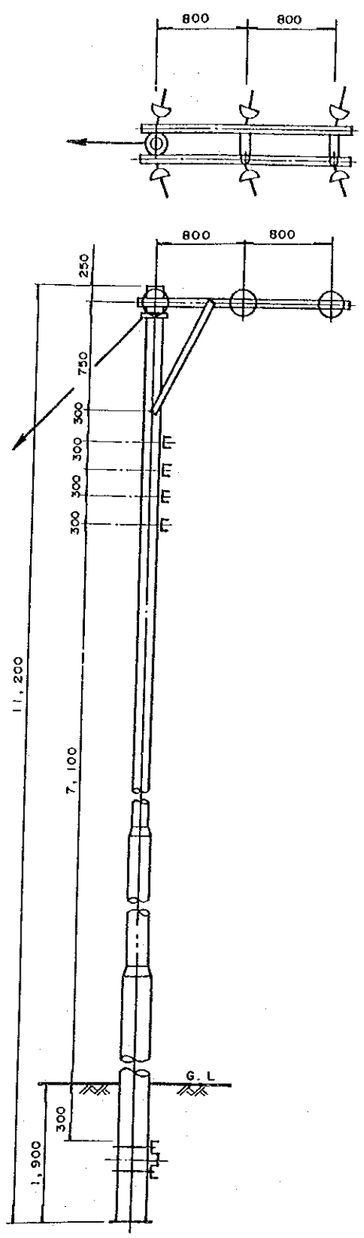


(ONE SHOULDER ARRANGEMENT)

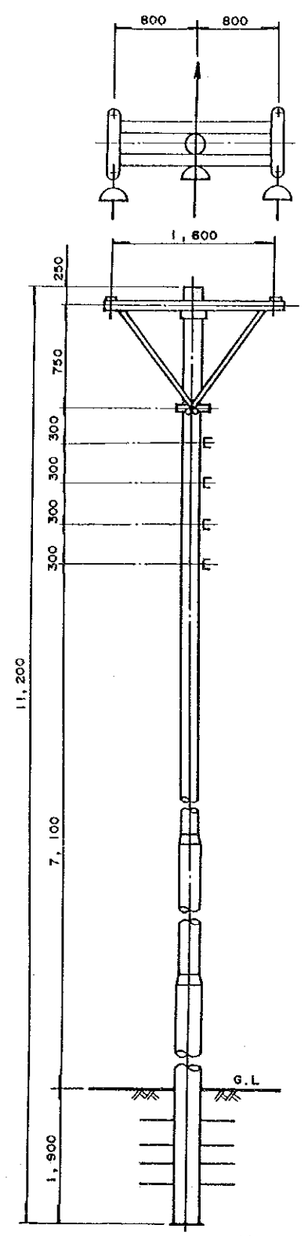
STRAIGHT TYPE POLE



ANGLE TYPE POLE



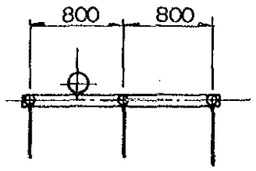
DEAD END TYPE POLE

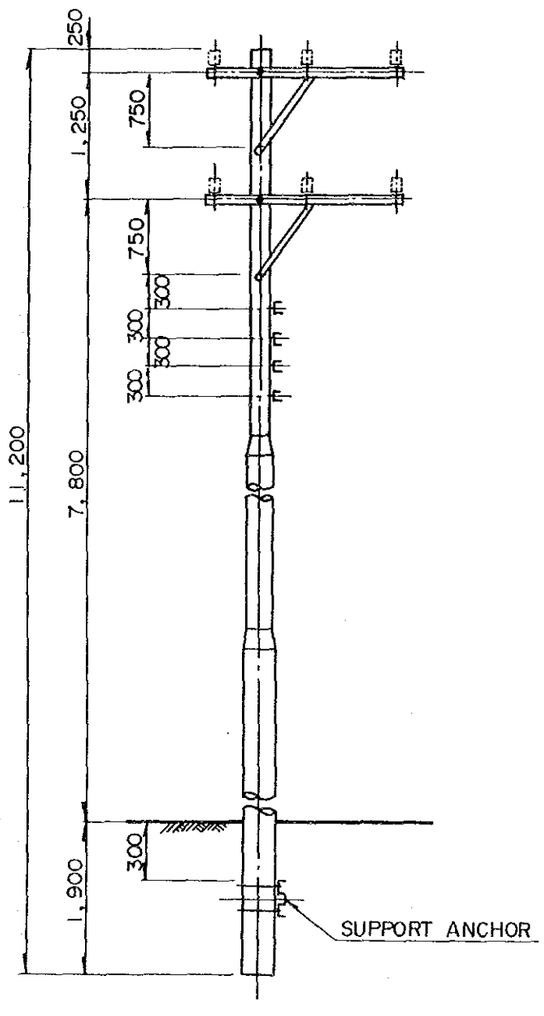


MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Fig. 12.7 General Layout of 11kV Single Circuit Poles

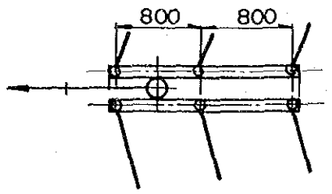
(DOUBLE CIRCUIT TYPE POLES)

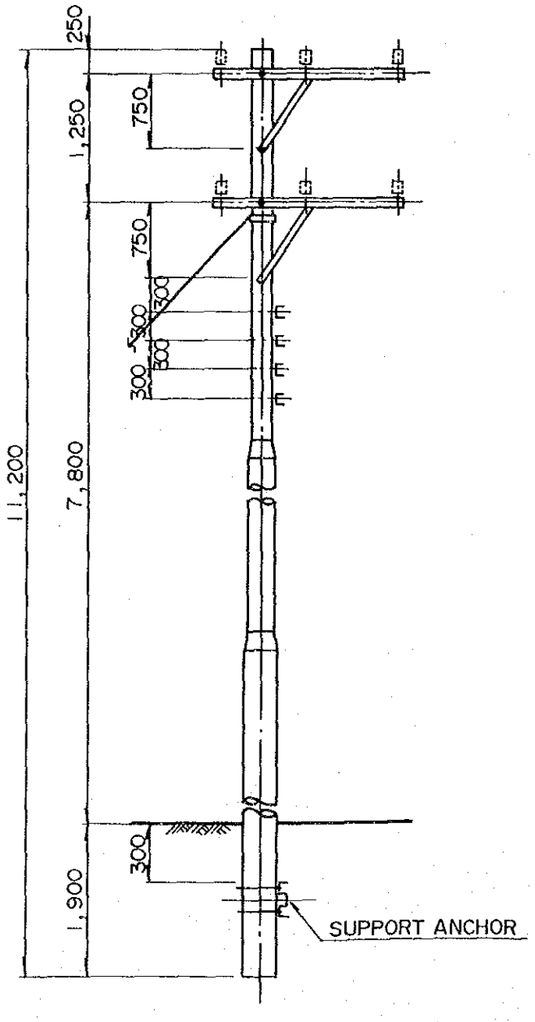
STRAIGHT TYPE POLE



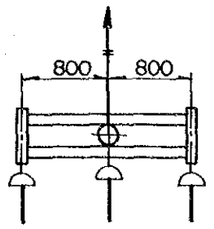


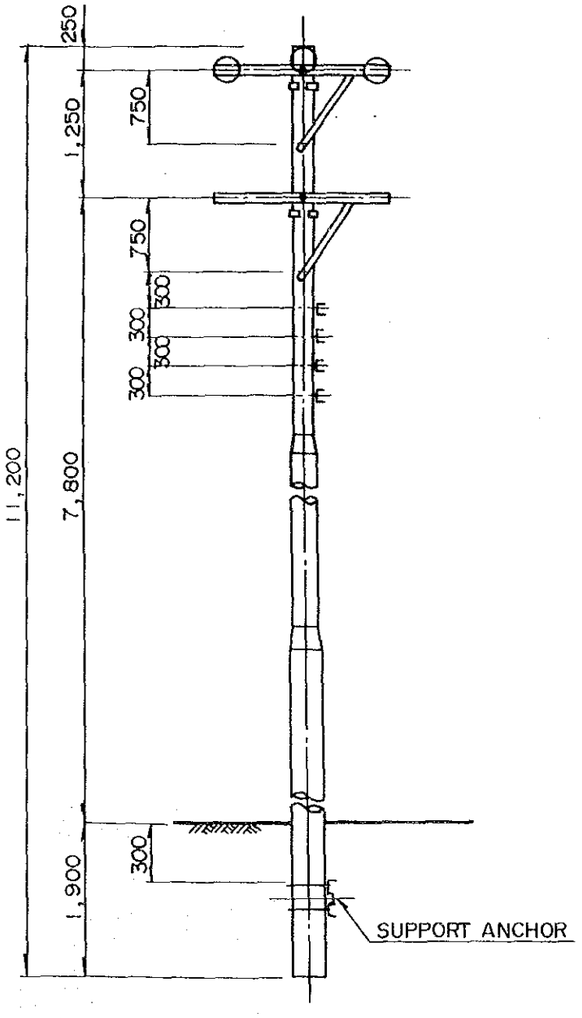
ANGLE TYPE POLE





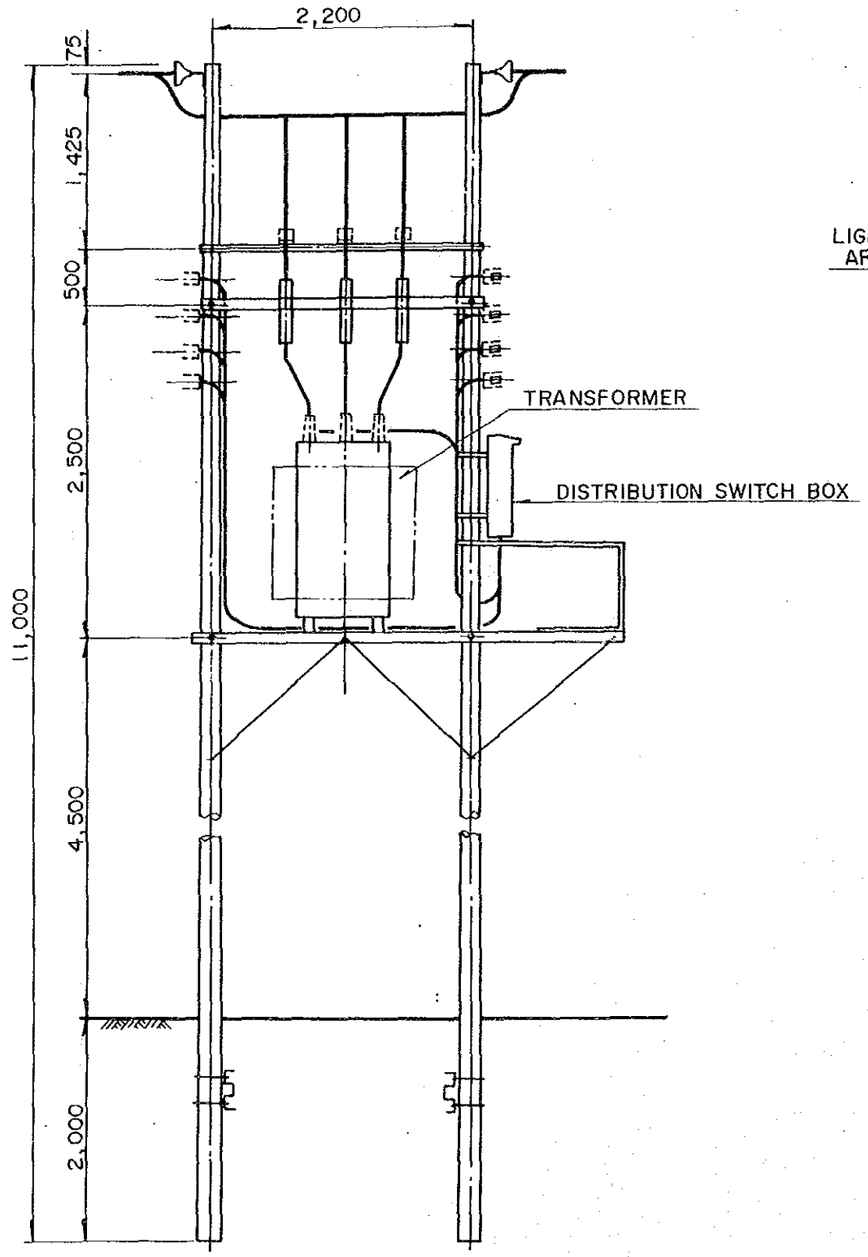
DEAD END TYPE POLE



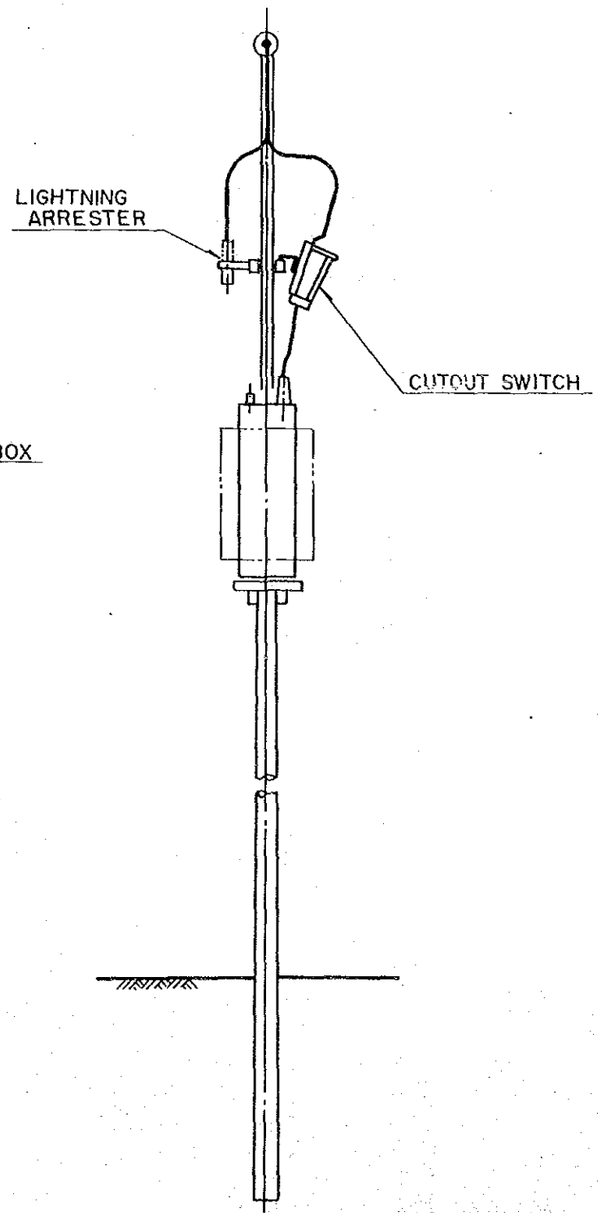


MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Fig. 12.8** **General Layout of 11kV Double Circuit Poles**

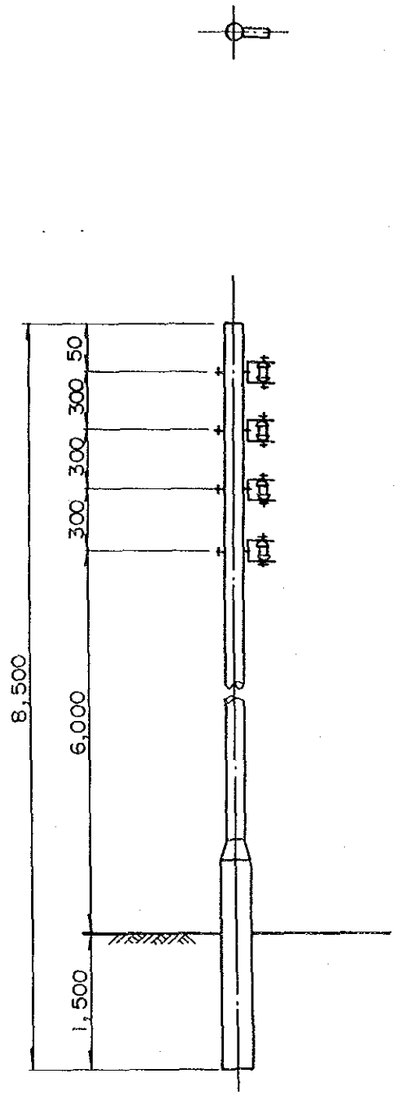
INTERMEDIATE TRANSFORMER POLE



TRANSFORMER POLE



L.T POLE



MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Fig. 12.9 General Layout of Transformer Pole and L.T. Pole**

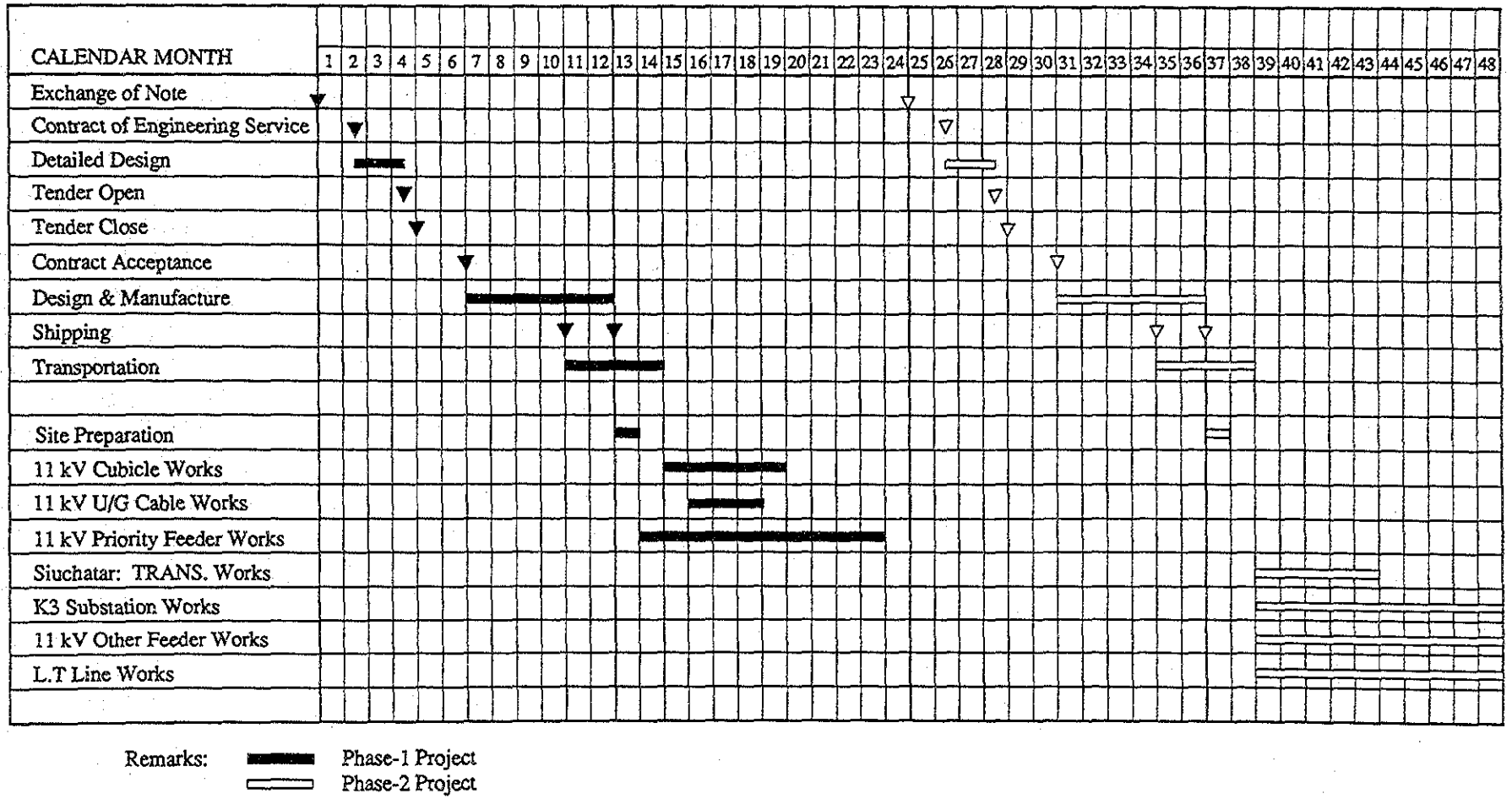
MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY

NEPAL ELECTRICITY AUTHORITY

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

Fig. 13.1
Construction Schedule



ANNEXES

SCOPE OF WORK
FOR
MASTER PLAN STUDY
AND
FEASIBILITY STUDY
ON
EXTENSION AND REINFORCEMENT
OF
POWER TRANSMISSION AND DISTRIBUTION SYSTEM
IN
KATHMANDU VALLEY

AGREED UPON BETWEEN
NEPAL ELECTRICITY AUTHORITY
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

KATHMANDU
MARCH 19, 1990

TAKASHI NODA
LEADER
PRELIMINARY STUDY TEAM
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

K.C. THAKUR
MANAGING DIRECTOR
NEPAL ELECTRICITY
AUTHORITY

I. INTRODUCTION

In response to the request of His Majesty's Government of Nepal (hereinafter referred to as "HMG/N"), the Government of Japan has decided to implement the Master Plan Study and Feasibility Study on Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley in accordance with the relevant laws and regulations in force in Japan.

Accordingly the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities of HMG/N.

Nepal Electricity Authority (hereinafter referred to as "NEA") shall act as counterpart agency to the Japanese Study Team and also coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to formulate the Master Plan and to assess technical, economic and financial feasibility of the project for Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley.

III. SCOPE OF THE STUDY

The study consists of the following two (2) parts :

1. Master Plan Study
2. Feasibility Study

The Scope of the Study for the respective parts are itemized as follows :

1. Master Plan Study

1-1. Collection and Review of Data

Collection and review of existing data, study reports and relevant information for the Study.

1-2. Field Survey

(1) Existing power generation, transmission, substation and distribution line facilities.

(2) On-going and planned projects sites for power generation, transmission, substation and distribution networks.

(3) Existing telecommunication facilities and load dispatching facilities.

(4) Power supply reliability.

(5) System loss and counter measures for loss reduction.

(6) Tariff system.

(7) Load shedding and blackout.

1-3. Power Demand Forecast

(1) Integrated power demand forecast for twenty (20) years from commencement of the Master Plan Study.

(2) Areawise power demand forecast for ten (10) years from commencement of the Master Plan Study.

1-4. Planning of Power Transmission and Substation Facilities

(1) Study on load flow analysis and system stability.

(2) Study on application of 11kV, 33kV, 66kV and 132kV voltages.

(3) Study on upgrading of existing 11kV substations to 66kV.

(4) Study on ring system of transmission line.

(5) Formulation of optimum plan for power transmission and substation facilities.

- Construction plan of transmission line.
- Plan for new construction, reinforcement and rehabilitation of substation facilities including existing circuit breakers.

1-5. Planning of Distribution Line Facilities

(1) Study on adoption of 11 kV multi-circuit switching gear for underground cable.

(2) Study on application of underground cable and insulated overhead line cable.

(3) Formulation of optimum plan for new construction, reinforcement and rehabilitation of distribution line facilities.

1-6. Implementation Schedule

1-7. Cost Estimation

2. Feasibility Study

Feasibility Study shall be conducted for the works which will be executed within five (5) years from commencement of this Feasibility Study.

2-1. Detailed Field Survey for Candidate Construction Site

2-2. Feasibility Design

Feasibility Design shall be prepared for the projects identified in the Master Plan such as :

(1) Transmission line.

- Route, voltage, conductor size, number of circuit, support, etc.

(2) Substation.

- Number of-bank, unit transformer capacity, protective relay system, insulation system, number of feeder, etc.

(3) Distribution network.

- Route, voltage, number of phase, conductor size, overhead or underground system, insulation method, etc.

2-3. Implementation Schedule

2-4. Cost Estimation

2-5. Economic Evaluation and Financial Analysis

IV. STUDY SCHEDULE

The whole work will be conducted in accordance with the tentative time schedule as shown in Appendix.

V. REPORT

JICA shall prepare and submit the following reports in English to NEA according to the attached schedule.

1) Inception Report . . . . 30 copies
2) Progress Report . . . . 10 copies
3) Interim Report . . . . 30 copies
4) Draft Final Report . . . . 30 copies

NEA shall forward his comments on the Draft Final Report to JICA within one (1) month after receiving the reports.

5) Final Report . . . . 50 copies

This report shall be submitted two (2) months after receiving the comments on the Draft Final Report from NEA.

VI. UNDERTAKING OF HMG/N

1. To facilitate the smooth conduct of the Study, HMG/N shall take the following necessary measures :

(1) To secure the safety of the Japanese study team,
(2) To permit the members of the Japanese study team to enter, leave and sojourn in Nepal for the duration of their assignment therein,

and exempt them from alien registration requirements and consular fees,

(3) To exempt the members of the Japanese study team from taxes, duties and any other charge on equipment, machinery and other materials brought into or taken out of Nepal for the conduct of the Study,

(4) To exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emolument or allowance paid to the member of the Japanese study team for their as services in connection with the implementation of the Study,

(5) To provide the necessary facilities to the Japanese study team for remittance as well as utilization of the funds introduced into Nepal from Japan in connection with the implementation of the Study,

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

(7) To secure permission to take all data and documents (including photographs) related to the Study out of Nepal to Japan by the Study team, and

(8) To provide medical services as needed. Its expenses will be chargeable on the members of the Japanese study team.

2. HMG/N shall bear claims, if any arises against the members of the Japanese study team resulting from, occuring 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 willfull misconduct on the part of the Japanese study team.

3. NEA shall, at its own expense, provide the Japanese study team with the followings, in cooperation with other relevant organizations :

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

(2) Counterpart personnel,

(3) Suitable office space with necessary equipment in Kathmandu,

(4) Credentials or identification cards,

(5) Necessary vehicles with drivers, fuel and spare parts for the implementation of the Study, and

(6) Any other necessary communication facilities during the course of the Study, such as telephone, telex and tranceivers etc.

VII. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures :

(1) To dispatch, at its own expense, the Japanese study team to Nepal, and

(2) To pursue technology transfer to the Nepalese counterpart personnel in the course of the Study.

VIII. CONSULTATION

JICA and NEA shall consult with each other in respect of any matter that may arise from or in connection with the Study.

Appendix TENTATIVE SCHEDULE

Master Plan and Feasibility Study on

Extension and Reinforcement of Power Transmission and Distribution

in Kathmandu Valley

■ Work in Nepal by JICA

□ Work in Japan

Working Item		Project Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Year	1990						1991												1992		
		Calendar Month	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1. Field survey and data collection			■						■														
2. Analysis of collected data			□	□	□																		
3. Power demand forecast				□	□	□																	
4. Master plan					□	□	□	□	□	□	□	□											
5. F/S study																							
- Feasibility Design										□	□	□											
- Cost Estimation											□	□											
- Economic Evaluation and Financial Analysis													□	□									
Reports	Inception Report		▽																				
	Interim Report								▽■														
	Progress Report											▽											
	Draft Final Report												▽■										
	Final Report															▽							

MINUTES OF MEETING

Subject: Master Plan Study and Feasibility Study on Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley.

Venue : Nepal Electricity Authority, Kathmandu.

Date : March 11, 1990 to March 19, 1990.

Participants :

NEA (Nepal Electricity Authority)

1. Mr. K.C. Thakur
   Managing Director

2. Mr. T.B. Pradhanang
   Director-In-Chief
   Distribution and Consumer Services
   Directorate

3. Dr. M.R. Tuladhar
   Director,
   Technical Service Department.

4. Mr. S.B. Pun
   Director,
   Bagmati Department.

JICA (Japan International Cooperation Agency)

1. Mr. Takashi Noda
   Team Leader, JICA.

2. Mr. Shinji Shibata
   Coordinator, JICA.

3. Mr. Toshinori Honma
   Electrical Engineer, JICA.

4. Mr. Yoshiyuki Kudo
   Electrical Engineer, JICA.

Discussions were held at NEA office in Kathmandu between NEA officials and members of JICA Preliminary Study Team (hereinafter referned to as "the JICA Team") from March 11, 1990 to March 19, 1990 in connection with the Draft Scope of Work for Master Plan Study and Feasibility Study on Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley. After extensive discussions the following points were mutually agreed by both parties:

1. The JICA Full Scale Study Team will review the Load Forecast Study report prepared by NEA / EDF.

2. NEA requested the JICA Team to train two of NEA Engineers on Distribution Planning in Japan for technology transfer.

3. NEA explained the JICA Team that some of the existing Network Facilities in Kathmandu Valley need urgent improvement such as :

   a. To increase the transformer capacity at (i) Baneswar (ii) Lainchaur and (iii) New Chabel 66/11 KV substations.

   b. To Construct a 132 KV pie-connection on the Marsyangdi-Balaju Transmission Line to connect Siuchatar 132 KV Substation with Marsyangdi Hydro Power Station for the enhancement of the system operation flexibility.

   c. To string second circuit between Siuchatar and Patan at 66 KV substations.

   d. To construct a 66 KV switching substation at Raniban to connect Devighat and Trisuli Power Stations at 66 KV.

   e. To Construct a 66 KV substation at existing 11 KV switching station at Teku.

4. NEA also explained the JICA Team that :

   a. NEA will provide the JICA Full Scale Study Team necessary office space in Kathmandu.

   b. NEA will assist the JICA Full Scale Study Team to procure vehicle rental services and the cost will be borne by the JICA Full Scale Study Team.

   c. NEA will provide telephone.

5. Both parties agreed to cooperate with each other for the benefit of the Study.

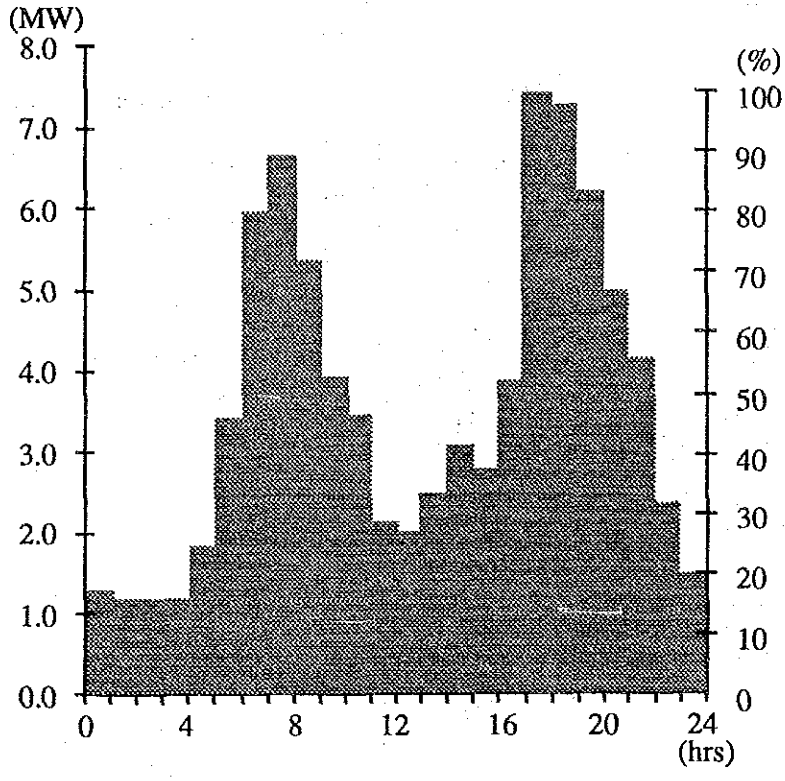
6. The Scope of Work and the conditions therein is subject to the approval of HMG/N which will be obtained before the end of May 1990.

Kathmandu,
March 19, 1990

(K.C. Thakur)
Managing Director
NEA

(Takashi Noda)
Team Leader
JICA

Jan. 5, 1990



Peak Load Value : 7.38 MW

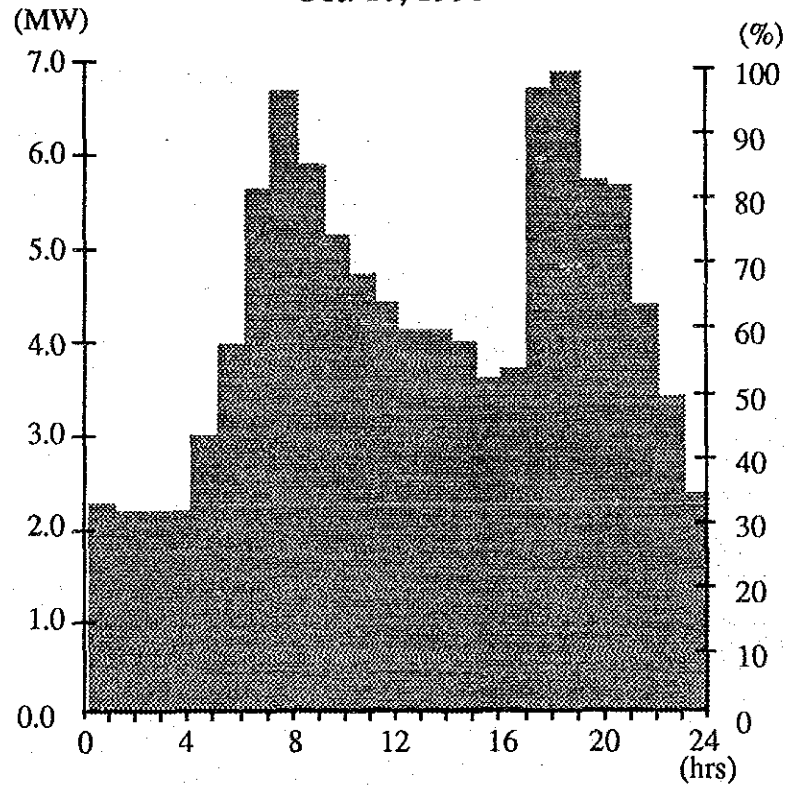
Mean Load Value : 3.53 MW

Load Factor : 48%

Breakdown of Peak Value

Ring Road	:	0.78 MW
Radio Nepal	:	1.05 MW
Patan	:	1.83 MW
Jawalakhel	:	1.31 MW
Pharping	:	1.57 MW
Mangal Bazar	:	0.84 MW

Oct. 10, 1990



Peak Load Value : 6.82 MW

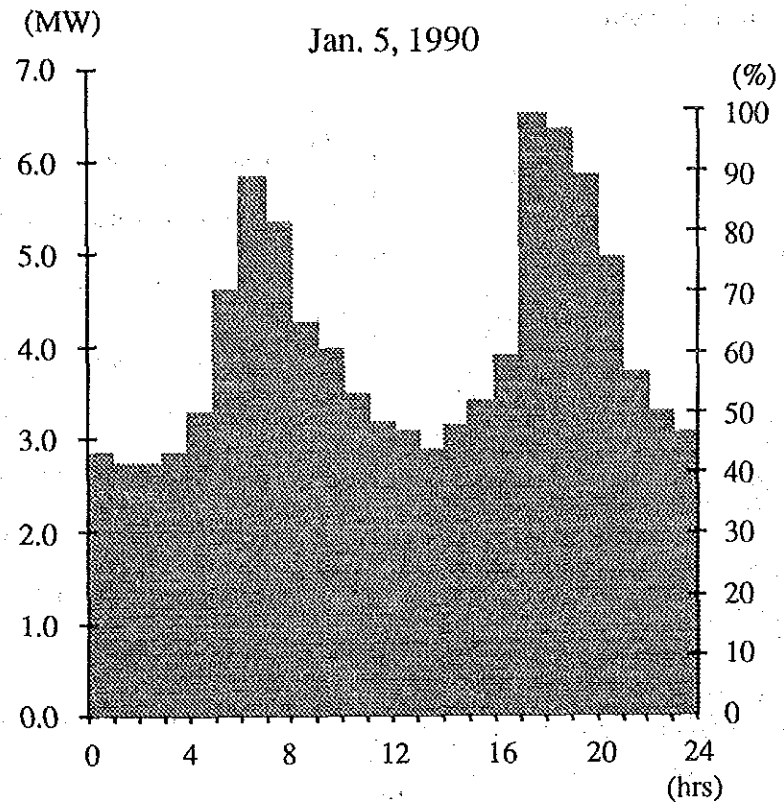
Mean Load Value : 4.24 MW

Load Factor : 62%

Breakdown of Peak Value

Ring Road	:	0.71 MW
Radio Nepal	:	0.78 MW
Patan	:	1.25 MW
Jawalakhel	:	1.24 MW
Pharping	:	2.13 MW
Mangal Bazar	:	0.71 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-2 (1/13)** Aggregate Daily Load Curve of 11kV Local Supply Feeders at Patan Substation



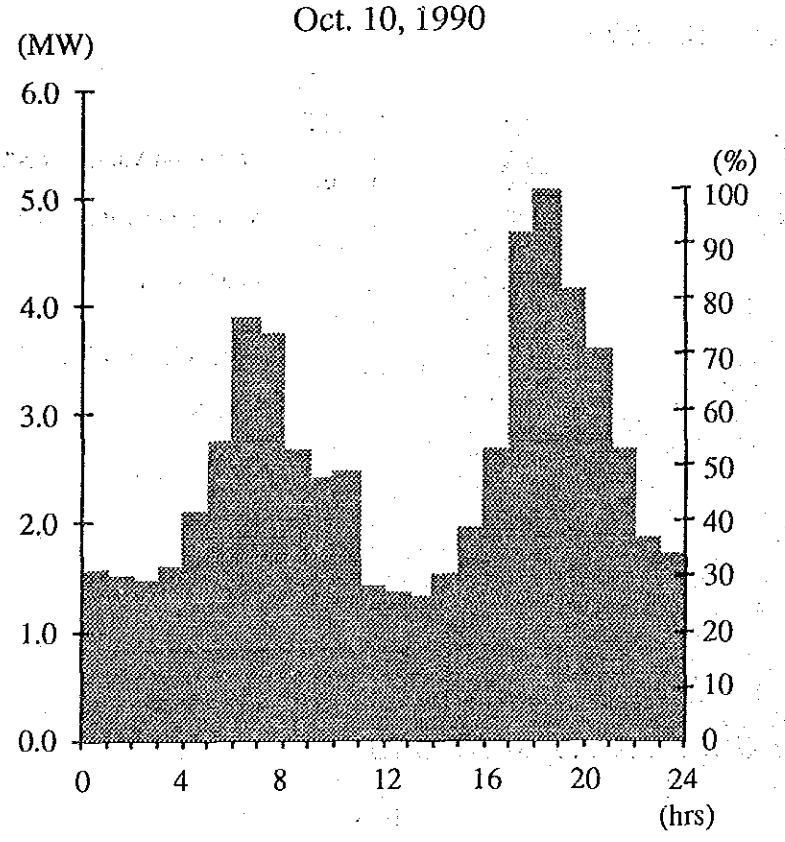
Peak Load Value : 6.52 MW

Mean Load Value : 3.96 MW

Load Factor : 61%

Breakdown of Peak Value

Ropeway Feeder	:	1.80 MW
Kalimati	:	1.40 MW
Kalanki	:	0.10 MW
Swayambhu	:	0.54 MW
Thankot	:	1.80 MW
Tahachal	:	0.88 MW



Peak Load Value : 5.07 MW

Mean Load Value : 2.50 MW

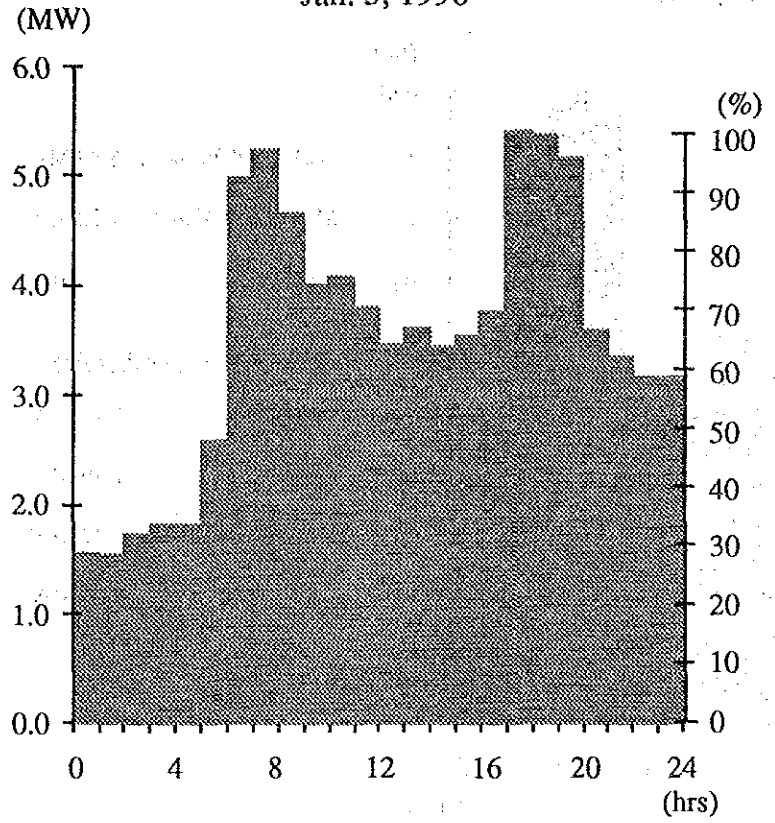
Load Factor : 49%

Breakdown of Peak Value

Ropeway Feeder	:	1.70 MW
Kalimati	:	1.40 MW
Kalanki	:	0.10 MW
Swayambhu	:	0.53 MW
Thankot	:	0.04 MW
Tahachal	:	1.30 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-2 (2/13)** Aggregate Daily Load Curve of 11kV Local Supply Feeders at Siuchatar Substation

Jan. 5, 1990



Peak Load Value : 5.42 MW

Mean Load Value : 3.53 MW

Load Factor : 65%

Breakdown of Peak Value

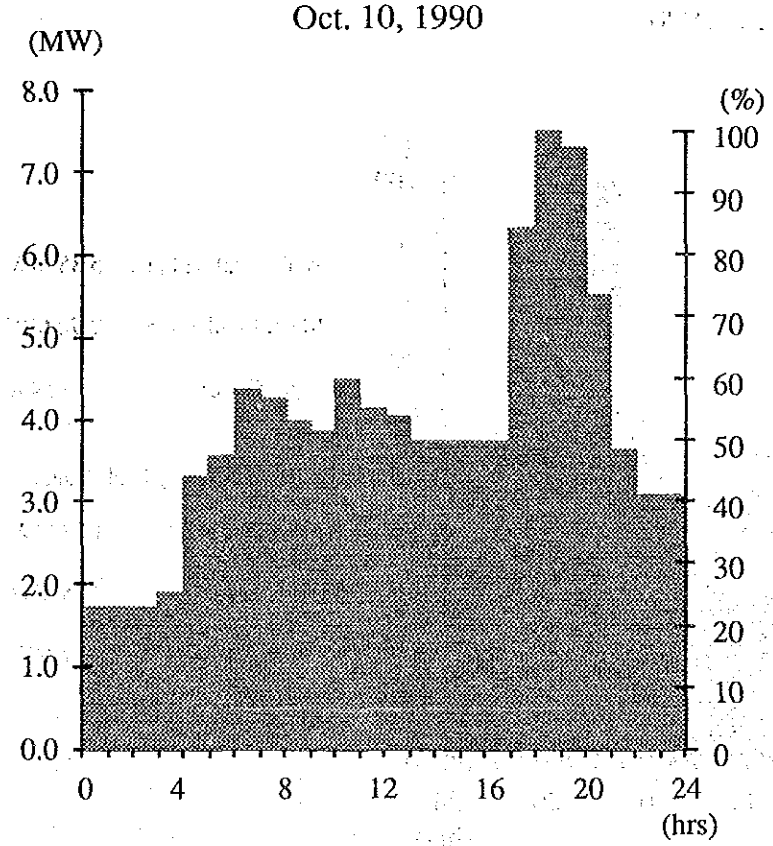
Dharmasthali : 1.33 MW

Swayambhu : 0.89 MW

B. I. D. : 1.07 MW

Naya Bazar : 2.03 MW

Oct. 10, 1990



Peak Load Value : 7.48 MW

Mean Load Value : 3.93 MW

Load Factor : 53%

Breakdown of Peak Value

Dharmasthali : 1.58 MW

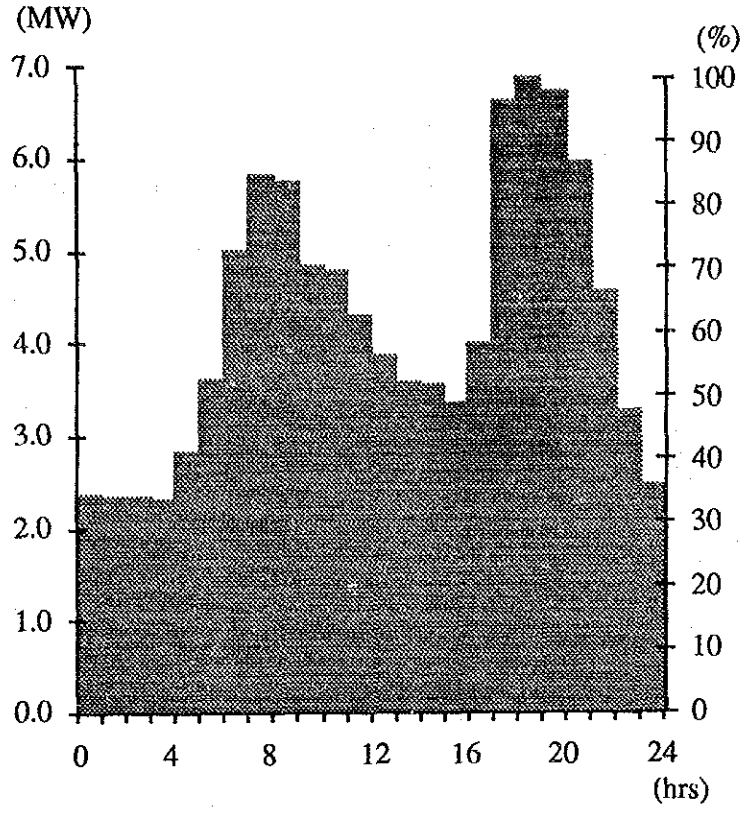
Swayambhu : 1.06 MW

B. I. D. : 1.67 MW

Naya Bazar : 3.17 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Annex-2 (3/13) Aggregate Daily Load Curve of 11kV Local Supply Feeders at Balaju Substation

Jan. 5, 1990



Peak Load Value : 6.89 MW

Mean Load Value : 4.22 MW

Load Factor : 61%

Breakdown of Peak Value

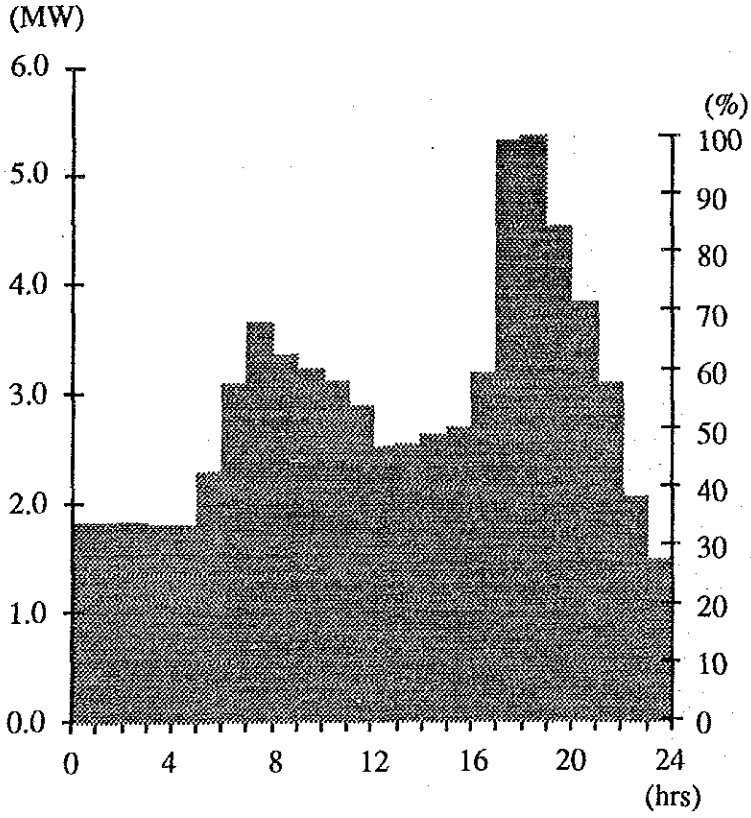
Lajimpat : 1.79 MW

Gairidhara : 1.79 MW

Kingsway : 2.37 MW

Naya Bazar : 0.94 MW

Oct. 24, 1990



Peak Load Value : 5.35 MW

Mean Load Value: 2.90 MW

Load Factor : 54%

Breakdown of Peak Value

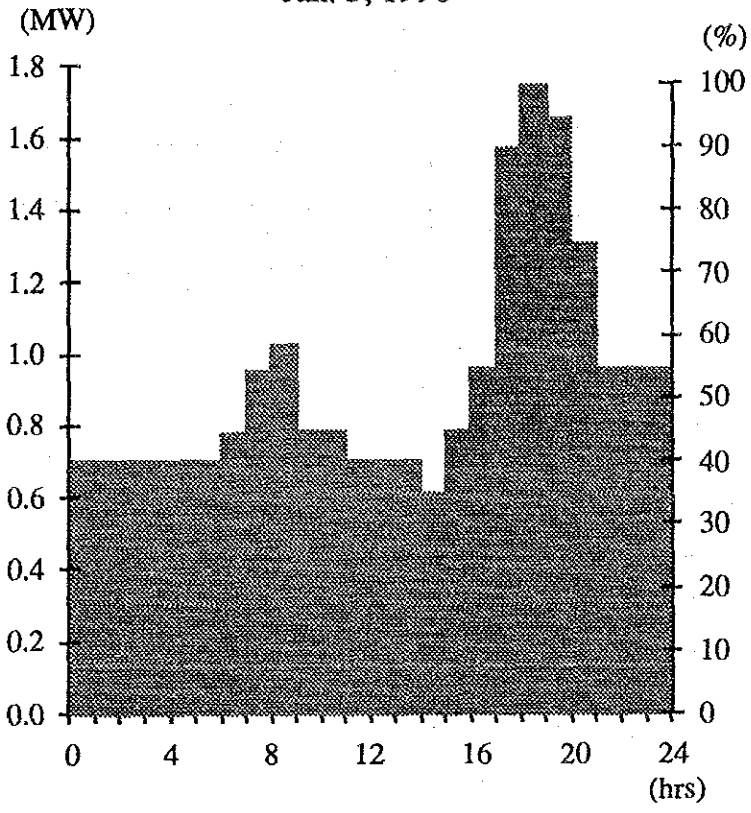
Gairidhara : 1.53 MW

Kingsway : 2.75 MW

Naya Bazar : 1.07 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-2 (4/13)** Aggregate Daily Load Curve of 11kV Local Supply Feeders at Lainchaur Substation

Jan. 5, 1990



Peak Load Value : 1.74 MW

Mean Load Value: 0.92 MW

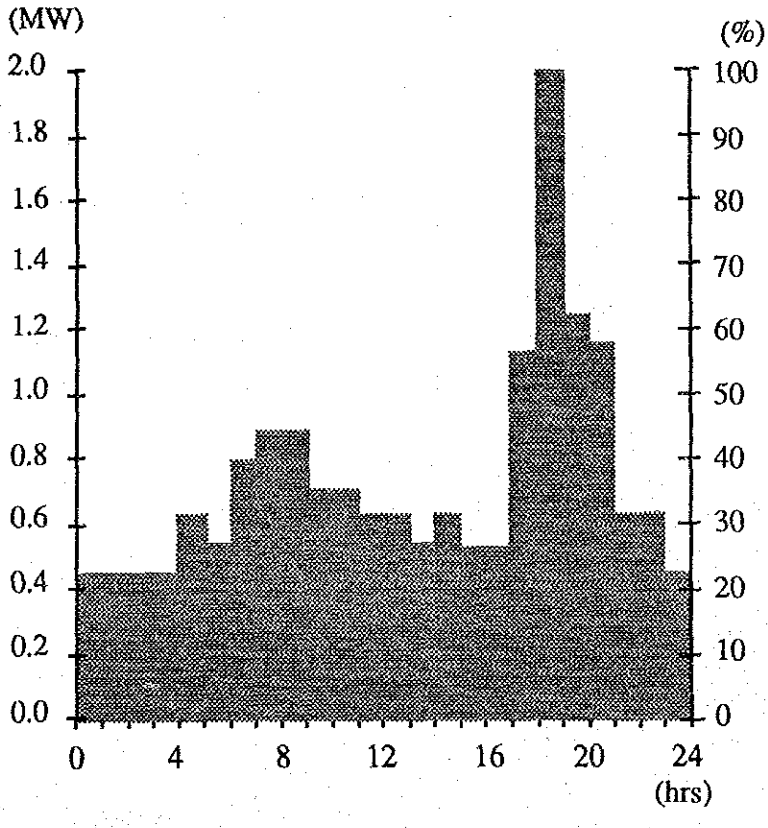
Load Factor : 53%

Breakdown of Peak Value

Maharajgunj : 1.13 MW

Sundarijal : 0.61 MW

Oct. 10, 1990



Peak Load Value : 2.01 MW

Mean Load Value : 0.74MW

Load Factor : 37%

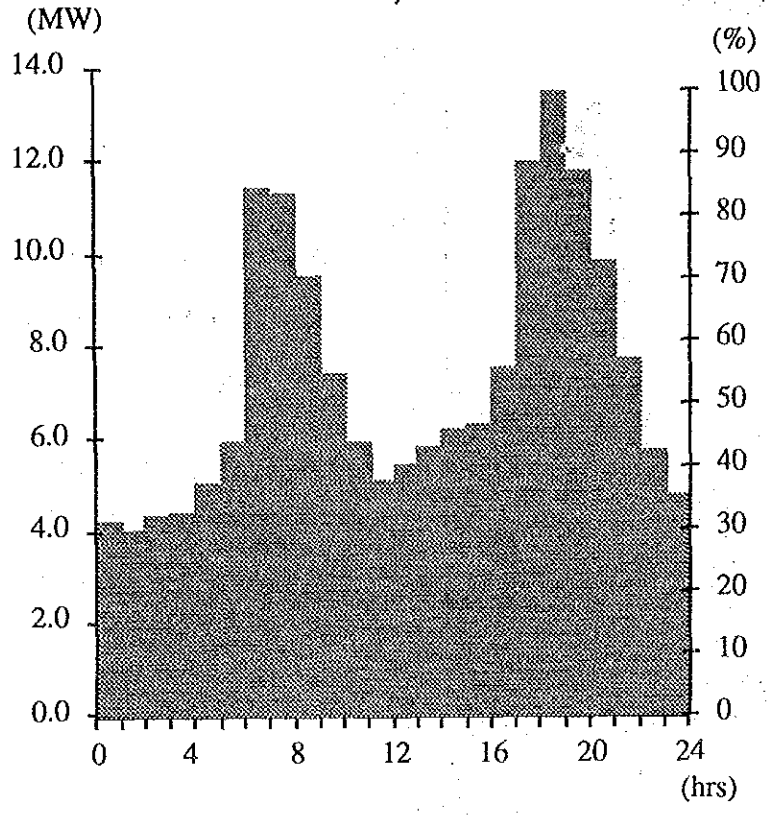
Breakdown of Peak Value

Maharajgunj : 1.31 MW

Sundarijal : 0.70 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Annex-2 (5/13) Aggregate Daily Load Curve of 11kV Local Supply Feeders at New Chabel Substation

Jan. 5, 1990



Peak Load Value : 13.5 MW

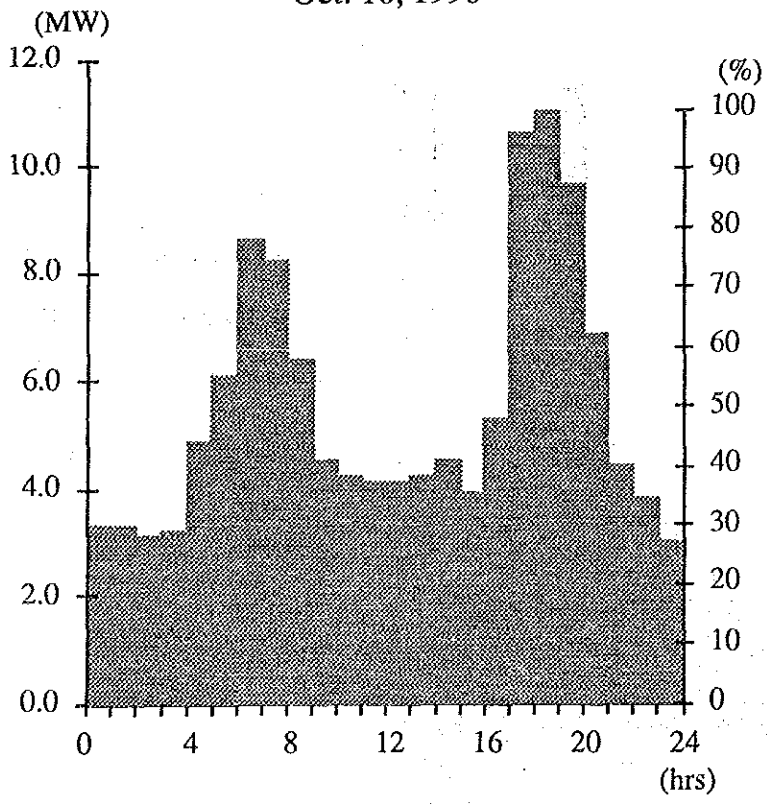
Mean Load Value : 7.29 MW

Load Factor : 54%

Breakdown of Peak Value

Beneswar	: 2.4 MW
Airport	: 3.4 MW
Godawary - 1, 2	: 5.2 MW
Shankhamul	: 2.5 MW

Oct. 10, 1990



Peak Load Value : 11.0 MW

Mean Load Value : 5.46 MW

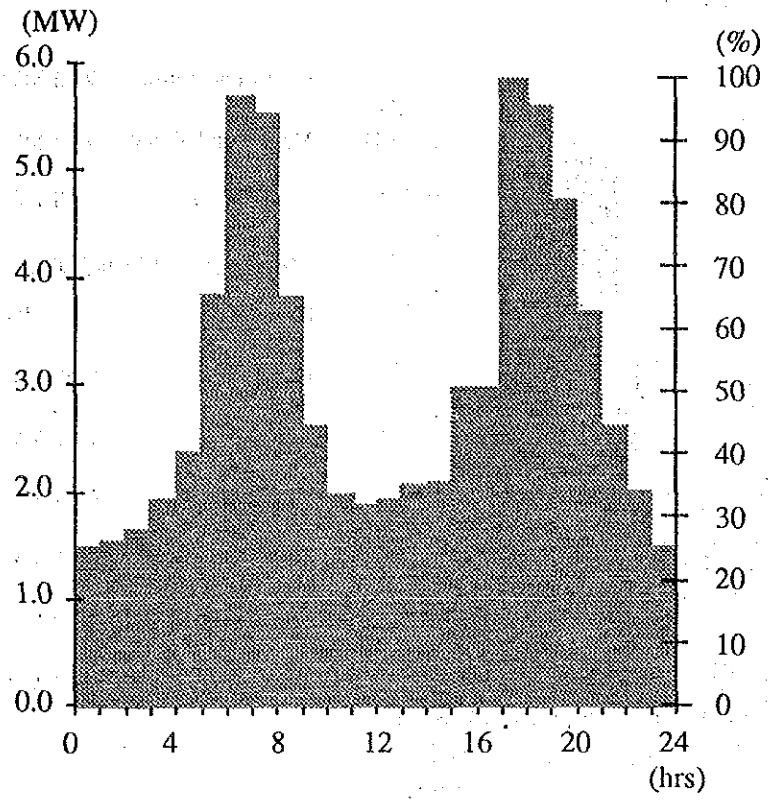
Load Factor : 50 %

Breakdown of Peak Value

Beneswar	: 2.1 MW
Airport	: 2.2 MW
Godawary - 1, 2	: 4.4 MW
Imadol	: 1.2 MW
Shankhamul	: 1.1 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-2 (6/13)** Aggregate Daily Load Curve of 11kV Local Supply Feeders at Baneswar Substation

Jan. 5, 1990



Peak Load Value : 5.86 MW

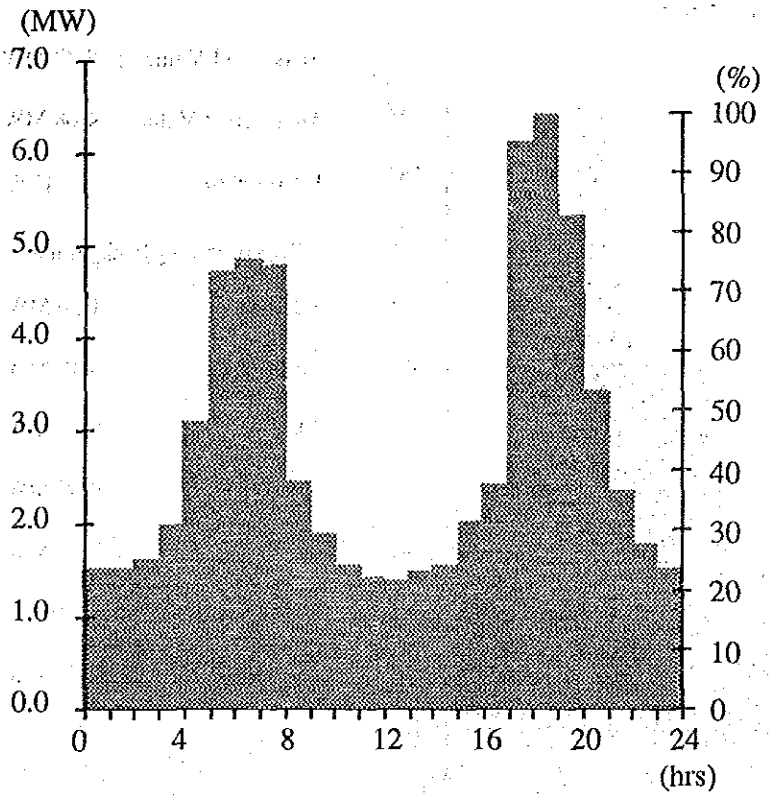
Mean Load Value : 3.01 MW

Load Factor : 51 %

Breakdown of Peak Value

Nagarkot	:	0.72 MW
Bhaktapur	:	1.65 MW
Khopasi	:	0.95 MW
Nalinchok	:	0.07 MW
Katunje	:	0.69 MW
Byasi	:	1.78 MW

Oct. 10, 1990



Peak Load Value : 6.44 MW

Mean Load Value : 2.79 MW

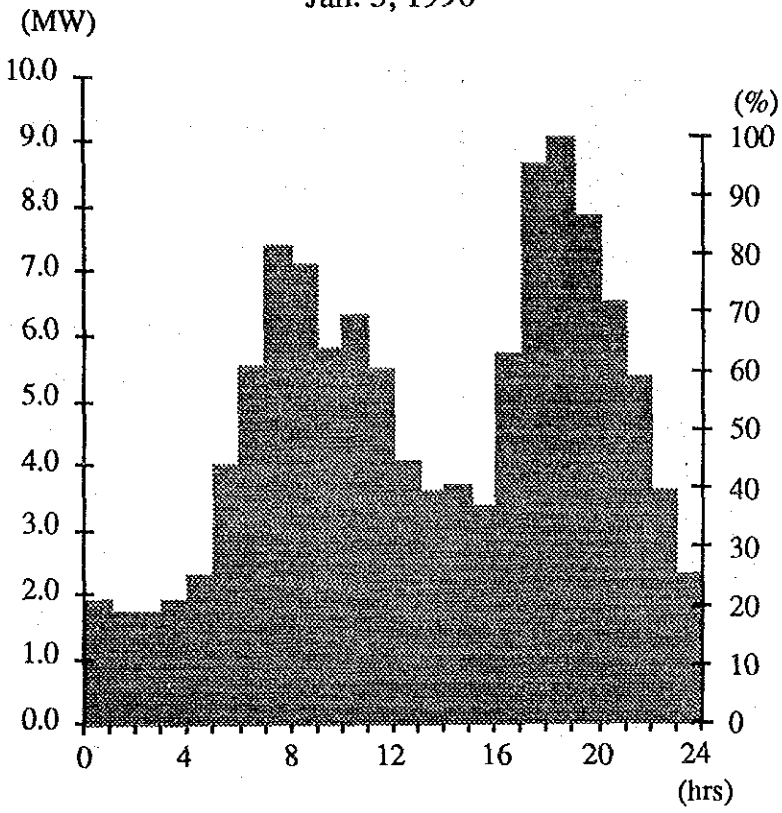
Load Factor : 43 %

Breakdown of Peak Value

Nagarkot	:	0.86 MW
Bhaktapur	:	1.69 MW
Khopasi	:	1.03 MW
Nalinchok	:	0.35 MW
Katunje	:	0.69 MW
Byasi	:	1.82 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Annex-2 (7/13) Aggregate Daily Load Curve of 11kV Local Supply Feeders at Bhaktapur Switching Station

Jan. 5, 1990



Peak Load Value : 9.03 MW

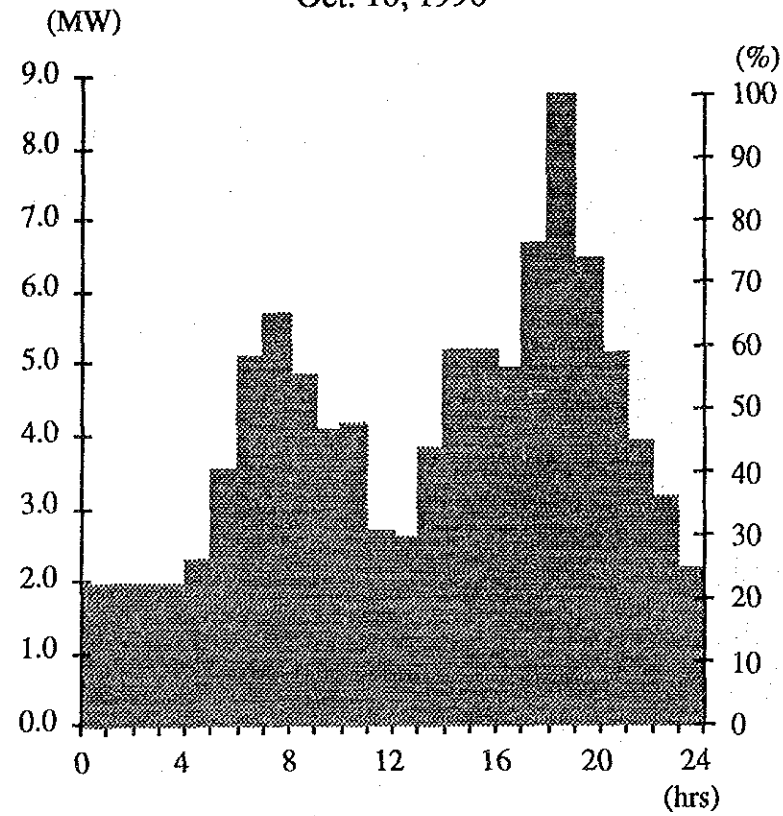
Mean Load Value : 4.77 MW

Load Factor : 53 %

Breakdown of Peak Value

Pulchowk	:	2.05 MW
Kirtipur	:	0.53 MW
Mint	:	2.22 MW
Tahachal	:	0.84 MW
Thankot	:	0.37 MW
Bhimsensthan	:	2.40 MW
Tripureswor	:	0.62 MW

Oct. 10, 1990



Peak Load Value : 8.72 MW

Mean Load Value : 4.08 MW

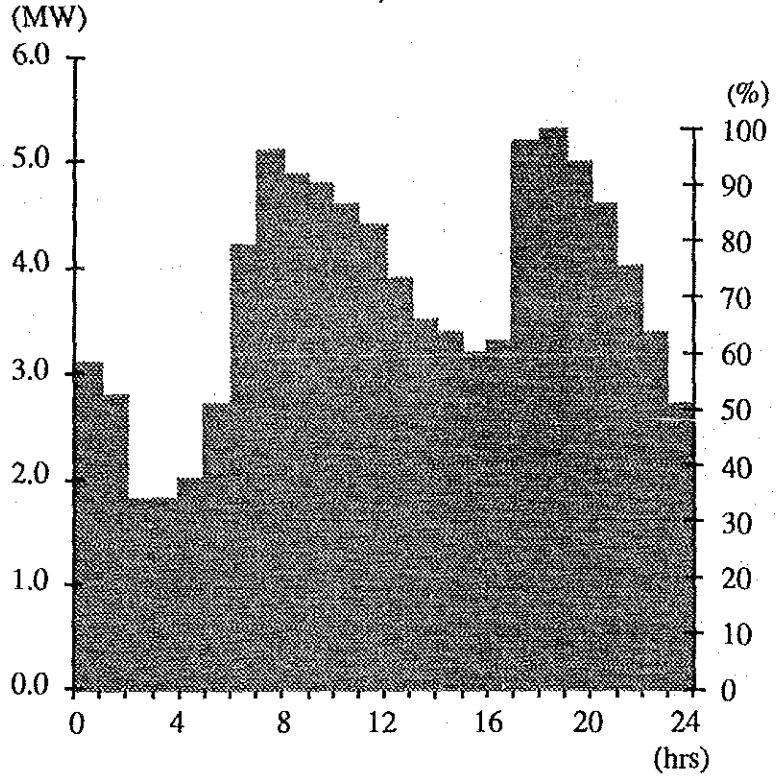
Load Factor : 47 %

Breakdown of Peak Value

Pulchowk	:	1.50 MW
Kirtipur	:	0.18 MW
Mint	:	2.02 MW
Tahachal	:	0.69 MW
Thankot	:	0.37 MW
Bhimsensthan	:	3.43 MW
Tripureswor	:	0.53 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-2 (8/13)** Aggregate Daily Load Curve of 11kV Local Supply Feeders at **Teku Switching Station**

Jan. 5, 1990



Peak Load Value : 5.3 MW

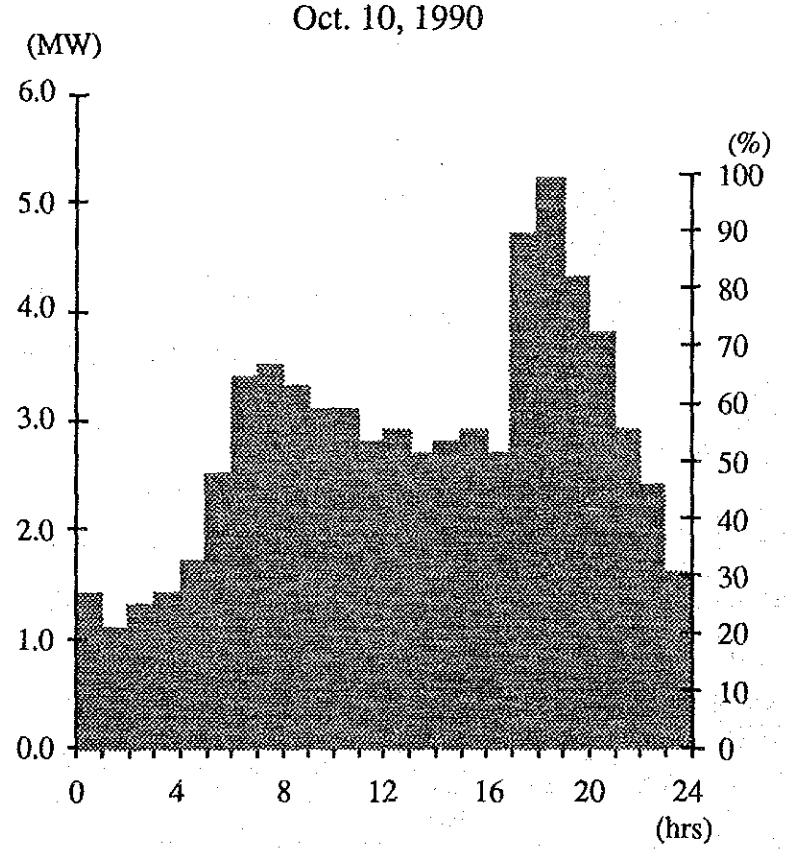
Mean Load Value : 3.7 MW

Load Factor : 70 %

Breakdown of Peak Value

Teku	: 0.90 MW
Patan	: 2.30 MW
Thapathali	: 0.60 MW
Singha Durbar	: 0.60 MW
Sanepa	: 0.90 MW

Oct. 10, 1990



Peak Load Value : 5.2 MW

Mean Load Value : 2.8 MW

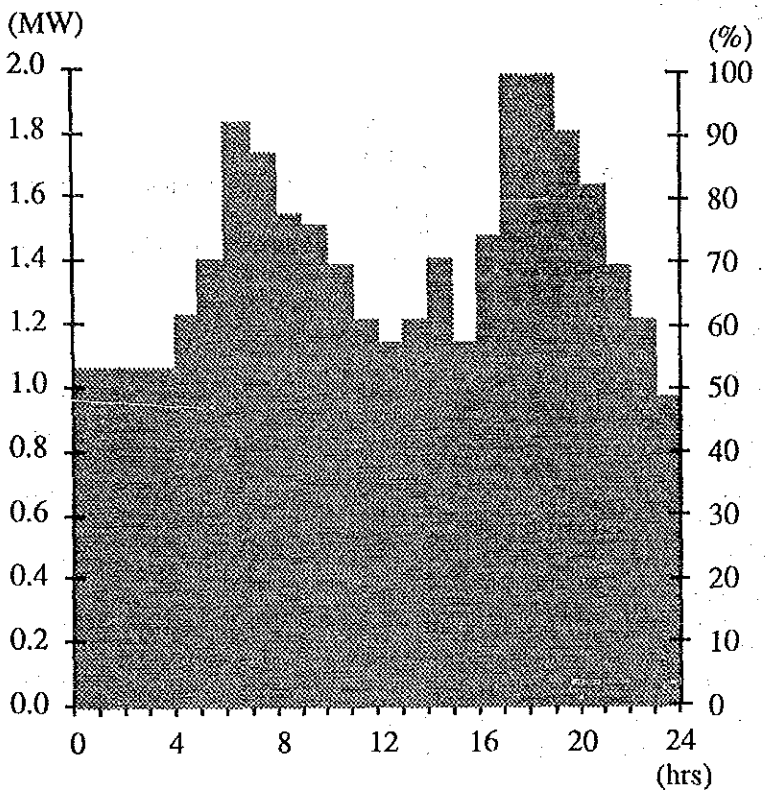
Load Factor : 54 %

Breakdown of Peak Value

Teku	: 0.80 MW
Patan	: 1.90 MW
Thapathali	: 0.40 MW
Singha Durbar	: 1.30 MW
Sanepa	: 0.80 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-2 (9/13)** Aggregate Daily Load Curve of 11kV Local Supply Feeders at Thapathali Switching Station

Jan. 5, 1990



Peak Load Value : 1.97 MW

Mean Load Value : 1.39 MW

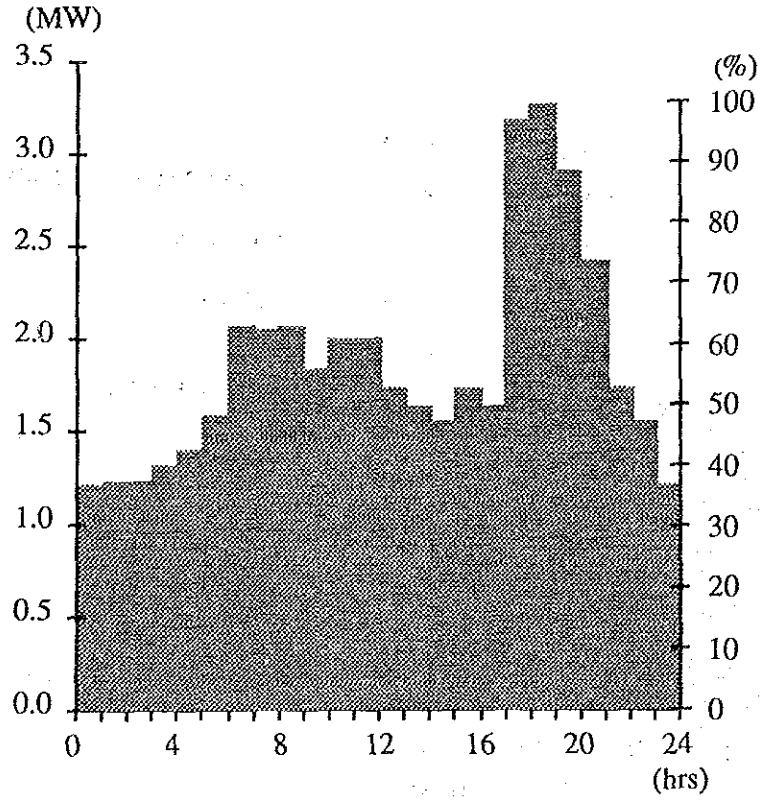
Load Factor : 71 %

Breakdown of Peak Value

Buddhamilkantha : 1.20 MW

Balumatar : 0.77 MW

Oct. 10, 1990



Peak Load Value : 3.25 MW

Mean Load Value : 1.84 MW

Load Factor : 57 %

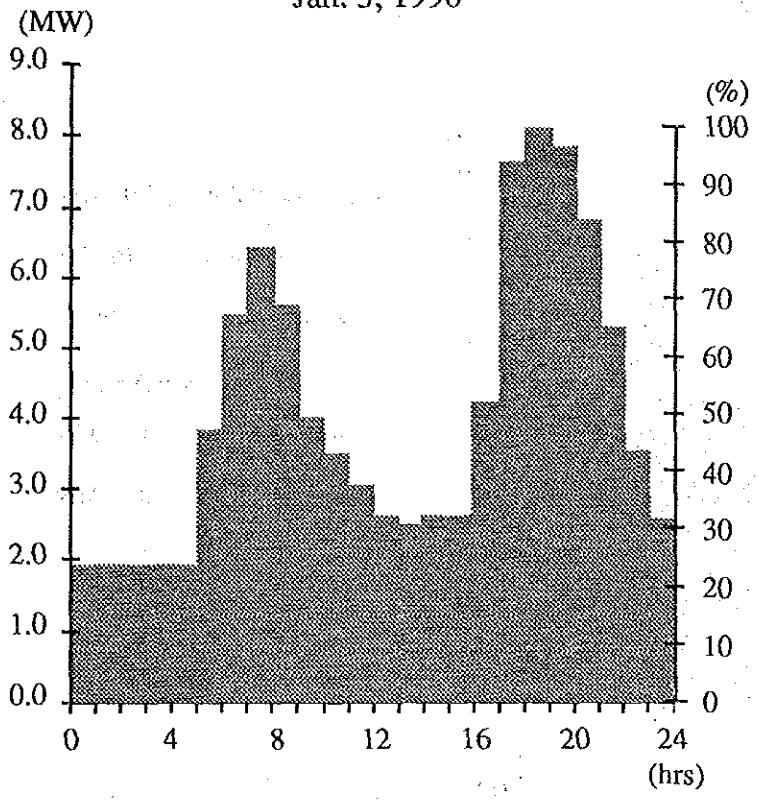
Breakdown of Peak Value

Buddhanilkantha : 0.60 MW

Baluwatar : 2.65 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Annex-2 (10/13) Aggregate Daily Load Curve of 11kV Local Supply Feeders at **Maharajgunj Switching Station**

Jan. 5, 1990

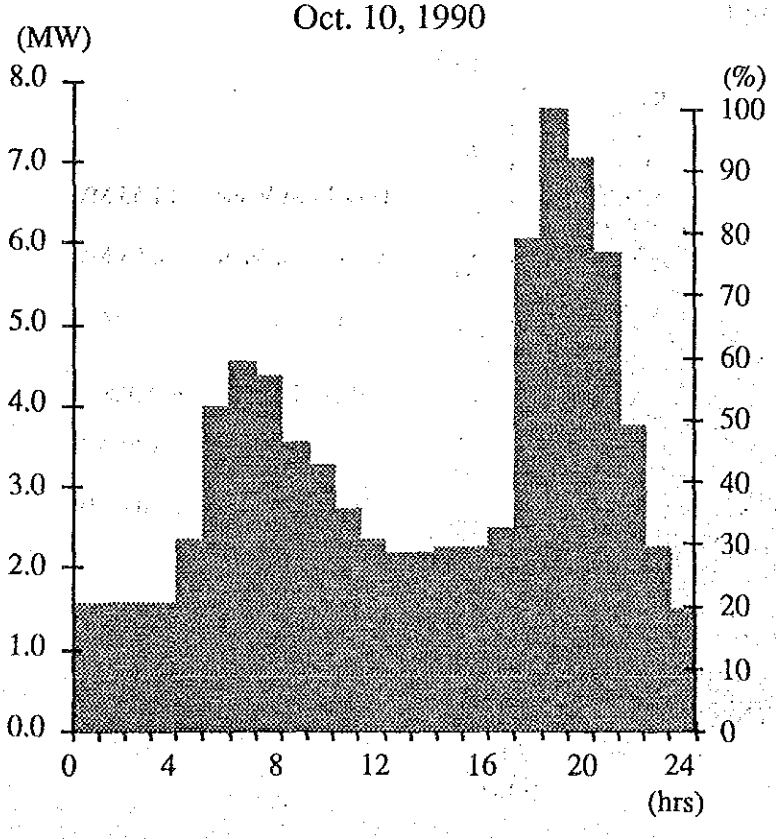


Peak Load Value	: 8.08 MW
Mean Load Value	: 4.06 MW
Load Factor	: 50 %

Breakdown of Peak Value

Baneswar	: 1.69 MW
Naxal	: 2.12 MW
Boudha Jorpati	: 2.71 MW
Airport	: 0.68 MW
Tangal	: 0.88 MW

Oct. 10, 1990



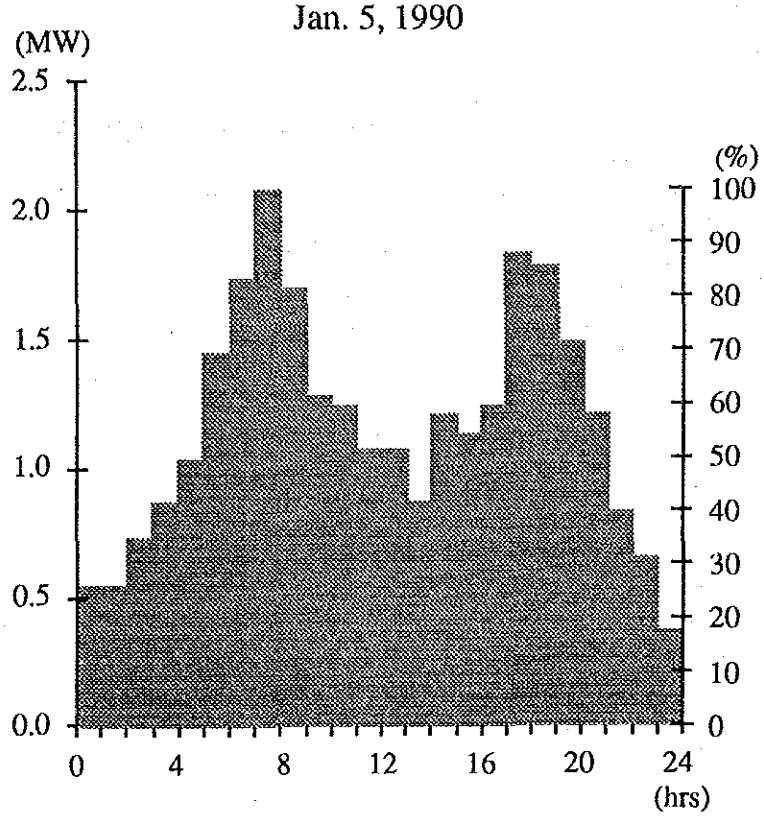
Peak Load Value	: 7.64 MW
Mean Load Value	: 3.27 MW
Load Factor	: 43 %

Breakdown of Peak Value

Baneswar	: 1.05 MW
Naxal	: 1.66 MW
Boudha Jorpati	: 2.79 MW
Airport	: 0.61 MW
Tangal	: 1.53 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Annex-2 (11/13) Aggregate Daily Load Curve of 11kV Local Supply Feeders at Chabel Switching Station

Jan. 5, 1990



Peak Load Value : 2.07 MW

Mean Load Value : 1.16 MW

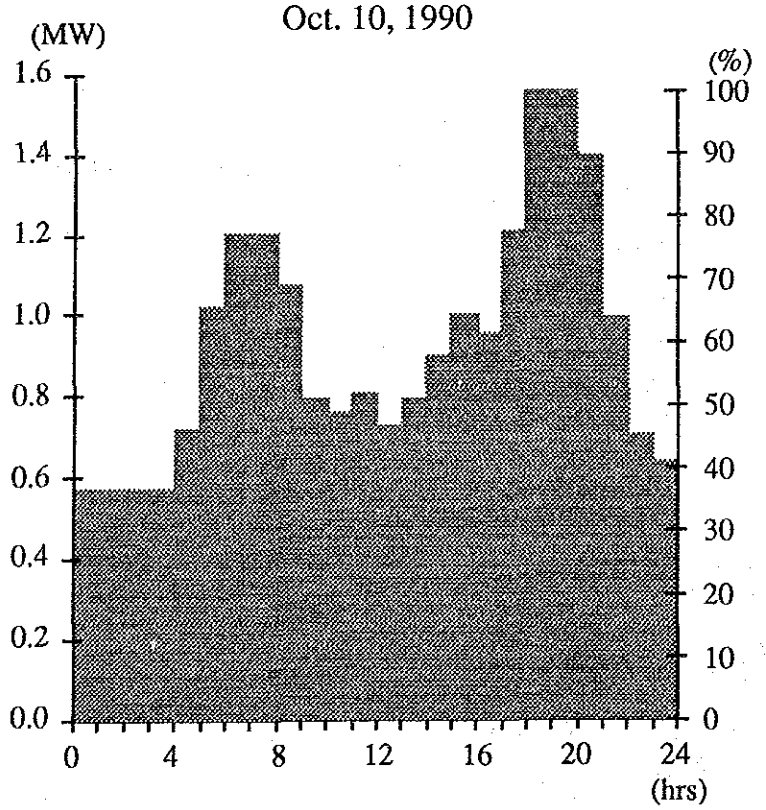
Load Factor : 56%

Breakdown of Peak Value

Thimi : 1.55 MW

Trolley Bus : 0.52 MW

Oct. 10, 1990



Peak Load Value : 1.55 MW

Mean Load Value : 0.93 MW

Load Factor : 60 %

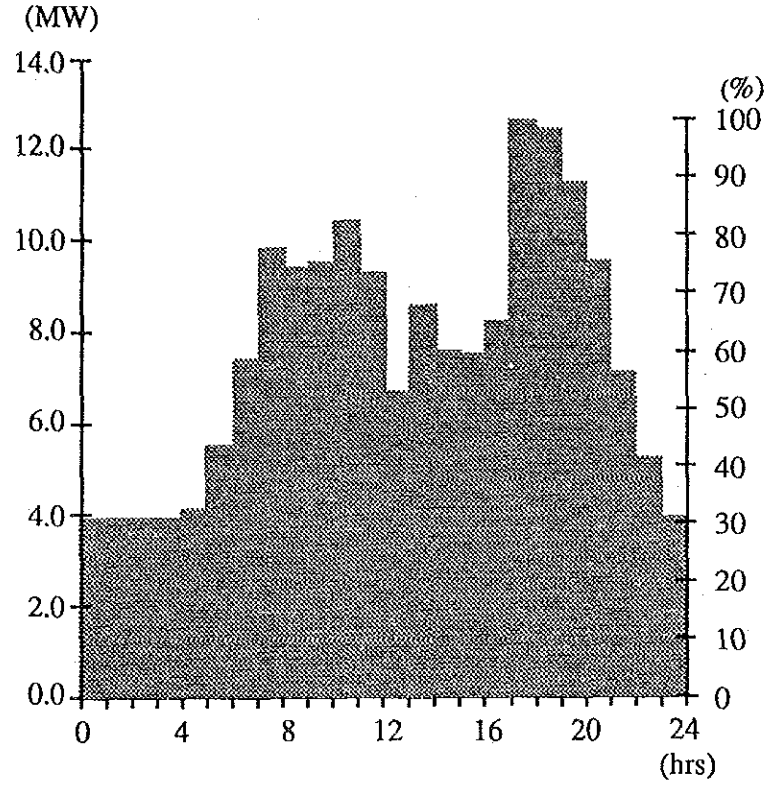
Breakdown of Peak Value

Thimi : 1.55 MW

Trolley Bus : 0.0 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Annex-2 (12/13) Aggregate Daily Load Curve of 11kV Local Supply Feeders at **Thimi Switching Station**

Jan. 5, 1990



Peak Load Value : 12.6 MW

Mean Load Value : 7.60 MW

Load Factor : 60 %

Breakdown of Peak Value

Kingsway : 2.80 MW

Kamaladi : 1.80 MW

Singha Durbar : 0.40 MW

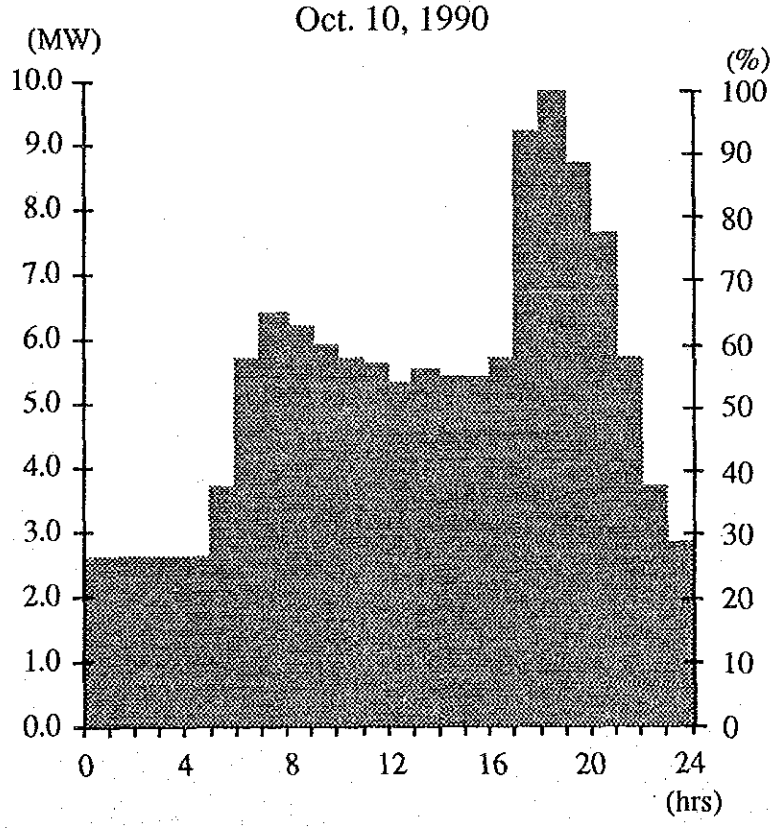
City - 1, 2 : 2.90 MW

Mahabaudha : 1.30 MW

Tangal : 2.80 MW

Babar Mahal : 0.60 MW

Oct. 10, 1990



Peak Load Value : 9.80 MW

Mean Load Value : 5.29 MW

Load Factor : 54 %

Breakdown of Peak Value

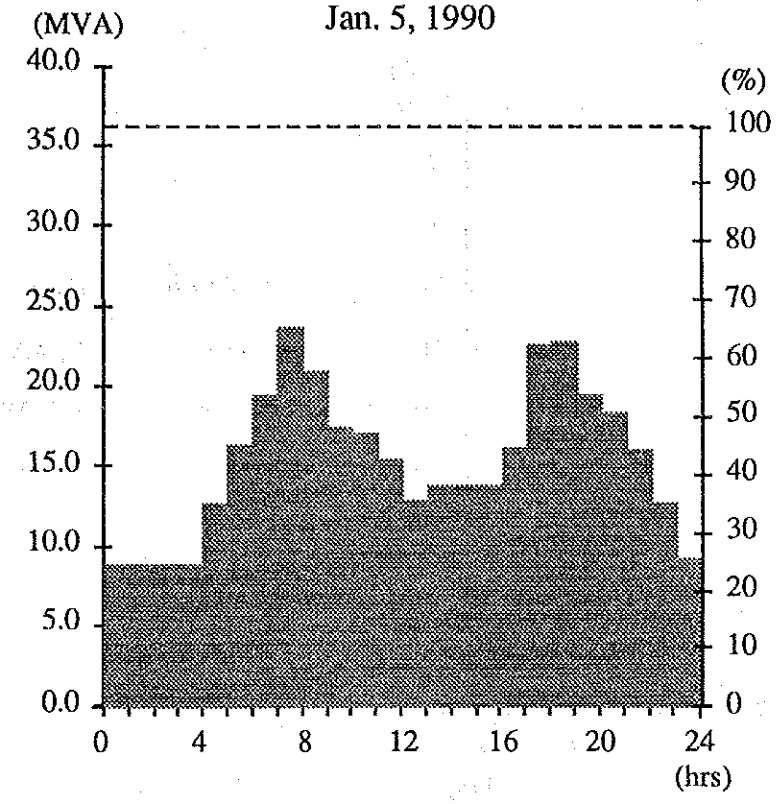
Kingsway : 3.0 MW

Kamaladi : 1.4 MW

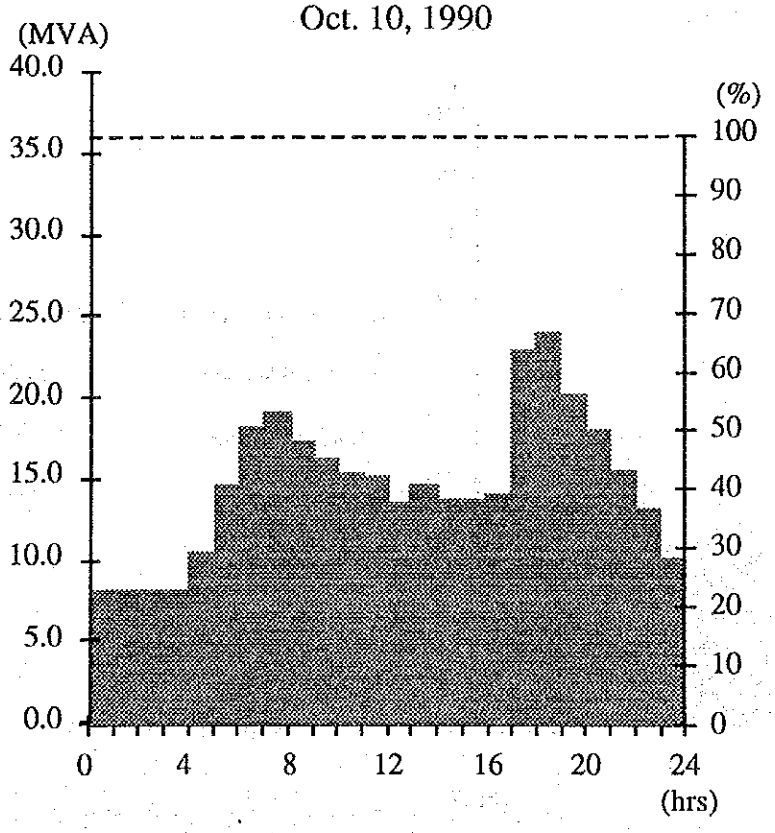
City - 1, 2 : 3.0 MW

Tangal : 2.4 MW

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-2 (13/13)** Aggregate Daily Load Curve of 11kV Local Supply Feeders at **K2 Switching Station**



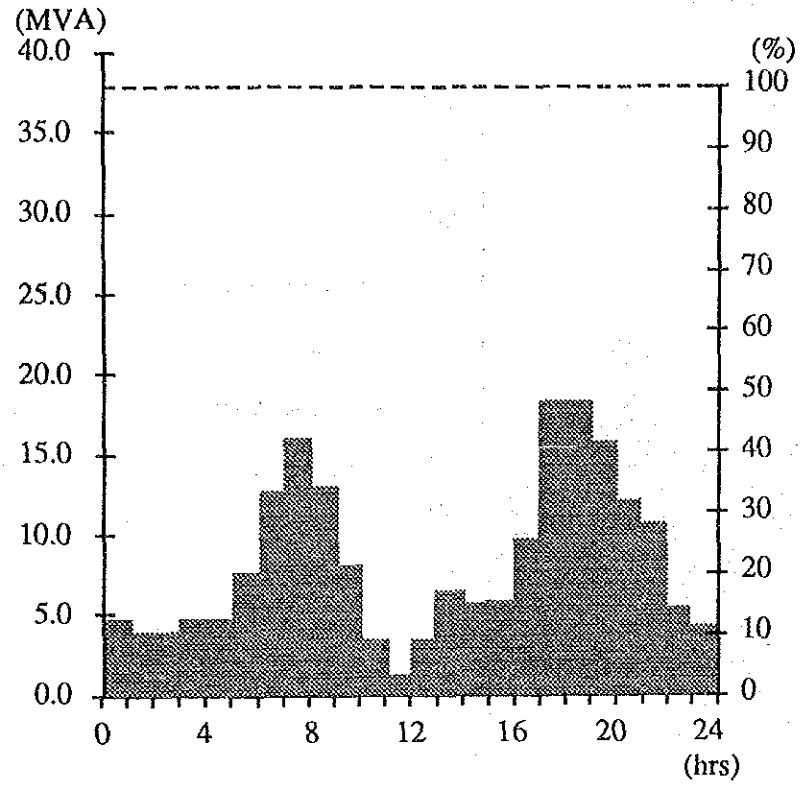
Transformer Capacity :	18MVA x 2
Peak Load Value :	23.5 MVA
Mean Load Value :	15.3 MVA
Demand Factor :	65 %



Transformer Capacity :	18MVA x2
Peak Load Value :	23.9 MVA
Mean Load Value :	14.6 MVA
Demand Factor :	66%

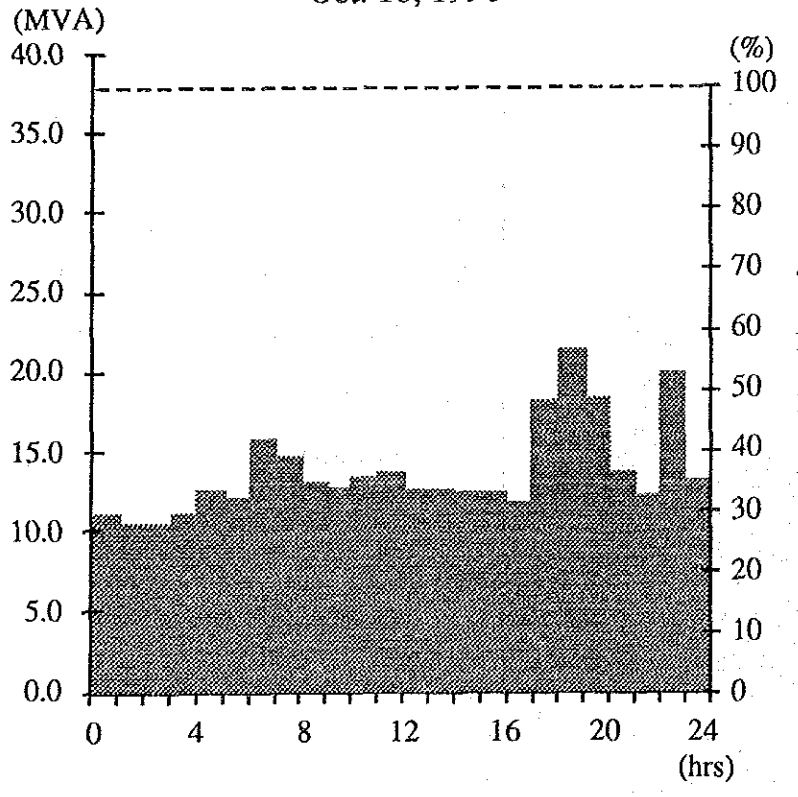
MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-3 (1/8)** Daily Load Curve of Transformer (66/11kV) at **Patan Substation**

Jan. 5, 1990



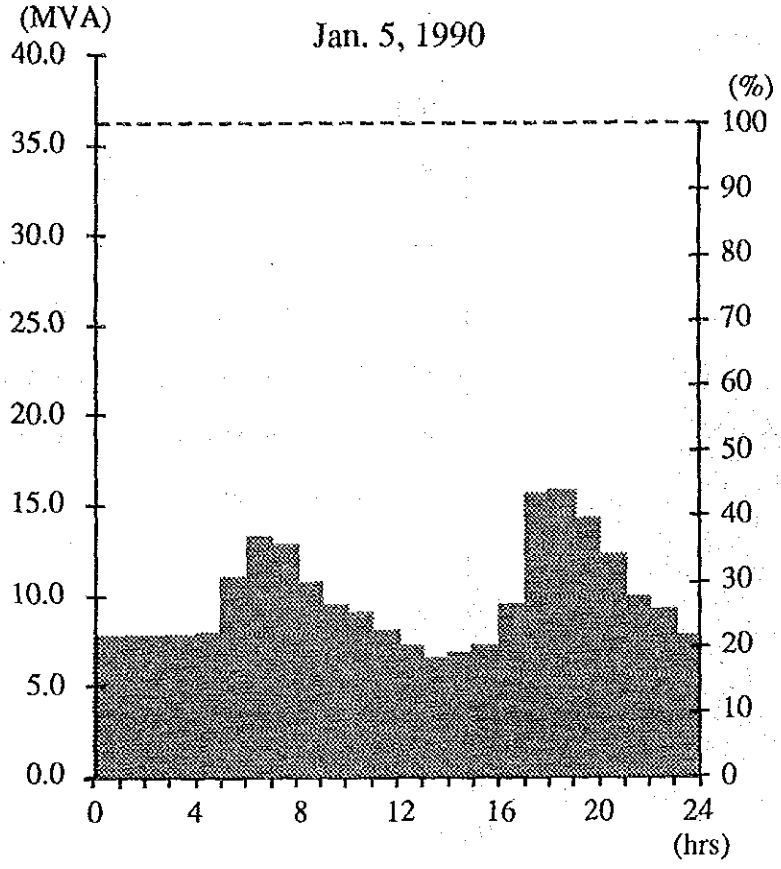
Transformer Capacity :	37.8 MVA
Peak Load Value :	18.3 MVA
Mean Load Value :	8.26 MW
Demand Factor :	48%

Oct. 10, 1990

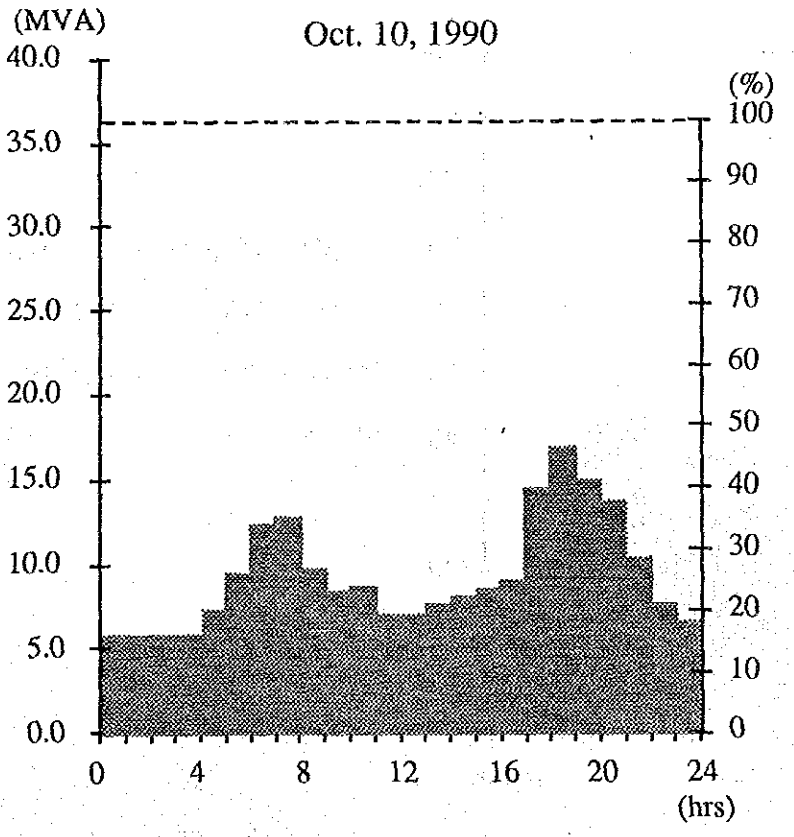


Transformer Capacity :	37.8 MVA
Peak Load Value :	21.3 MVA
Mean Load Value :	13.7 MVA
Demand Factor :	56%

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-3 (2/8)** Daily Load Curve of Transformer (132/66kV) at Siuchatar Substation



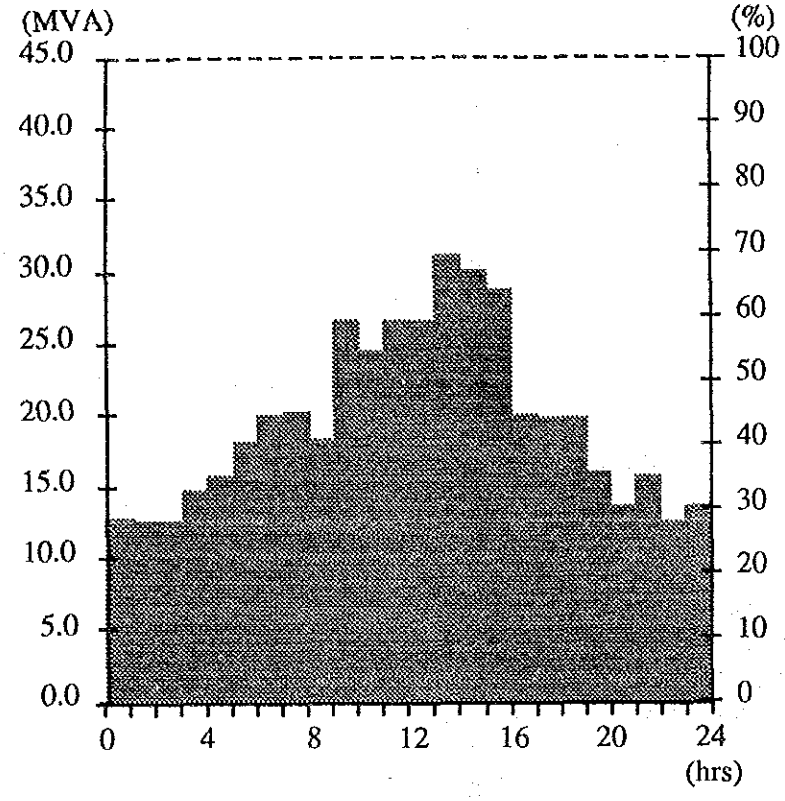
Transformer Capacity : 18 MVA x 2
Peak Load Value : 15.8 MVA
Mean Load Value : 9.78 MVA
Demand Factor : 44%



Transformer Capacity : 18 MVA x 2
Peak Load Value : 16.8 MVA
Mean Load Value : 9.28 MVA
Demand Factor : 47%

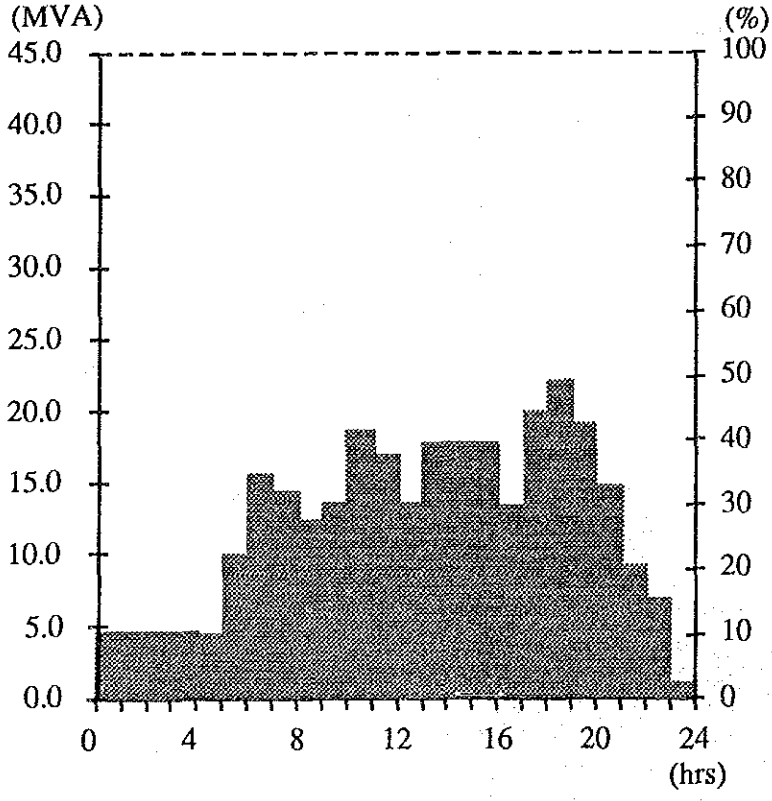
MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-3 (3/8)** Daily Load Curve of Transformer (66/11kV) at Siuchatar Substation

Jan. 5, 1990



Transformer Capacity :	45 MVA
Peak Load Value :	31.0 MVA
Mean Load Value :	19.5 MVA
Demand Factor :	69%

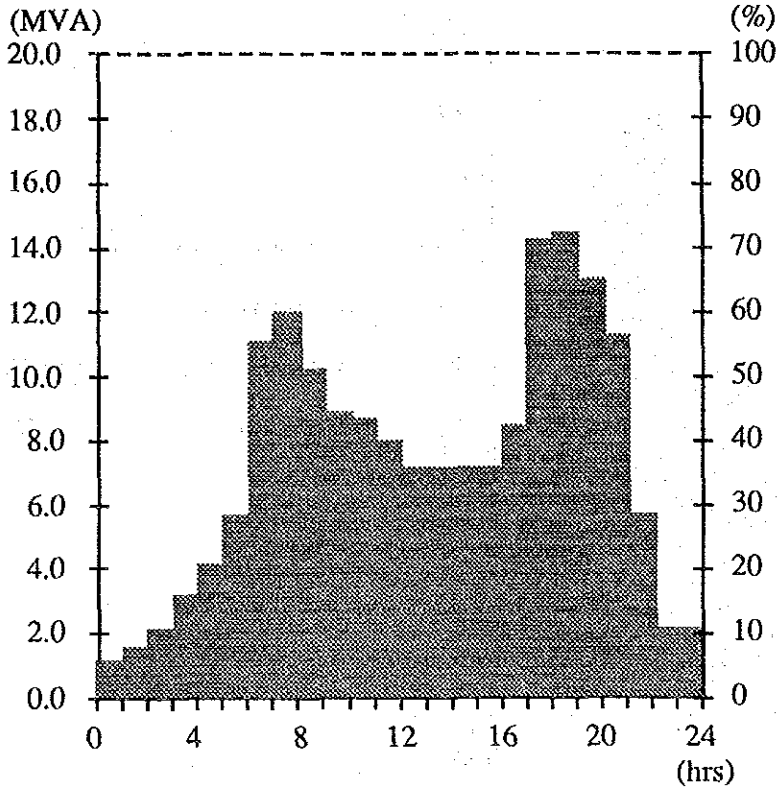
Oct. 10, 1990



Transformer Capacity :	45 MVA
Peak Load Value :	22.2 MVA
Mean Load Value :	12.4 MVA
Demand Factor :	49%

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-3 (4/8)** Daily Load Curve of Transformer (132/66kV) at **Balaju Substation**

Jan. 5, 1990



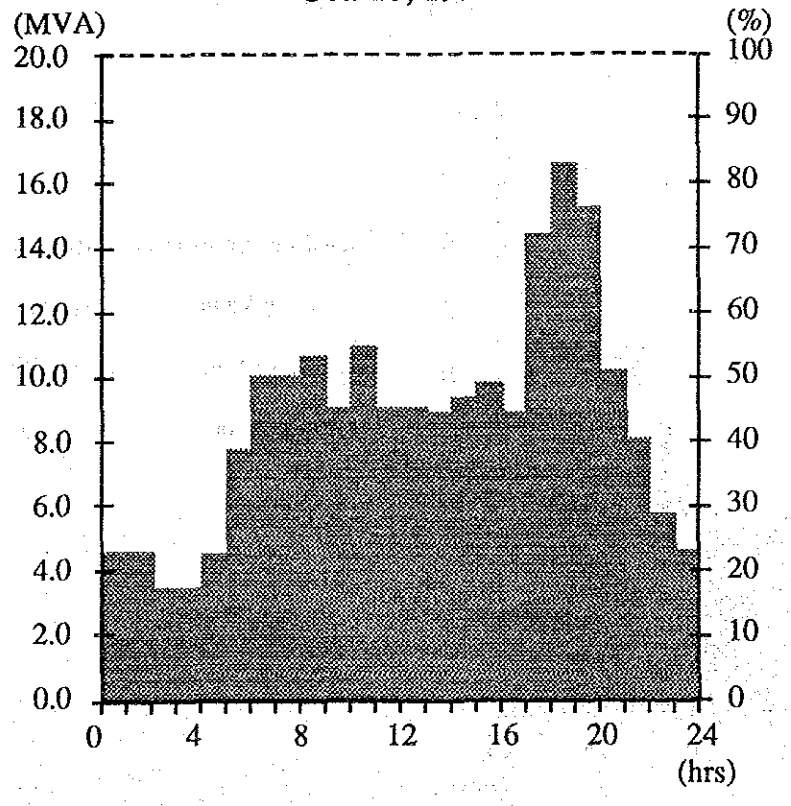
Transformer Capacity : 10 MVA x2

Peak Load Value : 14.4 MVA

Mean Load Value : 7.33 MVA

Demand Factor : 72%

Oct. 10, 1990



Transformer Capacity : 10 MVA x2

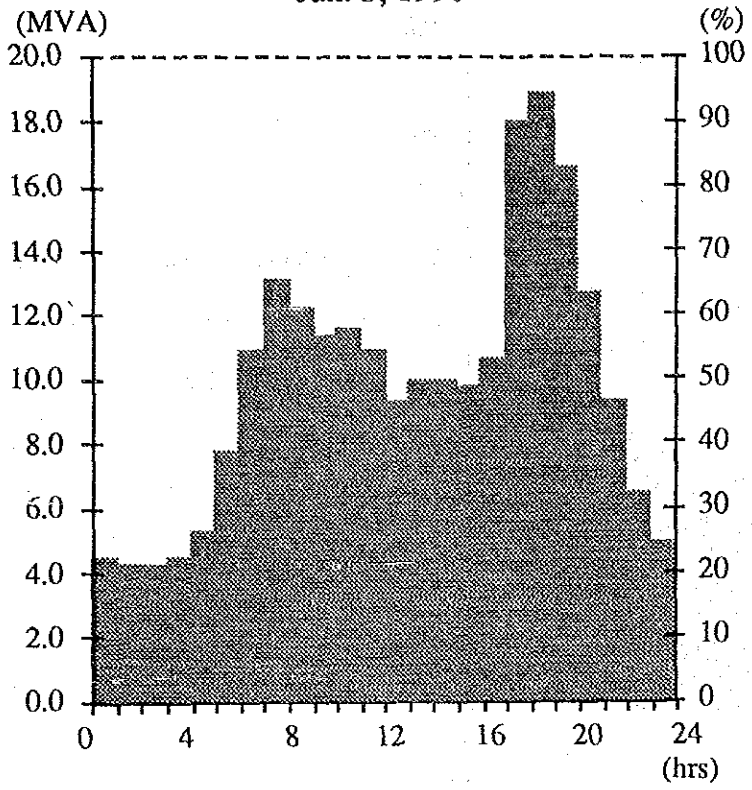
Peak Load Value : 16.6 MVA

Mean Load Value : 8.67 MVA

Demand Factor : 83%

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Annex-3 (5/8) Daily Load Curve of Transformer (66/11kV) at Balaju Substation

Jan. 5, 1990



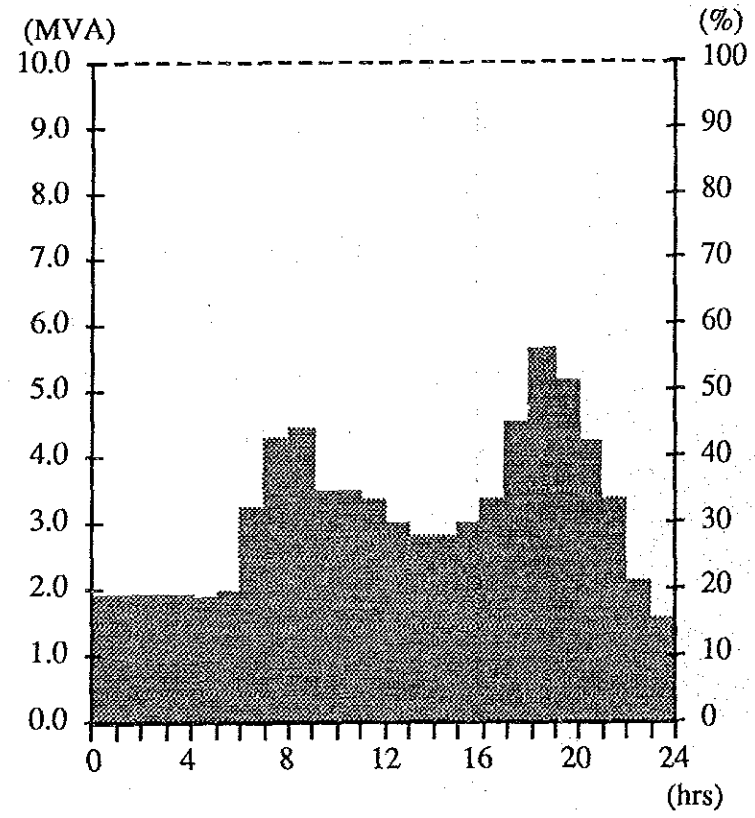
Transformer Capacity : 10 MVA x 2

Peak Load Value : 18.8 MVA

Mean Load Value : 9.88 MVA

Demand Factor : 94%

Oct. 24, 1990



Transformer Capacity : 10 MVA

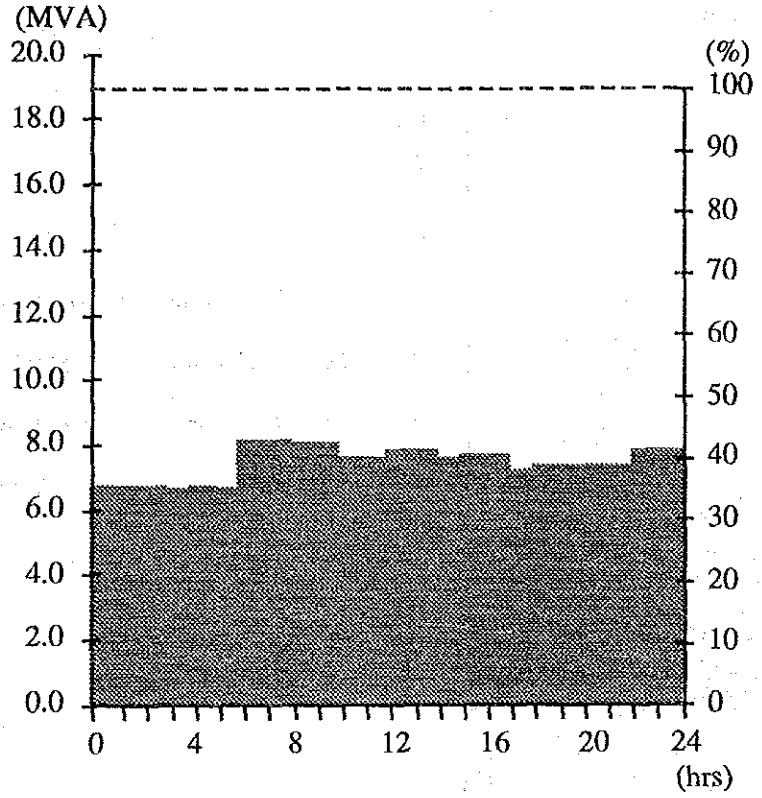
Peak Load Value : 5.61 MVA

Mean Load Value : 3.11 MVA

Demand Factor : 56%

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-3 (6/8)** Daily Load Curve of Transformer (66/11kV) at **Lainchaur Substation**

Jan. 5, 1990



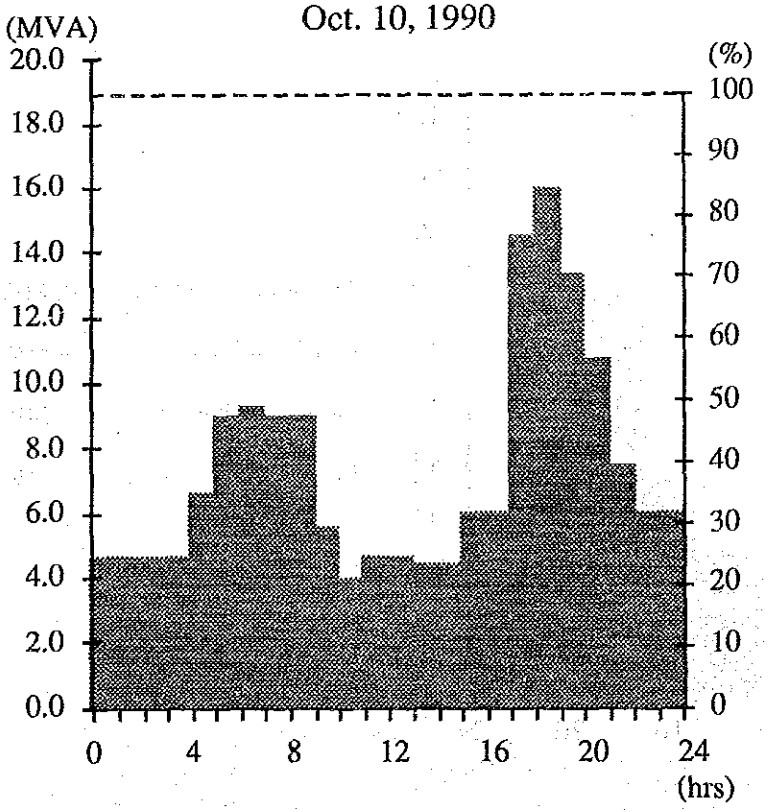
Transformer Capacity : 6.3 MVA x 3 (18.9 MVA)

Peak Load Value : 8.1 MVA

Mean Load Value : 7.4 MVA

Demand Factor : 43%

Oct. 10, 1990



Transformer Capacity : 6.3 MVA x 3 (18.9 MVA)

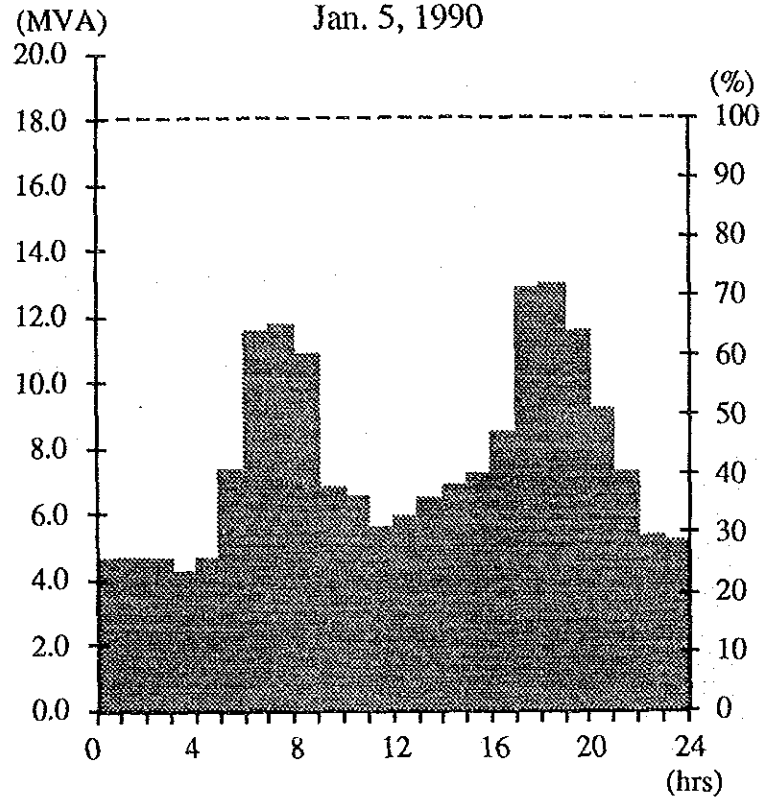
Peak Load Value : 16.0 MVA

Mean Load Value : 7.30 MVA

Demand Factor : 85%

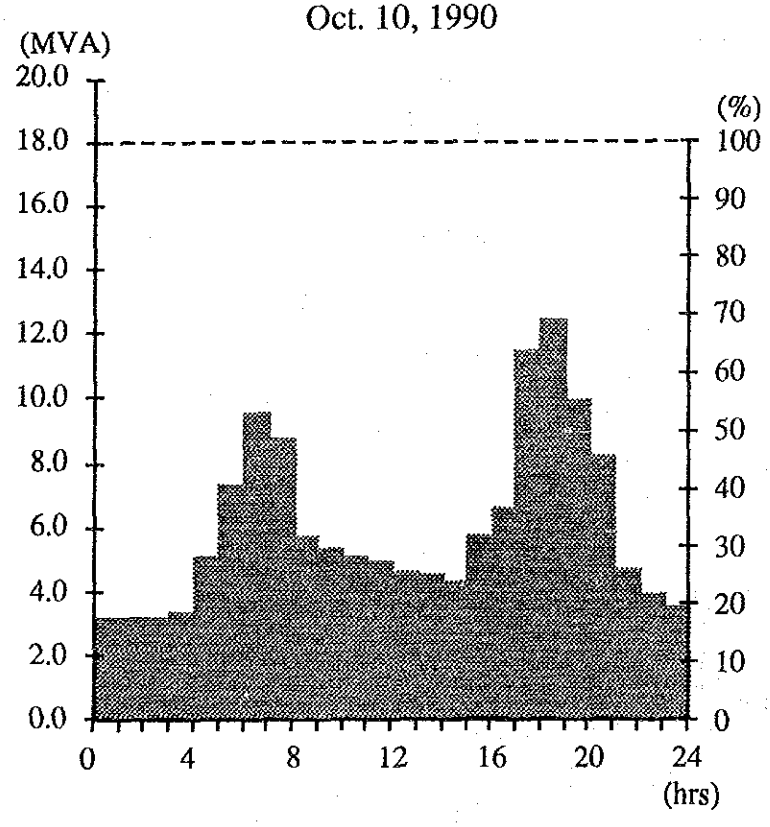
MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-3 (7/8)** Daily Load Curve of Transformer (66/11kV) at New Chabel Substation

Jan. 5, 1990



Transformer Capacity :	18 MVA
Peak Load Value :	13.0 MVA
Mean Load Value :	7.59 MVA
Demand Factor :	72%

Oct. 10, 1990



Transformer Capacity :	18 MVA
Peak Load Value :	12.4 MVA
Mean Load Value :	6.0 MVA
Demand Factor :	69%

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **Annex-3 (8/8)** Daily Load Curve of Transformer (66/11kV) at **Baneswar Substation**

ANNEX - 4
SYSTEM ENERGY LOSSES

(Extraction from System Loss Study of BEI, Dec.1987)

The system loss of Nepal was about 29.4% in 1985/86 and 27.9% in 1986/87. The losses of electrical energy are the result of following two reasons:

(A) Technical loss, and
(B) Non-Technical loss

The factors contributing to the energy losses can be summarized as follows:

(A) Technical Loss:

(a) In most places the existing Distribution System facilities are rather old which no longer can serve the existing demand of the consumers leaving aside the anticipated growth.
(b) Increase in load density due to connection of more and more new loads to the existing distribution system.
(c) Increase in power consumption by consumers due to extensive use of the electrical appliances.
(d) Unplanned distribution extensions.
(e) Unplanned transformer locations.
(f) Unbalanced load.
(g) Poor quality energy meters.
(h) Loads with poor power factor.
(i) Low quality of joints.

(B) Non-Technical Losses

(1) Unmetered Supply

Most of the street and temple lights are supplied directly without meters. Generally, the time period for assessing consumption unit is eight hours, but the lightings are not switched off even in the day time, generally, and increasing the hours of use.

Recently a large number of street lighting lamps are replaced by effective Sodium Vapour Lamps and on the replaced routes, meters are being installed. Energy meters have been installed in most of the big temples.

(2) Authority Use

Most of the power houses, staff quarters and NEA offices do not have energy meters. The consumption unit is assessed approximately. Recently meters are installed in most of the power houses, staff quarters and office buildings.

(3) Pilferage

Pilferage of electric energy is one of the main problem in Nepal. It constitutes the main part of non-technical loss. The way of misusing electricity are as follows:

(a) Consumer shunts the meter by tapping energy before the meter terminals or at some other point of the installation.
(b) Consumer brakes the seal of meter and interferes in the meter.
(c) Consumer brakes seals of disconnecting devices.
(d) Consumer damages the meter.
(e) Consumer sets up a sophisticated practice of fraud, i.e, arrangements using as a return path the earth instead of the neutral conductor.
(f) Removal of P.T fuses.
(g) Shorting of C.T.
(h) Direct tapping from distribution line(rural area).
(i) Direct tapping from distribution cable joints.
(j) Applications of powerful magnets on the meters.
(k) Opening of potential linkage in the meter.
(l) Some of the teeth of wheels of the indicator mechanism in the meter are broken or filed.

(4) Poor Metering System

In many location the metering system found to be defective. The defects are:

(a) Meters are mounted inside the house and inside a room making it easy for the customers to tamper and difficult for the meter readers to read.
(b) There is no regular programme for checking,sealing, calibrating, repairing and maintaining the meters from division offices.
(c) Meter records are not kept properly.
(d) Meters are generally in short supply making it difficult to replace defective ones in a timely manner.
(e) Meters are of poor quality.

(5) Unmetered Legal Connection

Due to shortage of meters, NEA has taken decisions supply the consumers without meter. They are charged on the basis of estimated consumption, which is generally under-estimated.

(6) Under-Billing

Under-billing is experienced in the following situations.

(a) Meters are defective, and bills are made on arbitrary basis.
(b) Billing is done without physically reading the meter by the meter readers.
(c) NEA staffs in collection with consumers under bill the consumers.
(d) Irregular meter reading by the meter readers.

(7) Non-Billing

This is purely a case of negligence of duty on the part of the meter readers, bill clerks, and supervisory officers. There are several examples where meter have not been read for months and non-delivering of bills.

(8) Lack of Utility Owned Meters for HT Consumers

There has been widespread use of meters belonging to HT consumers who accounts for more than 40% of total sale. Although meters are checked, calibrated and sealed by NEA, the instrument transformers, being part of the consumers switchgear, may be tampered. And in most case consumer owned meters are non-standard meters.

(9) Non-Standardization of Metering Devices

There are different types of metering on single phase and three phase distributions, and on low voltage and high voltage systems. Even in low voltage systems, for heavier load current transformers of different transformation ratios are used to read energy meters. In high voltage metering, both CT as well as PT are used. Cases of reversal of CT are found in three phase supply.

(10) No Records for Consumers Supplied

This is normally the result of the connection being made without the completion of proper form or the form is lost or destroyed and never reaches the record section and the consumers never being billed.

(11) Consumers Originally Recorded but The Record is Lost

Existing records are lost either through negligence or by deliberate action.

(12) Untrained Meter Reader

The following are encountered through readings taken from kWH meters.

(a) Wrong readings taken because of not knowing what multiplying factors are to be applied.
(b) Omission of zero at end of read-out making error deviate by factor of 10.
(c) Guess-work often done by meter readers by taking average of each house hold's previous readings.

(13) Accounting Omission and Errors

The procedure which excludes from units billed, the units charged to consumers when access has not been gained to the premises has not been amended.
Recognizing the importance of system loss reduction HMG/N and NEA determined to launch an intensive loss reduction programme both Technical and Non-Technical.

ADB, in its second power loan to Nepal provided technical assistance for a comprehensive study. A specialist, distribution engineer from British Electricity International, UK, visited and worked in Nepal to analyze the incidence of high distribution system, most of the losses occurring in the distribution system of Bagmati Zone are assumed to be due to improper metering in the distribution system and theft of electricity. Based on the recommendations of the specialist, NEA had started its seven point programme in the Bagmati Zone in early 1981. During loan negotiations for the Marsyandi Hydro Electric project, the targets for reducing losses were agreed as follows:

(a) In the central region losses are to be reduced to 25% by FY 1986 and 20% by FY 1991.
(b) The overall losses in Nepal is to be reduced to 24% by FY 1986 and 18% by FY 1991.

ANNEX - 5
DETAILS OF MAJOR IMPROVEMENT AND REINFORCEMENT PLANS OF LOW TENSION POWER SYSTEM IN EACH POWER DIVISION

(A) Kathmandu Central Power Division

(1) Tripureswar area for improvement of voltage regulation as well as extension of lines

(2) Jaisi Dewal area for improvement of voltage regulation as well as extension of lines

(3) Paknajol area for improvement of voltage regulation as well as extension of lines

(4) Lazimpat area for improvement of voltage regulation and supply reliability as well as extension of lines

(5) Panipokhari East area for extension of lines

(6) Ghaffekula area for improvement of voltage regulation and supply reliability

(7) Maitidevi area for improvement of voltage regulation and supply reliability as well as extension of lines

(8) Bagbazar area for improvement of supply reliability by installation of underground cables

(9) Main streets of Tripureswar, Bhrikuti Mandap Marga, Darbar Marga, Kanti Path, Juddha Sadak, Dharma Path and Ganga Path for improvement of voltage regulation and supply reliability together with improvement of 11kV system in the areas.

(B) Kathmandu Eastern Power Division

(1) West Battishputally area for improvement of voltage regulation and supply reliability

(2) Prayagmarga area for improvement of supply reliability as well as extension of lines

(3) Budha Nagar, Bhakta Bhdur Koirala, Shri Kirau, Battish putally, Bhimshen Gola, Paneh Kumaristha and Parajuli Craun areas for improvement of supply reliability and voltage regulation

(4) Maha Laxme Garment, Bagmati bridge area, Koteshwar Tinkuno and Shanker Lamichhaue Louse for improvement of voltage regulation and reliability

(5) Kolopur, Madhaw KhakurelLouse and Radha-Krishem Mandir areas for improvement of supply reliability and voltage regulation with extension of lines

(6) Jorpati Nayabasti Chour, Jorpati Aryal Goun, Ganrighat, Kumarigal and Besi Gaun areas for improvement of voltage regulation and supply reliability

(7) Dhakal Gaun Chour, Bauth Gumiba, Bauth Tusal, Shanti Goreto and Maiju Bahal areas for improvement of supply reliability with extension of lines

(8) Kumarigal, Mahakal Chour, Mahakal Phout, Gadaha Pate, Bhuwaldada areas for improvement of voltage regulation and supply reliability

(9) Andha Apang, Gokaru Dhakshin Dhoka and Jay Bageshwary-Mitra Dark areas for extension of lines

(C) Kathmandu Eastern Power Division

(1) North of hotel Saltee and Gurgulhara areas for extension of lines

(2) Nagoan area with extension and rehabilitation of lines

(3) Chabhar Bhanjagal area with extension of lines

(4) Kalanki area with extension of lines and improvement of supply reliability

(5) Dhungaadda area with extension lines for new supply

(6) Replacement of existing aged poles in various areas

(D) Lalitpur Power Division

(1) Tufe Pani and Satdobato areas with extension of lines

(2) Talehikhel, Nakhipol, Bakundol and Gusingal areas for improvement of exiting facilities

(3) Khumaltar, Thanagaon and Patipa areas with extension of lines and improvement of voltage drop

(4) Saibu market, Lavu, Bagdol and Harisiddi areas with up-grade of conductors for improvement of voltage regulation

(5) Sunakothi Lohachok, Luvu bazar, Balkumari, Chakupal, Jwagal, Sanepa, Bairabsthan and Sunakothi areas with extension of lines

(6) South of Patipa, Aphaldol, Thaiba, Thecho Panehayat Bhawan, Sunakothi bazar, Harisiddi, Tusal Chapagaon and Chapagaon Bulu areas for improvement of voltage regulation and supply reliability

(7) Lele ward No.4,5,7 and 8 for line extensions

(8) Dukuchap ward No.7 and 8 and Champi area for new line extensions

(E) Bhaktapur Power Division

Following areas will be improved by replacement of the existing conductors with larger size conductors and/or extension of lines for voltage regulation and supply reliability. Poles and spool insulators will also be replaced.

(1) Nonkhel Mahat village ward No.6 and 7

(2) Dadhikot ward No.6 (Neupane village)

(3) Pikhel Pakunepati

(4) Katunje ward No.8

(5) Suryavinayak Trolley bus stop

(6) Sirutal ward No.7 and Balkot ward No.8

(7) Thimi Locanthali near Om Surgical

(8) Sano Thimi near controller office