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 INTEGRAGED 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 ±10% of the nominal voltage.

The target voltage variation of MV at the end of a MV line is ±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 (50mm², 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 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;

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

Where; LF: Load factor

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Japan International Cooperation Agency (JICA) Study Team

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

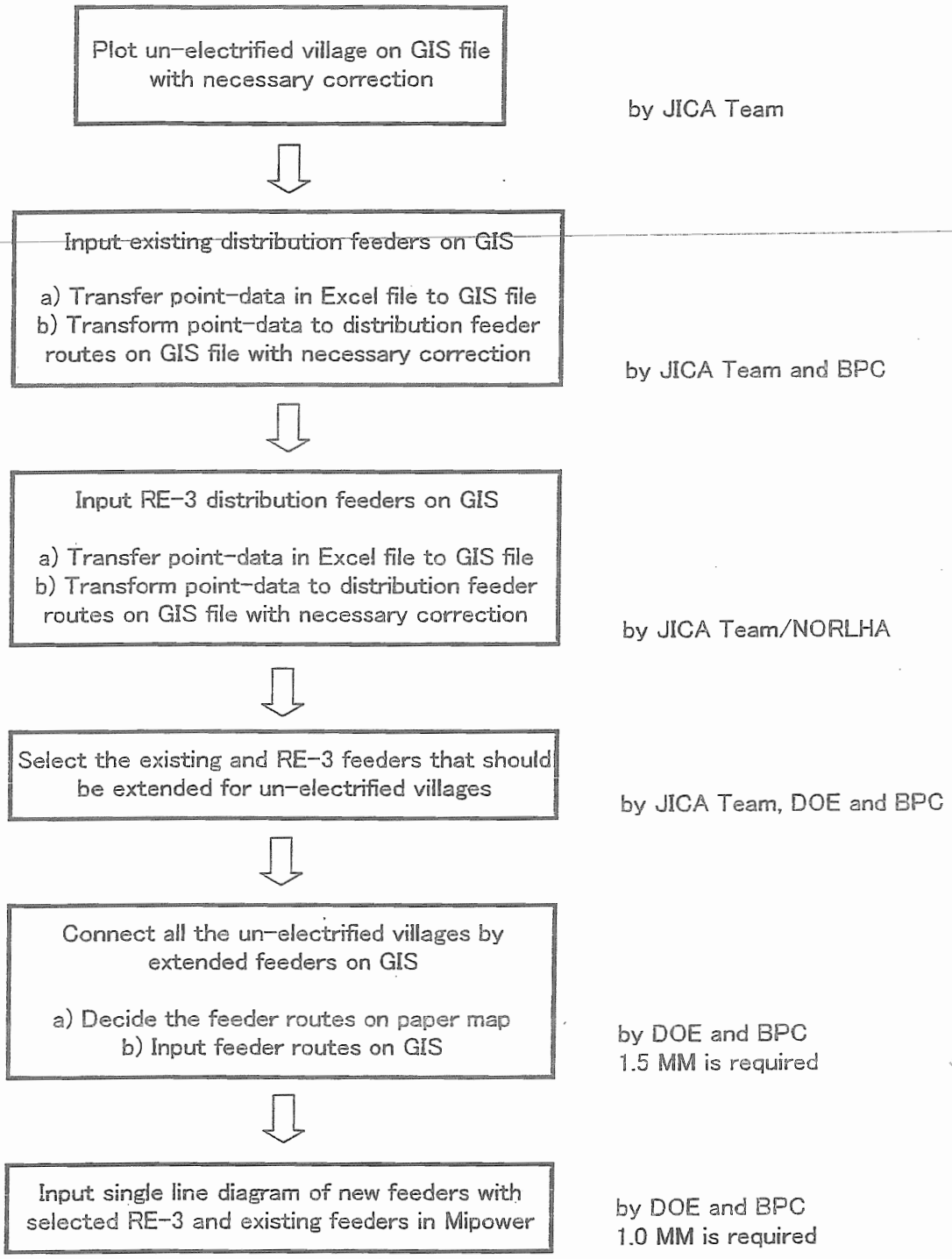
Your kind attention and cooperation to the above will be much appreciated.

Yours sincerely,

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

Attachment: Flow of Joint Preparatory Work for Distribution Extension Plan

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.

Attachment -3

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.

Attachment -3

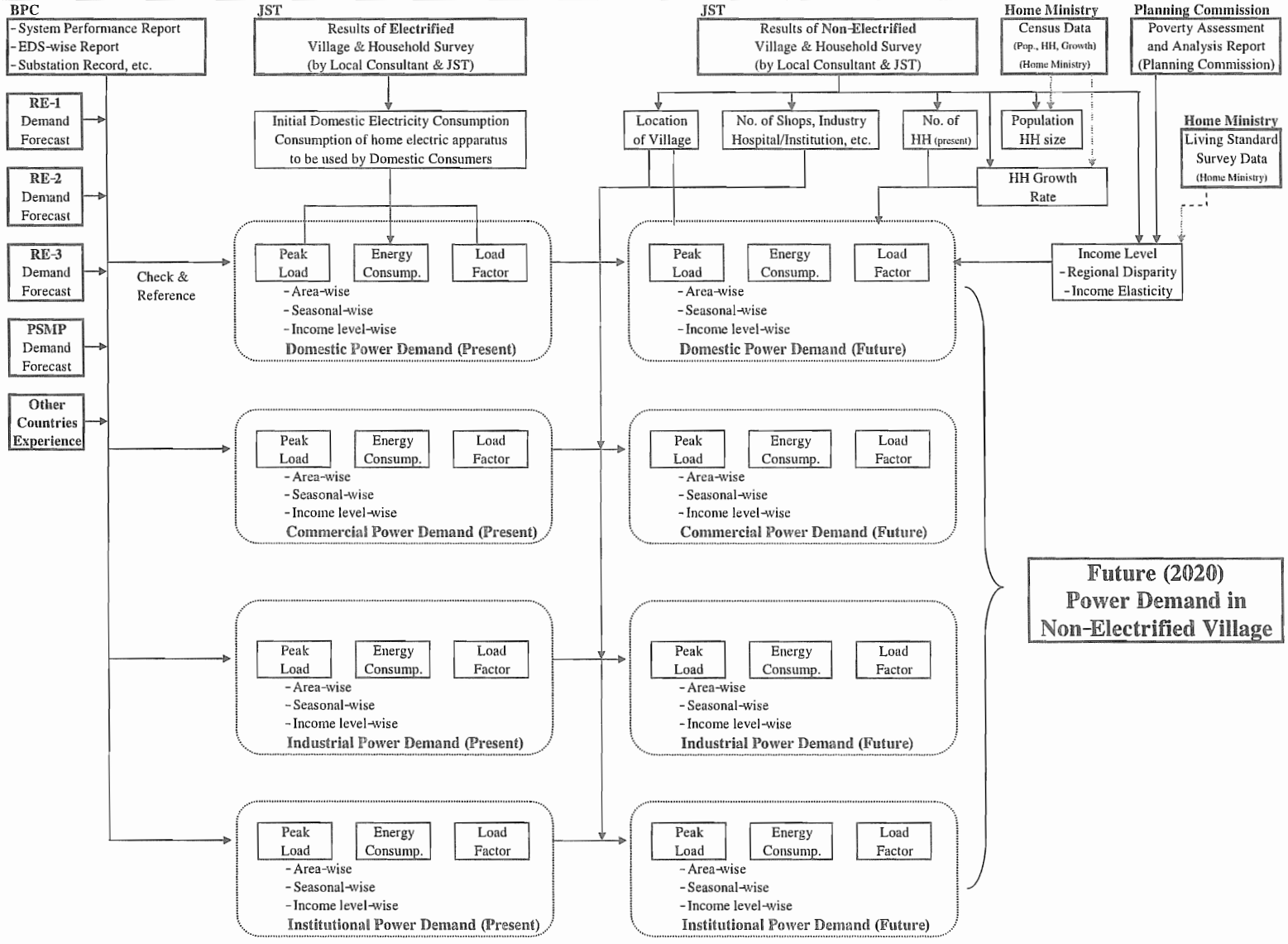


Figure-1 Flowchart of Power Demand Forecast for RE Master Plan

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.

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 9th 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 utililized. 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 tress 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 8th 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 inorder to provide Electricity, there was no other option but to go ahead with the task of clearing certain areas inorder 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 aforestation 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 8th 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) (Gopal Mahat) (Thinley Dorji)

(Jigme Tobgyel) (Karma P Dorji) (Sonam Palden)

(T. Fukuchi) (Kamishita) (Sonam Tshering)

Attachment-6 (1/3)

བྱུས་ཤུགས་ལས་ཁུངས། བསྟུན་ཁྲུས་ལྷན་ཁག།

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. NGHA/ADM-35/2004/1742 dated 12th 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.

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.

Attachment-6 (3/3)

ནང་སྡེད་སྤྱན་ཁབ།

བཀྲིས་ཆོས་རྫོང་།

ཡིག་ཚང་

NGHA/ADM-35/2004/1742

སྤྱི་ལོ ༢༠༠༤ ཟླ ༢ ཚེས ༡༢ ལྷག

12th 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,

(Nob Tshering)
Deputy Secretary

To note

13/2/04

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. Therefore, the JICA may kindly write this and convey the inconvenience to JICA head quarter for information.

13/2/04

National Project Manager
RE Project, Planning & Coordination Division
Department of Energy, Thimphu

ANNEX-6

MINUTES OF MEETING (THIRD SITE WORK) BETWEEN

THE MASTER PLAN STUDY TEAM

AND

DEPARTMENT OF ENERGY MINISTRY OF INDUSTRY

NOVEMBER 16, 2004

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

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

THIMPHU
November 16, 2004

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

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

Mr. Jigme Tobgyel
Senior Manager
Planning & Monitoring 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 September 29, 2004 through November 17, 2004 as the third site work. On November 15, 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. **Progress Report** : The Team submitted twenty copies of Progress Report to DOE on September 30, 2004 and discussed the contents with DOE and BPC. The Team was informed that the DoE will be consolidating the comments from different agencies and will be submitted within 2 weeks (By end of November 2004). However, the Team informed that the comments will be incorporated in Interim Report to be submitted in February 2005.

2. **Second Workshop** : The second workshop took place at Bhutan Chamber of Commerce and Industry Conference Hall, Thimphu on October 26, 2004. The agenda, list of participants and record of discussion are shown in the Attachment-1.

3. **Technical Standard** : The technical standards and design conditions of distribution lines for the master plan were decided as shown in the minutes of meeting of the second site work dated July 9, 2004. The team discussed again the standard and conditions with BPC and the following were revised.

   - Height of pole: Pole of 10 m height is applied for both 11 kV and 33 kV distribution lines. In original, 9 m for 11 kV lines and 10 m for 33 kV lines were adopted.
   - Ice loading: Ice loading conditions for distribution line design is proposed to be applied only for lines to be constructed at altitudes of 3000 meters and above. Previously, ice loading was applied to all the distribution lines. For the integrated Communication and Electricity lines using same poles, due consideration must be given for selecting the pole strength.
   - Covered conductors: It is proposed to use covered conductors in the environmentally protected areas. Previously, no standards existed.
   - Wind pressure to pole: 45 kg/m^2 of wind pressure with shape factor of 2/3 is applied to pole (45 x 2/3 = 30).

4. **Formulation of Dzongkhag-wise Electrification** : The master plan of Dzongkhag-wise electrification will be formulated according to the flow-chart shown as Attachment-2.

5. **Institutional Framework** : The Team presented the idea of institution and organization for off-grid electrification in the second workshop. The matter was subsequently discussed with the Team, DOE and BPC including that for on-grid electrification. As the framework for the further discussion, the parties agreed to the following concepts:

   - incorporate local participation to reduce the BPC's burden of operation and maintenance for on-grid and off-grid electrification.
   - realize off-grid electrification with local initiative and ownership for sustainability through a cost sharing mechanism.
   - make good use of private sector or incorporate public-private partnership for efficient realization of off-grid electrification.
   - leave the merit after grid extension to the local people who introduce off-grid system to enhance the motivation for the local people to introduce off-grid system.

6. **Demand Forecast** : The Team explained the demand forecasts for non-electrified villages and the electrified area. The forecasts were accepted for the master plan study. However, the BPC and DoE expressed the requirement to monitor and confirmed the results during next few years. Major figures of the forecasts are shown below.

   - Average peak demand of non-electrified households (2020): 1.47 kW/HH
   - Average energy demand of non-electrified households(2020): 141 kWh/HH/month
   - Estimated Potential Peak demand of total non-electrified villages (2020): 58.6 MW
   - Projected Peak demand of total electrified area (2020): 368.1 MW
   - Projected National Peak Demand (2020): 427 MW

7. **Development Plan for Information and Telecommunication Network** : Coordination meeting was held on October 19, 2004 with the attendances from the Team, DOE, Bhutan Telecom (BT), Bhutan Communication Authority (BCA) and Department of Information Technology to coordinate the development plan for information and telecommunication network. The parties understood the concept of the development as shown in Attachment-3 and agreed to cooperate for realizing the

development plan.

8. **Coordination Committee** : The coordination committee will be held in the 4th site work in February 2005.

9. **Next Site Work** : The 4th site work is scheduled to be conducted from February 6 to 24, 2005.

End

Attachment

1. Agenda, List of Participants and Record of Discussion of Second Workshop
2. Flow-chart for Formulating the Master Plan of Dzongkhag-wise Electrification
3. Telecommunication Network for Internet/VoIP Telephone and Future Schedule

Attachment-1

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 Thimphu

Conference Hall, Bhutan Chamber of Commerce and Industry

Agenda

SP-1	9:30 - 9:40	Welcome and Introduction	Mr. Chhewang Rinzin Managing Director, BPC
SP-2	9:40 - 9:50	Greetings by JICA Bhutan Office	Mr. Mitsukuni Sugimoto Representative of JICA Bhutan Office
SP-3	9:50 - 9:55	Background of the Study, Introduction of JICA Study Members and Procedure of Workshop-2	Mr. Tomoyasu Fukuchi Team Leader, JICA Study Team
AD-1	9:55 - 10:00	Introduction of Study Members from DoE and BPC	Mr. Karma P Dorji National Project Manager, Planning and Coordination Division, DoE
AD-2	10:00 - 10:10	Status of Existing Power System	Mr. Bharat Tamang Head, Planning and Coordination Division, DoE
	10:10 - 10:30	*Tea Break*	
MP-1-12	10:30 - 13:00	**Progress of Master Plan Study** (details are as attached)	DoE, BPC and JICA Study Team
	13:00 - 14:00	*Lunch*	
AD-3	14:10 - 14:30	Question and Answers for Progress of Master Plan Study	
AD-4	14:30 - 14:40	Off-grid System and Institution	Ms. Yuka Nakagawa JICA Study Team
AD-5	14:40 - 15:25	Discussions of Actual Status of Rural Area and Request to Master Plan Study	Dzongkhag Representatives
	15:25 - 15:45	*Tea Break*	
~~AD-6~~	~~15:45 - 16:15~~ (Canceled)	~~Special Leeture on Renewable Energy~~	~~Prof. Izumi Ushiyama — Ashikaga Institute of Technology~~
AD-7	16:15 - 16:25	Possibility of Applying New Technology	Mr. Kiyoshi Hirata JICA Study Team
AD-8	16:25 - 16:30	Next Step of Master Plan Study	Mr. Tomoyasu Fukuchi Team Leader, JICA Study Team
AD-9	16:30 - 17:00	Distribution of Certificate	
SP-5	17:00	Closing Remarks	Mr. Chhewang Rinzin Managing Director, BPC

Attachment-1

10:30 - 13:00 Progress of Master Plan Study

	Time		
10:30 - 10:40	10:00min	Overview of Study Methodology	Mr. Karma P, DoE
10:40 - 10:50	10:00min	Result of Village Survey	Mr. Karma P, DoE
10:50 - 11:00	10:00min	Methodology and Result of Demand Forecast	Mr. Jigme Tobgyal, BPC
11:00 - 11:15	15:00min	Distribution System Planning by GIS	Mr. Ujjwal, BPC
11:15 - 11:25	10:00min	Distribution System Analysis by Mi Power	Ms. Dechen Dema, BPC
11:25 - 11:40	15:00min	Applied Standard for Distribution system Planning	Mr. Sunil K. Rassaily, BPC
11:40 - 11:50	10:00min	Off-grid Model Plan-1: Small Hydro	Mr. Karma Tshewang, DoE
11:50 - 12:00	10:00min	Off-grid Model Plan-2: Solar	Mr. Satchi, DoE
12:00 - 12:20	20:00min	Financial and Economic Approach and Methodology On/Off-Grid Cut-off Point Decision	Mr. Jigme Tobgyel, BPC
12:20 - 12:30	10:00min	Telecommunication Development Plan along with Rural Electrification	Mr. Pema Chogyel, MoIC
12:30 - 12:40	10:00min	Policy of Strategic Environmental Consideration	Mr. K.C Nyedrup, NEC
12:40 - 13:00	20:00min	First Draft of Rural Electrification Master Plan and Option of Draft Master Plan	Mr. Karma P, DoE

Attachment-1

List of Participants for the 2st Workshop
Integrated Master Plan Study for Dzongkhag-wise Electrification in Bhutan

No	NAME	TITLE	ORGANIZATION	
		DZONGKHAGS		
1	Mr. Y. K. Pradhan	Planning Officer		Bumthang
2	Ms. Tandin Lhamo	Planning Officer		Chukha
3	Mr. Kezang Jamtsho	Junior Engineer		
4	Mr. Singye Dorji	Dzongkhag Yargay Tshogdu Chairman		
5	Mr. Sangay Penjor	Planning Officer		Dagana
6	Ms. Ugyen Dema	Junior Engineer		
7	Mr. N. B. Tamang	Planning Officer		Gasa
8	Mr. G. B. Chhetri	Planning Officer		Haa
9	Mr. Norbu Tshering	Junior Engineer		Lhuntse
10	Mr. Pelden Norgay	Dzongkhag Engineer		Mongar
11	Mr. Daba	Junior Engineer		Pemagatshel
12	Mr. Tashi Dorji	Dzongkhag Engineer		Punakha
13	Mr. Tashi Tobgay	Junior Engineer		Sarpang
14	Mr. Tshewang Penjor	Junior Engineer		Samdrup Jongkhar
15	Mr. Lhapchu	Dzongkhag Engineer		Tsirang
16	Mr. Lhabula	Human Resource Officer		
17	Ms. Chhoki Wangmo	Junior Engineer		Wangduephodrang
18	Mr. Tashi Norbu	Junior Engineer		Zhemgang
			subtotal	18
		OTHER ORGANIZATIONS		
19	Mr. Pema Chewang	Chief Program Officer	Dept. of Aid and Debt Management	Ministry of Finance
20	Mr. Ugyen Norbu	Chief Program Officer	Dept. of Aid and Debt Management	
21	Mr. Karma Dupchu	Assistant Planning Officer	Dept. of Planning	
22	Ms. Kinga Wangmo	Assistant Planning Officer	Dept. of Planning	
23	Mr. Pema Choejey	System Analyst	Dept. of Information Technology	Ministry of Information & Communications
24	Mr. Dorji Tshering	Head of Cadastral Information Division	Dept. of Survey & Land Records	Ministry of Agriculture
25	Mr. Raling Ngawang	Deputy Director	Nature Conservation Division	
26	Ms. Chemi Om	Engineer	Nature Conservation Division	
27	Mr. N. P. Katel	Executive Engineer		Ministry of Works & Human Settleme
28	Mr. Tashi Dendup	Junior Engineer	National Housing Development Corporation	
29	Mr. Karma C. Nyedrup	Deputy Director		National Environmental Commission
30	Mr. Thinley Dorji	EIA Officer		
31	Mr. R. N. Adhikari	Consultant		Norlha Associates
32	Mr. Pema Norbu	Consultant		Norlha Associates
33	Ms. Yeshey Selden	Under Secretary	Policy and Planning Division	Ministry of Trade and Industry
34	Mr. Gunther Schwartzler	Project Coordinator		ACB
			subtotal	17
		DEPARTMENT OF ENERGY		
35	Mr. Bharat Tamang	Head of Planning and Coordination Division	Planning and Coordination Division	Department of Energy
36	Mr. Karma P Dorji	National Project Manager		Department of Energy
37	Mr. Karma Tshering	Executive Engineer	Planning and Coordination Division	Department of Energy
38	Mr. Karma Yonten	Head of Bhutan Electricity Authority	Bhutan Electricity Authority	Department of Energy
39	Mr. Ngawang Choeda	Assistant Engineer	Planning and Coordination Division	Department of Energy
40	Mr. Satchi	Assistant Engineer	Renewable Energy Division	Department of Energy
41	Mr. Tashi Dorji	Hydropower Development Engineer	Planning and Coordination Division	Department of Energy
42	Mr. Karma Tshewang	Assistant Engineer	Planning and Coordination Division	Department of Energy
43	Ms. Dechen Wangmo	Junior Engineer	Planning and Coordination Division	Department of Energy
44	Ms. Wangmo	Junior Engineer	Planning and Coordination Division	Department of Energy
45	Ms. Beneta K. Gurung	Assistant Engineer	Planning and Coordination Division	Department of Energy
46	Mr. Gem Dorji	Executive Engineer	Planning and Coordination Division	Department of Energy
			subtotal	12
		BHUTAN POWER CORPORATION		
47	Mr. Chhewang Rinzin	Managing Director		Bhutan Power Corporation
48	Mr. Tenzing Yonten	General Manager		Bhutan Power Corporation
49	Mr. B. B. V. Ramana Rao	Senior Consultant		Bhutan Power Corporation
50	Mr. Tshering Tenzin	Deputy Manager	Rural Electrification Division	Bhutan Power Corporation
51	Mr. Jigme Tobgyel	Senior Manager	Planning & IT Division	Bhutan Power Corporation
52	Ms. Dechen Dema	Engineer	Customer Service Department	Bhutan Power Corporation
53	Mr. Sunil Rasaily	Engineer	Customer Service Department	Bhutan Power Corporation
54	Mr. Suresh Nepal	Senior Manager		Bhutan Power Corporation
55	Mr. Ujjwal Deep Dahal	Deputy Manager	Planning and Monitoring Department	Bhutan Power Corporation
56	Mr. Dorji Namgay	Engineer		Bhutan Power Corporation
57	Mr. Ngawang Norbu	Engineer		Bhutan Power Corporation
58	Mr. Sonam Pelden	Deputy Manager		Bhutan Power Corporation
59	Mr.Ugyen Dorji	Senior Manager		Bhutan Power Corporation
			subtotal	13

Attachment-1

EMBASSY OF JAPAN				
60	Mr. Hiroyuki Terasaki	First Secretary		Embassy of Japan, New Delhi
			subtotal	1
JBIC				
61	Mr. Mikio Hataeda	Director		JBIC Tokyo
62	Mr. Tomohide Ichiguchi	Deputy Director		JBIC Tokyo
63	Mr. Yoshibumi Bito	Representative		JBIC New Delhi
64	Mr. Nori Iai	Chief Consultant	Corporate Strategy Department	UFJ Institute Ltd., Japan
65	Mr. Yoichi Hara	Chief Consultant	Policy Studies Department	UFJ Institute Ltd., Japan
			subtotal	5
JICA				
66	Mr. Mitsukuni Sugimoto	Resident Representative		JICA Bhutan Office
67	Mr. Yosuke Kubo	Project Formulation Advisor		JICA Bhutan Office
68	Mr. Junya Yamaguchi	JICA Expert		JICA (Bhutan Telecom)
69	Mr. Masami Kido			JICA Tokyo
70	Dr. Akira Niwa	Senior Advisor	Institute for Int'l Cooperation	JICA Tokyo
			subtotal	5
JICA STUDY TEAM				
71	Mr. Tomoyasu Fukuchi	Team Leader		Nippon Koei Co., Ltd.
72	Mr. Keiji Shiraki	Distribution System and Design Standard Planning		Nippon Koei Co., Ltd.
73	Mr. Kazunori Ohara	Power Transmission Planning		Nippon Koei Co., Ltd.
74	Mr. Ko Nakajima	Power Demand and Supply Planning		Nippon Koei Co., Ltd.
75	Mr. Toshiyuki Arita	Power Distribution Facility Planning		Nippon Koei Co., Ltd.
76	Ms. Kyoko Usuda	GIS/Database		Nippon Koei Co., Ltd.
77	Mr. Kiyoshi Hirata	Small Hydro Power / Power Demand and Supply Planning		Nippon Koei Co., Ltd.
78	Mr. Ryosuke Ogawa	Information and Telecommunication Planning		Nippon Koei Co., Ltd.
79	Mr. Hiroshi Nishimaki	Financial and Economic Analysis		Nippon Koei Co., Ltd.
80	Mr. Kazuhiko Dobeta	Socio Economic Study		Nippon Koei Co., Ltd.
81	Mr. Deepak Bista	Solar Power and Renewable Energies Planning		Nippon Koei Co., Ltd.
82	Mr. Takahiro Kamishita	Environmental Impact Analysis		Nippon Koei Co., Ltd.
83	Ms. Yuka Nakagawa	Coordinator/Biomass Energies Planning		Nippon Koei Co., Ltd.
84	Ms. Reiko Nobuhiro	Coordinator		Nippon Koei Co., Ltd.
85	Ms. Kesang Anayat Yaganegi	Assistant		Nippon Koei Co., Ltd.
			subtotal	15
			Total	85

BPC	: Bhutan Power Corporation
ESD	: Electricity Service Division
CSD	: Customer Services Department
DYT	: Dzongkhag Yargay Tshogdu
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

Attachment-1

Record of Discussions
Second Workshop Held on October 26, 2004

Welcome and Introduction

Mr. Chhewang Rinzin
Managing Director, BPC

- Welcomed officials from JICA, JBIC, Representatives from Dzongkhags, other Officials from various Government and non-government agencies.
- Importance of power sector for socio-economic development of a country
- Overall importance of the Master Plan study
- Importance of participation of counterparts for success of technology transfer

Greeting by JICA Bhutan Office

Mr. Mitsukuni Sugimoto
Representative of JICA Bhutan Office
Since 1964 that Dasho Nishioka was assigned to serve for an agricultural development in the country, JICA has assisted the country for the last 28 years in agricultural, infrastructure, governance and power sectors and is currently contributing approximately 10% of development activities of the country.
While many things to be done to achieve an ambitious target of 100% electrification by 2020, the accessibility to electricity is a key development factor in the country.
Japan as well as ADB, the Indian government and other donors should consider each role to help the country achieve to provide electricity for each household in the country.
It was strongly addressed that a new technology of GIS that the Study used is important for DOE and BPC in locating identified non-electrified villages and planning distribution lines.
It is hoped that the Bhutan government shall utilize a report of the Study, which was prepared under the conditions that data necessary for planning is lacking in the country.

Background of the Study and Procedure of Workshop-2

Mr. Tomoyasu Fukuchi
Team Leader, JICA Study Team
It was explained that the Study had been promoted for a study of JICA because no master plan for electrification was identified in the country.
In the First Workshop (January 2004), the necessity of technical transfer was mentioned because a RE Master Plan shall be revised by DOE and BPC.
It was then decided that in the Second Workshop that almost all presentations will be done by DOE and BPC.

Status of Existing Power System

Mr. Bharat Tamang
Head, Planning and Coordination Division, DOE
His presentation covered the following items: (a) Energy Organization, (b) Hydro Power Outlook, (c) Salient Features of Bhutan Hydro Power Sector, (d) Power Supply and Demand Situation, (e) Status of Hydro Power Development, (f) Role of Hydro Power in Socioeconomic Development of the Country, (g) Planning and Policy Interventions to

Enhance the Role of Hydro Power, (h) Hydro Power Master Plan, (i) RE Master Plan, (j) Sustainable Tariff for Socioeconomic Development and (k) Hydro Power Development – Challenges and Opportunities.

Key Concerns raised during the presentation of Progress of Master Plan Study

Result of Village Survey

Clarification of the results of Village Baseline Survey on an averaged time to get to motorable roads by walking from non-electrified villages (6.1 hours), which is a concern of BPC in undertaking meter reading and tariff collection for the identified non-electrified villages. There was a concern that the figure may not be realistic with the remoteness of the unelectrified. The Study Team was requested to study the implementation strategies on how the meter reading and tariff collection process could be implemented keeping in view the remoteness of villages and opportunities of involving communities in carrying out these functions so as to reduce the cots of providing the rural electricity services.

Distribution System Planning by GIS

A concern was raised on the sustainability of GIS system created under the Study after the Study ends. The Managing Director, BPC assured that BPC and DOE would sustain the system and will coordinate with the Survey Department and other related departments and agencies. Also, the Dy. Director from Department of Survey, in particular informed the floor that the locations of those unidentified villages due to security reasons are available with them and we could avail those for completing the Master Plan. Furthermore, he also pointed out that his Department is still working on accurate base map for Bhutan and disadvantage of using WGS84 Datum he said is that it will lead to error of 200 to 300meters on actual ground.

Distribution System Analysis using MiPower

The Managing Director, BPC informed that BPC will be carrying out GPS Survey for LV lines and asked if this could be of some use for the Study. Dechen Dem, BPC replied that the data would be of use in the study for carrying out 3 Phase & Single Phase load analysis.

Presentation on Applied Standard for Distribution System

Reliability of RE lines

The reliability of lines used for rural electrification will not be as high as the ones in the urban areas. RE lines are invariably long, sometimes pass through dense vegetation, have a single supply source and therefore are prone to more outages. Reliability can definitely be improved by investing more into the system by using covered conductors, UG cables, ARCBs, frequent preventive maintenance, etc but however it comes at a cost. There has to be a trade-off between cost and reliability.

However, reliability in rural areas is not a high priority as compared to urban areas simply due to factors such as customer base, quantum of energy sold, losses to the overall economy, etc. For the purpose of the master-plan study, we have collected feeder wise fault interruption reports from BPC's archives and analyzed this data. The output of this analysis will be used in the RE master-plan design.

Temperature range – What was the basis of assuming a minimum temperature range of -10 °C? A lower temperature threshold may be required.

This is in line with the past standards that have been adopted. However, in areas where lower temperatures are probable, special design and construction practices will be adopted. This standard (-10 °C) has been adopted as a general case and will be applicable to a large portion of the RE master-plan area.

Pole standard

We are presently in the process of pole selection and as of now, we have not yet adopted a particular standard. Adoption of a pole standard (such as strength of the pole, height of the pole, etc) has a bearing on the permissible span of the line and therefore has huge financial implications. It will therefore be prudent to do a more detailed analysis on this before a standard is adopted. Many factors have to be borne in mind. We are however in the process of study and a based the outcome of the study, a pole standard will be adopted.

Use of wooden poles

As directed by the RGoB, the use of wooden poles instead of steel tubular poles for the LV system is being studied and in due course will be adopted as feasible with due consideration to all aspects such as availability, cost of transportation, etc. Information from several countries has already been collected and is presently being analyzed.

Off-grid Model Plan 1: Small Hydro

On the presentation of Mini/Micro Hydel proposal as an off-grid option 1, the Managing Director, BPC mainly raised these two concerns;
1. He said that Master Plan Study Team (MPST) should look into the aspects of the willingness of the communities to pay the tariffs set and contributions in any form
2. He also said that from the BPC's observation, many of the off grid areas will be served with the grid so, MPST should look into this matter as well as what should be done?

Methodology and Demand Forecast

(i) Population of 44,000 by year 2020 - There was a concern that the figure may not be realistic with the present trend of rural to urban migration. The projected increase of about 14,000 HH from 30,000 HH in 2003 need to be further substantiated.

(ii) Energy consumption projected per HH in 2020 is about 219 kWH (if you divided 9623 MWH by 44000 HH). - There was a concern that this may be a bit low in the year 2020 considering that most of the rural houses can be expected to own and use many electrical gadgets. Now this 219 kWH is also including all other categories of rural consumers such as saw mills, shops, schools etc. If only rural houses are included the per HH demand projection is only 140 kWH in 2020 which indeed looks small.

(iii) The average peak load is 1.25 kW/HH for the 51 HH surveyed and the co-incident peak load is 0.81 kW/HH for the same 51 HH. The projected peak load in the year 2020 for domestic houses is 1.47 kW/HH. The concern here is again whether this is realistic or not.

There was also concern about the sample size of 51 HH surveyed whether it is statistically large enough. Moreover, these houses were picked from 13 districts with only 3 to 5 houses per district. Also, we need to substantiate 1.47 kW/HH projection in the year 2020.

There were no questions for the economic and financial portion but it is felt that the quantification of the economic costs and benefits when comparing the ON and OFF grid options in the MP studies must be convincing.

Telecommunication Development Plan along with Rural Electrification

On the presentation of proposed OPGW on the 132kV system in eastern Bhutan Transmission line, the Managing Director, BPC and Mr. Bharat Tamang, Dept of Energy pointed out that the assumption is not in the plan because of budgetary constraint. They also requested that the Team should revisit the assumption and Department of Information Technology should clarify the basis.

Policy of Strategic Environment Consideration

There were some concerns raised about the option 1 estimated cost, whether the increment cost of using insulated conductors so as to minimize the ROW for lines passing through environmentally protected areas have been incorporated. The consensus was that it is very important to identify the environmental cost and opt for the least cost option using the Life Cycle Cost approach.

Number of households

There was a concern raised on the definition of a household and doubted the figure of unelectrified households. However, the numbers will have to be updated simultaneously when the Master Plan is updated in future.

Feedback on RE Master Plan by Gasa Planning Officer and DYT Chairman, Chukha Dzongkhag.

- Establishment of hydro power at Khatoe (Gasa) and Khamae were not possible due to transportation problem and also suitable site for station were not found.
- Laya has the potential for establishing hydro power but transportation of turbine is a problem and budget constraint, though the villages are in cluster
- During the DYT, the members have expressed that the Vision 2020 of every house holds to be electrified may be completed at the earliest. As Gasa is the only Dzongkhag where neither vehicle road nor electricity has reached. Light will make life easier for heating, cooking and preserving environment.
- Chukha Chairman was satisfied with progress of the Master Plan and also pointed out the importance of not leaving those villages lying nearer to Hydropower stations as a priority to derive the immediate benefits.

Off-grid System and Institution

Regarding an off-grid power system in the country, Dr. A Niwa of JICA Tokyo mentioned that a master plan or policy for an off-grid power system might be required. He also pointed out that from the village baseline survey, other priorities like Road/Transportation, telecommunication etc. have been noted besides electricity and it is a vital step to consider other sectors while deciding ON and OFF grid potentials.

Possibility of Applying New Technology

Clarification was sought whether the proposed new technologies of renewable energy will be included in a RE Master Plan and the Mini Hydro Power Expert of the Study Team answered that these proposed technologies will be included in a RE Master Plan.

Closing Remarks

Mr. Chhewang Rinzin
Managing Director, BPC

Overall presentation – commended the jobs undertaken by the counterparts and the Study Team
Data Collection – the difficulty of getting accurate data at the same time costly and tedious job, and a need for further review and update.
Demand Forecast – to incorporate realistic demand so that the system design envisages no further upgradation in future.
Environment – 60% of the households in the country are still without electricity and desirable to provide access to electricity as early as possible. However, it is imperative to understand the environmental cost implication while carrying out electrification by different means and requested the study Team, DOE and BPC to work out to seek the best way and approach with National Environment Commission for implementation of a RE Master Plan.

GIS – On the sustainability of GIS system, assured that the DoE and BPC will keep updating the system in coordination with Department of Survey and land Records, Ministry of Agriculture.

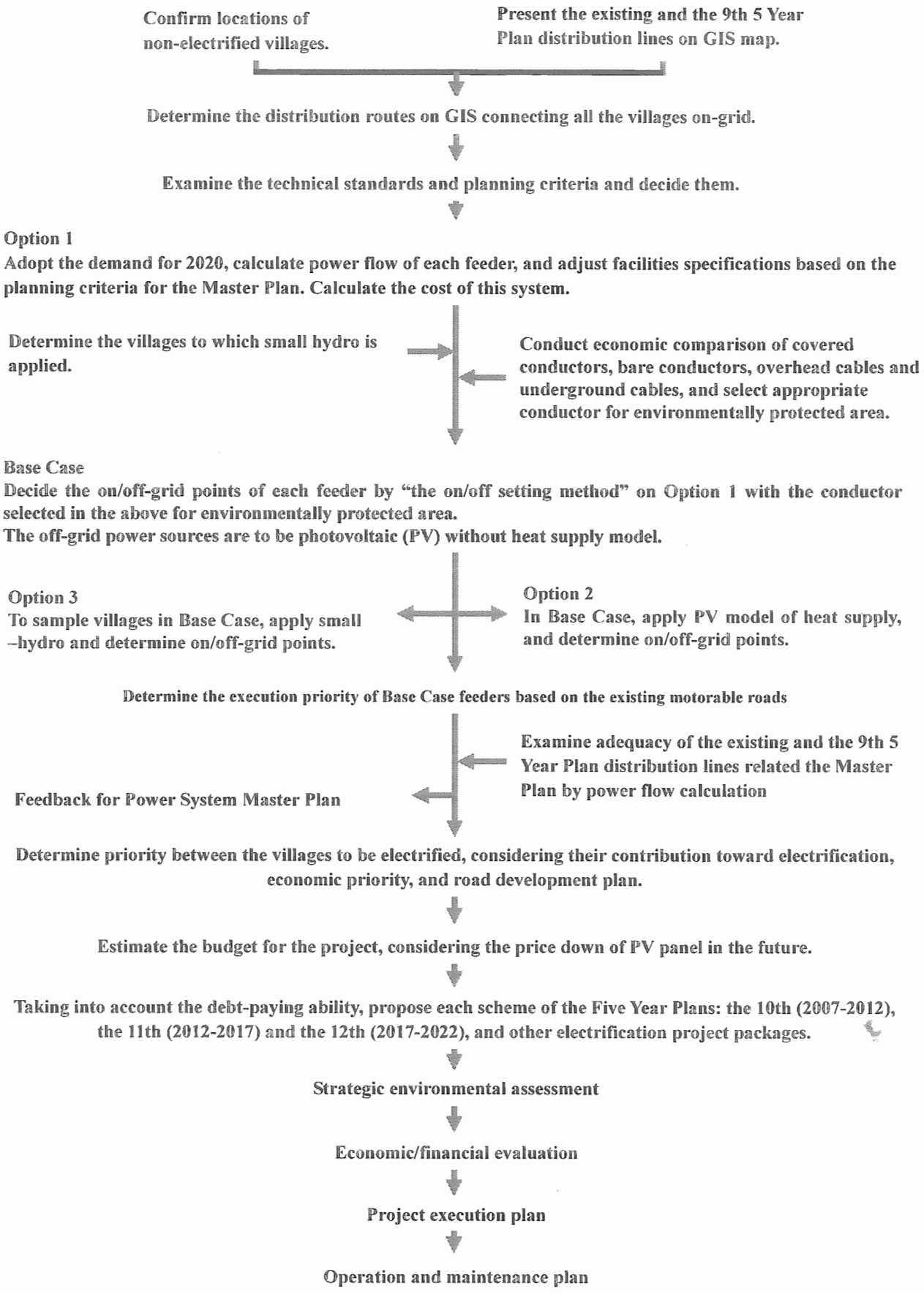
Off-grid System – While proposing for off-grid system, the Team must take into consideration that all the Mini/Micro Hydels will generally to come on grid in future.

Financing – proposal of plough back mechanism from the revenues earned through export of electricity looks promising. However, study team was requested to come up with detail financing strategies.

Dzongkhag – Appreciation to the Dzongkhag Representatives for participating and requested future coordination and further cooperation.

Thanked JICA for the funding, JBIC's presence appreciated in view of likely future request to be made by power sector for JBIC loans.

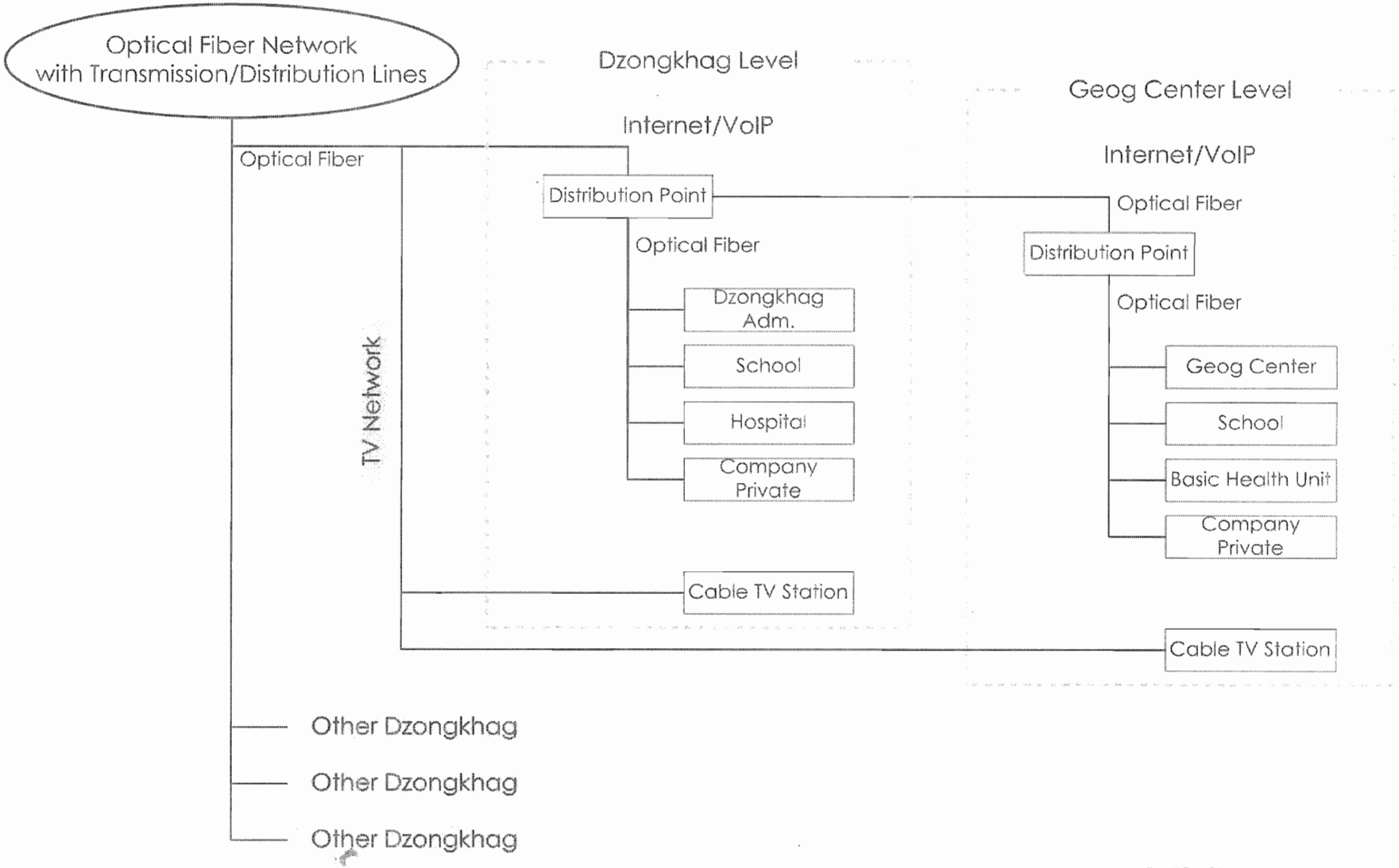
Attachment-2



Flow-chart for Formulating the Master Plan of Dzongkhag-wise Electrification

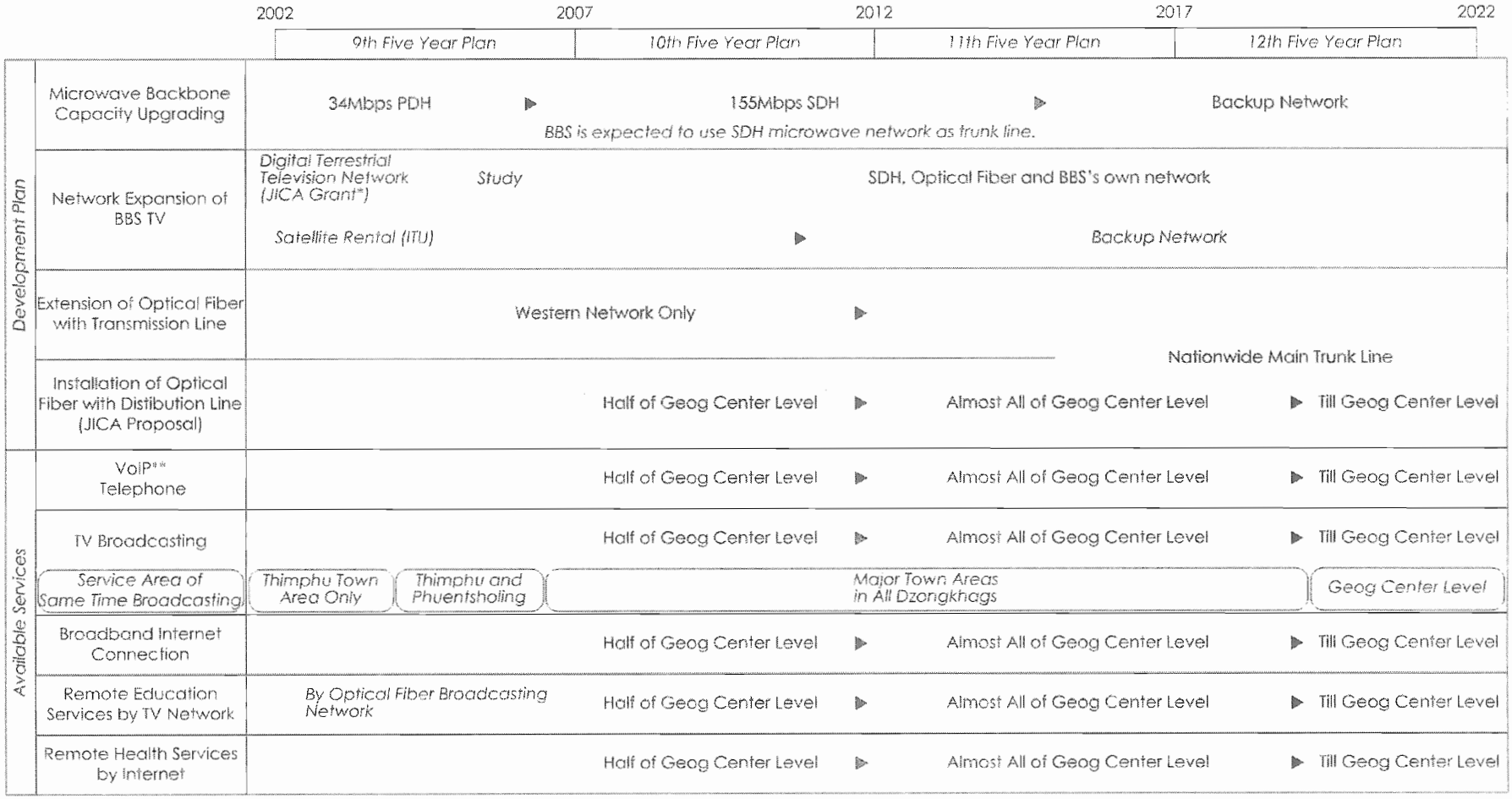
Telecommunication Network for Internet/VoIP Telephone

2004/11/15



By JICA Study Team
15 November, 2004

Future Schedules
Concerned with Information and Communication Network



Note: * it is high possibility to be realized by JICA Grant.
** Voice over Internet Protocol.

By JICA Study Team
15 November 2004

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

MEETING PARTICIPANT LIST

Date 11-Oct-04

Place : Meeting Room of BPC

Subject **Kick-off Meeting on the Master Plan Study**

No.	Name	Country/ Department	Title	Signature
1	Jigme Tobgyel	BPC	Sr. Manager	
2	Ishewang Jamtsho	BPC	Engineer	
3	B B V Ramanarao	BPC	Sr. Consultant	
4	Tenzing Yonten	DPC	Gen. Manager	
5	Suresh Nepal	BPC	Engineer	
6	SUNIL RASAILY	CSD, BPC.	ENGINEER.	
7	Tenpa Gyurme	RED	Sr Mgr.	
8	TSHERING TENZIN	RED	Dy. Manager	
9	Techen Wangmo	DOE	JE	
10	Sonam Tobgey	BPC	Sr. Manager (FAD)	
11	GEMPO JAMPEL	BPC	ENGINEER.	
12	Deki Choden	DoE	Engineer	D.choden
13	Dechen Dema	CSD, BPC	Engineer	Dechen D.
14	Kinga Tshering	PSD, BPC	Gm-CSD	11/10/04
15	Chhewang Rinzin	MD BPC		
16	Ujjwal Deep Dahal	PSM, BPC.	Dy. Mgr.	
17	KARMA P. DORJI	PCD, DOE	P.M.	
18				
19				
20				

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

MEETING PARTICIPANT LIST

Date 11-Oct-04

Place : Meeting Room of BPC

Subject **Kick-off Meeting on the Master Plan Study**

No.	Name	Country/ Department	Title	Signature
1	T. Fukuchi	JICA Study Team	Team Leader	
2	K. Dobeta	〃	Socioeconomic Survey Expert	
3	K. Ohara	〃	MiPower Analysis	K Ohara
4	K. Usuda	〃	GIS / DB	
5	D.B. Dista	〃	Renewable Energy	
6	T. ARITA	〃	Distribution Equ.	
7	K. NAKAJIMA	〃	Power Facilities	
8	Y. NAKAGAWA	〃	Biomass Energies Planning/ Coordinator	
9	R. Ogawa	〃	Information and Tele communication Planning	
10	R. Jadhiro	SAME AS ABOVE	Coordinator	
11	K. Shiraki	JICA st.	Distribution Expert	
12	NISHIMAKI	〃	Financial and Economic Analysis	
13	K. Hirata	〃	MHP / Demand Fo.	
14				
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New Energy Office, Emerging Business Division, Overseas Consulting Administration

JICA Study Team

The Integrated Master Plan Study for Dzongkhag-wise Electrification in the Kingdom of Bhutan
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E-mail : a4260@n-koei.co.jp

Your ref. Our ref. FKLBHE-04-031 Date: September 30 2004

Mr. Sonam Tshering
Director General, Department of Energy,
Ministry of Trade and Industry,
The Royal Government of Bhutan

Subject : Submission of Progress Report

Dear Sir:

We, hereby submit twenty-(20) copies of our Progress Report on the "*The Integrated Master Plan Study for Dzongkhag-wise Electrification in the Kingdom of Bhutan*" in accordance with Article 5 of "Scope of Work" for this Study that agreed upon between Japan International Cooperation Agency (JICA) and Ministry of Trade and Industry on June 27, 2003.

In addition, we would like to inform you that the Study Team leader with other 4 team members arrived in Thimphu City on September 29th, 2004 for the 3rd Site Work.

Thank you for your time and cooperation.

Sincerely,

Tomoyasu Fukuchi
Team Leader, JICA Study Team

Received on 30th Sept '04.

National Project Manager
R.E. Project, Planning & Coordination Division
Department of Energy, Thimphu

Attachment: twenty-(20) sets of Progress Report

c.c.:
1) Mr. Karma P. Dorji ((National Project Manager, Rural Electrification Project, Planning & Coordination Division, Department of Energy, Ministry of Trade and Industry)
2) Ms. Masami Kido (Electric Power Team, Group II, Economic Development Department, JICA)

ANNEX-7

MINUTES OF MEETING

AGREED UPON BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
MINISTRY OF TRADE AND INDUSTRY

FEBRUARY 18, 2005

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

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

THIMPHU
February 18, 2005

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

Mr. Bharat Tamang
Oftg. Director General
Department of Energy
Ministry of Trade and Industry

Mr. Jigme Tobgyel
Senior Manager
Planning & Monitoring 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 February 6 through 24, 2005 as the fourth site work. On February 18, 2005, 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. **Interim Report** : The Team submitted twenty copies of Interim Report to DOE on February 8, 2005 and discussed the contents with DOE and BPC. The Team was informed that the DoE will be consolidating the comments from different agencies and will send the comments to the Team by March 4, 2005.

2. **Coordination Committee** : The coordination committee meeting was held on February 16, 2005. DOE is preparing the minutes of meeting and will send it to the Team after obtaining the signature of the key attendances by the end of February 2005.

3. **Draft Final Report** : The comments on Interim Report will be incorporated in the Draft Final Report which is to be submitted officially in September 2005. The Team, however, will present the major contents of Draft Final Report in the third workshop to be held in June 2005. The Draft Final Report includes the following chapters and sections in addition to the contents of Interim Report.

Chapter 15	Implementation Plan
15.1	Project Packages
15.2	Implementation Schedule
15.3	Funding Arrangement
15.4	Implementation Organization
Chapter 16	Operation and Maintenance Plan
16.1	Institution and Organization
16.2	Budget Planning
16.3	Rural Arrangement for Operation and Maintenance
16.4	Capacity Building
Chapter 17	Conclusion and Recommendation

4. **Institutional Framework** : Based on the concept mutually agreed in the third site work, which is shown below, the Team will prepare the institutional framework and guidelines for both on- and off-grid electrification and incorporate them into the Draft Final Report.:

(Agreed Concept)

- incorporate local participation to reduce the BPC's burden of operation and

maintenance for on-grid and off-grid electrification.
- realize off-grid electrification with local initiative and ownership for sustainability through a cost sharing mechanism.
- make good use of private sector or incorporate public-private partnership for efficient realization of off-grid electrification.

5. **Third Workshop** : The third workshop will take place in Thimphu on June 9, 2005 at Bhutan Chamber of Commerce and Industry Conference Hall. The Team will prepare the draft agenda and send it to DOE by March 4, 2005. 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 April 8, 2005.
   Together with the invitation, DOE will send the related Dzongkhag-wise electrification plan (drawing, table and briefing) and the environment document to the above personnel concerned of each Dzongkhag.
   As the final milestone of the technology transfer, the presentation will be basically done by Bhutanese counterparts. Besides, the result of the counterpart training, which is scheduled to be conducted in Japan in May, 2005, will be presented by the trainees.
   The Team has provision to provide budgetary support for the workshop such as conference hall charges and other associated logistic cost.

6. **Counterpart Training** : For the counterpart Training in Japan to be executed by JICA, the following five personnel will be nominated as trainees.

   - Mr. Nawang Choeda, Asst. Project Manager, RE Master Plan Project, DoE
   - Mr. Hari Prasad Sharma, Asst. Engineer, DoE
   - Mr. Ujjwal D Dahal, Dy. Manager, Planning and Monitoring Div, BPC
   - Ms. Dechen Dema, Dy. Manager, Customer Service Dept.,BPC
   - Mr. Shankar Sharma, GIS Expert, Dept. of Survey & Land Records

7. **Next Site Work** : The 5th site work is scheduled to be conducted from June 4 to 21, 2005.

End