

***ANNEX-4***

***MINUTES OF MEETING  
(FIRST SITE WORK: NO.2)  
BETWEEN***

***THE MASTER PLAN STUDY TEAM***

***AND***

***DEPARTMENT OF ENERGY  
MINISTRY OF INDUSTRY***

***FEBRUARY 9, 2004***

**MINUTES OF MEETING  
FOR  
THE INTEGRATED MASTER PLAN STUDY  
FOR DZONGKHAG-WISE ELECTRIFICATION  
IN  
THE KINGDOM OF BHUTAN  
(FIRST SITE WORK: NO.2)**

**BETWEEN  
THE MASTER PLAN STUDY TEAM  
AND  
DEPARTMENT OF ENERGY  
MINISTRY OF TRADE AND INDUSTRY**

**THIMPHU  
FEBRUARY 9, 2004**



---

Mr. Tomoyasu Fukuchi  
Team Leader, JICA Study Team  
Nippon Koei Co., Ltd.



---

Mr. Sonam Tshering  
Director  
Department of Energy  
Ministry of Trade and Industry

The Master Plan Study Team (the Team) of the Japan International Cooperation Agency (JICA), which is headed by Mr. Tomoyasu FUKUCHI, stayed in Bhutan from January 13, 2004 through February 11, 2004 as a last half of the first site work. On February 6, 2004, the Team had a wrap-up meeting with Department of Energy (DOE), Ministry of Trade and Industry and Bhutan Power Corporation (BPC), and the parties confirmed the followings.

1. **Inception Report** : The Team submitted twenty copies of the final version of Inception Report to DOE on January 13, 2004 according to the clause 1 of the minutes of meeting for the first site work No.1.
2. **Coordinating Committee Meeting** : The coordinating committee was held on January 23, 2004 and discussion was made as shown in its minutes of meeting (Attachment-1).
3. **Workshop** : The first workshop took place at the conference hall of RICB on January 30, 2004 according to the agenda shown in the Attachment –2 along with list of participants. Record of discussions on 1<sup>st</sup> National Workshop is attached herewith (Attachment-3).
4. **List of Non-Electrified Villages** : The Team received the remaining list of non-electrified villages. The status of received data is shown in the Attachment-4.
5. **Collection of Distribution Line Data** : DOE/BPC will collect and check the data of all the existing distribution lines by the end of May, 2004; see the Attachment-5 for reference, and submit the same to the Team at the beginning of 2nd site work which is scheduled to commence in June 2004.

The required data to submit is shown below.

- a) Location data (GPS) of distribution transformers with their capacities and routes and conductor size of distribution lines
  - b) Location data (GPS) of substations and their transformers' capacities
6. **GIS Training** : GIS training was imparted by the Team from January 19/Mon through 21/Wed and 23/Fri, 2004 (4 days) at BPC office to 9 personnel listed in the Attachment-6.
  7. **GPS Training** : According to the request of DOE/BPC to collect the location data of the existing distribution lines, GPS training was executed by the Team on January 26/Mon and 28/wed, 2004 (2 days) to 12 personnel listed in the Attachment-7.
  8. **Mipower Training** : One license of power system analysis program - Mipower – was installed and the training for the same was executed from January 26 through 28 (3 days) to Ms. Dechen Dema of BPC and Mr. K. Ohara of the Team by the package supplier: Technology & Business Power Research & Development Consultant Private Limited (PRDC).  
The Mipower hardware key is kept by the Team.

9. **Standard Spelling of Dzongkhag and Gewog** : Standard spellings to be used in this study of all the Dzongkhags and Gewogs were decided as shown in the Attachment-8. The boundaries of the Dzongkhags and Gewogs were also finalized as shown in the same Attachment.
10. **Lending GPS and Software & Hardware Key of GIS** : The Team lends DOE 14 sets of GPS (Garmin eTrex, "Yellow Color") and two sets of software & hardware key of Arc-GIS (Ver.8.3) from January 10, 2004 to the commencement of the 2nd site work only for the purpose to locate the existing distribution transformers and the other power facilities.
11. **Village Survey by Local Consultant** : DOE will monitor and check the progress of the village survey conducted by local consultant: NORLHA ASSOCIATES, and inform the progress once in every month to the Team.
12. **Base Line Data of the Study** : The baseline data of the existing power facilities for this study will be finalized with available data by end of May 2004.
13. **The Original Data of Living Standard Survey 2003** : The Team requested for the original data of the living standard survey 2003 being compiled by National Statistical Bureau vide letter No. LBRE-03-003. DoE will obtain the data before the commencement of 2nd site work.
14. **Water Discharge Data** : DOE will submit the water discharge data of the following rivers in dry season to the Team at the beginning of 2nd site work.

No.	Name of River	Dzongkhag	Gewog
1	Jabkang Broksar-chu	Trashigang	Sakten
2	Sam-chu	Samtse	Dorokha

15. **Collaborative Project Planning with DIT and BBS** : The Team and DOE agreed in principle to collaborate project planning and promotion for Rural ICT Services with Department of Information Technology, Ministry of Information and Communication, expansion of TV Broadcasting with Bhutan Broadcasting Service (BBS). This main objective of such collaboration is more from perspective of cost sharing and value addition to Rural Electrification.
16. **Policy of Technology Transfer to Counterparts** : For the effective transfer of the technology to DOE/BPC, the Team and DOE/BPC agreed to the following:
- to set the final target;
  - to decide the key subjects of technology transfer to achieve the final target;
  - to set the target of each subjects;
  - to decide the persons who receive the technology transfer by each subject;
  - to set the benchmarks to evaluate the achievement of the technology transfer; and
  - to evaluate the achievement of the persons using the benchmarks

g) Draft "Design of technology transfer" attached as Attachment -9

17. **Census Data** : The Team is expecting to receive the census data requested by their letter LKLBHE-03-048 dated February 6, 2004 by the commencement of 2nd site work.

18. **Next Site Work** : The 2nd site work is scheduled to be conducted in June to July, 2004.

End

**Attachment**

1. Minutes of the 1st Project Coordination Committee Meeting
2. Agenda and List of Participants for 1st Workshop
3. DOE's letter: DOE/PCD/RE-MP/03-04/562 dated 9<sup>th</sup> February 2004
4. Status of Received Data of Non-Electrified Villages
5. BPC's Inter Office Memo: BPC/PLANNING/F-2(A)/020 dated January 29/30,2004
6. Participants list of GIS Training
7. Participants list of GPS Training
8. Definition of Names and Boundaries of Dzongkhags and Gewogs
9. Draft Design of Technology Transfer



## Minutes of the 1<sup>st</sup> Project Coordination Committee Meeting on the Integrated Master Plan Study for Dzongkhag-wise Electrification

Venue: Department of Energy Conference Hall, Thimphu

Date: 23<sup>rd</sup> January 2004.

Time: 10.00 am

Following members were for the meeting:

1. *Mr. Sonam Tshering, Director, Department of Energy- Chairman.*
2. *Mr. Fukuchi Tomoyasu, Team Leader, JICA Study Team-Member.*
3. *Mr. Bharat Tamang, Head, Planning & Coordination Division, Department of Energy-Member*
4. *Mr. Jigme Tobgyel, Sr. Manager, Planning Division, Bhutan Power Corporation-Member*
5. *Mr. Kinley Dorji, JICA Bhutan Office, Thimphu (Representative on behalf of RR, JICA Bhutan Office)-Member.*
6. *Mr. Phuntsho Wangyel, Program Officer, Department of Aid and Debt Management-Member.*
7. *Mr. Karma P Dorji, Project Manager, Planning and Coordination Division, Department of Energy-Member Secretary.*

### **Background**

In response to the request of the RGoB, the Government of Japan kindly agreed to conduct the Integrated Master Plan study for Dzongkhag-wise Electrification in Bhutan in accordance with the relevant laws and regulations in force in Japan.

The objective of the study is to formulate comprehensive rural electrification plan to achieve RGoB's vision of "Electricity for All" by 2020. Thus the study is expected to produce a sustainable tech-economic rural electrification plan envisaging environment, technical, socio-economic and financial parameters.

In pursuance to the minutes of meeting for the project " the Preliminary Study for the integrated master plan study for Dzongkhag-wise Electrification in the kingdom of Bhutan" between Japan International Cooperation Agency and Department of Energy, Ministry of Trade and Industry held on 27<sup>th</sup> June 2003, the Executing Agency "Department of Energy" has committed to establish a Project Coordination Committee (PCC) consisting of members from DOE, BPC, JICA/JOCV (Thimphu), MOF (DADM) and Study Team.

On 23<sup>rd</sup> January 2004, 1<sup>st</sup> Project Coordination Committee Meeting was convened in order to confirm the members, discuss the draft TOR and presentation of progress of the project.

### **Discussion**

The Chairman welcomed the members for the 1<sup>st</sup> Project Coordination committee meeting. The Chairman informed the members that the Department felt the need of Rural

Electrification Master Plan during 8<sup>th</sup> Five Year Plan and later it was submitted to Japanese Government requesting for funding the project. In response, Government of Japan kindly agreed to conduct the study. In October 2002, Department received JICA mission to assess and evaluate the request. As far as Royal Government is concerned, rural electrification is given highest priority in order to fulfill the objective of providing electricity for all by 2020. In June 2003, appraisal mission from JICA visited Bhutan to determine the "Scope of work". A country agreement was signed between JICA and Ministry of Trade and Industry spelling out the scope of work and separate minutes of meeting between Department of Energy and JICA to implement the scope of work. In the minutes of meeting, it was identified to establish a coordination committee in order to facilitate the smooth implementation of the study. The committee is responsible for monitoring the progress of the study.

The Chairman also pointed out that although he has been referred to as Chairman of the committee but that does not mean the decisions made during meeting will be based on his position, rather should be based on collective decision by the committee. The role and support of the committee is very crucial and important in terms of leading and providing direction of the project. The committee should be in a position to take responsibility and ownership of final outcome (Report) of the project.

On the composition of the committee members, Chairman pointed out the need for including Sr. Manager, Planning Division, Bhutan Power Corporation in addition to General Manager, Customer Service Department, Bhutan Power Corporation. Further, a representative from Ministry of Trade and Industry's Planning and Policy Department to be included as committee member. The meeting finalized the PCC members as follows:

Designation	Organization	Position
Director	Department of Energy	Chairman
Head	Planning & Coordination Division, Dept. of Energy	Member
Resident Representative	JICA/JOCV, Thimphu	Member
General Manager	Customer Service Department, Bhutan Power Corporation	Member
Representative	DADM, MOF	Member
Team Leader	Nippon Koei Co. Ltd. JICA Study Team	Member
Sr. Manager	Planning and IT Division, BPC	Member
Representative	Planning and Policy Division, MTI	Member
Project Manager	PCD, DoE	Member Secretary

The Project Manager presented the project background, key areas of study, schedules and progress of the project (attached appendix 1) along with submission of two issues to the committee on scheduled 1<sup>st</sup> National Workshop.

1. Few Dzongkhag deputing Chairman of the DYT for the workshop and felt a need for English-Dzongkhag interpreter for interpreting the discussion during the workshop.
2. Most of Dzongkhag and the BPC's District Manager requesting to cover the travel and DSA from the project. Whereas, the earmarked budget of US\$ 4000 by the JICA for the workshop is inadequate to meet the request.

The meeting discussed two issues presented by project manager and agreed that Mr. Gem Tshering, General Manager, Transmission Department, Bhutan Power corporation may be requested for his assistance if an interpreter is required. Besides, the Planning Officers from the Dzongkhags should be responsible for disseminating the information to DYT members. The Chairman also pointed out that limitation of representatives should not be constrained by budget limitation. The importance of the 1<sup>st</sup> National Workshop scheduled on 30<sup>th</sup> January 2004 particularly in terms of number of Dzongkhag representations and dissemination of objectives/purpose of the study to the representatives was felt very pertinent and vital. The Team Leader of Nippon Koei Co. and Project Manager was asked to work on cost estimate for covering DSA and transportation for the participants and request JICA for additional financing. Under extreme conditions Project Manager should explore counterpart funding if budget is available. Further, the Head, Planning and Coordination Division to present the paper on policy, current status and constraints being faced in carrying out RE in the workshop.

The representative from DADM also pointed out that they would not be in any position to arrange any additional funds from RGoB for the project, as it was not committed specifically in the agreed minutes. However, if Project has earmarked counterpart funding in the current fiscal year, it was suggested that the additional funds required be met from the fund if possible.

The Team Leader presented issues/problems being faced by study team mainly on baseline data, counterpart personnel and technology transfer. He highlighted the need for correct baseline data such as GPS positions of existing power facilities and commitment of counterpart personnel on priority basis to work in close association with experts, so as to achieve technology transfer and thereby resulting into fruitful master plan study.

*Comments on submission by the Team Leader:*

Counterpart personnel: The Chairman highlighted the importance of counterpart personnel to take advantage of availability of experts and working with more purpose rather than just fulfilling counterpart assignments. He also pointed out that as far as commitment of fulltime jobs with counterparts is concerned, it would be realistic to provide the detail schedule dates of consultants in field to Bhutanese counterparts. The Team Leader and Project Manager is expected to provide the detail list of roles of all counterparts and inform the counterparts accordingly emphasizing the importance of their participation. Chairman has asked Project manager to call on all counterpart personnel from DoE to meet him in a separate meeting.

The Sr. Manager, BPC, submitted that although the BPC counterpart personnel had been identified, there has been some confusion due to the various counterparts reporting to



different departments of BPC. He informed that, as assured in the earlier meeting held between the Study Team, DoE and BPC, the matter was immediately taken up with the Managing Director of BPC, who has accordingly issued an order to all counterpart personnel from BPC instructing them to be available for the study team during the entire duration of their stay in Bhutan. He also submitted that a BPC counterpart personnel for the Transmission expert had not been identified earlier and that during the meeting referred above, the General Manager, Transmission Department, BPC, was also out of station. However, the Sr. Manager submitted that a BPC counterpart for transmission services could be made available and that he would request the General Manager, Transmission Department, for the same. He also submitted that it would be very helpful if the study team could prepare a more detailed schedule so that the various counterpart parts from BPC know exactly when their respective counterparts in the study team would require interactions and discussions.

Baseline data: Chairman informed the members that BPC has earmarked a goal in corporate strategy to collect and compile baseline data of the entire existing infrastructure by end of December 2003 and should follow up with BPC on the status of the work.

The Head, PCD also highlighted the requirement of correct baseline information and that it is also obligatory for the BPC/DOE to provide them in accordance with the agreed scope of work with JICA.

Regarding the availability of the GPS data up to year 2000, the Sr. Manager, BPC, submitted that the GM, CSD, had informed during the meeting with the consultants (at the BPC conference hall) that the GPS data available had been collected for asset valuation purposes and that it would not be adequately accurate for the master plan studies. He also submitted that the GM, CSD, during the same meeting with the consultants, had requested for help from the consultants on the GPS and GIS system establishment since GIS system is new to the BPC. Somehow these requests were not included in the consultants TOR. He stated that immediate collection of GPS data without a planned GIS system would most probably require the BPC to redo the GPS data collection later and such requirement would be wasteful of resources for the BPC. He also informed that even if the available GPS data up to 2000 were to be used, it would be difficult to clearly differentiate the infrastructure existing before year 2000 from that added later. The Sr. Manager also submitted that the GPS data collection can commence immediately after the ongoing GIS training and formulation of the desired GIS system where the consultant's assistance would be very beneficial.

Team Leader apprised the members that although not envisaged in their TOR for provision of additional GPS equipment, based upon request by the Project Manager and with further consultation with JICA, they have procured 14 more GPS equipment feeling the importance of correct baseline information for the study.

#### *Discussion on draft TOR*

Chairman pointed out the main purpose of the coordination committee is to monitor the progress of the project. In performing this functions, if there were any provisions or clear

indication by JICA to disclose the budgetary allocations for the project would actually assist the committee in carrying out its roles.

However, the Technical Officer, JICA Bhutan Office pointed out that since the implementation contract is signed between JICA and Nippon Koei, it will not be possible to point out the budgetary allocations. He advised that DOE should be guided by the scope of work signed between DoE and JICA. Any change in implementation of project can be worked out in the committee and put up to JICA headquarter for consideration.

Based on above deliberations, the meeting decided to finalize the functions of the coordination committee as follows:

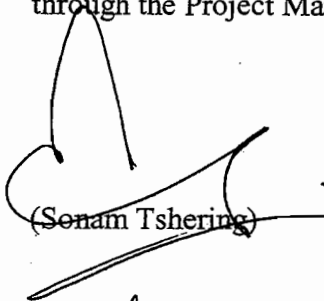
1. To review and monitor progress of the project and provide recommendation as and when deemed necessary.
2. To advice on policy matters and environment and socio-economic planning issues of the project.
3. Provide guidance and direction for smooth implementation of the project.
4. The coordination committee meeting shall be held at least once in every quarter.
5. DoE shall coordinate the meeting and also coordinate participation of other Government agencies in the event of need.

#### *Next Action Plan*

It was that the Project Manager with consultation with Team Leader will inform the committee members for next meeting.

#### *Conclusion*

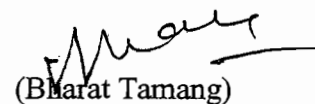
Chairman concluded the meeting by thanking all the members and pointed out once again the important role of committee members in ensuring the completion of project successfully. He also informed the Team Leader if there is any need for him to consult him or Head-PCD, he should feel free to contract them anytime instead of routing through the Project Manager.



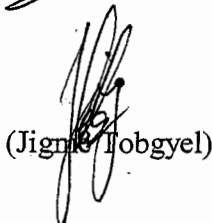
(Sonam Tshering)



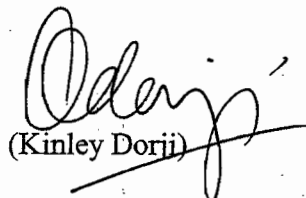
(Fukuchi Tomayasu)



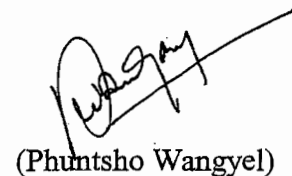
(Bharat Tamang)



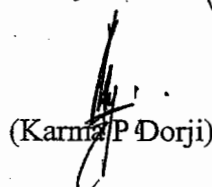
(Jigme Tobgyel)



(Kinley Dorji)



(Phuntsho Wangyel)



(Karma P Dorji)

Japan International Cooperation Agency (JICA)  
Department of Energy (DOE), Ministry of Trade and Industry

**The Integrated Master Plan Study for  
Dzongkhag-wise Electrification in the Kingdom of Bhutan**

**First Workshop**  
**30 January 2003, in Thimphu**  
**Venue: RICB Conference Hall (3rd Floor of BPC Main Office Building)**

**Agenda**

9:00 - 9:30	Arrival of Delegates	
9:30 - 9:40	Welcome and Introduction	Director, Department of Energy
9:40 - 9:45	Greetings by JICA Bhutan Office	Representative of JICA Bhutan Office
9:45 - 10:00	Explanation of General Flow of the Study Introduction of Study Team Members and	Team Leader, JICA Study Team
10:00 - 10:30	Presentation on Rural Electrification Program Overview	The Head, Planning & Coordination Division, Department of Energy
10:30 - 10:50	Coffee Break	
10:50 - 12:30	Presentation of Methodology of Master Plan Study (see attached Detailed Program)	Study Team Members
12:30 - 13:00	Questions and Answers	
13:00 - 14:00	Lunch	
14:00 - 15:00	Presentation on "A perspective of electrification in your Dzongkhag - an articulation of rural folks that need to be focused in the Study"	Dzongkhag Representatives
15:00 - 15:30	Discussions	
15:30 - 15:45	Coffee Break	
15:45 - 16:00	Presentation of New Technology	Study Team Members
16:00	Closing Remarks	Director, Department of Energy

### Detailed Program by the Study Team

10:50 - 12:30	Presentation of Methodology of Master Plan Study by Study Team Members	
10:50 - 10:55	Overview of Study Methodology	Fukuchi
10:55 - 11:10	Present Situation of GIS in Bhutan and How to Apply GIS to Study	Usuda
11:10 - 11:20	Purpose and Methodology of Village Survey	Dobeta
11:20 - 11:35	Available Data of Existing Facilities and Study Methodology on Distribution Line Extension Planning	Shiraki (supported by Oohara and Arita)
11:35 - 11:40	Short Break	
11:40 - 11:50	Review and Comments on Power System and Coordination with Rural Electrification	Nakajima
11:50 - 11:55	Methodology of Demand Forecast	Hirata
11:55 - 12:05	Study Methodology for Off-grid Power Supply	Bista and Hirata
12:05 - 12:15	Financial and Economic Approach and On/Off-Grid Cutoff Point Methodology	Nishimaki
12:15 - 12:25	Methodology of Environmental Impact Analysis	Kamishita
12:25 - 12:30	Policy of Technology Transfer	Fukuchi
15:45 - 16:00	Presentation of New Technology	Bista and Hirata

**List of Participants for 1st Workshop  
on Integrated Master Plan Study for Dzongkhag-wise Electrification in Bhutan**

No	NAMES	TITLE	ORGANIZATION
<b>DZONGKHAGS</b>			
1	BP Rai	Sr. Planning Officer	Paro Dzongkhag
2	Sonam Tshering	DYT Chairman	Paro Dzongkhag
3	Nado	Dzongrab	Sarpang Dzongkhag
4	Jambay	DYT Chairman	Bumthang Dzongkhag
5	Kunzang N Tshering	Dzongda	Bumthang Dzongkhag
6	Lobzang Dorji	Planning Officer	Bumthang Dzongkhag
7	K.B. Rai	Planning Officer	Trongsa Dzongkhag
8	Kunzang L Sangay	Planning Officer	Thimphu Dzongkhag
9	Lhawang Dorji	DYT Chairman	Dagana Dzongkhag
10	Sangay Penjore	Planning Officer	Dagana Dzongkhag
11	Namgyal Phuntsho	DYT Chairman	Punakha Dzongkhag
12	Namgyal Wangchuk	Planning Officer	Samdrupjonghar
13	NB Tamang	Planning Officer	Gasa Dzongkhag
14	Sabadev Maps	Planning Officer	Yangtse Dzongkhag
15	Singye Dorji	DYT Chairman	Chukha Dozngkhag
16	Tshering Dorji	Planning Officer	Chukha Dozngkhag
17	Tshewang Dorji	DYT Chairman	Haa Dzongkhag
18	Ugyen Dema	JE, Dagana Dzongkhag	Dagana Dzongkhag
<b>OTHER ORGANIZATIONS</b>			
19	Jigme Tobgyal	Programme Assistant	UNDP
20	Deki Choden	Reporter	Bhutan Broadcasting Service
21	Samten Wangchuk	Reporter	Kuensel Corporation
22	Monira Tsewang	Deputy Director, Department of Planning	Ministry of Finance
<b>DEPARTMENT OF ENERGY</b>			
23	Sonam Tshering	Director	DOE
24	Bharat Tamang	Chief Engineer, PCD	DOE
25	Karma P Dorji	National Project Manager	DOE
26	Karma Tshering	Executive Engineer, PCD	DOE
27	Karma Yonten	Head, BAE	DOE
28	Mewang Gyeltsen	RED	DOE
29	Ngwang Choeda	Assistant Engineer, PCD	DOE
30	Satchi	Assistant Engineer, RED	DOE
31	Tashi Dorji	Hydropower Development Engineer, PCD	DOE
32	Thukten Wangmo	Assistant Engineer, BAE	DOE
33	Karma Tsewang	Assistant Engineer, PCD	DOE
34	Dechen Wangmo	JE, PCD	DOE
35	Wangmo	JE, PCD	DOE
<b>BHUTAN POWER CORPORATION</b>			
36	Jigme Tobgyal	Sr. Manager, Planning & IT Division	BPC
37	CM Rai, Manager*	ESD, Yangtse Dzongkhag	BPC
38	Dechen Dema	Engineer, CSD	BPC
39	Gem Tshering	GM, Transmission Department	BPC
40	K.B. Wakhlay	GM, D&CD	BPC
41	K.B. Gurung*	Sr. Supervisor, ESD, Zhemgang Dzongkhag	BPC
42	Sam Tshewang*	Assistant Manager, Sr. Supervisor, Wangdi Dzongkhag	BPC
43	Norbu Tshering*	JE, Lhunsi Dzongkhag	BPC
44	Sonam Palden	Deputy Manager	BPC
45	Sonam Tobgay	Sr. Manager Finance	BPC
46	Sunil Rasaily	Engineer, CSD	BPC
47	Suresh Nepal	Manager, D&CD	BPC
48	Tashi Dorji	Hydropower Development Engineer, PCD	BPC
49	Tashi Tobgay *	JE, CSD, Punakha Dzongkhag	BPC
50	Ugyen Dorji	CSD	BPC
51	Ujjwal Dahal	Deputy Manager	BPC
52	Chencho Tshering Namgyal	Dy. Manager, DCD	BPC

No	NAMES	TITLE	ORGANIZATION
<b>JICA</b>			
53	Sugimoto Mitsukuni	Resident Representative	JICA
<b>JICA STUDY TEAM</b>			
54	Tomoyasu Fukuchi	Team Leader	Nippon Koei Co., Ltd.
55	Keiji Shiraki	Distribution System and Designstandard planning	Nippon Koei Co., Ltd.
56	Kazunori Ohara	Power Transmission Planning	Nippon Koei Co., Ltd.
57	Ko Nakajima	Power Supply and Demand Planning	Nippon Koei Co., Ltd.
58	Toshiyuki Arita	Power Distribution Facility Planning	Nippon Koei Co., Ltd.
59	Kyoko Usuda	GIS/Database	Nippon Koei Co., Ltd.
60	Kiyoshi Hirata	Small Hydro Power / Power Demand and Supply Panning (village level)	Nippon Koei Co., Ltd.
61	Hiroshi Nishimaki	Financial and Economic Analysis	Nippon Koei Co., Ltd.
62	Kazuhiko Dobeta	Socio Economic Study	Nippon Koei Co., Ltd.
63	Deepak Bista	Solar Power and Renewable Energies Planning	Nippon Koei Co., Ltd.
64	Takahiro Kamishita	Environment Impact Analysis	Nippon Koei Co., Ltd.
65	Kensuke Yamamura	Coordinator	Nippon Koei Co., Ltd.
66	Kesang Anayat	Secretary	Nippon Koei Co., Ltd.

\* Note: These persons were representing Dzongkhags

BPC : Bhutan Power Corporation  
 ESD : Electricity Service Division  
 CSD : Customer Services Department  
 DYT : Dzongkhag Yargay Tshogdue  
 D&CD : Development and Construction Depart  
 BEA : Bhutan Electricity Authority  
 PCD : Planning and Coordination Division  
 RED : Renewable Energy Division  
 JICA : Japan International Cooperation Agency  
 JE : Junior Engineer  
 UNDP : United Nations Development Programe

from 13 Dzongkhags : 18 persons  
 from 5 Dzongkhags of BPC : 5 persons



འབྲུག་རྒྱལ་ཁབ་ལྷན་ཁྲིམས་ལྷན་ཁྲིམས་ལྷན་ཁྲིམས་

DEPARTMENT OF ENERGY  
MINISTRY OF TRADE & INDUSTRY  
THIMPHU : BHUTAN

DOE/PCD/RE-MP/2003-04/ 562

9 February, 2004

Mr. Fukuchi Tomoyasu  
Team Leader  
Nippon Koei Co. Ltd.  
JICA Study Team

**Subject: *Forwarding of record of discussions on 1<sup>st</sup> National Workshop on "Integrated Master Plan Study for Dzongkhag-wise Electrification in Bhutan".***

Sir,

Please find enclosed herewith record of discussions on 1<sup>st</sup> National Workshop on "Integrated Master plan Study for Dzongkhag-wise Electrification in country".


Congratulations for success of the first workshop. It has been very informative and the team has shown utter professionalism.

You may also note that later sections of the comments made by the participants from DoE for your kind information and perusal.

Your assistance has always been appreciated.

Thanking you,

Sincerely yours

  
(Karma P Dorji)  
Project Manager

**RECORD OF DISCUSSIONS ON 1<sup>ST</sup> NATIONAL WORKSHOP ON THE  
INTEGRATED MASTER PLAN STUDY FOR DZONGKHAG-WISE  
ELECTRIFICATION IN BHUTAN**

The Department of Energy in association with Japan International Cooperation Agency Study Team Nippon Koei Co. Ltd conducted the **1<sup>st</sup> National Workshop on the Integrated Master Plan Study for Dzongkhag-wise Electrification in Bhutan** on **30<sup>th</sup> January 2003**, at the RICB conference hall, Thimphu from 10:00 Hours to 16:00 Hours.

The main objective of the workshop was to disseminate Rural Electrification Master Plan study activities including study methodologies being carried out by the JICA Study Team to all the stakeholders especially targeted to all the Dzongkhags for their information.

About 65 participants from various government and non government agencies including Dasho Dzongdag, Bumthang Dzongkhag, 7 DYT Chairman and Planning Officers from 14 Dzongkhags participated in the workshop. The agenda for the workshop is attached as Annex I and list of participants as Annex II.

In the opening remarks, Director, Department of Energy, Ministry of Trade and Industry welcomed all the participants and informed the gathering about the background of the workshop. He also emphasized the importance of the study and pointed out roles to be played by all the stakeholders especially seeking cooperation and inputs during the visits of JICA Study team to various Dzongkhags.

The Resident Representative, JICA Bhutan Office pointed out the importance of the study and highlighted the contributions made by JICA for socio-economic development of Bhutan as of date.

The Team Leader, JICA Study Team briefly explained the general flow of study followed by the introduction of study team members.

Mr. Bharat Tamang, Head Planning and Coordination Division, Department of Energy presented the Rural Electrification Program overview. This was followed by presentations of JICA Study Team. The copies of the presentations were distributed to all the participants.

After the presentations by Dagana and Samdrupjongkhar Planning Officers, open discussions were held. The following is the summary of discussions/comments/views expressed by Dzongkhag representatives during the workshop.

1. The Chairman of DYT, Haa Dzongkhag.

He expressed appreciations for availing the opportunity to participate in national workshop. He presented Dzongkhag's electrification statistical information. Out of total



1274 HH, 967 Gungs have been electrified. That makes almost 76% electrification in the Dzongkhag. The aspire further assistance and supports from Department of Energy and other Donor agencies like JICA to provide electricity for the remaining unelectrified households and gungs.

2. Mr. Jambay, Bumthang DYT Chairman.

He pointed out that in RGOB's effort to electrify all the gungs and Dzongkhags, Bumthang and Trongsa have been deprived from lack of adequate supply of power. Out of 1400 gungs in 4 gewogs in the Dzongkhag, 600HH still have not been electrified. Further, villages like Ura and Tamshing have been electrified with Micro Hydel with assistance from JICA. Their sincere request to the Study Team to look into consideration of upgrading those existing hydels.

It has also been observed that Tang and Choekhar Toe villages will not be feasible at any cost with grid extensions from Chamkhar. Therefore, JICA is requested to assist for providing electricity by Micro or Solar PV power.

Director, DoE commented that the Department is fully aware of acute shortage of power in Bumthang and Trongsa. Recently, in the plan talks with India, GOI have committed funds for Trongsa-Tingtibi and Bumthang grid lines. Now we are working on tender documents and implementation will commence within this fiscal year. Further, JICA Team will incorporate in their study and recommend the feasibility of either Grid or Off Grid options for electrification in Tang, ChoekharToe villages. But they are not responsible for implementation.

3. Mr. Lhawang Dorji, Dagana DYT Chairman.

He pointed out in the 11 gewogs of Dzongkhag, 443 HH is getting electricity from Micro Hydel and still have 732 HH unelectrified. He also questioned about the funding aspects of planned works after completion of study by JICA Team. He highlighted that because of lack of social infrastructures, the Dzongkhag has no socio-economic development as Road and Electricity is necessary prerequisite for fueling any development.

JICA study Team Leader responded that JICA Study Team is only responsible for carrying out study component and cannot commit the implementation of the plan. However, JBIC has indicated interest in funding the implementation.

Director, DoE added that as per 9<sup>th</sup> Five Year Plan, grid supply will be provided to Dagana and Tsirang. However, due to lack of donor financing, the work is yet to start. He expressed his optimism that the work would be carried out within the plan possibly through soft financing.

#### 4. Mr. Kuenzang N Tshering, Bumthang Dzongdag.

He pointed out the importance of supply of electricity for people and honored the Rural Electrification Master Plan as important steps to achieve universal electricity for Bhutanese.

He than expressed the availability of our natural resources “White Gold” to fulfill the expectations of our people. Expectation of people getting electricity thereby moving out of darkness, generating income through local/rural initiatives with availability of electricity.

He also pointed out that there is a need for Department of Energy and JICA Study to think seriously on options of renewable energies such as Solar, Biomass and Pico/Micro hydels to provide alternative source of electricity. 2020 is too long to wait given the geographical situation of the country, where grid extension might not be the viable solution.

Further, he pointed out that one of the main objectives of the RE Master Plan is being viewed as technology transfer. If this objective could be shared and implemented beyond Thimphu/DoE/BPC to Dzongkhag people.

Director, DoE commented that technology transfer by JICA to DOE/BPC was basically to upgrade capacity within the two organizations for upgrading the master plan in future. Since this is the function of the central Government, technology transfer to there Dzongkhag would not be necessary. However, within the project responsibility of management of off grid hydros by Dzongkhag could be studied.

#### 5. Mr. Singye Dorji, Chukha DYT Chairman.

He raised four questions.

1. Under 9FYP, 15,000HH is targeted to provide electricity. Will the new additional households get electricity although not incorporated in plan?
2. What is a main objective of DYT Chairman requiring attending the workshop?
3. How will the Master Plan be implemented in future as the plan is being made in 2004-05?
4. List of JICA’s major assistance to Bhutan.

Director, DoE responded to question as follows.

1. Yes, there will not be any disparity over getting electricity whether it is new or old households. All the households are entitled to get the access to electricity. The identification of 15,000 HH is as per discussions with the various Dzongkhags and the list provided by them.
2. The workshop is being organized with an objective to disseminate our plan and process of carrying out study to achieve electricity for all by 2020 to all the

stakeholders, mainly targeted to all the Dzongkhags as they have major roles to play and therefore it's a process of consultation with Dzongkhags.

3. JICA assisted projects to power sector are
  1. 13 Micro Hydels all over the country,
  2. Punatshangchu Pre-feasibility study and
  3. RE Master Plan Study

***Some technical comments on the various presentations made by the JICA Study Team on 30 January 2004 expressed by participants from DoE:***

1. We know that about 26% of our land is under protected area, which means that the provision of electricity for those citizens residing within the protected area will be very difficult if not impossible. The study team may need to work out clear methodologies and strategies to electrify the residents within the protected area without much difficulty if we have to achieve 100% electrification by 2020.
2. With regard to the household survey, it was mentioned that 2 households per village will be selected. Will this method provide realistic and sufficient information for the village? Is this sample selection based on some international norms?
3. Regarding the collection of available data for existing facilities, it was mentioned that the maximum and minimum demands of each feeder of all substations will be collected. In doing this, it is important to remember that some substations have restricted demands while some others have malfunctioning (recording) instruments/equipments. Therefore, some kind of cross-checking mechanisms will have to be developed if we have to gather true demands of every substation.
4. As for the various standards being currently adopted by the DoE/BPC, JICA study mentioned that in order for the JICA study team to come up with a suitable standard, three main factors viz. Safety, Reliability and Cost will be considered. Besides these three factors, it will be also important to consider the suitability/adaptability of technology. We neither wish to adopt a technology, which will become obsolete after few years of their commissioning nor that technology which is too advanced and their operation and maintenance including purchase of spares become too expensive in future.
5. With regard to the power systems map showing the power infrastructure expected by 2020, it has been mentioned at the presentation that the map was reproduced from the PSMP Update of NORAD. JICA Study team further mentioned that during the course of their study, they might propose another suitable map of their own. In this respect, our request to Team is come up with harmonized map that is acceptable to all the counterparts of Bhutan.
6. It was also mentioned during the presentation that the JICA study team do not fully agree with the demand forecasts made in the PSMP Update. We strongly agree with the views expressed by the JICA study team and therefore we look forward to more comprehensive and realistic demand forecasts to be made by JICA study team in the course of their study.

7. In one of the presentations, it was pointed out that the least cost method of electrification will be applied to select grid extension or off-grid supply electrification. While this methodology will be acceptable in general, we may encounter some sites in Bhutan whereby both the grid extension and off-grid supply may become unfeasible in economic terms. This may have to be kept in mind while rigorously applying the principles of economics.

Annex -I

**The Integrated Master Plan Study for Dzongkhag wise Electrification in the Kingdom of Bhutan**

**First Workshop (AGENDA)**

**30 January 2004, in Thimphu**

Venue: *RICB Conference Hall, Near BPC Main office, Thimphu Town.*

9.00-9.30	Arrival of Delegates (Registration)	
9:30 -9:40	Welcome and Introduction	Director DoE
9:40 -9:45	Greetings by JICA Bhutan Office	Representative of JICA Bhutan Office
9:45 -10:00	Introduction of Study Team Members and Explanation of General Flow of the Study	Team Leader, JICA Study team
10:00 -10:30	Presentaion on Rural Electrification Program overview	The Head, Planning & Coordination Division, Department of Energy
10:30 -10:50	Coffee Break	
10:50 -12:30	Presentation of Methodology of Master Plan Study	Study Team Members
12:30 -13:00	Questions and Answers	
13:00 -14:00	Lunch	
14:00 -15:00	Presentation on "A perspective of electrification in your Dzongkhag - an articulation of rural folks that need to be focused in the study"	Planning Officer, Samdrupjongkhar Dzongkhag Planning Officer & DYT Chairman, Dagana Dzongkhag
15:00 -15:30	Discussions	
15:30 -15:45	Coffee break	
15:45 -16:00	Presentation of New Technology	Study Team Members
16:00	Closing Remarks	Director DoE

**List of Participants for 1st Workshop  
on Integrated Master Plan Study for Dzongkhag-wise Electrification in Bhutan**

No	NAMES	TITLE	ORGANIZATION
<b>DZONGKHAGS</b>			
1	BP Rai	Sr. Planning Officer	Paro Dzongkhag
2	Sonam Tshering	DYT Chairman	Paro Dzongkhag
3	Nado	Dzongrab	Sarpang Dzongkhag
4	Jambay	DYT Chairman	Bumthang Dzongkhag
5	Kunzang N Tshering	Dzongda	Bumthang Dzongkhag
6	Lobzang Dorji	Planning Officer	Bumthang Dzongkhag
7	K.B. Rai	Planning Officer	Trongsa Dzongkhag
8	Kunzang L Sangay	Planning Officer	Thimphu Dzongkhag
9	Lhawang Dorji	DYT Chairman	Dagana Dzongkhag
10	Sangay Penjore	Planning Officer	Dagana Dzongkhag
11	Namgyal Phuntsho	DYT Chairman	Punakha Dzongkhag
12	Namgyal Wangchuk	Planning Officer	Samdrupjonghar
13	NB Tamang	Planning Officer	Gasa Dzongkhag
14	Sabadev Maps	Planning Officer	Yangtse Dzongkhag
15	Singye Dorji	DYT Chairman	Chukha Dozngkhag
16	Tshering Dorji	Planning Officer	Chukha Dozngkhag
17	Tshewang Dorji	DYT Chairman	Haa Dzongkhag
18	Ugyen Dema	JE, Dagana Dzongkhag	Dagana Dzongkhag
<b>OTHER ORGANIZATIONS</b>			
19	Jigme Tobgyal	Programme Assistant	UNDP
20	Deki Choden	Reporter	Bhutan Broadcasting Service
21	Samten Wangchuk	Reporter	Kuensel Corporation
22	Monira Tsewang	Deputy Director, Department of Planning	Ministry of Finance
<b>DEPARTMENT OF ENERGY</b>			
23	Sonam Tshering	Director	DOE
24	Bharat Tamang.	Chief Engineer, PCD	DOE
25	Karma P Dorji	National Project Manager	DOE
26	Karma Tshering	Executive Engineer, PCD	DOE
27	Karma Yonten	Head, BAE	DOE
28	Mewang Gyeltsen	RED	DOE
29	Ngwang Choeda	Assistant Engineer, PCD	DOE
30	Satchi	Assistant Engineer, RED	DOE
31	Tashi Dorji	Hydropower Development Engineer, PCD	DOE
32	Thukten Wangmo	Assistant Engineer, BAE	DOE
33	Karma Tsewang	Assistant Engineer, PCD	DOE
34	Dechen Wangmo	JE, PCD	DOE
35	Wangmo	JE, PCD	DOE
<b>BHUTAN POWER CORPORATION</b>			
36	Jigme Tobgyal	Sr. Manager, Planning & IT Division	BPC
37	CM Rai, Manager*	ESD, Yangtse Dzongkhag	BPC
38	Dechen Dema	Engineer, CSD	BPC
39	Gem Tshering	GM, Transmission Department	BPC
40	K.B. Wakhlay	GM, D&CD	BPC
41	K.B. Gurung*	Sr. Supervisor, ESD, Zhemgang Dzongkhag	BPC
42	Sam Tshewang*	Assistant Manager, Sr. Supervisor, Wangdi Dzongkhag	BPC
43	Norbu Tshering*	JE, Lhuntsi Dzongkhag	BPC
44	Sonam Palden	Deputy Manager	BPC
45	Sonam Tobgay	Sr. Manager Finance	BPC
46	Sunil Rasaily	Engineer, CSD	BPC
47	Suresh Nepal	Manager, D&CD	BPC
48	Tashi Dorji	Hydropower Development Engineer, PCD	BPC
49	Tashi Tobgay *	JE, CSD, Punakha Dzongkhag	BPC
50	Ugyen Dorji	CSD	BPC
51	Ujjwal Dahal	Deputy Manager	BPC
52	Chencho Tshering Namgyal	Dy. Manager, DCD	BPC

## Attachment-3 (9/9)

JICA			
53	Sugimoto Mitsukuni	Resident Representative	JICA
JICA STUDY TEAM			
54	Tomoyasu Fukuchi	Team Leader	Nippon Koei Co., Ltd.
55	Keiji Shiraki	Distribution System and Design standard planning	Nippon Koei Co., Ltd.
56	Kazunori Ohara	Power Transmission Planning	Nippon Koei Co., Ltd.
57	Ko Nakajima	Power Supply and Demand Planning	Nippon Koei Co., Ltd.
58	Toshiyuki Arita	Power Distribution Facility Planning	Nippon Koei Co., Ltd.
59	Kyoko Usuda	GIS/Database	Nippon Koei Co., Ltd.
60	Kiyoshi Hirata	Small Hydro Power / Power Demand and Supply Panning (village level)	Nippon Koei Co., Ltd.
61	Hiroshi Nishimaki	Financial and Economic Analysis	Nippon Koei Co., Ltd.
62	Kazuhiko Dobeta	Socio Economic Study	Nippon Koei Co., Ltd.
63	Deepak Bista	Solar Power and Renewable Energies Planning	Nippon Koei Co., Ltd.
64	Takahiro Kamishita	Environment Impact Analysis	Nippon Koei Co., Ltd.
65	Kensuke Yamamura	Coordinator	Nippon Koei Co., Ltd.
66	Kesang Anayat	Secretary	Nippon Koei Co., Ltd.

\* Note: These persons were representing Dzongkhags

BPC : Bhutan Power Corporation  
 ESD : Electricity Service Division  
 CSD : Customer Services Department  
 DYT : Dzongkhag Yargay Tshogdue  
 D&CD : Development and Construction Depart  
 BEA : Bhutan Electricity Authority  
 PCD : Planning and Coordination Division  
 RED : Renewable Energy Division  
 JICA : Japan International Cooperation Agency  
 JE : Junior Engineer  
 UNDP : United Nations Development Programme

### Overview of Non-Electrified Villages after RE-3

Sl.#	Dzongkhag	No of Gewogs	No of vVllages	No of Non-Electrified Households	Remarks
1	Bumthang	4	36	600	
2	Chukha	11	121	2603	
3	Dagana	11	84	2142	
4	Gasa	2		233	Estimated
5	Haa	3	8	307	
6	Lhuentse	8	170	2494	
7	Mongar	9	77	2912	
8	Paro	5	35	430	
9	Pemagatshel	4	27	662	
10	Punakha	8	73	357	
11	Samdrup Jongkhar	11	138	3449	
12	Samtse	16		5028	Number of households listed in Gewog-wise only
13	Sarpang	13	100	2104	
14	Thimphu	9	38	243	
15	Tashigang	12	91	1745	
16	Tashiyangtse	6	65	1607	
17	Trongsa	5	39	1030	
18	Tsirang	12	73	2643	
19	Wangdue	12	188	1531	
20	Zhemgang	8	54	1639	
	<b>Grand Total</b>	<b>169</b>	<b>1417</b>	<b>33759</b>	

Note: This list of the unelectrified villages after RE-3 was prepared by Planning and Coordination Division of Department of Energy in February 2004, in close cooperation with all 20 Dzongkhag Administrations.





ལྷན་སྐྱོང་གི་ལྷན་པོ།

## Bhutan Power Corporation

Planning & IT Division

Thimphu, Bhutan

BPC/PLANNING/F-2(A)/ 020

29 January 2004  
30

### INTER OFFICE MEMO

To:

✓ The National Project Manager, Planning & Coordination Division, DoE

From:

Sr. Manager, Planning Division, BPC

Copy to:

- 1) The Managing Director, BPC
- 2) The GM, CSD, BPC
- 3) The GPS/GIS counterparts, BPC

Subject:

**Data for the Integrated Master Plan Study for Dzongkhag-wise Electrification in Bhutan**

Dear Sir:

Please refer to your letter no. DOE/PCD/RE/2003-2004/337 dated December 12, 2003, seeking data for the RE-master plan studies. In this regard, I would like to submit the following data compilations based on what I have received from the other BPC departments: (i) Existing power system infrastructure, (ii) The ESD-wise customers and energy sales (from July 2002 – June 2003), (iii) Details of ESD infrastructure and customers (as of October 2003), (iv) For Semtokha substation, the daily energy (MWh), daily feeder peak (MW) for the months of January 2003 and July 2003, hourly peak MW records for the 15<sup>th</sup> January and 15<sup>th</sup> July 2003, (v) For Haa substation, monthly peak load from August 2002 to February 2003.

In relation to GPS data, we have called the focal persons from the various ESDs, conducted the training on the use of GPS, and also prepared the framework (i.e. terminology and nomenclature for naming feeders, sub-feeders, transformers, poles, the data required, etc). It has been finalized after much discussion amongst ourselves. As scheduled, the GPS data collection team members are to complete the entire GPS data collection for the existing system by the 15 April 2004 so that the complete and correct GPS data (including substations, 33 kV, 11 kV, and 6.6 kV feeders and sub-feeders, poles, and distribution transformers) can be provided by the end of April 2004.

Kindly share the above information and that attached with the RE-Master Plan study team.  
Thanking you.

Yours faithfully,

(Jigme Tobgyel)

## List of Participant For GIS Training

No	Name	Title	Division / Organization
1	Mr. Sunil Rasaily	Engineer	Planning Cell CSD Head Office Thimphu, BPC
2	Ms. Dechen Dema	Engineer	Planning Cell CSD Head Office Thimphu, BPC
3	Mr. Sonam Dorji	Supervisor	Planning Cell CSD Head Office Thimphu, BPC
4	Mr. Ujjwal Deep Dahal	Deputy Manager	Planning Division Head Office Thimphu, BPC
5	Mr. Sonam Palden	Deputy Manager	Environment Cell Head Office Thimphu, BPC
6	Mr. Suresh Nepal	Manager	D&CD Head Office Thimphu, BPC
7	Mr. Tshewang Jamtsho	Associate Engineer	TD Head Office Thimphu, BPC
8	Ms. Wangmo	Junior Engineer	DOE
9	Ms. Dechen Wangmo	Junior Engineer	DOE

**BPC:** Bhutan Power Corporation

**CSD:** Customer Service Department

**D&CD:** Development and Construction Department

**TD:** Transmission Department

**DOE:** Department of Energy

## List of Participant For GPS Training

No	Name	Title	Division / Organization
1	Mr. Sunil Rasaily	Engineer	Planning Cell CSD Head Office Thimphu, BPC
2	Ms. Ugyen Tshomo	Senior Supervisor	ESD, Thimphu, BPC
3	Ms. Namgay Lhamo	Technician	ESD, Thimphu, BPC
4	Mr. Sandeep Rai	Deputy Manager	ESD, Tashigang, BPC
5	Mr. Kumba Rai	Manager	ESD, Paro, BPC
6	Mr. Sonam Tsewang	Senior Supervisor	ESD, Wangdue, BPC
7	Mr. Sangay Tenzing	Senior Supervisor	ESD, Haa, BPC
8	Mr. Tshenga Dorji	Associate Manager	ESD, Tsirang, BPC
9	Mr. Norbu Tshering	Associate Manager	ESD, Paro, BPC
10	Mr. Kuenzang Thinley	Supervisor	ESD, Gelephu, BPC
11	Ms. Wangmo	Junior Engineer	DOE
12	Ms. Dechen Wangmo	Junior Engineer	DOE

**BPC:** Bhutan Power Corporation  
**CSD:** Customer Service Department  
**ESD:** Electricity Supply Division  
**DOE:** Department of Energy

**Dzongkhag I.D. & Gewog I.D.**  
for  
**Village Baseline Survey for Rural Electrification**

**Number of Dzongkhag (District) = 20**

**Number of Geog (Block) = 201**

**1. Thimphu Dzongkhag**

- 1-1 Bapisa
- 1-2 Chang
- 1-3 Dagala
- 1-4 Genye
- 1-5 Kawang
- 1-6 Lingzhi
- 1-7 Mewang
- 1-8 Naro
- 1-9 Soe
- 1-10 Toepisa

**2. Chukha Dzongkhag**

- 2-1 Bhalujhora
- 2-2 Bjachho
- 2-3 Bongo
- 2-4 Chapchha
- 2-5 Dala
- 2-6 Dungna
- 2-7 Geling
- 2-8 Getana
- 2-9 Logchina
- 2-10 Metap
- 2-11 Phuentsholing

**3. Haa Dzongkhag**

- 3-1 Bji
- 3-2 Katsho
- 3-3 Sama
- 3-4 Sangbay
- 3-5 Uesu

**4. Paro Dzongkhag**

- 4-1 Doga
- 4-2 Dopshari
- 4-3 Doteng
- 4-4 Hungrel
- 4-5 Lamgong
- 4-6 Lungnyi
- 4-7 Naja
- 4-8 Shapa
- 4-9 Tsento
- 4-10 Wangchang

**5. Samtse Dzongkhag**

- 5-1 Bara
- 5-2 Biru
- 5-3 Chorgharay
- 5-4 Chengmari
- 5-5 Denchhukha
- 5-6 Dorokha
- 5-7 Dungtoe
- 5-8 Mayona
- 5-9 Namgyeltchholing
- 5-10 Pagli
- 5-11 Samtse
- 5-12 Sipsu
- 5-13 Tading
- 5-14 Tendu
- 5-15 Ugyentse
- 5-16 Yoeseltse

**6. Tsirang Dzongkhag**

- 6-1 Barshong
- 6-2 Beteni
- 6-3 Dunglegang
- 6-4 Gosaling
- 6-5 Kikhorthang
- 6-6 Mendrelgang
- 6-7 Patala
- 6-8 Phuentsenchhu
- 6-9 Rangthang Ung
- 6-10 Semjong
- 6-11 Tshokhorlong
- 6-12 Tsirangtoe

**7. Dagana Dzongkhag**

- 7-1 Dorona
- 7-2 Drugyelgang
- 7-3 Gesarling
- 7-4 Gozhi
- 7-5 Kalidzinkingha
- 7-6 Khipisa
- 7-7 Lajab
- 7-8 Trashidhing
- 7-9 Tsangkha
- 7-10 Tsendagang
- 7-11 Tseza

**8. Punakha Dzongkhag**

- 8-1 Chhubu
- 8-2 Dzoma
- 8-3 Goenshari
- 8-4 Guma
- 8-5 Kabjisa
- 8-6 Lingmukha
- 8-7 Shenga- Bjime
- 8-8 Talo
- 8-9 Toewang

**9. Gasa Dzongkhag**

- 9-1 Goenkhamé
- 9-2 Goenkhatoe
- 9-3 Laya
- 9-4 Lunana

**10. Wangduephodrang Dzongkhag**

- 10-1 Athang
- 10-2 Bjena
- 10-3 Daga
- 10-4 Dangchhu
- 10-5 Gangte
- 10-6 Gasetsho Gom
- 10-7 Gasetsho Wom
- 10-8 Kazhi
- 10-9 Nahi
- 10-10 Nyisho
- 10-11 Phangyuel
- 10-12 Phobji
- 10-13 Ruepisa
- 10-14 Sephu
- 10-15 Thedtsho

**11. Bumthang Dzongkhag**

- 11-1 Chhoekhor
- 11-2 Chimume
- 11-3 Tang
- 11-4 Ura

**12. Sarpang Dzongkhag**

- 12-1 Bhur
- 12-2 Chhuzagang
- 12-3 Dekiling
- 12-4 Deorali
- 12-5 Doban
- 12-6 Gelephu
- 12-7 Hiley
- 12-8 Jigmechhoeling
- 12-9 Lhamoi Zinkha
- 12-10 Nichula
- 12-11 Sarpang
- 12-12 Senge
- 12-13 Serzhong
- 12-14 Taklai
- 12-15 Umling

**13. Zhemgang Dzongkhag**

- 13-1 Bardo
- 13-2 Bjoka
- 13-3 Goshing.
- 13-4 Nangkhor
- 13-5 Ngangla
- 13-6 Phangkhar
- 13-7 Shingkar
- 13-8 Trong

**14. Trongsa Dzongkhag**

- 14-1 Dragteng
- 14-2 Korphu
- 14-3 Langthil
- 14-4 Nubi
- 14-5 Tangsibji

**15. Lhuntse Dzongkhag**

- 15-1 Gangzur
- 15-2 Jaray
- 15-3 Khoma
- 15-4 Kurtoe
- 15-5 Menbi
- 15-6 Metsho
- 15-7 Minjay
- 15-8 Tsenkhar

**16. Mongar Dzongkhag**

- 16-1 Balam
- 16-2 Chaskhar
- 16-3 Chhali
- 16-4 Drametse
- 16-5 Drepung
- 16-6 Gongdue
- 16-7 Jurme
- 16-8 Kengkhar
- 16-9 Mongar
- 16-10 Ngatshang
- 16-11 Saleng
- 16-12 Shermung
- 16-13 Silambi
- 16-14 Thangrong
- 16-15 Tsakaling
- 16-16 Tsamang

**17. Pemagatshel Dzongkhag**

- 17-1 Borang
- 17-2 Chhimung
- 17-3 Dungme
- 17-4 Khar
- 17-5 Shume
- 17-6 Yurung
- 17-7 Zobel

**18. Samdrup Jongkhar Dzongkhag**

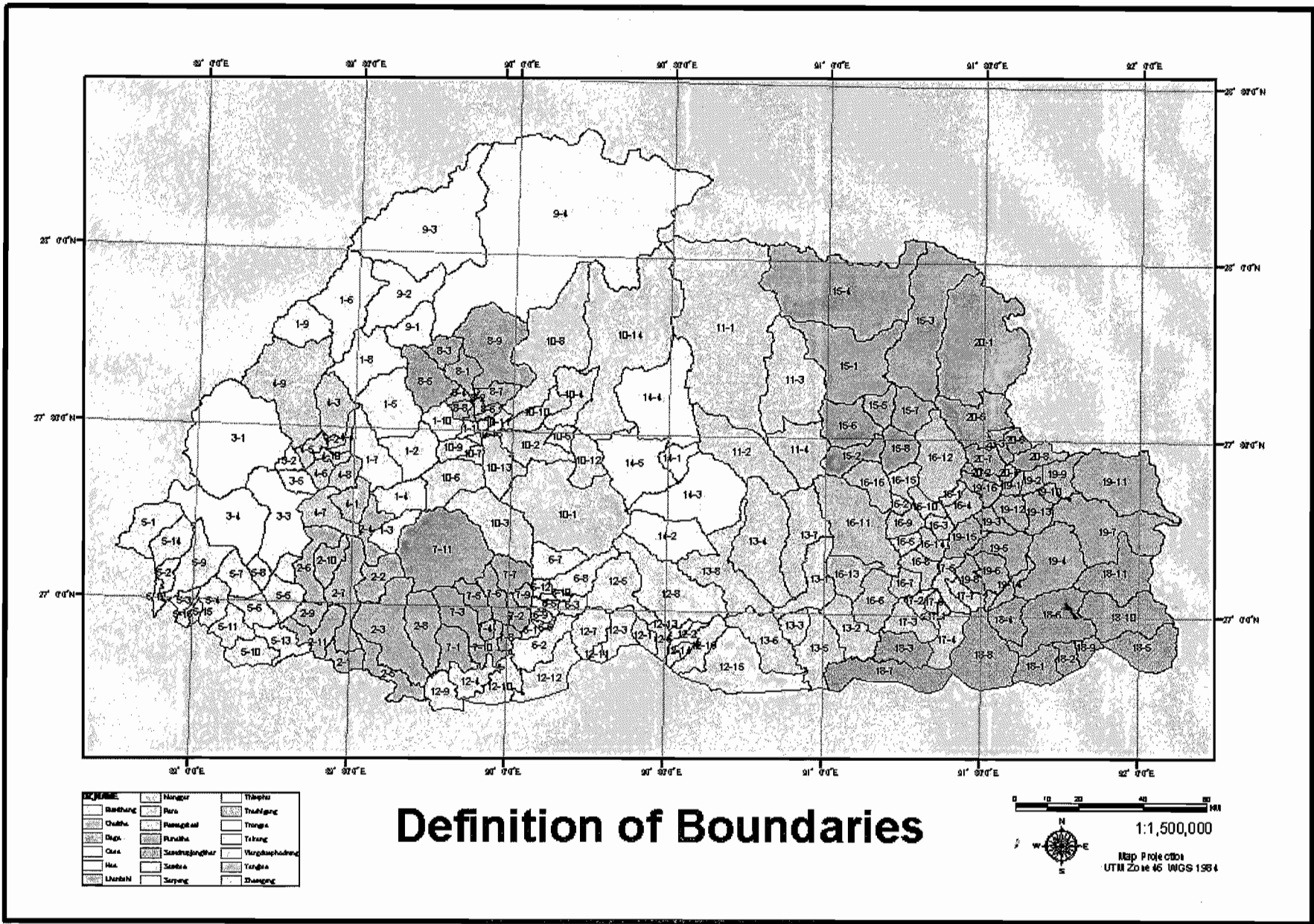
- 18-1 Dechenling
- 18-2 Gomdar
- 18-3 Hastinapur
- 18-4 Lauri
- 18-5 Martshala
- 18-6 Norbugang
- 18-7 Orong
- 18-8 Pemathang
- 18-9 Phuentshothang
- 18-10 Samrang
- 18-11 Serthig

**19. Trashigang Dzongkhag**

- 19-1 Bartsham
- 19-2 Bidung
- 19-3 Kanglung
- 19-4 Kangpara
- 19-5 Khaling
- 19-6 Lumang
- 19-7 Mera
- 19-8 Nanong
- 19-9 Phongme
- 19-10 Radi
- 19-11 Sakteng.
- 19-12 Samkhar
- 19-13 Shongphu
- 19-14 Thrimshing
- 19-15 Udзорong
- 19-16 Yangnyer

**20. Yangtse Dzongkhag**

- 20-1 Bumdeling
- 20-2 Jamkhar
- 20-3 Khamdang
- 20-4 Ramjar
- 20-5 Tashi Yangtse
- 20-6 Toetsho
- 20-7 Tomzhangtshen
- 20-8 Yalang



## Draft Design of Technology Transfer

**Final Target :** For DOE/BPC to be able to update the Master Plan by themselves after this Master Plan Study

\*) 1st site work : Dec 2003 to Feb 2004  
 2nd site work : Jun to July 2004  
 3rd site work : Sept to Nov 2004  
 4th site work : Feb 2005  
 5th site work : Jun 2005  
 6th site work : Sep 2005

\*) 1st workshop : Jun 2004 (in 1st site work)  
 2nd workshop : Oct 2004 (in 3rd site work)  
 3rd workshop : Jun 2005 (in 5th site work)

No.	Key Subject	Target	Way of Technology Transfer	Time *) of Technology Transfer	Benchmark for Evaluation	Time *) of Evaluation	Personnel who receive Technology
1	GIS Data Base	Master basic operation of GIS program	Training class	1st site work	Achievement test	1st site work	9 persons from BPC & DOE
		Master planning skill and methodology of distribution line extension on GIS	Training class On-the-Job training	2nd site work 3rd and 5th site works	Achievement test Result of the job and presentation at 2nd and 3rd workshops	2nd site work 3rd site and 5th site works	to be named later
2	GPS	Master basic operation of GPS	Training class	1st site work	Accurate data collection of distribution facilities	At the beginning of 2nd site work	12 persons from BPC & DOI
3	Power System Analysis	Master how to apply system analysis to distribution expansion planning	Training class On-the-Job training	2nd site work 2nd and 3rd site works	Result of the job and presentation at 2nd and 3rd workshops	3rd site and 5th site works	to be named later
4	Transmission System Expansion Planning	Master basic methodology of transmission system expansion planning	On-the-Job training	2nd to 5th site works	Result of the job and presentation at 2nd and 3rd workshops	3rd site and 5th site works	to be named later
		Understand the background and philosophy to decide proposed plan	ditto	ditto	ditto	ditto	to be named later
5	Demand Forecast	Understand the procedure of data collection and actual meaning of collected data	ditto	2nd site work	ditto	ditto	to be named later
		Master the methodology of demand forecast	ditto	2nd and 3rd site works	ditto	ditto	to be named later
6	Distribution Line Expansion Planning	Understand the procedure and background to decide the design standard	ditto	2nd to 5th site works	ditto	ditto	to be named later

## Draft Design of Technology Transfer

Final Target : For DOE/BPC to be able to update the Master Plan by themselves after this Master Plan Study

\*) 1st site work : Dec 2003 to Feb 2004  
 2nd site work : Jun to July 2004  
 3rd site work : Sept to Nov 2004  
 4th site work : Feb 2005  
 5th site work : Jun 2005  
 6th site work : Sep 2005

\*) 1st workshop : Jun 2004 (in 1st site work)  
 2nd workshop : Oct 2004 (in 3rd site work)  
 3rd workshop : Jun 2005 (in 5th site work)

No.	Key Subject	Target	Way of Technology Transfer	Time *) of Technology Transfer	Benchmark for Evaluation	Time *) of Evaluation	Personnel who receive Technology
		Master skill and methodology of cost estimates for construction and operation and maintenance	ditto	ditto	ditto	ditto	to be named later
		Understand the procedure and background to decide the proposed expansion plan	ditto	ditto	ditto	ditto	to be named later
		Understand the procedure and background to decide the proposed operation and maintenance plan	ditto	3rd to 5th site works	ditto	ditto	to be named later
7	Economic Evaluation	Master skill and methodology of economic evaluation	ditto	2nd to 5th site works	ditto	ditto	to be named later
		Understand and master the on/off-grid cutoff point methodology	ditto	ditto	ditto	ditto	to be named later
8	Off-grid Power Supply Planning with Renewable Energy	Understand the current situation of meteorological observation stations	ditto	ditto	ditto	ditto	to be named later
		Master skill and methodology of power supply planning by solar, wind and biomass	ditto	ditto	ditto	ditto	to be named later
		Master skill and methodology of power supply planning by small hydro	ditto	ditto	ditto	ditto	to be named later
		Understand the procedure and background to decide the proposed operation and maintenance plan	ditto	ditto	ditto	ditto	to be named later

## Draft Design of Technology Transfer

**Final Target :** For DOE/BPC to be able to update the Master Plan by themselves after this Master Plan Study

\*) 1st site work : Dec 2003 to Feb 2004  
 2nd site work : Jun to July 2004  
 3rd site work : Sept to Nov 2004  
 4th site work : Feb 2005  
 5th site work : Jun 2005  
 6th site work : Sep 2005

\*) 1st workshop : Jun 2004 (in 1st site work)  
 2nd workshop : Oct 2004 (in 3rd site work)  
 3rd workshop : Jun 2005 (in 5th site work)

No.	Key Subject	Target	Way of Technology Transfer	Time *) of Technology Transfer	Benchmark for Evaluation	Time *) of Evaluation	Personnel who receive Technology
9	Strategic Environment Assessment	Understand the overview of the master plan	ditto	ditto	ditto	ditto	to be named later
		Master skill and methodology of strategic environmental assessment	ditto	ditto	ditto	ditto	to be named later
10	Total Management for updating Master Plan	Understand the overall procedure and background to formulate the master plan	ditto	ditto	ditto	ditto	Mr. Karma P Dorji, DOE
		Understand the ability and achievement of each personnel who receive technology transfer	ditto	ditto	ditto	ditto	Mr. Karma P Dorji, DOE
		Build planning, scheduling and coordination ability for the collaboration work to update the master plan	ditto	ditto	Presentation of schedule and methodology of updating work of the master plan in 5th workshop	5th site work	Mr. Karma P Dorji, DOE



***ANNEX-5***

***MINUTES OF MEETING  
(SECOND SITE WORK)  
BETWEEN***

***THE MASTER PLAN STUDY TEAM***

***AND***

***DEPARTMENT OF ENERGY  
MINISTRY OF INDUSTRY***

***JULY 9, 2004***

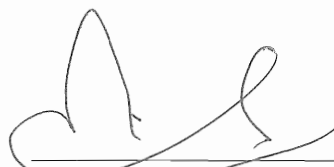
MINUTES OF MEETING  
FOR  
THE INTEGRATED MASTER PLAN STUDY  
FOR DZONGKHAG-WISE ELECTRIFICATION  
IN  
THE KINGDOM OF BHUTAN  
(SECOND SITE WORK)

BETWEEN  
THE MASTER PLAN STUDY TEAM  
AND  
DEPARTMENT OF ENERGY  
MINISTRY OF TRADE AND INDUSTRY

THIMPHU  
July 9, 2004



Mr. Tomoyasu Fukuchi  
Team Leader, JICA Study Team  
Nippon Koei Co., Ltd.



Mr. Sonam Tshering  
Director  
Department of Energy  
Ministry of Trade and Industry



Mr. Jigme Tobgyel  
Senior Manager  
Planning & IT Division  
Bhutan Power Corporation

The Master Plan Study Team (the Team) of the Japan International Cooperation Agency (JICA), which is headed by Mr. Tomoyasu FUKUCHI, stayed in Bhutan from June 2, 2004 through July 13, 2004 as the Second site work. On July 8, 2004, the Team had a wrap-up meeting with Department of Energy (DOE), Ministry of Trade and Industry and Bhutan Power Corporation (BPC), and the parties confirmed the followings.

1. **Basic Condition for Distribution Extension Planning** : Basic condition for distribution expansion planning was discussed and concluded as Attachment-1 between the Team and BPC. DOE agrees with the conclusion.
2. **GIS Training** : GIS training was executed including the distribution expansion planning by the Team on June 17, 18 and 27 through 30, 2004 to six personnel listed below.
  - DOE: Mr. Karma P Dorji, Ms. Dechen Wangmo, Ms. Wangmo
  - BPC: Mr. Sunil K. Rasaily, Mr. Ujjwal Deep Dahal, Mr. Tshering Tenzing.
3. **Mipower Training** : The training for Mipower was executed by the team on June 21, 22, and 23, 2004 to four personnel listed below.
  - DOE: Mr. Karma P Dorji, Ms. Dechen Wangmo, Ms. Wangmo
  - BPC: Mr. Tshering Tenzing
4. **Remaining Work on Existing Distribution Line Data** : In order to complete GIS data of the existing distribution lines, DOE and BPC will carry out GPS data correction, creating points and calculating distribution line length for ten Dzongkhags: Punakha, Wangdue, Haa, Tsirang, Dagana, Bumthang, Trongsa, Zhemgang, Pemagatshel and Chukha.
5. **Joint Preparatory Work for Distribution Extension Plan** : For effective work in the 3rd site work on the distribution extension planning, DOE and BPC will complete the work in the manner and by the time stated in Attachment-2.
6. **Basic Idea on Demand per Consumer for Estimation** : For the demand forecast, the Team will apply the basic idea on the demand per consumer as mentioned in Attachment-3.
7. **Second Workshop** : The second workshop will take place in Bumthang, on October 26, 2004. The draft agenda is shown in Attachment-4. DOE will send the invitation to the members of coordinating committee, the official concerned, the representatives of each Dzongkhag (Planning Officers, DYT Chairman and other

related representative to Power Sector), the related donors and NGO/NPO by July 31, 2003.

The Team has provision to provide budgetary support for the workshop such as conference hall charges and other associated logistic cost.

8. **Standard Spelling of Gewog** : DOE will check and revised the standard spelling of Gewog in coordination with Norlha Consultants.
9. **Lending Study Software and Equipment** : The Team lends DOE the following software and equipment by the time of commencement of the 3rd site work only for the purpose of this study.
 

▪ Arc-GIS ver.8.3 with hardware key	2 sets
▪ Arc-GIS 3D Analyst with hardware key	2 sets
▪ GPS (Garmin eTrex, Yellow & Black Color)	26 sets
▪ Desktop Computer with Monitor	2 sets
▪ Laptop Computer	1 set
▪ Color Laser Printer	1 set
▪ Digital Camera	4 sets.
10. **Workshop of Environmental Consideration** : The workshop was held on July 2, 2004 at Tala Conference Hall, MTI Complex to discuss the national policies and strategies on environmental consideration for the master plan of rural electrification with attendances from the several organizations. The discussion and attendances are recorded in Attachment-5.
11. **Census Data** :The Team is expecting to receive the census data requested by the Team through DOE's letter (Attachment-6).
12. **Next Site Work** : The 3rd site work is scheduled to be conducted from September 29 to November 19, 2004.

End

#### Attachment

1. Basic Condition for Rural Electrification
2. Joint Preparatory Work for Distribution Expansion Plan
3. Basic Idea on Demand per Consumer for Estimation
4. Draft Agenda for Second Workshop
5. Records of Discussion on the Environmental Considerations/Policies for the RE Integrated Master Plan Study
6. DOE's Letter DOE/PCD/RE-MP/03-04/1173 dated June 28, 2004

23 June, 2004

## Basic Condition for Rural Electrification

The basic conditions for rural electrification come to agreement as follows:

### 1 Technical Standards

#### 1.1 Voltage

##### 1.1.1 Nominal Voltage

The nominal voltage is 11/(6.35\*)kV and 33kV for MV, and 230/400V for LV.

\* 6.35kV is used only for expansion from the existing 6.35kV line.

##### 1.1.2 Voltage Variation

The voltage variation of LV at the connecting point between BPC and a customer shall be  $\pm 10\%$  of the nominal voltage.

The target voltage variation of MV at the end of a MV line is  $\pm 5\%$  of the nominal voltage.

#### 1.2 Basic Specification of Equipment

##### 1.2.1 Conductor

The MV conductor is ACSR and the sizes are as follows:

	Wolf	Dog	Rabbit
Nominal diameter (mm)	18.1	14.2	10.1
Maximum current (A)	398	300	193

The covered conductor may be used when the line is installed through woods.

The LV conductor is ABC (50mm<sup>2</sup>, 2 or 4 cores).

##### 1.2.2 Pole

The pole is painting tubular steel pole composed of 2 parts. The minimum length of pole is 7.5m for LV, 9m for 11kV and 10m for 33kV.

Wooden pole may be used for LV line.

### 1.2.3 Transformer

The capacity of transformer is as follows:

		Capacity (kVA)
33kV	3 Phase	16*, 25*, 63, 125, 160, 250, 500
	Single Phase	5*, 10*, 20(25)*
11kV	3 Phase	16, 25, 63, 125, 160, 250, 500
	Single Phase	5*, 10*, 20(25)*

\* Availability is under investigation

### 1.3 Clearance of Overhead line

The clearance shall be as follows:

#### 1.3.1 Clearance from ground

	33kV	11kV	LV (ABC)
Across road (m)	6.1	6.1	5.5
Others (m)	5.8	5.8	4.5

#### 1.3.2 Clearance between plural lines

33kV & 11kV (m)	1.2
33kV & LV (m)	1.5
11kV & LV (m)	1.2
MV & Communication line (m)	1.8
LV & Communication line (m)	0.6

## 2 Design Standards of MV Distribution Line

### 2.1 MV Voltage

The voltage of MV (33kV or 11kV) is decided considering based of following conditions.

- Capacity of Transmission substation
- Current and voltage drop (Length of distribution line and load of un-electrified village)

### 2.2 Line

#### 2.2.1 Route Selection

The route is selected along a road.

When line is installed in a mountain and there are no roads, route is selected along the contour avoiding a steep slope considering the geographical features. (Slope is selected so that the inclination is 30 degrees or less basically.) The span and the clearance are studied in this case.

The route is selected considering scenery.

When line is installed in the National Park, the route is selected avoiding the protection area.

#### 2.2.2 Phase

The phase of line is 3 Phase generally. If there are no possibilities of 3 Phase loads and the line is a branch line, Single Phase may be adopted.

#### 2.2.3 Conductor

The conductor is Wolf or Dog for a trunk line, and Dog or Rabbit for a branch line.

### 2.3 Distribution Substation

#### 2.3.1 Phase

The phase of substation is 3 Phase generally. Single Phase transformers may be used, if there are no possibilities of 3 Phase loads

### 2.3.2 Capacity

In rural area, the smaller capacity which is proper to the demand of village is selected not only to improve the workability but also to reduce the LV line costs and the energy loss. Generally the capacity of a transformer is 125kVA or less when the substation is installed along a road, and is 25kVA or less when it is installed on a place inaccessible by vehicle.

### 2.3.3 Composition of substation

A transformer of which capacity is 160kVA or less is installed on poles. On the other hand, a transformer of which capacity is more than 160kVA is installed on the ground with a fence.

When a substation is installed on a private land, it shall be done by the permission of the land owner.

## 2.4 Pole

### 2.4.1 Length of pole

The length of pole is decided considering both the span and clearance from the ground.

### 2.4.2 Composition of Pole

The pole shall withstand the exerted load.

The double pole is used for following cases;

- Substation pole
- Switch pole
- Tapping point
- Angle pole
- Section pole
- Long span
- Across a river
- Steep slope

## 2.5 Line Switch

A line switch is installed at appropriate position in order to divide a line. It is installed approximately every 10km for the trunk line, and is installed at the tapping point when the branch line expanding from the point is long.

## 2.6 Voltage regulator

A voltage regulator may be installed in order to keep the MV voltage variation.



### 3 Cost Estimation

The cost for electrification is evaluated by the life cost. The life cost includes not only the initial cost (the material cost, the labor cost and the transportation cost) but also the operation & maintenance cost and the energy loss.


The initial cost is converted into the annual cost by annual expense rate based on the interest rate and the life of equipment. The applied the life of equipment is 30 years.

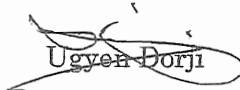
The energy loss (kWh loss) is estimated by the kW loss at the maximum demand and the load factor. The conversion formula is as follows:

$$\text{kWh loss} = \text{kW loss} \times (0.3 \times \text{LF} + 0.7 \times \text{LF}^2) \times 8,760$$

Where; LF: Load factor

  
Keiji Shiraki  
JICA Study Team

  
Jigme Tobgyel  
Senior Manager  
Planning & IT Division  
Bhutan Power Corporation

  
Ugyen Dorji  
Senior Engineer  
Customer Services Department  
Bhutan Power Corporation


**NIPPON KOEI CO., LTD.**
*Consulting Engineers*

2, Kojimachi 4-Chome, Chiyoda-Ku, Tokyo  
 New Energy Office, Emerging Business Division, Overseas Consulting Administration

**Japan International Cooperation Agency (JICA) Study Team**

The Integrated Master Plan Study for Dzongkhag-wise Electrification in Bhutan

Address: JICA Study Team, C/O Department of Energy, Ministry of Trade and Industry P.O. Box No. 106, Thimphu, Bhutan

 Office in Tokyo, Japan  
 Office in Thimphu, Bhutan

 TEL : (+81)-3 (5276) 7504 FAX : (+81)-3 (5276) 3306  
 TEL : (+975)-2-328 279 FAX : (+975)-2-328 278

Your ref.

Our ref. : LKLBHE-04-011 Date : June 28, 2004

To:

Mr. Karma P. Dorji  
 Project Manager  
 Department of Energy,  
 Ministry of Trade and Industry

**Subject : Joint Preparatory Work for Distribution Extension Plan**

Dear Sir,

Regarding the captioned matter, we are planning to execute this joint work according to the attached flow. The contents and procedure of the work is self-explanatory on the attachment. The work is the core part of the master plan study, so timely and definite completion of the work is strongly expected. The scheduled work period is July 1 to August 15, 2004.

In this regard, you are kindly requested to designate the personnel who are able to dedicate themselves to this work in the scheduled period; estimated work volume is 2.5 men months, and also arrange that the outcome of the work be taken to Japan by the appointed trainees of JICA training.

Your kind attention and cooperation to the above will be much appreciated.

Yours sincerely,

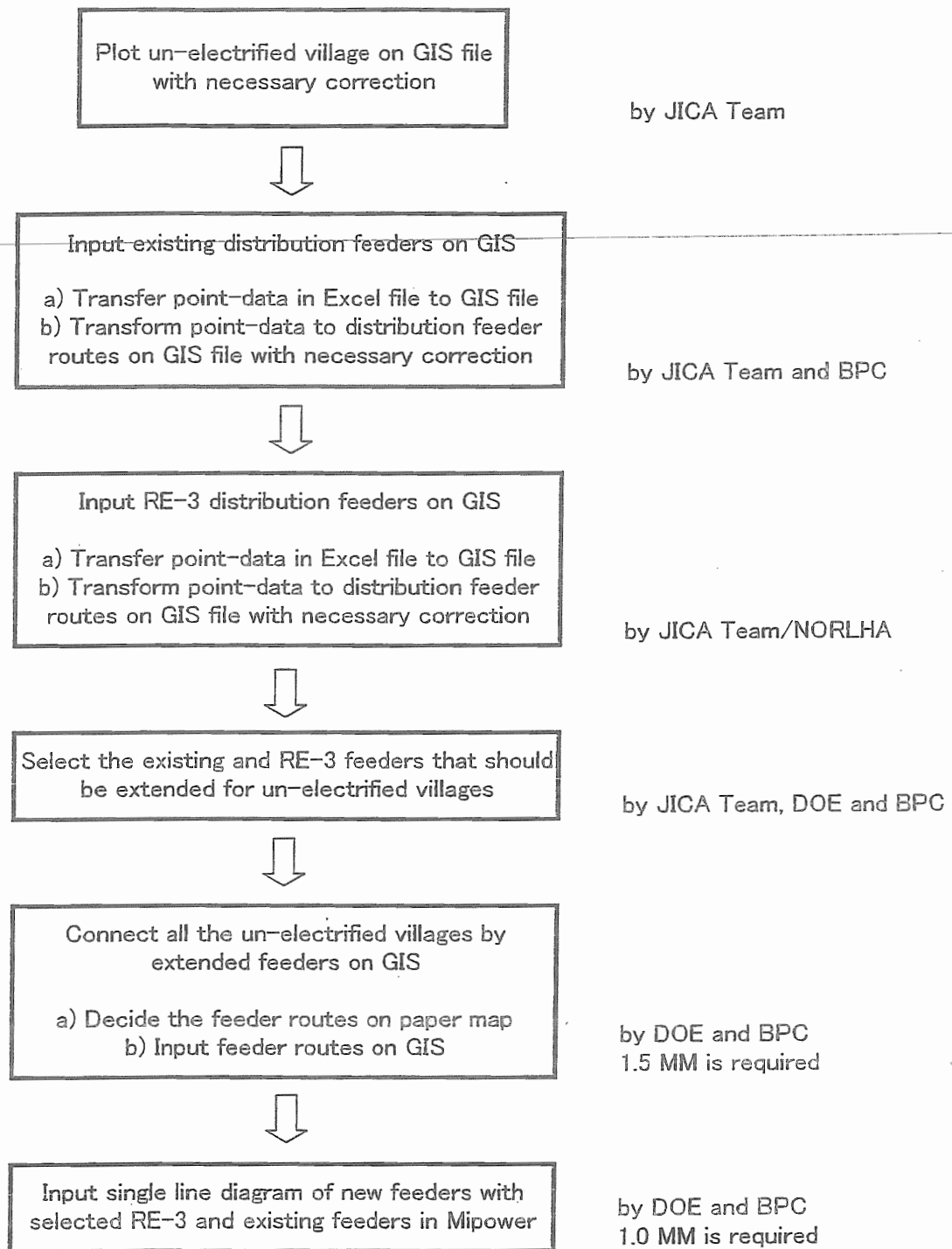
Tomoyasu FUKUCHI  
 Team Leader of JICA Study Team  
 Nippon Koei Co., Ltd.

Attachment: Flow of Joint Preparatory Work for Distribution Extension Plan



Nippon Koei Co., Ltd. Overseas Consulting Administration  
 Registered in England and Japan No. 958024  
 Registered Office: 2-5 Kojimachi, Chiyoda-ku, Tokyo

## Flow of Joint Preparatory Work for Distribution Extension Plan



### Notes

- 1) Scheduled work period is July 1 to August 15, 2004.
- 2) The work will be carried out each Dzongkhag by Dzongkhag.
- 3) DOE and BPC are requested to designate the personnel who are able to dedicate themselves to this work in the scheduled period.
- 4) The outcome of the work will be taken to Japan by the appointed trainees of JICA training.
- 5) The single line diagram of un-selected existing and RE-3 feeders for Mipower will be prepared by BPC based on his necessity for operation and maintenance apart from this study.

**BASIC IDEA  
ON  
POWER DEMAND PER CONSUMER  
FOR  
ESTIMATION  
IN  
JICA RE MASTER PLAN STUDY**

Date : July 9, 2004  
JICA Study Team

**1. Target Year**

The study must identify and provision for electrifying the entire country by 2020 as envisioned by the RGOB with adequate provisions for increase in the number of population (households). The study will conduct a Dzongkhag wise electricity demand forecasting as deemed foreseeable (i.e. up to 2035 or 2040).

Power demand forecast will be conducted at following target years.

- Project Target Year : 2020 (100% electrified)
- Demand Forecast Year : 2003, 2008, 2013, 2018, 2020, and 2030

**2. Demand Category**

Power demand forecast will be estimated based on by following categories.

- 1) Domestic Household
- 2) Commercial
- 3) Industry
- 4) Public/Institutional (Government office, schools, BHU, public light, etc.)

Electricity demand will be forecast for each category of customer and for each Dzongkhag.

**3. Power Demand per Consumer**

General workflow of the power demand forecast in this study is shown in Figure-1: The methodologies of power demand per each sector consumer are described below.

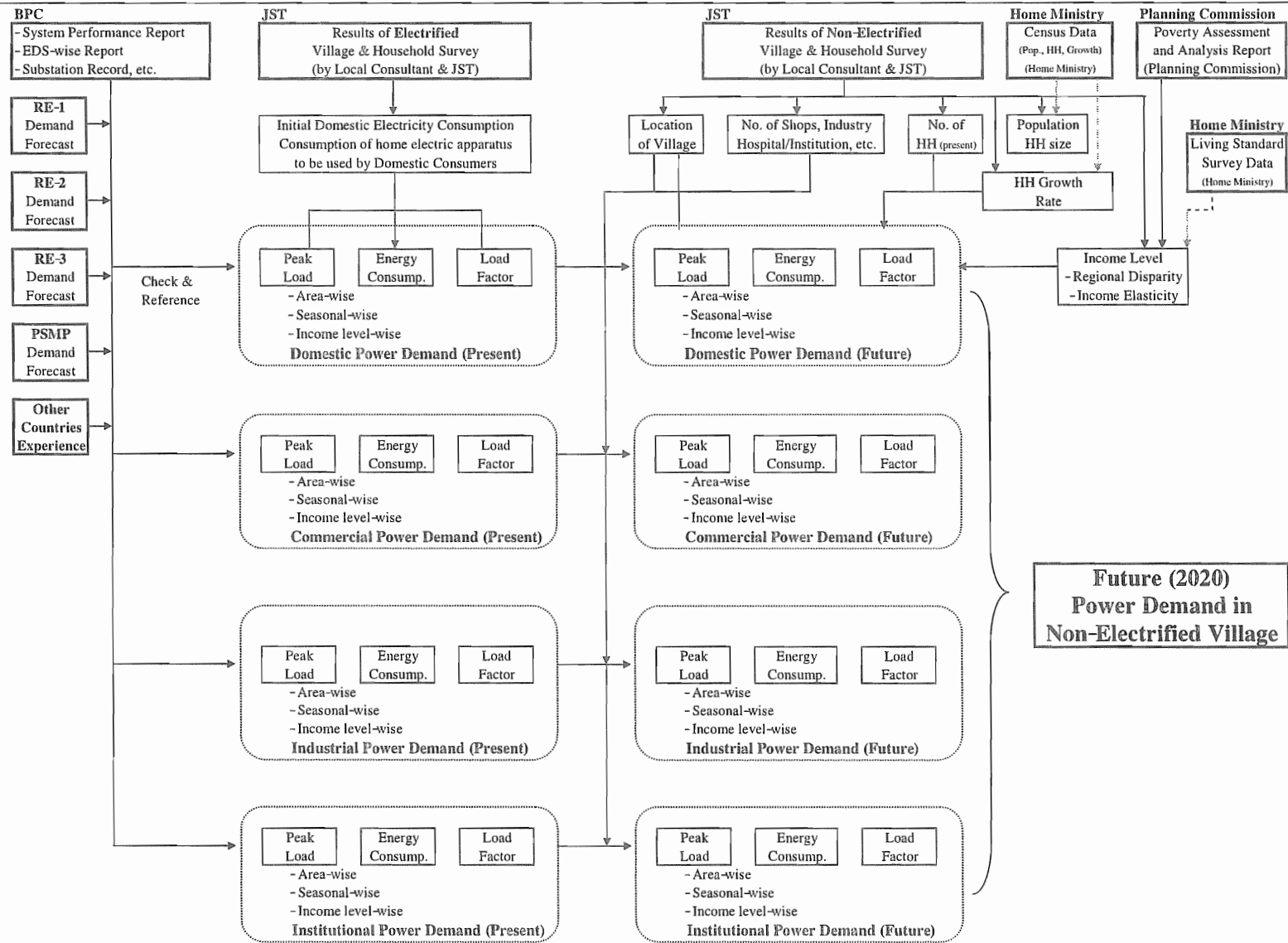


Figure-1 Flowchart of Power Demand Forecast for RE Master Plan

### 3.1 Domestic Consumption

#### (1) General

A peculiarity of energy demand of rural villages in Bhutan is that electricity is mainly consumed for lighting and cooking, and also heating in the highlands in the winter. Electricity consumption of domestic consumers in Bhutan concentrates in a single time zone, which seems to result in a low load factor.

The Team analyzed such local characteristics and considered them as key factors in designing the distribution system. This consumption pattern might lead to bigger conductor sizes being required compared with normal distribution networks.

In non-electrified areas indicated by the DOE, initial electricity consumption of the domestic category will be assumed summing up consumption of home electric apparatus to be used by a consumer. The demand will be verified from the recorded trend of current electrified consumers in both Bhutan and other similar countries.

Power demand per domestic consumer will be estimated based on the following information.

- “Electrified Village Household Survey” by JICA Study Team
- BPC Performance report and sales record
- Poverty Assessment and Analysis Report 2002, Planning Commission
- Agricultural Sector GDP growth rate
- etc.

The total number of surveyed household and commercial household such as shop or restaurant in the “Electrified Village Household Survey” by JICA Study Team are 51 HH and 12 HH, respectively. The surveyed 13 villages are electrified by grid and micro hydro power (MHP). In this “electrified village household survey”, actual number of having electrical facilities and the utilization of each electrical facility in each hour by the household was surveyed. Around 65% of the surveyed households use rice cooker (average power demand of 640W) and 29% use curry cooker (1,000W). Only 29% of household use the fluorescent lamp (40W) due to power supply shortage or unstable voltage in some village.

### **3.2 Commercial Sector Consumption**

Commercial sector such as shop or restaurant in rural area is very small scale at present. Most of the shops or restaurants are in the same building of domestic household. The power demand of commercial sector will be also estimated base on the results of interview survey by the Study Team in the electrified village.

### **3.3 Industrial & Public Sector Consumption**

Historical electricity consumption and annual growth of each consumer category will be obtained from analysis of past records, and the forecast will be examined in consideration of the past trends. The industrial sector, the biggest electric consumer in the country, could be analyzed for elasticity of consumption against economic indexes.

New electricity demand from various development plans will be added to average demand growth of standard consumers.

Demands of industrial and public categories of consumers will be forecast based on the present record at electrified village and BPC sales records.

## **4. Power Demand in the Master Plan**

Load centers of the Dzongkhags assumed from the demand forecast analyses will then be input into a GIS database for clarifying their geographical locations. From such demand forecasts for the Dzongkhags, total capacity required at substations (both existing and new stations) that are to be the origin of medium voltage distribution lines will be forecasted for each year up to the year 2020. The results of these forecasts will then be verified for appropriateness of locations of substations planned under the PSMP. If relocation of the substations is desired from the Team's study, the Team will recommend it to the DOE with a firm justification.

**DRAFT***Attachment-4 (1/2)*

Japan International Cooperation Agency (JICA)  
Department of Energy (DOE), Ministry of Trade and Industry

**The Integrated Master Plan Study for  
Dzongkhag-wise Electrification in the Kingdom of Bhutan**

**Second Workshop  
26 October 2004, in Bumthang**

**Draft Agenda**

9:30 - 9:40	Welcome and Introduction	Director DoE
9:40 - 9:50	Greetings by JICA Bhutan Office	Representative of JICA Bhutan Office
9:50 - 9:55	Background of the Study, Introduction of JICA Study Members and Procedure of Workshop-2	Team Leader, JICA Study Team
9:55 - 10:00	Introduction of Study Members from DoE and BPC	DoE and BPC
10:00 - 10:15	Existing Power Supply System and Policy of Rural Electrification	DoE
10:15 - 10:30	Current Status and Problem of Rural Electrification	BPC
10:30 - 10:50	Coffee Break	
10:50 - 12:30	Progress of Master Plan Study (details are as attached)	DoE, BPC and JICA Study Team
12:30 - 13:00	Questions and Answers	
13:00 - 14:00	Lunch	
14:00 - 15:00	Presentation of Actual Status of Rural Area and Request to Master Plan Study	Dzongkhag representatives
15:00 - 15:30	Discussions	
15:30 - 15:45	Coffee Break	
15:45 - 16:15	Special Lecture on Renewable Energy (not decided)	
15:15 - 16:25	Possibility of Applying New Technology	JICA Study Members
15:25 - 16:30	Next Step of Master Plan Study	Team Leader, JICA Study Team
16:30	Closing Remarks	Director DoE



---

10:50 - 12:30	Progress of Master Plan Study	
10:50 - 10:55	Overview of Study Methodology	DoE
10:55 - 11:05	Data Collection and Creating GIS Database of Existing Distribution System	BPC
11:05 - 11:10	Plan of RE-3 and Combined GIS Database with Existing System	DoE
11:10 - 11:20	Result of Village Survey	DoE
11:20 - 11:30	Methodology and Result of Demand Forecast	DoE and BPC
11:30 - 11:35	Work Procedure for Distribution Extension Planning	DoE and BPC
11:35 - 11:40	Criteria and Standard for Distribution Extension Planning	BPC
11:40 - 11:45	Financial and Economic Approach and Methodology On/Off-Grid Cut-off Point Decision	DoE and BPC
11:45 - 11:50	Off-grid Model Plan-1: Small Hydro	BPC
11:50 - 11:55	Off-grid Model Plan-2: Solar	DoE
11:55 - 12:05	Policy of Strategic Environmental Consideration	NEC
12:05 - 12:25	First Draft of Rural Electrification Master Plan	DoE and BPC
12:25 - 12:30	Other Option of Draft Master Plan	DoE and BPC

---

Records of discussion on the Environmental Considerations/Policies for the RE  
Integrated Master Plan Study

A meeting was convened on the afore-mentioned topic on July 2, 2004 at Tala conference hall and following are the discussions and decisions taken;

1. The Director gave the introductory remarks and highlighted on the launching of the Dzongkhag-wise Rural Electrification Integrated Master Plan Study, one of the most important deliverances of the 9<sup>th</sup> FYP. He mentioned the importance of realizing the national goal of "Electrification of all by 2020". He informed the floor that the meeting was held in order to correlate more effectively with different organizations directly or indirectly related to the Study for exchange of views and to come out with clear cut strategies which will help to sort out environmental issues in relation to Rural Electrification.
  
2. The Senior Manager, Planning & Monitoring Division, BPC, presented BPC's perspective on sustainable rural electrification. He informed that there are two main facets of sustainable rural electrification first of which pertains to the requirements of the customer and the other pertaining to electricity supplier (BPC) requirement. From the customer point of view, he stated that customers require the provisions of adequate, affordable, reliable and of acceptable quality electricity supply. From the supplier's point of view as the supplier, he said that the sales from electricity services provided must be greater than the cost of providing the services. He explained that in the Bhutanese context the costs of providing rural electrification services greatly exceed sales and that the rural electrification schemes are not financially viable without subsidies and are not likely to be viable in the foreseeable future. Since the costs of RE services are very high, he said that it is very important to identify and opt for the least cost option using the Life Cycle Cost approach. He also stated that it was in this light, that the Hon'ble Chairman of BPC had instructed the BPC to study the possibilities of using treated wooden poles instead of costly steel poles. He submitted that a lot of countries around the world including most developed countries are using treated wood poles and felt that Bhutan could also use the same in a sustainable manner given its vast forest resources. The Joint Director, Department of Forest, welcomed the proposition and suggested that the multitude of trees felled along the RoW for new power transmission lines could be salvaged and utilized. The Director, DoE mentioned that using the felled trees along the transmission right of way may not be appropriate due to the high transportation cost and in some cases, the areas were not accessible. This would make wooden poles very expensive unless the Department of Forest considers allocating trees from easily accessible areas. The National Project Manager, RE Project informed the floor that as per mandate received from the Hon'ble Minister to look into the feasibility of using wooden poles, he has submitted a document as per his findings from a study to the JICA study team.

3. The Deputy Director, Dept. of Planning informed the floor that when the line from Kurichhu project was being stringed, a little complication had set in whereby the logs were not being allowed to be used by the public even for community developments and attributed it to possible conflicts between the different park regimes. The Deputy Director, Dept of Forests informed that such problems rose basically due to the cutting of unmarked trees without prior approval from the Department. He told that this particular issue had not come to their notice.
4. Mr. Kezang, Bhutan Communication Authority mentioned that basically two factors were seen to co-exist from his perspective on RE i.e. firstly the level of community involvement to sustain operation and maintenance in the rural areas and secondly the sense of ownership was retained within DoE/ BPC. The Director, DoE mentioned that in the past, 7th FYP and beyond, when RE project was being implemented, the community contributed Labour free of charge and the erstwhile Dept. of Power provided the technology support and the necessary skills. Since 8<sup>th</sup> FYP the community people were paid for their labour and infact he mentioned that from personal perspective, the dual standard in thinking whereby urban areas were left out from above mentioned schemes was not fair. He mentioned that the main issue was the amount of subsidy the government is able to provide in rural areas.
5. The Officiating Director, Dept of Forests gave a brief presentation highlighting the Forest scenario prevalent in the country. The Head, EIA section informed the floor about the prevalent EIA Acts and various other related acts and highlighted that each and every project had to comply with the prescribed Environmental Impact Assessments acts and regulations set by the Government. The Director, DoE, mentioned that it was a necessary requisite to comply with the various acts and regulations and the major concern was to address the environmental constraints in pursuit of the RE Integrated Master Plan Study. He informed the floor that conservation of forest is a very important task but in order to provide Electricity, there was no other option but to go ahead with the task of clearing certain areas in order to obtain the Right of Way for the power lines. He also asked for a clarification that whether DoF had any scheme whereby the organization directly involved in clearing a certain area of the forest plantation, should plant in some other place to compensate for the plantation loss? The Joint Director, DoF, mentioned that from the Policy perspective, 60% forest coverage was a necessary requisite at all times. He informed that as such there were no such schemes and most probably the area utilized for laying such power lines needs to be calculated and the replacement schemes needs to be formulated. The Director, DoE mentioned that for large transmission lines, we need to clear the Right of Way but it was not necessary that no vegetation should grow under it. He quoted an example of a 220 kV line which has a Right of Way of approximately 35m width and that if the area under it was left arid, it would cause a huge impact to the environment and allowable vegetation growth of height less than the actual clearance height should definitely be planted to account for a certain percentage of loss of vegetation/forest. The Jt. Director, DoFS mentioned that in case of RoW issues, proper adoption of vegetation management in the vicinity of power lines should be observed as applicable in order to

avoid complete clearing of RoW area. This was agreed in principle by the respective sector heads and the concerned agencies in particular was instructed to come out with such plans wherein the cost of vegetation management and other activities concerning afforestation and reforestation as such shall be borne by the concerned stakeholder and technical support will be assisted by DOFS.

6. The Director, DoE, mentioned that according to the Power System Master Plan, the country had an estimated 30,000 MW hydro-power potential and out of which around 23,500 MW was feasible. He told that if clearances were made a strict approach by DoFS keeping in mind issues related to forest conservation, the country would hardly be able to extract about 5000 MW. He also mentioned that as far as financing is concerned, the hydropower projects are donor driven at the moment and in the future it will be limited donor driven financing and more towards commercial financing. As such the cost of environment will become a costly affair to the concerned stakeholder. Therefore, it becomes necessary as to who will be responsible to bear such cost of environmental conservation. He mentioned that since Bhutanese economy is dependent very heavily on hydropower, some serious thought would be necessary so that hydro power plants and transmission line constructions continue in a sustainable manner at the same time our environment consensus are addressed.
7. The Joint Director, DoFS suggested that at some places the transmission lines could have been laid at the periphery of the forest boundary and fringes of agricultural land instead of lines going straight through it.
8. The National Project Manager, RE Project gave a brief presentation of the RE Master Plan and its development philosophy that was being incorporated in tandem to the existing environmental norms for views and comments as well as seeking clarifications from the organizations attending the meeting. Mr. Kezang, BCA sought clarification regarding the status of the private sector participation in the Energy Sector. The Director, DoE clarified that prior to 8<sup>th</sup> FYP, implementation of RE network expansion was carried out by erstwhile Department of Power and it was possible given the limited target of number of households. However, in order to be able to achieve the RE targets, it was absolutely necessary to contract out the construction of the rural electrification. While about 30% could be undertaken by the BPC, the balance 70% will need to be contracted to private parties. This will allow simultaneous execution of the works and will also enable acceleration of the RE program. This will mean deviating from the conventional method where the Department of Power and the communities only are involved in the RE works. This new approach being proposed would also help the private sector to grow and increase employment opportunities.
9. The Joint Director, DoP mentioned that each agency should not be driven by a trend to set some goals but rather focus on achieving positive impacts. The Director, DoE, mentioned that the Vision 2020 for 100% electrification was a National document received from the highest level and the vision laid down that pertains to the obligations to achieve the goal. He mentioned that electricity was not the end product but in order

to improve the quality of life and alleviate poverty especially in the rural areas by providing electricity as stimulant for socio-economic development. Today, we are developing Integrated Dzongkhag-wise RE Master Plan for 100% electrification by 2020 envisaging Five Year RE Plan including techno-economic feasibility study for phased development and electrification.

10. The JICA study team sought clarifications on whether there was a particular pattern of zoning to be considered in the RE master plan for preservation? The Dy. Director, NCD mentioned that no clear pattern of zoning on the ground was present at the moment. There were no fixed boundary pillars which could rightly demarcate the various zones in the protected area. However, he said the zoning was under process and the same shall be made available to the JICA study team as soon as it is completed. He also mentioned that NCD could provide zoning of protected area if given the specified name of protected area. Further, he also mentioned that while there is the possibility of RE intrusion into the protected areas, it must meet and comply with the governmental requirements such as EIA and other related aspects. The Director, DoE, sought clarification on how to conserve the environmental norms when a transmission line passes through a protected area? He mentioned that at present, the shortest route is chosen keeping in mind the economic/technical/cost factors. He also asked whether the clearances for RE could be delegated to RE Project Team. The Head, EIA section recommended that study team to work on the working clearance for the Power line ROW. The JICA team sought further clarifications whether adoption of renewable energy sources could be a better solution to avoid damage to protected areas in spite of incurring heavy costs. The Director, DoE mentioned that in terms of sustainability, grid extension is preferred over solar PV because of limited usage and life cycle of Solar PV sets. However, selection of viable options for such cases needs to be focused and studied keeping in mind how best we can have less negative impact on the environment.
11. The Head, EIA section, NEC suggested that if a cumulative impact assessment of Rural Electrification could be availed in order to better understand the pros and cons associated in the implementation of RE in the Master Plan Study.
12. The JICA study team sought clarification regarding the existence of any policies pertaining to protection of social aspects like heritage, residential areas of minorities. The Joint Director, DoP responded that Ministry of Home and Cultural Affairs would be in a better position to clarify.
13. The Team leader, JICA study team wrapped up the meeting by highlighting the plans/programmes achieved so far like the successful mapping of unelectrified villages and existing electrical infrastructures in the GIS (Geographic Information System) map. The team leader also informed the floor that the least cost options are being studied and other options like underground cable, off-grid methodologies as well as latest technologies is also being considered in the study. He further requested to finalize a decision by next National Stakeholder Workshop to be held in October 2004 on main objective of RE whether provision is for basic lighting or for catering other demand









such as heating, cooking etc. This he said will assist the study team to better understand and correlate the best methodology of provision of services to the rural beneficiaries. Further, the floor was informed that no specific policies were in place to promote the use of electricity in rural areas where the poor who cannot afford to pay its minimum charge reside.

Following members were present for the meeting.

1. Mr. Sonam Tshering, Director, Department of Energy
2. Mr. Raling Nawang, Dy. Director, Nature Conservatory Division, Dept. of Forestry Services
3. Mr. Gopal Mahat, Jt. Director, Department of Forestry Services
4. Mr. Kezang, Bhutan Communication Authority, Ministry of Information and Communication
5. Mr. K.C. Nyedrup, Head, EIA, National Environment Commission
6. Mrs. Yeshey Seldon, Planning Officer, Policy and Planning Division, Ministry of Trade and Industry
7. Mrs. Tashi Chuki Wangdi, Policy and Planning Division, Ministry of Trade and Industry
8. Mr. Karma Wangdi, Department of Information Technology
9. Ms. Thukten Wangmo, EIA Officer, Bhutan Electricity Authority, Dept. of Energy
10. Mr. Jigme Tobgyel, Sr. Manager, Planning Division, Bhutan Power Corporation
11. Mr. Rinzin Dorji, Dy. Director, Department of Planning
12. Mr. Thinley Dorji, EIA Officer, National Environment Commission
13. Ms. Kinga Wangmo, Department of Planning
14. Mr. Sonam Tobgyel, Department of Planning
15. Mr. Tomoyasu Fukachi, Team Leader, JICA Study Team
16. Mr. H. Nishmaki, JICA Study Team
17. Mr. Kiyoshi Hirata, JICA Study Team
18. Mr. T Kamishita, JICA Study Team
19. Mr. Nawang Choeda, Ass. Project Manager, Department of Energy
20. Mr. Sonam Palden, Environmentalist, Bhutan Power Corporation
21. Karma P Dorji, National Project Manager, RE Master Plan Study, Dept. of Energy

(Raling Nawang)

(Jigme Tobgyel)

(T. Fukuchi)

(Gopal Mahat)

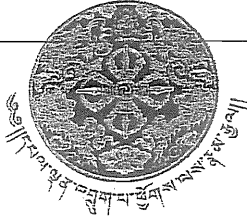
(Karma P Dorji)

(Kamishita)

(Thinley Dorji)

(Sonam Palden)

(Sonam Tshering)



འབྲུག་རྒྱལ་ཁབ་ལྷན་ཁྲིམས་། བསྟན་འཛིན་རྒྱལ་ཁབ་།

DEPARTMENT OF ENERGY  
MINISTRY OF TRADE & INDUSTRY  
THIMPHU : BHUTAN

DOE/PCD/RE-MP/03-04/ 1173

June 28, 2004

The Director General  
Department of Census Records  
Ministry of Home and Cultural Affairs  
Thimphu.

Subject: Request for Census Data- Integrated Master Plan Study for Dzongkhag-wise Electrification.

Hon'ble Dasho,

With the Technical Assistance from Japan International Cooperation Agency (JICA), Department of Energy is implementing the "Integrated Master Plan Study for Dzongkhag-wise Electrification". The study is very important and crucial for us considering our mandate to fulfill Vision for 100% electrification by the year 2020.

In this context, we had written to your Ministry requesting for the National Population Census in January 2004 and received response from your Ministry vide letter No. NGHIA/ADM-35/2004/1742 dated 12<sup>th</sup> February 2004 (a copy enclosed for kind reference).

According to the above letter, we were informed that Ministry is still in process of collecting data from all the Dzongkhags and is yet to complete the National Population Census. The study team has requested once again to confirm whether the collection of National Population Data has been completed by now.

Since we have limited duration of study period and a collection of necessary baseline data for the study is scheduled for completion by mid July 2004, we would appreciate if you could kindly notify us on the availability of the data listed as follows and if available kindly provide us with the data.

- |                                  |   |
|----------------------------------|---|
| (1) Population Number            | (Dzongkag-wise, Geog-wise and Village-wise) |
| (2) Household Number             | (Dzongkag-wise, Geog-wise and Village-wise) |
| (3) Population Pyramid data      | (age and sex-wise, Dzongkag-wise)           |
| (4) Population growth projection | (Dzongkag-wise, up to 2020)                 |

The data is required for the socio-economic analysis and power demand forecast study.

OLC

Telephone # 322505/323555 Fax # 328278

Page 1 of 1

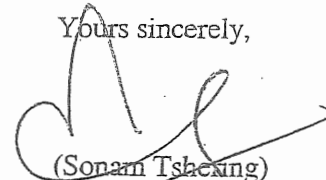
1452  
29/6/04

(32693)

We would appreciate for your kind cooperation.

Thanking you,

Yours sincerely,



(Sonam Tshering)  
Director

Cc: The Team Leader, JICA Study Team.





# ནང་སྲིད་ལྷན་ཁག་།

བཀྲིས་ཚེས་ཚེད།

ལྷི་ཡུ་ རྒྱ་ ཚེས་ ལྷ

ཡིག་མཚན་

NGHA/ADM-35/2004/1742

12<sup>th</sup> February, 2004.

The Director,  
Department of Energy,  
Ministry of Trade & Industry,  
Thimphu.

Sir,

This has reference to your letter no. DOE/PCD/RE-MP/03-04/567 dated February 2, 2004, regarding the availability of census data in the Ministry.

In this regard, the Ministry regrets to inform that at present the Ministry is not in a position to provide you with the census information as the Ministry is still in the process of collecting census information of all the Dzongkhags and is yet to complete the National Population Census.

Please bear with us for the inconvenience caused.

Thanking you.

Yours sincerely,

*Kenzo P*  
*to note*

*12/2/04*

*(Nob Tshering)*  
Deputy Secretary

*The Team Leader, JICA Study*  
*Based on our request to Ministry of Home Affairs*  
*for the census data, we are being informed*  
*formally through this letter that they are not*  
*in position to provide any data.*  
*You may wish to advise this and cover the*  
*inconvenience to JICA head quarter for*  
*information.*

*12/2/04*  
National Project Manager  
R E Project, Planning & Coordination Division  
Department of Energy, Thimphu