

Fig. 5.13 Steel Tubular Pole  
for 11 kV Transformer



# ***APPENDICES***



APPENDIX I

NAMES OF HMG OFFICIALS AND JICA TEAM MEMBERS

A) Nepalese Officials and Counterparts

National Planning Commission:

Mr. P.P. Shah Co-member

Ministry of Finance:

Mr. H.S. Shrestha Additional Secretary

Ministry of Water Resources:

Mr. M.S. Dhakal Secretary

Electricity Department:

Mr. H.M. Shrestha Chief Engineer

Mr. B.M. Singh Deputy Chief Engineer

Mr. R.K. Bajracharya Chief of Electrical Design Division

Mr. R.S. Pandey Project Manager of Kathmandu Valley  
Power System Improvement Project

Mr. C.M. Pockarel Engineer of K.V.P.S.I. Project

Mr. Jivan Kasaju Engineer

Mr. J.M. Pradhan Engineer

Dr. G.R. Bhatta Project Manager of Dumkibas-Butwal  
Transmission Project

Nepal Electricity Corporation:

Mr. L.M. Dixit General Manager

Mr. R.M. Shakya Manager of Planning and Generation Dept.

Mr. N.T. Bhutia Chief of Planning Div.

Mr. K.G. Shrestha Chief of Transmission and Distribution  
Maintenance Div.

Mr. T.M. Shakya Engineer of Planning Div.

Mr. C.B. Shrestha Engineer of Generation Div.

Mr. S.S. Dongol Resident Engineer of Sunkosi Power Station

Mr. A.K. Thakur Resident Engineer of Trisuli Power Station

Mr. G.K. Shrestha	Resident Engineer of Kulekhani No.1 Power Station
Mr. K.P. Koirala	Resident Engineer of Gandak Power Station
Mr. K.L. Joshi	Resident Engineer of Pokhara
Mr. G.P. Shrestha	Resident Engineer of Bhaktapur Substation
Mr. Ramchandra Mandel	Resident Engineer of Birganj Substation
Mr. S.M. Amatya	Resident Engineer of Hetauda Substation

Indian Mission to Devighat:

Mr. J.I. Thakkal	Representative
------------------	----------------

B) Embassy of Japan

Mr. K. Kaneko	Ambassador
Mr. T. Arinobu	Councillor

C) JICA Team Members

Mr. H. Noguchi	Team Leader
Mr. N. Shimomura	Project Coordinator
Mr. S. Tsukahara	Load Dispatching and Power Distribution Planning Engineer
Mr. T. Sugo	Load Dispatching Engineer
Mr. T. Matsushita	Distribution Engineer - I
Mr. T. Arita	Distribution Engineer - II
Mr. Y. Hoshi	Communication Engineer
Mr. T. Hoshi	Resident Representative of Kathmandu Office
Mr. H. Nakagawa	Staff of Kathmandu Office

## APPENDIX II

### MEMBER LIST OF THE STUDY TEAM

Names of the study team members and duties of each staff were given below:

- (a) Hiroyuki Noguchi ..... Acting Leader (Ministry of Foreign Affairs)
  - Review of the survey results, final discussion with HMG and grant aid programing
- (b) Norio Shimomura ..... Project Coordinator (JICA)
  - Project coordination for initial discussion with HMG and arrangement for starting the site survey
- (c) Sumio Tsukahara ..... Load Dispatching and Power Distribution Planning Engineer
  - Overall responsibility in site investigation and preparation of basic design
  - Coordination between HMG and the team staff
- (d) Tetsuo Sugo ..... Load Dispatching Engineer
  - Site survey and preparation of basic design for the load dispatching center
  - Coordination with the communication engineer for establishing proper data transmission paths
  - Preparation of manuals for establishing proper organization for operation and maintenance of the load dispatching center
  - Evaluation for establishing the load dispatching center
- (e) Takayoshi Matsushita ..... Distribution Engineer-I
  - Site survey and preparation of basic design for reinforcement of the Kathmandu valley distribution network
  - Evaluation of reinforcement plan for the Kathmandu valley distribution network

(f) Toshiyuki Arita ..... Distribution Engineer-II

- Sharing duties with Distribution Engineer-I above in divided survey areas

(g) Yutaro Hoshi ..... Communication Engineer

- Site survey and basic design of PLC and other communication systems

- Coordination with the load dispatching engineer in order to establish data transmission paths for load dispatching





APPENDIX III

SCHEDULE OF BASIC DESIGN STUDY TEAM

Date	Mr. H. Noguchi Team Leader	Mr. N. Simomura PJT Coordinator	Mr. S. Tsukahara LDC, D/L Engineer	Mr. T. Sugo LDC Engineer	Mr. T. Matsushita D/L Engineer - I	Mr. T. Arita D/L Engineer - II	Mr. Y. Hoshi Communication Engr.
Oct. 30 (Tue.)	-	NRT - BKK	NRT - BKK	-	NRT - BKK	NRT - BKK	-
31 (Wed.)	-	BKK - KTM Discussion in JICA	BKK - KTM Same as Mr. N. Shimomura	-	BKK - KTM Same as Mr. N. Shimomura	BKK - KTM Same as Mr. N. Shimomura	-
Nov. 1 (Thu.)	-	Courtesy call to ED and Japanese Embassy	Courtesy call to ED and Japanese Embassy D/L site survey	-	Same as Mr. S. Tsukahara	Same as Mr. S. Tsukahara	-
2 (Fri.)	-	Nepalese horiday (for mourning to late Mr. I. Gandhi, India)	Nepalese horiday Visit to New Chabel, Balaju, Teku, Thimi, Baktapur S/S	-	Nepalese horiday Same as Mr. S. Tsukahara	Nepalese horiday Same as Mr. S. Tsukahara	-
3 (Sat.)	-	Holiday	Holiday	-	Holiday	Holiday	-
4 (Sun.)	-	General meeting in ED and technical meeting in NEC	Same as Mr. N. Shimomura	-	Same as Mr. N. Shimomura	Same as Mr. N. Shimomura	-
5 (Mon.)	-	Discussion in NEC	Discussion in NEC Collection of data and information	-	Discussion with ED, NEC for survey items and schedule. Site investigation, Chabel, Siuchatar	Same as Mr. T. Matsushita	-
6 (Tue.)	-	Preparation of draft minutes of meeting	Technical discussion with NEC Discussion with ED on rural distribution	-	Site investigation, Patan, Bhaktapur Discussion with ED on rural distribution	Same as Mr. T. Matsushita	-
7 (Wed.)	-	National Holiday (Her Majesty's birth- day)	National Holiday Study on 66 kV system	-	National Holiday Arrangement of survey results	National Holiday Arrangements of survey results	-
8 (Thu.)	-	Meeting with NEC on draft minutes	Meeting with NEC Site investigation Lainchaur, Balaju	-	Site investigation, Maharajgunj line, etc.	Site investigation Shipadol, Sudal, Tatheli	-
9 (Fri.)	-	Report preparation	Technical discussion Meeting on distribu- tion in city area	NRT - BKK	Site investigation Thapathali-Sanepa, Trolley-bus connection	Site investigation Lapsepladi	NRT - BKK
10 (Sat.)	-	KTM - BKK	Holiday Review of data	BKK - KTM	Site investigation Kathmandu area	Same as Mr. T. Matsushita	BKK - KTM

Date	Mr. H. Noguchi Team Leader	Mr. N. Simomura PJT Coordinator	Mr. S. Tsukahara LDC, D/L Engineer	Mr. T. Sugo LDC Engineer	Mr. T. Matsushita D/L Engineer - I	Mr. T. Arita D/L Engineer - II	Mr. Y. Hoshi Communication Engr.
Nov. 11 (Sun.)	-	-	Discussion on LDC Inspection of Siucharta S/S	Discussion on LDC Site investigation Siucharta S/S	Site investigation 3.3 kV area	Site investigation Jhor, Sangal, Kabresthali	Same as Mr. T. Sugo
12 (Mon.)	-	-	Discussion on LDC Data collection	Site investigation Patan, Balaju S/S	Discussion on 3.3 kV area, site investiga- tion of Patan	Site investigation Dachok, Chapagaon	- ditto -
13 (Tue.)	-	-	Site investigation Sunkoi P/S	Site investigation Sunkosi P/S	Mapping and prepara- tion of drawings for survey area	Site investigation Champi, Naikap	- ditto -
14 (Wed.)	-	-	Study on data Site investigation of Bhaktapur	Site investigation, New Chabel, etc.	Site investigation, Kathmandu and Bhaktapur	Mapping and prepara- tion of drawings for survey area	- ditto -
15 (Thu.)	-	-	Site investigation Trisuli P/S and Devighat P/S	Same as Mr. S. Tsukahara	Mapping and prepara- tion of drawings for survey area	- ditto -	- ditto -
16 (Fri.)	-	-	Discussion, data collection and site investigation	Discussion with NEC Study on survey result	Site investigation Kathmandu city	- ditto -	- ditto -
17 (Sat.)	-	-	Holiday Study on S/S and T/L	Holiday	- ditto -	- ditto -	Holiday
18 (Sun.)	-	-	Site investigation Pokhara S/S Stay at Bharatpur	Same as Mr. S. Tsukahara	Site survey and drawing preparation	Site survey and draw- ing preparation	Same as Mr. T. Sugo
19 (Mon.)	-	-	Site investigation Gandak, Dumkibas and Butwal	- ditto -	- ditto -	- ditto -	- ditto -
20 (Tue.)	-	-	Site investigation Bharatpur, Birganj and three substations	- ditto -	- ditto -	- ditto -	- ditto -
21 (Wed.)	-	-	Site investigation Kulekhani No. 1 and Hetauda	- ditto -	Site investigation city area discussion with NEC	Same as Mr. T. Matsushita	- ditto -
22 (Thu.)	-	-	Discussion with NEC	Discussion with NEC Study on Survey result	- ditto -	- ditto -	- ditto -
23 (Fri.)	NRT - BKK	-	Site investigation Baneswar area, Basic design study	Basic design study	Mapping, preparation of drawings, etc.	- ditto -	- ditto -
24 (Sat.)	BKK - KTM	-	Holiday Basic design study	Holiday - ditto -	Holiday - ditto -	KTM - BKK	- ditto -

Date	Mr. H. Noguchi Team Leader	Mr. N. Simomura PJT Coordinator	Mr. S. Tsukahara LDC, D/L Engineer	Mr. T. Sugo LDC Engineer	Mr. T. Matsushita D/L Engineer - I	Mr. T. Arita D/L Engineer - II	Mr. Y. Hoshi Communication Engr.
Nov. 25 (Sun.)	Internal Discussion visit to ED	-	Various discussions	- ditto -	- ditto -	-	- ditto -
26 (Mon.)	Visit to government officials Meeting with ED	-	- ditto - Preparation of minutes of meeting	- ditto -	- ditto -	-	- ditto -
27 (Tue.)	- ditto -	-	- ditto -	- ditto -	- ditto -	-	- ditto -
28 (Wed.)	Final meeting	-	Final meeting	Supplemental survey Siuchatar, Balaju	Site investigation Rural area (add.)	-	- ditto -
29 (Thu.)	Check of minutes, etc.	-	Preparation of final minutes	Finalization	Finalization of survey results	-	Finalization
31 (Fri.)	Minutes signing Report to embassy, etc.	-	Minutes signing, Data collection Report to embassy	Finalization Report to embassy	Same as Mr. T. Sugo	-	Same as Mr. T. Sugo
Dec. 1 (Sat.)	KTM - BKK	-	KTM - BKK	KTM - BKK	KTM - BKK	-	KTM - BKK
2 (Sun.)	BKK - NRT	-	BKK - NRT	BKK - NRT	BKK - NRT	-	BKK - NRT



**APPENDIX IV**

**MINUTES OF MEETINGS**

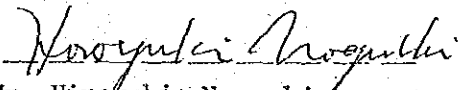
MINUTES OF DISCUSSION

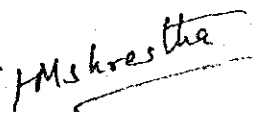
In response to the request made by His Majesty's Government of Nepal (HMG), the Government of Japan has sent through the Japan International Cooperation Agency (JICA) a team headed by Mr. Hiroyuki Noguchi, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, to conduct a basic design study on (1) the Establishment of a Load Dispatching Centre and (2) the Reinforcement of the Distribution Network in Kathmandu Valley for 34 days from 30th October to 2nd December, 1984.

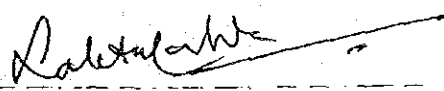
The team has had a series of discussions with the authorities concerned and has carried out field survey.

As a result of the study, the both parties have agreed to recommend to their respective Governments to examine the result of the study attached herewith towards the realization of the Projects.

30th November, 1984.

  
Mr. Hiroyuki Noguchi  
Team Leader, Basic Design Study  
Team, JICA

  
Mr. H.M. Shrestha  
Chief Engineer,  
Electricity Dept., HMG of Nepal

  
Mr. L.M. Dixit  
General Manager  
Nepal Electricity Corporation

ATTACHMENT

1. The team will review the Feasibility Study report of "Kathmandu Valley Distribution Network Project" prepared by JICA in 1979 taking into account the power stations to be commissioned in the near future, The Second Kulekhani and Marsyangdi, as well as the current situation of the distribution network in Kathmandu Valley.

Based on the result of the review, the team will carry out a basic design study on (1) the Establishment of a Load Dispatching Centre and (2) the Reinforcement of the Distribution Network in Kathmandu Valley.

2. The Project for Establishment of a Load Dispatching Centre aims to establish a system for systematic management of the power supply system and effective operation of the major power stations through the setting up of proper communication network.

The Project for Reinforcement of the Distribution Network aims to strengthen the existing distribution network as well as to supply electricity to the areas where electricity supply is still not available in Kathmandu Valley.

3. The Projects will be administrated, operated and maintained by the Nepal Electricity Authority (NEA) which will be newly organized. The establishment of NEA has already been approved by the His Majesty's Government and will be in operation in 1985. The proposed organization of NEA is shown in Annex I. After completion, the Projects will be operated by either NEA or NEC as the case may be.

Before the establishment of NEA, the Projects will be implemented under the administration of Electricity Department (ED) of the Ministry of Water Resources with cooperation of Nepal Electricity Corporation (NEC).

*Hms*

*L* *HMS*



4. The team will convey to the Government of Japan the desire of HMG of Nepal that the former takes necessary measures to cooperate in implementing the Projects and provide the facilities and equipment necessary for the implementation of the Projects within the scope of the Grant Aid by the Government of Japan. The outline of the Projects are shown in Annex II and III.

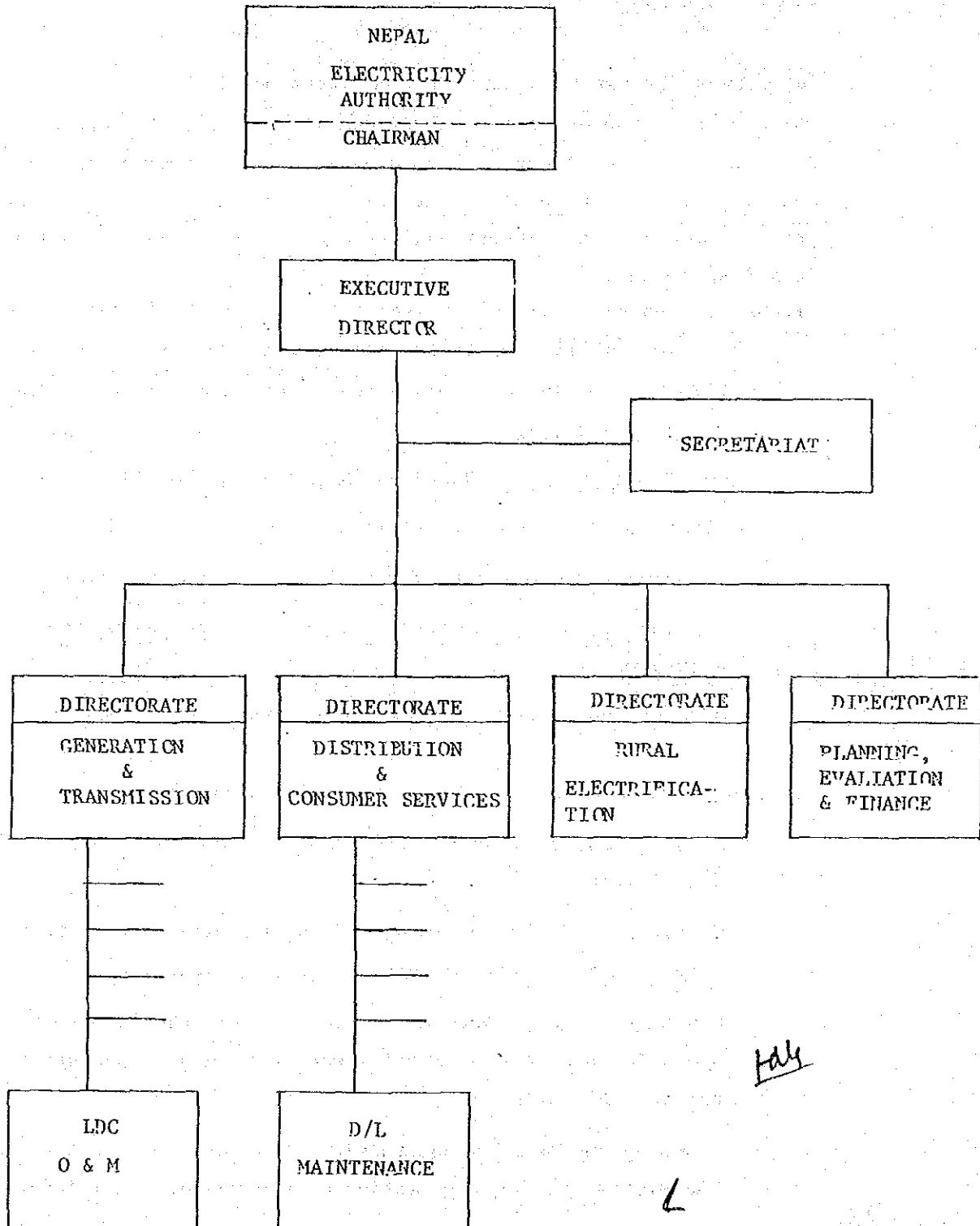
5. HMG of Nepal will take necessary measures as listed in Annex IV on condition that the Grant Aid by the Government of Japan is extended to the Projects.

4

May

Hu

ANNEX I ORGANIZATION OF NEPAL ELECTRICITY AUTHORITY



*Hro*

*Hdy*

*L*

## ANNEX II. ESTABLISHMENT OF LOAD DISPATCHING CENTER

Through a series of discussion between the officials of HMG of Nepal and JICA study team. The following basic principles were confirmed by the both parties.

### 1. Objectives for Establishment of Load Dispatching Center.

Objectives of the establishment of the load dispatching center for reliable supply of power with good quality to consumers are defined and are based on the present situation of the power system without proper communication network and absence of established idea for load dispatching.

a). Generation planning to meet the estimated power demand so as to effectively utilize water resources, only indigenous source of energy in Nepal and delivering instructions to power stations.

- Planning for allocation of power to be generated at each power station for meeting variation of system power demand.
- Planning for adjustment of system frequency
- Planning for operation of standby diesel power plants
- Sending necessary instructions, information and advices to each power station.
- Others

b). Power system management under established procedures

- Sending instructions for operation of major switches on the power system.
- Management of proper timing for maintenance of facilities in power stations, transmission lines and substations.
- System voltage adjustment by sending instructions for operating static capacitors, shunt reactors, transformer tap ratios, etc.
- Planning and sending instruction necessary for starting up the system and for restoration of the system after faults.
- Others.

- c). Securing communication as an essential medium for performing load dispatching functions among the load dispatching center, power stations and substations.
  - Load dispatching voice channel for sending directives
  - Data transmission channel for collecting necessary data.
  - Administrative telephone channel

2. Basic Principle for Design of Load Dispatching Center.

Taking into account the situation of the anticipated power system and general level of technology in Nepal, the load dispatching center is to be designed so as to:

- a). afford the maximum benefit to the contemplated Nepalese power system.
- b). be simple in construction for easy operation and maintenance by Nepalese staff.

The load dispatching center is to be designed so as to be extendable with expansion of the power system in the foreseeable future, say 15 years.

3. Location of Load Dispatching Center.

The load dispatching center is to be installed in the compound of ED. The building for the load dispatching center will be constructed under the Grant Aid Program of the Government of Japan.

4. Power System to be Supervised.

Remote terminal units for data transmission will be installed in the following power stations and substations:

- a). Power stations:
  - Kulekhanj No.1 (H/P)
  - Kulekhanj No.2 (H/P)
  - Trisuli (H/P)
  - Devighat (H/P)
  - Sunkoshi (H/P)
  - Gandak (H/P)
  - Hetauda (Diesel)

Hans

- b). Substations: Siuchatar  
Patan  
Balaju  
New Chabel  
Hetauda  
Bharatpur

The transmission lines to be supervised are 132kV and 66kV transmission lines.

#### 5. Major Functions

HMG of Nepal requested the following major functions for the load dispatching center.

- a). Power system supervision through the system supervisory board.
- b). Data logging for major power system records.
- c). Sending load dispatching directives for power generation and power system operation.
- d). Securing communication among the load dispatching center and the remote stations.

All operations will be performed by operators in the respective remote stations according to instructions from the load dispatching center.

#### 6. Communication System.

Proper communication network is essential for the establishment of the load dispatching center. The communication network for the load dispatching center is to be established with the PLC system on the transmission lines.

← file

Hmo

7. Operations and Maintenance

As the proposed load dispatching center is quite new in Nepal and requires rather high class skill of operators, necessity for establishing proper organization and for training of staff was understood by the both parties. A manual which covers recommendation for establishing a proper organization, for staff training and for operation and maintenance of the load dispatching center will be prepared under the Grant Aid Program of the Government of Japan.

←

July

Hes

ANNEX 111 REINFORCEMENT OF DISTRIBUTION NETWORK IN KATHMANDU VALLEY

On arrival of the JICA basic design study team, ED and NEC presented their requests for study of:

- 1) Improvement of the power system
- 2) Reinforcement of the distribution network in the city areas
- 3) Electrification in rural areas
- 4) supply of distribution materials and maintenance tools

for urgent implementation utilizing grant aid from the Government of Japan.

In reply the study team has surveyed all of the requests with help of counterparts from ED and NEC. After going back to Japan the basic design study will be made taking into account the priority requirement from HMG of Nepal and also the Grant Aid Scheme of the Government of Japan. The result of the study will be submitted to HMG/N as Basic Design Report.

Details of each request mentioned above are as given below:

1. Improvement of Power Supply System

Total capacity of the existing 66/11 KV step down transformers in the substations is not enough to deliver the power to the increasing demand in the valley expected in a few years time. In order increase the power receiving capacity, construction of Lainchaur and Baneswar substations was requested. The power from these two substations will also contribute to relieving heavy load of K2 and Teku substations.

With further expansion of the power supply system around Kathmandu valley, the rupturing capacity of the existing old 11KV switchgear, 150MVA, will become insufficient with the completion of Kulekhani No.2 and Marsyangdi power projects. Their replacement is required to maintain power supply to consumers. Under such circumstance, renewal of K2 and Patan substations was requested.

*Hms*

*L Hly*

### 1.1 Construction of Lainchaur Substation

Major work items are as given below:

a) Outgoing facilities at Balaju substation:

The site for the existing temporary supply transformer is to be utilized.

b) Overhead transmission line:

A 66KV single circuit line with ACSR of  $160\text{mm}^2$  is to be strung on the existing 11KV double circuit ring line poles after dismantling the 11KV line conductors.

c) Underground cable between the end pole and Lainchaur substation.

d) Outdoor switchyard with (3+1) single phase 6MVA transformers to be constructed within the premises of the existing switching station.

e) 11KV cable termination at the existing 11KV switchgear.

### 1.2 Construction of Baneswar Substation:

Major work items are as given below:

a) Relocation of the switchyard facilities in the existing Sunkosi substation (Patan).

b) Construction of 66kV switchyard with two bays at the same place.

c) Installation of 66kV control panels in the Kulekhandi control room (Patan).

d) Double circuit 66kV transmission line with  $160\text{mm}^2$  ACSR conductors is to be constructed upto the ring road utilizing right of way of the existing Sunkosi line. Therefrom, one circuit shall be branched to Baneswar substation and the other shall be connected to Sunkosi line.



- e) Single circuit transmission line strung on double circuit towers from the branching point to Baneswar substation.
- f) Construction of 66/11 kV Baneswar substation with three 6MVA, 1-phase transformers. Number of 11kV panels is ten (1-incoming, 8-feeders, 1-station service).

Note: Removal and re-installation of the necessary equipment in Sunkosi substation (Patan) are to be undertaken by HMG of Nepal.

### 1.3 Renewal of K2 Substaion.

The site of new substaion is selected within the premises of the Electricity Department.

- a) Installation of 19 new panels (4-incomings, 3-buscouplers, 11-feeders, 1-station service) in the new building.
- b) Change of Cable connections

Note: The K2 substation equipment should be housed in the building for the load dispatching center.

### 1.4 Remodelling of Patan Substation.

New switchgear are to be arranged in the control room of old Sunkosi substation (Patan) which will be extended including the annexed PLC room.

- a) Enlarging the control room utilizing the annexed PLC equipment room.
- b) Installation of new-11kV panels in this room. Number of panels is 18 (2-incomings, 1-bus coupler, 14-feeders, 1-station service).
- c) Change of cable connections.

## 2. Reinforcemnet of Distribution Network in City Areas.

## 2.1 New construction and Improvement of 11kV Systems.

In order to meet increasing power demand and to improve reliability and quality of power supply in the city areas of Kathmandu, Patan and Bhaktapur, new construction and connection changes of 11kV lines were requested.

- a) Construction of 11kV lines for connection of Baneshwar Substation feeders with the existing system, 4km with ACSR 95mm<sup>2</sup> conductors.
- b) Construction of Swayambhu feeder from Siuchatar with 95 mm<sup>2</sup> ACSR conductors.
- c) Supply from Siuchatar to Ramkot Feeder now supplied from Balaju by construction of an interconnector with 58 mm<sup>2</sup> ACSR conductors.
- d) Supply from Siuchatar to Kalimati feeder (95 mm<sup>2</sup> ACSR conductors)
- e) Connection of Thankot Feeder to Siuchatar with a power cable of Al 200 mm<sup>2</sup>.
- f) Supply to Baudha feeder from New Chabel (95 mm<sup>2</sup> ACSR conductors)
- g) Supply to Maharajganj feeders from New Chabel (95 mm<sup>2</sup> ACSR conductors)
- h) Installation of additional circuit on Chapagaon feeder (95 mm<sup>2</sup> ACSR conductors)
- i) Two Feeders from Bhaktapur Substation for connection to the Banepa feeder and local Diwacot feeder (95 mm<sup>2</sup> ACSR conductors)

## 2.2 Upgrading and Interconnection of Existing Lines

Upgrading of some feeders and interconnection of feeders are required to meet increasing load in the area and to improve reliability of supply

a) Singha Darbar to Babarmahal

Upgrading of conductor size from ACSR 25 mm<sup>2</sup> to 95 mm<sup>2</sup>.  
New construction of a line of about 300 m in length with  
ACSR 95 mm<sup>2</sup>.

b) Babarmahal to Baneswar

Upgrading of conductor size from ACSR 25 mm<sup>2</sup> to 58 mm<sup>2</sup>.

c) Maharajganj Feeder

Extension of the feeder up to the Maharajganj crossing.

d) Trolley Bus Line and Baneswar Feeder

Interconnection with an Al 200 mm<sup>2</sup> underground cable.

e) Shahid Gate Path

Renewal of the existing damaged cable with an Al 100 mm<sup>2</sup>  
underground cable.

f) Patan Zoo Area

Rehabilitation of the road crossing underground cable.

### 2.3 Voltage Upgrading in City Center Area

The voltage upgrading in the congested city center area currently supplied at 3.3kV is planned. The existing 11/3:3 kV tie transformers for power supply to the area are already overloaded and urgent conversion to the 11kV supply or addition of tie transformers is essential. The conductors in this area are mostly underground cables. In view of importance of the supermarket building as a community center in the area it is planned to secure the supply to this area by connecting to three feeders from K2, Teku and Lainchaur.

#### 2.4 Installation of Sectionallizing Switches on 11 KV Lines

#### 2.5 Installation of Distribution Transformers

Additional installation of distribution transformers was requested for reinforcement of the power supply to the areas which are suffering from frequent interruption of supply or large voltage drop. Some extension of 11kV lines and construction of low tension lines are also required.

Quantity of transformers is as given below:

Kathmandu	53 sets,	7,250 KVA in total
Patan	15 sets,	1,600 KVA in total
Bhaktapur	7 sets,	700 KVA in total

#### 2.6 Installation of Metal-enclosed Transformers

In order to match with scenery of the town surrounded by the old historic structures in Bhaktapur and old Kathmandu city, installation of transformers encased in steel cubicles was requested.

#### 3. Electrification in Rural Areas

Further extension of the distribution system to 25 Panchayats still not yet electrified was requested.

The name of Panchayat's are:

Badikhel, Bageswari, Bhimdhonga, Chalnakehl, Chapagoan, Challing, Chhmpi, Dachhi, Dhachok, Godawari, Gokarna Baluwa, Goldhunga, Gundu, Jhar, Kabhresthali, Lamatar, Lapsephedi, Lubu Mahalakshmi, Nagarkot, Naikap Purano, Sangal, Shipadol, Sitapaila Ward No.1, Sundal and Tatheli.

#### 4. Distribution Materials and Maintenance Tools

Supply of essential distribution materials for installation by HMC's working crew and maintenance tools equipment was requested as seen in the attached list.

Hms

f

tdh

5. Priority for Implementation

- First : Substations (K2, Baneswar, Lainchaur and Patan)
- Second : Reinforcement of the distribution network  
in the city areas
- Third : Rural electrification

*2*

*10/15*

*Hms*

LIST OF DISTRIBUTION MATERIALS AND MAINTENANCE TOOLS

1. Cutout Switches for Transformers		
(A)	Cutout switches 12kv, 1-phase, 100AF	1000 nos.
(B)	Cartridge fuse	
i)	1A rating	500 nos.
ii)	2A rating	500 nos.
iii)	6A rating	1000 "
iv)	12A rating	1000 "
v)	15A rating	200 "
vi)	20A rating	200 "
vii)	25A rating	200 "
2.	Sectionalizing Switches	80 nos.
i)	200A rating	60 "
ii)	400A rating	20 nos
3.	Distribution Switch Boxes	Total 500 nos.
i)	3 - P 400 AF (400 AT)	50 nos.
ii)	3 - P 225 AF (175 AT)	250 nos.
iii)	3 - P 100 AF (100 AT)	100 nos.
iv)	3 - P 100 AF ( 60 AT)	100 nos.
4.	Watthourmeters:	
i)	1 - P 2 W 230 V 15/60A	5000 nos.
ii)	" " 10/40A	5000 "
iii)	" " 5/20A	10000 "
iv)	3 - P 4 W 400 V 15/60A	500 "
v)	" " 7.5/30A	500 "
5.	Watthourmeters with Maximam Demand Indicator	
i)	3 - P 4 W 400 V 200/5A CT	50 nos.
ii)	" " 100/5A CT	100 "
iii)	" " 60/5A CT	100 "

A

HAY

Hmv

- |   |         |
|---|---------|
| 6. Transformer Oil Testing Kit                            | 2 Sets  |
| 7. High Voltage Cable Testing Set<br>up to 40 kV, DC 10mA | 2 sets  |
| 8. Oil Filter Set, 200 l/h                                | 5 sets  |
| 9. Vehicles   | 3 units |
| 10. Working Truck<br>with insulated bucket (elevator)     | 2 units |
| 11. VHF Radio Equipment                                   |         |
| i) VHF radio equipment (3 channels)                       | 6 sets  |
| ii) DC Power supply system                                | 1 set   |

*h*

*July*

*Hno*

ANNEX IV NECESSARY MEASURES TO BE TAKEN BY HMG OF NEPAL

1. To secure a lot of land
2. To clear, level and reclaim the site when needed
3. To construct gates and fences in and around the sites when needed
4. To construct access roads to the sites when needed
5. To provide the facilities for city water distribution to the site when needed
6. To provide the drainage and sewerage facilities when needed
7. To provide general furnitures when needed
8. To bear the following commission to the Japanese foreign exchange bank for the banking services based on the Banking Application
  - 1) Advising commission of Authorization to Pay
  - 2) Payment commission
9. Tax exemption and custom clearance of the products at the port of disembarkation
10. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the Kingdom of Nepal and stay therein for the performance of their work
11. To maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant
12. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and the installation of the equipment
13. To construct drop wirings to consumers
14. To coordinate with the inhabitants living in the Projects areas on matters which may arise during the implementation of the Projects

✓  
HN

Hus



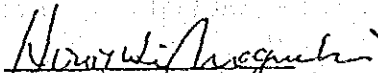
MINUTES OF DISCUSSIONS

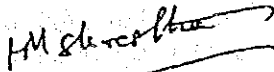
In order to explain about and discuss on the content of the Draft Basic Design Report on (1) the Establishment of a Load Dispatching Center and (2) The Reinforcement of the Distribution Network in the Kathmandu Valley, which was prepared based on the site survey as well as analysis in Japan, the Government of Japan has sent through the Japan International Cooperation Agency (JICA) a team headed by Mr. Hiroyuki Noguchi, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs and the team has stayed in the Kingdom of Nepal for 8 days from 24 February to 4 March 1985.

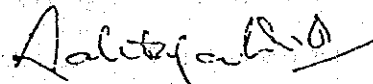
The team had three days' discussions from 27 February to 1 March 1985 with the authorities concerned of the His Majesty's Government of Nepal (HMG/N).

As the result of the discussions, the both parties have in principle agreed on the content of the Draft Basic Design Report with some modifications as per ATTACHMENT and to recommend to their respective Governments to examine the content of the report.

3 March 1985

  
Mr. Hiroyuki Noguchi  
Team Leader, JICA

  
Mr. H.M. Shrestha  
Chief Engineer  
Electricity Department, HMG/N.

  
Mr. L.N. Dixit  
General Manager  
Nepal Electricity Corporation

ATTACHMENT

1. The team will finalize the Basic Design Report on (1) The Establishment of a Load Dispatching Center and (2) The Reinforcement of the Distribution Network in the Kathmandu Valley based on the series of discussions which have been held between the both parties.
  
2. The HMG/N side made the following requests:
  - (a) Load Dispatching Center
    - i) To provide automatic remote indications for the data of at least the four additional power stations, Trisuli, Devighat, Sunkosi and Gandak, on the system diagram board in the load dispatching center by adding necessary facilities.
  
  - (b) Distribution Works in the City Areas:
    - i) To construct Patan Substation.
    - ii) To change the route of distribution line from Teku Substation for power supply to the supermarket area from the Mint Feeder to Bhimsensthan Feeder in order to improve supply reliability.
  
  - (c) Rural Electrification
    - i) To supply materials for erection by the Nepalese staffs to complete the electrification of 25 Panchayats which have been surveyed during the last visit of the Japanese team.
  
  - (d) Supply of Distribution Materials and Tools
    - i) To include cutout switches for transformers
    - ii) To include distribution switch boxes
    - iii) To increase number of watt-hour meters from 4,200 to requested 21,000 or at least 15,000
    - iv) To include one unit of working truck.
  
3. After a series of discussion it was mutually agreed to include the followings:
  - (a) Load Dispatching Center
    - i) To provide the communication link between Trisuli and Devighat Power Stations to facilitate load dispatching

communication and for intercommunication between two power stations. Length of the line is about 5 Km.

(b) Distribution Works in the City Area

- i) To change distribution line route from Teku Substation for power supply to the supermarket area as requested.

4. Annex IV in the last Minutes of Discussions covering the Necessary Measures to be taken by HMG/N was supplemented as given below:

(a) To demolish a building which is existing at the proposed site for the load dispatching center and clear the area.

(b) To relocate the Chinese equipment in the existing 66kV switchyard of Sunkosi Substation (Patan) and re-erect the necessary equipment for connection with the Sunkosi Transmission Line.

Lee

H. S. Chandra

H. S. Chandra

APPENDIX V SEVENTH FIVE YEAR PLAN (1985-89)

(Power Sector)

Draft

A. Hydro Electric Projects

A.1 Feasibility Study and Detail Study

	<u>Capacity</u>
1. Karnali (Upper Chisapani)	Not decided
2. Arun	Not decided
3. Tamakosi - 3	123 MW
4. Andhi Khola	180 MW
5. Seti	320 MW
6. Mugling	90 MW
7. Sapt Gandaki	225 MW

A.2 Project to be completed

	<u>Capacity</u>	<u>Expected date of completion</u>
1. Kulekhani Hydro Electric Project - 2	32 MW	1986/87
2. Andhi Khola	5.1 MW	1987/88
3. Marsyangdi	66 MW	1989/90

A.3 Project to be started

1. Shimruk	10 MW
------------	-------

B. Transmission Line Projects

B.1 Feasibility Study/Detail Investigation

	<u>Length</u>
1. Nepalgunj-Dhangadi-Mehendranagar 132 kV Transmission Line	150 km
2. Hetauda-Bharatpur 132 kV Transmission Line	90 km
3. 33 kV Transmission Line	
a. Bharatpur - Lothar	45 km
b. Lahan - Gai Ghat	30 km
c. Tulsipur - Salyan	50 km
d. Ghorai - Phyuthan	50 km
e. Anarmani - Ilam	40 km
f. Lahan - Kanchanpur	52 km
g. Dhangadi - Dadheldura	90 km
h. Damauli - Besisahar	38 km
i. Jaleshwar - Malangwa	52 km
j. Dhalkebar - Sindhuli	35 km

## B.2 Transmission Line Project under Construction

### 1. 132 kV Transmission Line and Sub-stations

a.	Kathmandu - Marsyangdi - Bharatpur	115 km
b.	Hetauda - Janakpur - Biratnagar	289 km
c.	Butwal - Dumkibas	43.5 km
d.	Biratnagar - Anarmani	80 km
e.	Pokhara Substation 132/11 kV	6 MVA
f.	Butwal - Nepalgunj	208 km

### 2. 33 kV Transmission Line and Substations

a.	Dharan - Dhankuta	25 km
b.	Dhalkebar - Janakpur - Malangwa/ Birgunj - Kalaya - Gour/ Janakpur - Gour - Birgunj	145 km
c.	Kohalpur - Nepalgunj	36 km
d.	Nepalgunj - Guleriya	36 km
e.	Lamahi substation - Lamahi	5 km
f.	Chanuta (Sivapur) - Bahadurgunj	18 km
g.	Butwal - Bhairawa	20 km
h.	Butwal - Lumbini	32 km
i.	Pokhara - Syangja	90 km

3. Small Hydro Electric Project

Projects under Construction

a.	Taplejung	125 kW
b.	Khandbari	250 kW
c.	Terathum	100 kW
d.	Bhojpur	260 kW
e.	Namche	480 kW
f.	Saleri	200 kW
g.	Okhaldhunga	100 kW
h.	Ramechhap	75 kW
i.	Manang	80 kW
j.	Chame	45 kW
k.	Tatopani	1,000 kW
l.	Chourjhari	200 kW
m.	Bajura	200 kW
n.	Bajhang	200 kW
o.	Darchula	
p.	Syarpudha	200 kW

## APPENDIX VI

### RULES FOR POWER SYSTEM OPERATION (LOAD DISPATCHING)

- Suggestion for Content -

#### I. General

1. Purposes for Establishing Load Dispatching Center
2. Scope of Load Dispatching Work
3. Functions of Load Dispatching Center

#### II. Detailed Description of Load Dispatching Center

1. Duties and Authority of Load Dispatching Center
2. Duties of Remote Power Stations and Substations

#### III. Basic Principles for Operation of Power System

##### 1. Operation under Normal Conditions

- a) Power System Configuration
- b) Power System Operation
- c) Frequency Control
- d) Control of Power and Demand Balance
- e) Regulation of Power System Voltage
- f) Power Flow Control
- g) Economical Operation
- h) Scheduled Maintenance of Major Facilities
- i) Operation of Protective System
- j) Operation of Neutral Grounding System
- k) Operation of Newly Installed or Extended Facilities
- l) Operation of Communication System
- m) Operation Records and Reporting

##### 2. Operation under Emergency Status

- a) Operation of Facilities which Require Emergency Stop
- b) Control to Prevent Spreading of Faults
- c) Disposal of System Troubles
- d) Restoration from Fault States
- e) Reporting under Emergency Status
- f) Reports about System Troubles
- g) Review of Records for Troubles and Restoration



## APPENDIX VII DESIGN CRITERIA FOR DISTRIBUTION FACILITIES

### 1. Applied Standards

Japanese standards, JIS, JEC, JEM, etc., or equivalent standards will be applied to all materials and equipment to be supplied related to the execution of the planned distribution network project.

### 2. Climatic Conditions

Climatic conditions to be considered in design will be as given hereunder:

#### (a) Air temperature

Average maximum air temperature : 23.8°C

Extremely highest air temperature : 33.0°C

Average minimum air temperature : 11.7°C

Extremely lowest air temperature : -3.9°C

#### (b) Wind velocity

The recorded highest wind velocity is 52 knot (26.75 m/sec).

#### (c) Humidity

The average relative humidity varies from about 40 percent in April to about 85 percent in August.

#### (d) Rainfall

The average rainfall in one year is 1,300 mm, of which 80 to 90 percent falls during 5 months during the rainy season from May to September.

### 3. Loading Conditions for Design

(a) The maximum wind pressure for design is decided based on wind velocity of 25 m/sec as given below:

- Conductors and groundwires	:	35 kg/m <sup>2</sup>	on the projected area
- Tower supports	:	130 kg/m <sup>2</sup>	"
- Pole supports	:	31 kg/m <sup>2</sup>	"
- Insulators	:	55 kg/m <sup>2</sup>	"
- Transformers and other equipment	:	100 kg/m <sup>2</sup>	"

(b) For sag calculation of conductors, the maximum temperature shall be assumed to be 70°C and the minimum temperature to be 0°C.

### 4. Conditions for Design of Supports

(a) Standard ground clearances of conductors shall be as given below:

	<u>66 kV</u>	<u>11 kV</u>	<u>400/230 V</u>
Road crossing	7.5 m	6.0 m	4.8 m
Along road	-	5.8 m	4.8 m
Other areas	6.5 m	5.2 m	4.8 m
Other lines	3.0 m	-	-

(b) Design span lengths and standard spacing of bare conductors shall be as given below:

<u>Line</u>	<u>Design Span</u>	<u>Spacing</u>
66 kV line	300 m	-
11 kV line	75 m	120 m
"	50 m	120 m
400/230 V line	50 m	30 m

- (c) Supports shall be so designed as to withstand the test load as given below without failure or permanent distortion:

Towers: 1.5 times of the loadings under normal conditions,  
1.1 times of the loading under broken wire conditions.

Poles : 2.0 times of the specified loadings.

- (d) The minimum sizes of the poles shall be as given below:

	<u>Outside Diameter</u>	<u>Thickness</u>
Upper portion	4 inches	4 mm
Lower portion	5 inches	5 mm

- (e) For interchangeability, the same poles shall be applied for all types of pole structures. Designs of poles is shown in Fig. 5.12 and 5.13.

#### 5. Insulation Design of 66 kV Lines

- (a) The suspension insulator discs with 12 ton strength shall be used. These insulator discs are same as those for the entire Kulekhani system.
- (b) The number of insulator discs per string shall be five. Arcing horns will be provided on both of the line and earth sides.

#### 6. Design of 11 kV Switchgear

- (a) The DC control source voltage for the operation of 11 kV switchgear shall be 110 V.
- (b) The rated rupturing capacity of 11 kV circuit breakers shall be 20 kA (400 MVA) and the rated current shall be 400 A for feeder circuits, 800 A for incoming circuits and for bus couplers and 1,200 A for the secondary circuits of 18 MVA transformers.

- (c) In order to limit the installation space of the 11 kV switchgear, cubicles containing two circuit breakers in one panel will be supplied. The type of circuit breakers will be vacuum type.
- (d) Copper conductors shall be used for distribution transformers.

APPENDIX VIII

PARTICULARS OF DISTRIBUTION LINE WORKS

WORK QUANTITY OF FINALLY PROPOSED DISTRIBUTION LINE WORKS

CITY AREA

1. New 11 kV line	24.89 km
a) Overhead line	18.90 km
b) Underground cable	5.99 km
2. Upgrading of voltage	2.32 km
a) Overhead line (Insulator change only)	0.5 km
b) Underground cable	1.82 km
3. Distribution transformers	8,450 kVA
a) 3 $\phi$ 100 kVA 44 Nos.	4,400 kVA
b) 3 $\phi$ 250 kVA 15 "	3,750 kVA
c) 3 $\phi$ 100 kVA 3 " (Cubicle type)	300 kVA
4. 400/230 V line	16.70 km
a) Overhead line	14.70 km
b) Underground cable	2.00 km
5. Sectionalizing Switches	20 nos.
a) 400 A rating	5 nos.
b) 200 A rating	15 nos.

Detail of Overhead Lines, Underground Cables  
and Transformers

Line Name	Distance (km)			Transformer (kVA)	
	O.H	U.G	L/T	100	250
1) New 11 kV Lines	18.90	5.99	14.70	43	11
a. City Area	7.30	1.13	14.50	43	11
(Kathmandu)	6.10	0.94	11.10	32	10
1. Watu		0.15		1	
2. Joisidawal		0.16		1	
3. Teku				1	
4. Kolonku	*0.30		0.50	1	
5. Paphal				1	
6. Koteswar (A)	*0.20		0.20	1	
7. Koteswar (B)			0.30	1	
8. Banewar	0.30		0.30		1
9. Goal Dhunga Na.	0.10				1
10. Pancha Kumari	-				1
11. Dhobi Khola	0.30				1
12. Gatekulo	0.20	0.19	0.50		1
13. Char Khal					1
14. Naran Choor	0.20		0.20	1	
15. Bijuli Bazar	0.10	0.15			1
16. Koria Goon Tha.				1	
17. Lajimpat	0.20		0.50	1	
18. Baluwatar	0.20		0.70	1	
19. Gyaneswar	0.30	0.09	0.60	1	
20. Naxal	0.20		0.20	1	
21. Bhandarkhal	0.30		0.50	1	
22. Basbari	0.60		0.90	1	
23. Balaju			0.30	1	
24. Kulesor	0.20		0.70	1	
25. Kalimati					1
26. Tahachal Garden	0.20		0.20	1	
27. Lakhechuir	0.40		0.40	1	

Line Name	Distance (km)			Transformer (kVA)	
	O.H	U.G	L/T	100	250
28. Baneswar Bhimsen	0.50		0.50	1	
29. Airport Harilantal			0.50	1	
30. Mahal			0.70	1	
31. Basbari Marajganj				1	
32. Gongabu			0.70	1	
33. Chauni				1	
34. Ravi Bhavan	0.30		0.30	1	
35. Sunargaen	0.20		0.70	1	
36. Kamal Pokhari	0.20		0.20	1	
37. Bulwatar Tukucha	0.30		0.30	1	
38. Bishal Nagar				1	
39. Kamladi	0.10				1
40. Nhiokha				1	
41. Kesar Mahal	0.20		0.20		1
42. Baneswar Tro. Bus				1	
43. Siuchatar tek (Patan)	0.70	0.20	2.90	8	1
1. Khumaltar			0.20	1	
2. Sanepa	0.20		0.40	1	
3. Nir Bhacuan	0.20		0.90	1	
4. Jhamsikhel				1	
5. Thashikhel				1	
6. Sundhore	0.10		0.40		1
7. Gwarko	0.20		0.20	1	
8. Gusirgal				1	
9. Bakhundo			0.40	1	
10. Sanchal (Bhaktapur)	0.50	0.19	0.50	3	
1. Suryabinayak	0.40		0.50	1	
2. Tulachhe	-	0.19		1	
3. Maheswari Ghat	0.10			1	
4. Nasumana				*1	
5. Golmadhe				*1	
6. Gatatre				*1	



Line Name	Distance (km)			Transformer (kVA)	
	O.H	U.G	L/T	100	250
b. Inter Connection		0.48			
1. Troll Bus Line - Baneswar		*0.07			
2. Shahia Gate Path		0.35			
3. Patan Zoo		*0.06			
c. New Feeder	11.60	1.78	0.20		
1. New Chabel S.S	<u>0.50</u>	<u>0.20</u>			
a. Baudha	*0.50	*0.20			
2. Siuchatar S.S	<u>3.20</u>	<u>0.33</u>			
a. Swanyambhu	*2.10	*0.09			
b. Kalimati	*1.10	*0.09			
c. Thankot	-	*0.15			
3. Patan S.S	<u>3.00</u>	<u>0.07</u>			
a. Chapagaon	*3.00	*0.07			
4. Thapathali S.S	<u>0.40</u>	<u>0.22</u>			
a. Sanepa	*0.40	*0.22	0.20		
5. Bhaktapur	<u>1.90</u>	<u>0.56</u>			
a. Banepa	*1.70	*0.28			
b. Katunje	*0.20	*0.28			
6. New Baneswar	<u>2.60</u>	<u>*0.40</u>			
7. K2 S.S.		<u>2.60</u>			
2) Upgrading of Voltage and Conductor Size		1.82		1	4
1. Hotel Cristal		0.50			1
2. Hanumon Dhoka				1	
3. Harisankhal		0.22			1
4. Athonarayan		0.16			1
5. Suppermarket		0.48			
6. Shura Path					1
7. Maha Baudha	0.5 <sup>/1</sup>	*0.46			

\* Represent ACSR 95 mm<sup>2</sup> for overhead lines and AC 200 mm<sup>2</sup> for underground cable.

<sup>/1</sup> Change of insulators only.







JICA